COLE

July 15, 2019
Reference No. 2017-0331

Tom Reeve
City of Barrie
City Hall
70 Collier Street
Barrie, ON, L4M 4T5

Attention: **Tom Reeve, P.Eng.**
Senior Infrastructure Planning Coordinator

City of Barrie Wastewater Collection Master Plan Update
Final Master Plan Report

We are pleased to submit the final City of Barrie Wastewater Collection Master Plan for your information and use. It has been a pleasure to work with City of Barrie staff on this project and we look forward to future assignments.

Best Regards,
COLE ENGINEERING GROUP LTD.

Christine Hill, M.Eng., P.Eng.
Project Manager

CH/ad

C. L. MOROZ
PROVINCE OF ONTARIO
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Draft Report	September 20, 2018	For client review
Updated Draft	March 14, 2019	For Client Review
Final Draft	April 5, 2019	Final Draft
Final	July 15, 2019	Final

Statement of Conditions

This Report / Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner / Client, City of Barrie and its affiliates (the "Intended User"). No one other than the Intended User has the right to use and rely on the Work without first obtaining the written authorization of Cole Engineering Group Ltd. and its Owner. Cole Engineering Group Ltd. expressly excludes liability to any party except the Intended User for any use of, and/or reliance upon, the work.

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Executive Summary

The City of Barrie has completed updates to four Master Plans: Water Supply, Water Distribution and Storage, Wastewater Collection, and Wastewater Treatment (includes a Biosolids Management and Contingency Plan). These Master Plans are updates to the City's 2013 Master Plans completed in support of the City's Official Plan Amendment and Secondary Plan to account for lands annexed from the Town of Inisfill, as per the Barrie-Inisfil Boundary Adjustment Act of 2009.

Each Master Plan Update identifies the water or wastewater servicing projects that will be required to accommodate and facilitate growth and intensification over the planning horizon, including:

- Residential and employment growth;
- Intensification of the City as required by Provincial policy; and,
- Optimal design and delivery of water and wastewater servicing City-wide.

This Master Plan, the Wastewater Collection System Master Plan, has followed Approach #2 under the Municipal Class Environmental Assessment process (MCEA, October 2000, as amended in 2007, 2011 and 2015). This Master Plan documents the completion of Phases 1 and 2 of the EA process. As an outcome to this Master Plan, where Schedule 'B' or Schedule 'C' projects are identified and prioritized in the next 10 year years, additional evaluation of alternatives to fully satisfy the requirements of Phase 2 (Schedule 'B') and Phases 3 and 4 (Schedule 'C' projects only) will be completed.

The Study Area for this Master Plan includes the entire municipal jurisdiction of the City of Barrie as shown in **Figure ES-1**. The Study Area includes the "Annexed Lands" as well as the pre-2010 City Boundary. **Figure ES-1** also shows the extent of the City's existing wastewater collection system, including existing pumping stations. Planning for growth within the Study Area has considered the various acts, regulations, guidelines and policies which government wastewater collection systems. These acts, regulations, guidelines and policies include the Safe Drinking Water Act (2002), Lake Simcoe Protection Action (2008), Provincial Policy Statement (2014), Growth Plan for the Greater Golden Horseshoe (2017) and City of Barrie Official Plan (January 2018 Office Consolidation). As part of the City's Official Plan Update, the City has prepared detailed residential and employment growth forecasts to the year 2041 planning horizon and beyond. By 2041, the City's residential and employment population is anticipated to reach 381,996 persons. By 2071, the City has projected that the residential and employment population will reach 452,979 persons.

This document is an update to the 2013 Wastewater Collection System Master Plan completed by the City. The 2013 Master Plan recommended upgrades to pumping stations, decommissioning of specific pumping stations, and new trunk sewers to service future growth. As a starting point for this Master Plan, the status of the recommendations in the 2013 Master Plan were updated. The City's existing wastewater collection system consists of local sanitary sewers, trunk sewers and pumping stations. The wastewater collection system terminates at the Barrie WwTF, which is the subject of the Wastewater Treatment Master Plan. Overall the system services a mix of residential, industrial, commercial and institutional land uses for the entire City, which is approximately 7,725 ha in size. **Figure ES-1** shows the components of the wastewater collection system.

Performance assessment of the existing wastewater collection system was completed as part of this study. To assess the system performance, a wastewater collection system hydraulic model was updated and utilized. The model was updated using the most recently available data and calibrated using flow and

rainfall data collected at 15 strategic flow monitoring sites and five rain gauges over a 3-month period. Collected data was reviewed and utilized to calibrate and validate the model in accordance with industry best practices. Collected data was also used to assess the extent of inflow and infiltration (I/) into the wastewater collection system. Based on the assessment of inflow and infiltration, three areas were identified primary priority areas and six areas were identified as secondary priority areas, where it is recommended that the City undertaken specific I/I reduction studies to identify and remediate the system, thereby reducing peak flows. Existing system performance was assessed for dry weather flow conditions and wet weather flow conditions (2-, 5-, 10-, and 25-year design storm events). For the 25-year design storm event, a significant number of trunk sewer and local sewers were identified where the depth ratio (d/D) exceeded 0.7 for sewers with diameters greater than 375mm and a d/D of 0.5 for sewers with diameters of 375mm and less. A small number of locations on Ferndale Drive (north of Edgehill, through Aboretum Sunnidale Park, south of Dunlop and east of Mulcaster) and south of Bear Eco Park were identified where the model predicted surcharge conditions and the available freeboard was estimated to be less than 1.8m, indicating a capacity constraint. The performance of the City's pumping stations was also assessed and improvements were identified at three pumping stations to provide adequate firm capacity to pump peak flows resulting from a 25-year storm event. These improvements included twin forcemains at PS1, PS2 and PS12, a firm capacity increase at PS12, and additional wet well storage at PS1.

Level of service requirements were developed based on a review of the City's Sanitary Sewage Collection System Policies and Design Guidelines (2017) as well as consideration of the Ministry of Environment, Conservation and Parks (MECP) design guidelines and criteria used in other jurisdictions. System performance criteria adopted included a maximum depth ratio (d/D) of 0.7 for sewers greater than 375mm in diameter and a maximum d/D ratio of 0.5 for sewers with diameters of 375mm and less. At pumping stations, 1-hour of storage at peak flows, was also identified. Future needs were assessed for the periods of 2021, 2026, 2031, 2036, 2041 and 2071. These assessments identified improvement needs. A total of four alternatives were developed and evaluated to meet system needs. Alternatives included do nothing, limit growth, water conservation and I/I reduction and upgrade and expansion of the existing system. The evaluation was completed with criteria that recognized the natural environment, social environment, technical and economic / financial considerations. Based on the evaluation results, expansion and upgrade of the existing wastewater collection system was identified as the preferred alternative. **Figure ES-2** presents the preferred alternative. In total, the preferred alternative consists of system expansion projects and system improvement projects. The expansion projects are needed to provide capacity for future growth. The system improvement projects are needed to support growth and address system elements, where the City's level of service criteria is not met. Expansion projects include two new pumping stations and forcemains (East Annex and West Annex), decommissioning of an existing pumping stations (Lockhart) and construction of new trunk sewers on McKay Road, Huronia Road, Mapleview Drive, extension of the Hewitt's Trunk Sewer and a new twin Lakeshore South twin trunk sewer. Replacement of an existing trunk sewer on Patterson Road and south of Bear Eco Park was also identified. Based on the timing of growth, implementation timelines were developed for these projects.

A number of system improvement projects were identified. It is noted that these projects were identified to meet the City's performance criteria (d/D<0.7 or d/D<0.5) for peak flow conditions during a 25-year design storm event. It is recommended that the scope for these projects be confirmed through additional flow monitoring and analyses as part of the design process. **Figure ES-3** shows the location of these improvement projects. These projects have been included as recommended projects but could be implemented in conjunction with transportation, water or stormwater improvements.

The performance of the improved and expanded wastewater collection system was assessed under a number of scenarios including 2041 conditions, a high flow scenario for 2041 conditions and 2071 conditions. The results of the analyses indicate that the system will meet long term system performance needs. The performance assessments considered the recommended equalization storage facility recommended as part of the Wastewater Treatment Master Plan. **Figure ES-4** presents the performance of the improved and expanded wastewater collection system under 2041 conditions.

It is also noted that all system assessments were completed using the City's design allowance for infiltration and inflow of 0.1L/s/ha for all new development areas. To ensure that this allowance is not exceeded for any specific development, the City is encouraged to consider requiring developers to complete flow monitoring to demonstrate that the design criteria is met. The City may wish to alter future subdivision agreements to add this requirement. A key recommendation is the implementation of an I/I reduction program through monitoring, field investigation, condition assessment, remediation and rehabilitation of the City's sanitary assets as well as private property programs to address I/I sources located on private property.

Figure ES-1
City of Barrie
Existing Wastewater Collection System

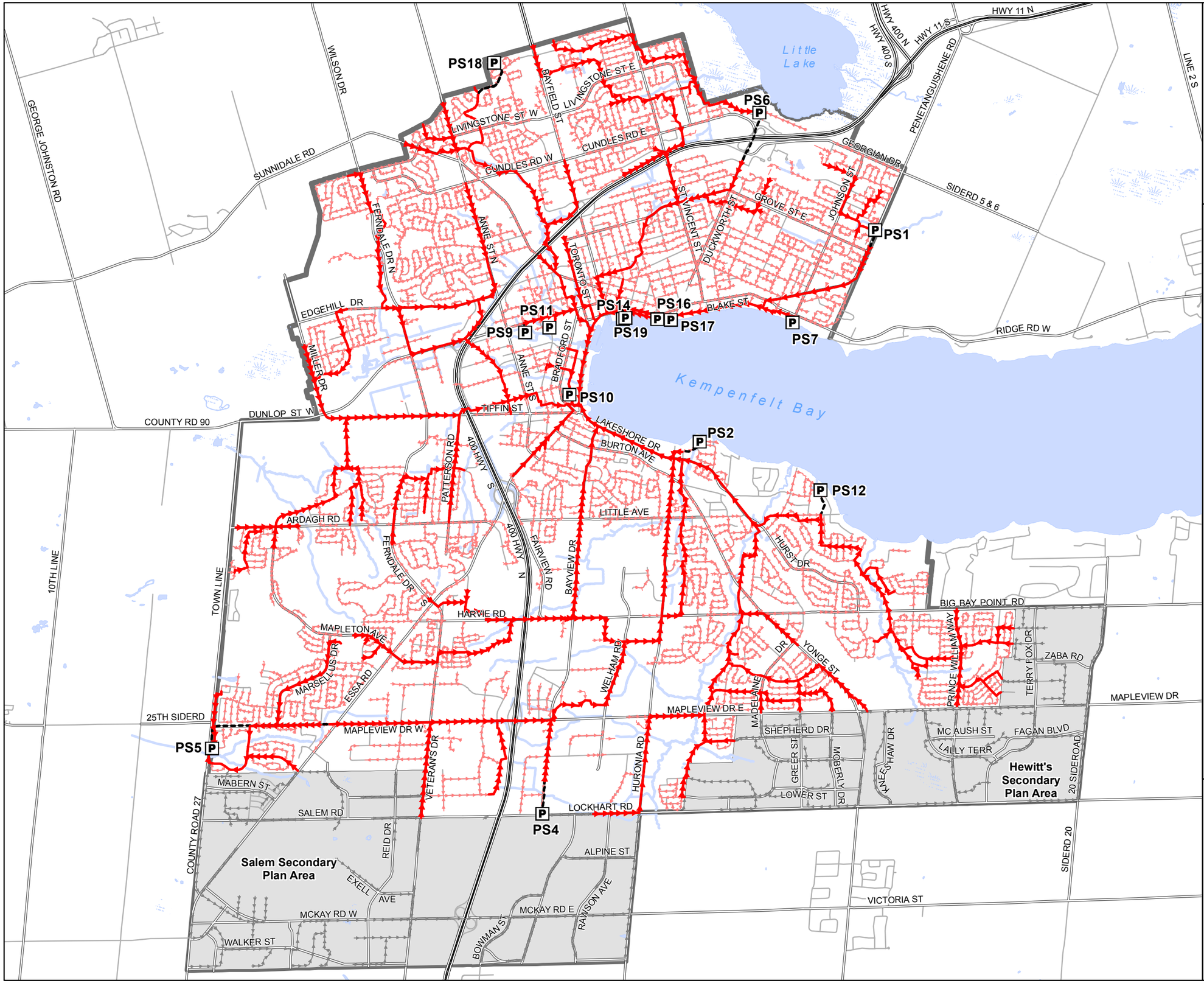
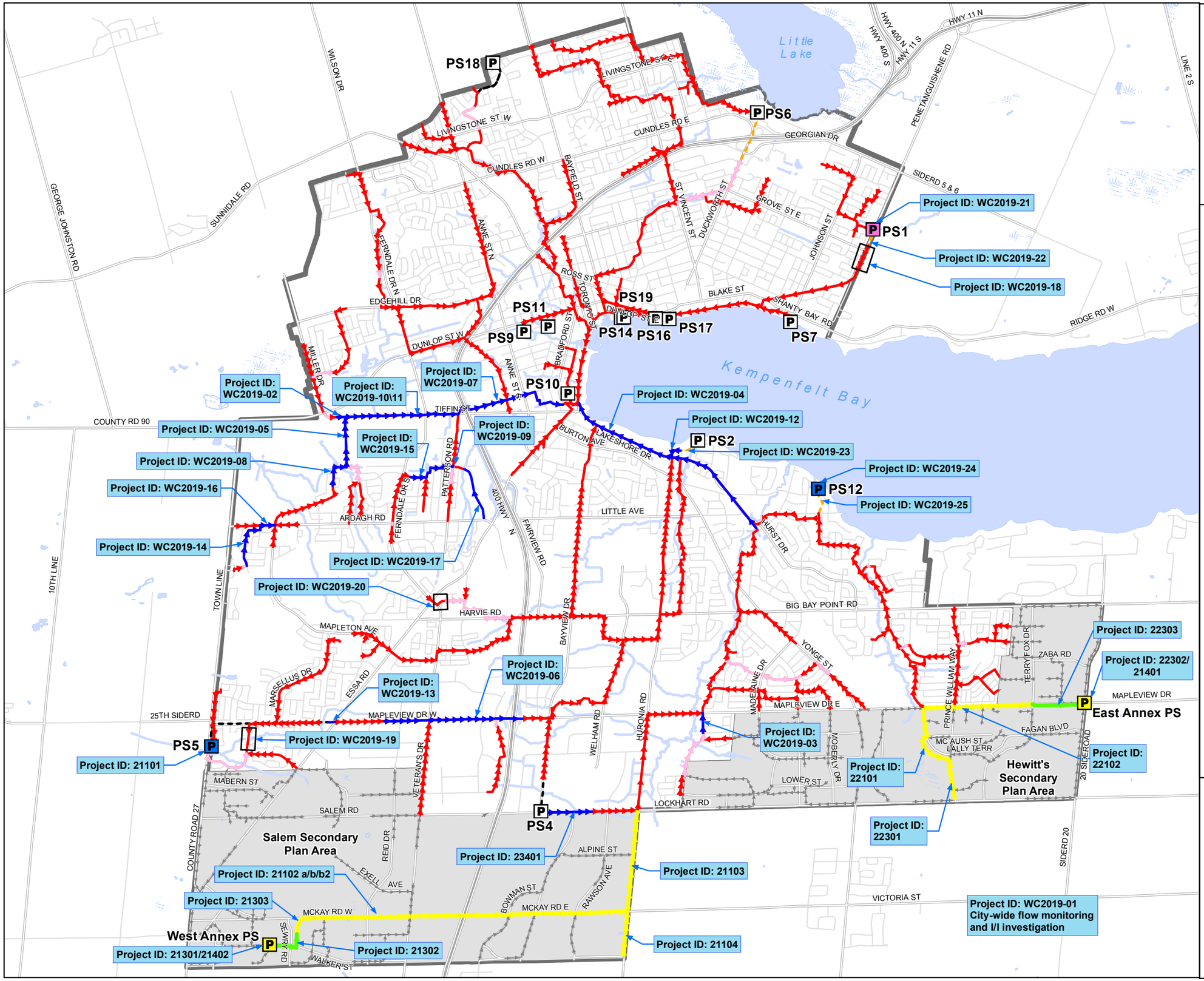


Figure ES-2
City of Barrie
Preferred Alternative



- New Sanitary Trunk Sewer
- Infrastructure Upgrades for Growth
- Infrastructure Upgrades for Existing Conditions
- New Forcemain
- Forcemain Twinning
- Forcemain
- Sanitary Trunk Sewer
- Future Annexed Lands Sewers
- Pumping Stations
- Pumping Stations Capacity Upgrades for Growth
- Pumping Station Wet Well Upgrade
- New Pumping Stations
- Monitioring and Assessment Project
- Secondary Plan Boundaries
- City of Barrie Limits

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Kilometers

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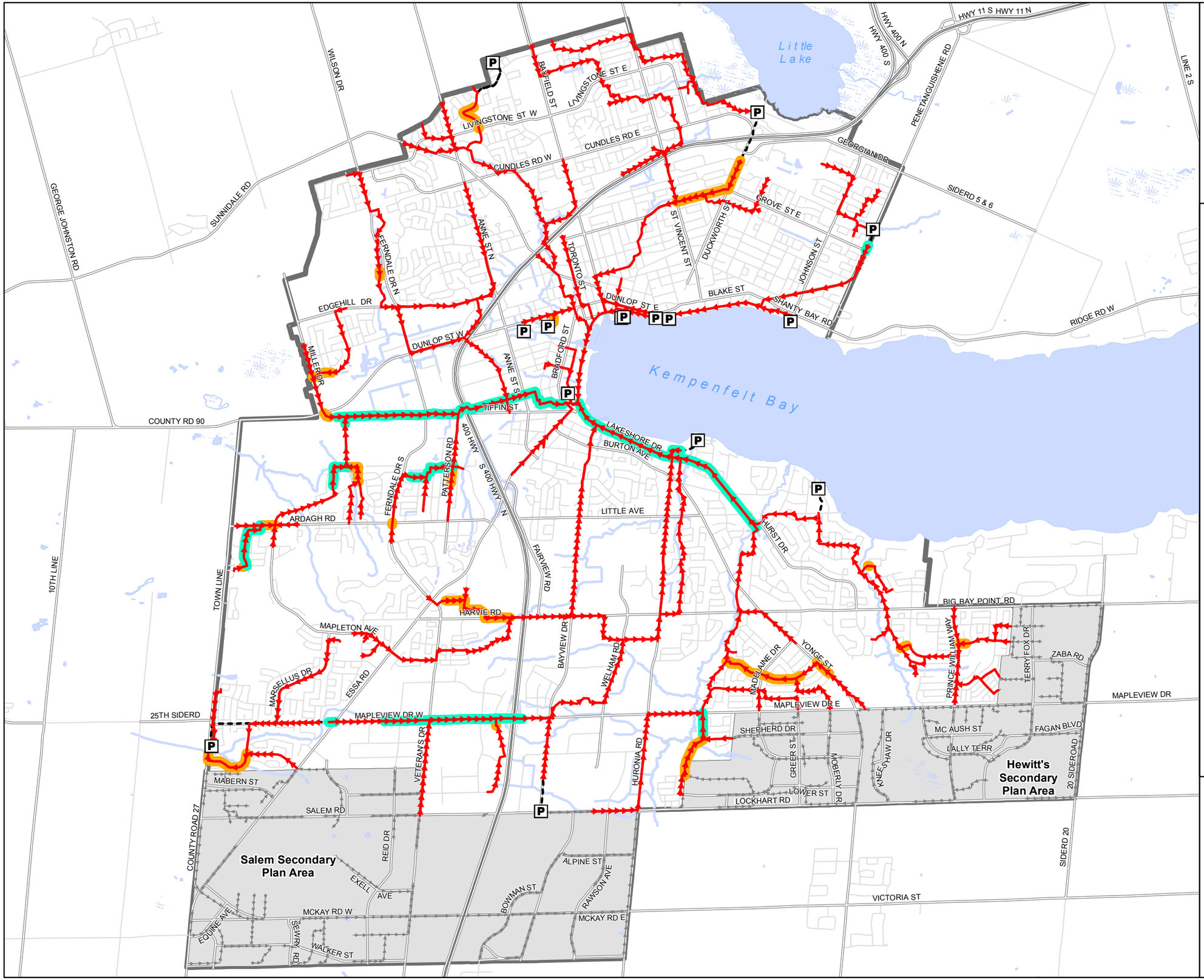
Figure ES-3
City of Barrie
Location of System Improvements



- Sewer Upgrades <= 375mm Diameter
- Sewer Upgrades >375mm Diameter
- Forcemain
- Sanitary Trunk Sewer
- Pumping Stations
- Secondary Plan Boundaries
- Future Annexed Lands Sewers
- City of Barrie Limits

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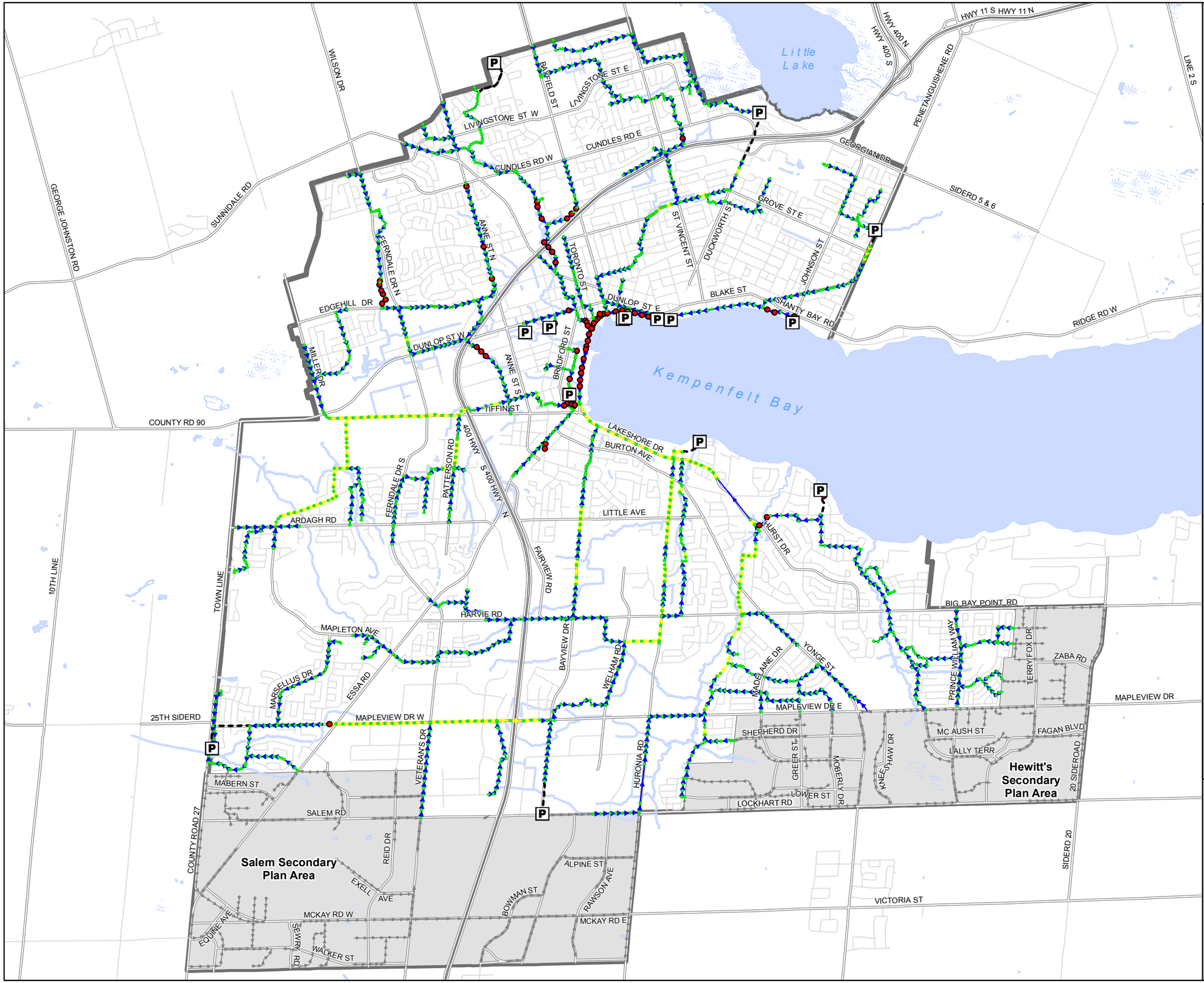
Kilometers

Updated: 4/5/2019

Figure ES-4
City of Barrie
Preferred Alternative
Performance - 2041 Wet Weather Conditions (25-Year Storm)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

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0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

1 Introduction

1.1 Study Purpose

The City of Barrie (The City) has completed updates to four Master Plans: Water Supply, Water Distribution and Storage, Wastewater Collection, and Wastewater Treatment. Each Master Plan Update identifies the water or wastewater servicing projects that will be required to accommodate and facilitate growth and intensification over the planning horizon, including:

- Residential and employment growth;
- Intensification of the City as required by Provincial policy; and
- Optimal design and delivery of water and wastewater servicing City-wide.

Alternative water and wastewater servicing solutions have been developed based on a high-level review of their natural, physical, social/cultural and financial impacts. In accordance with Approach #2 under the Municipal Class Environmental Assessment document (MCEA, October 2000, as amended in 2007, 2011, and 2015). This Master Plan Report documents the completion of Phase 1 and completion of Phase 2 at a high-level to satisfy the requirements of an MCEA Master Plan. Most importantly, this report identifies the necessary projects that should be completed to achieve the objectives of the Master Plan over the planning horizon. For Schedule 'B' Class EA projects identified in this report to be constructed within the next 10 years, the related public consultation, technical studies and detailed assessment of alternative solutions relating to these projects are contemplated under this assignment. If Schedule "C" Class EA projects are identified and prioritized within the next 10 years, then the City will complete a detailed evaluation of alternatives to satisfy Phase 2 as well as the completion of Phases 3 and 4 of the MCEA prior to the public review of an Environmental Study Report.

This report documents the MCEA Master Plan study for the Wastewater Collection System Master Plan. This report is an update to the Master Plan completed in 2013 in support of the City's Official Plan Amendment and Secondary Plan to account for lands annexed from the Town of Innisfil, as per the *Barrie-Innisfil Boundary Adjustment Act, 2009*.

1.2 Municipal Class EA Process

As required under the Ontario *Environmental Assessment Act (EAA)*, this study followed the MCEA (October 2000, as amended in 2007, 2011, and 2015) planning process. The MCEA establishes a framework by which broad environmental outcomes of public sector infrastructure projects are reviewed and evaluated. The stated purpose of the EAA is to provide *the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation and wise management in Ontario of the environment*. The EAA interprets environmental outcomes to be those associated with the natural, social, cultural, built, and economic environments.

The EAA requires that municipalities complete a MCEA for public works and infrastructure projects, including those for roads, transit ventures, and water and wastewater projects. Key principles of the MCEA process include:

- Consultation with stakeholders and affected parties upon study commencement, and throughout the process of the project;

- Consideration of all reasonable alternatives, including “alternatives to” and “alternative methods” of implementing a preferred solution;
- Identification and consideration of broad environmental effects, as identified previously, for each alternative under evaluation;
- The systematic evaluation of all alternative solutions and/or methods to determine the net environmental effects, based on available information; and,
- The provision of clear and comprehensive documentation that demonstrates how the MCEA planning process was followed, and to ensure transparency and traceability of the decision-making process for the project.

Under the MCEA, the Master Plan process allows a proponent, such as the City of Barrie, to prepare the planning, design, and construction of a group of related municipal works, rather than individually on a project-by-project basis. The benefits of the Master Plan approach include:

- The rationale for each individual project is more clearly articulated;
- The range of alternatives are more broadly addressed;
- The extent of potential environmental outcomes is better understood;
- There is an enhanced ability to assess cumulative outcomes; and,
- The process allows for the integration of land use planning.

The Master Planning process differs from project specific undertakings in several aspects and facilitates long range planning that enables the municipality to identify opportunities and proactively develop strategies for addressing any associated issues. This approach generally yields a series of individual activities, projects, and programs, together with a phased implementation plan that covers over an extended time period. Accordingly, the works may be implemented separately as individual projects but, collectively, they form part of the overall management system embodied in the Master Plan.

The Study is being undertaken in accordance with Approach #2, as described in Appendix 4 of the MCEA document. An overview of the Municipal Class Environmental Assessment process is provided in **Figure 1-1.** This approach involves the preparation of a Master Plan document upon the completion of Phase 1 and high-level analysis and public consultation completed as part of Phase 2 of the process. The Master Plan document is then made available for public comment prior to being approved by the municipality. Under Approach #2, the Master Plan is done at a high level of assessment.

The objective of the Master Plan is to identify required projects and their MCEA schedule. After the completion of the Master Plan, additional public consultation, technical studies and detailed evaluation of alternative solutions are needed at the project-specific level in order to fulfill the requirements for any specific Schedule “B” projects. Further study and the completion of Phases 3 and 4 are also required to fulfill the requirements for any specific “C” projects identified within the Master Plan itself.

c

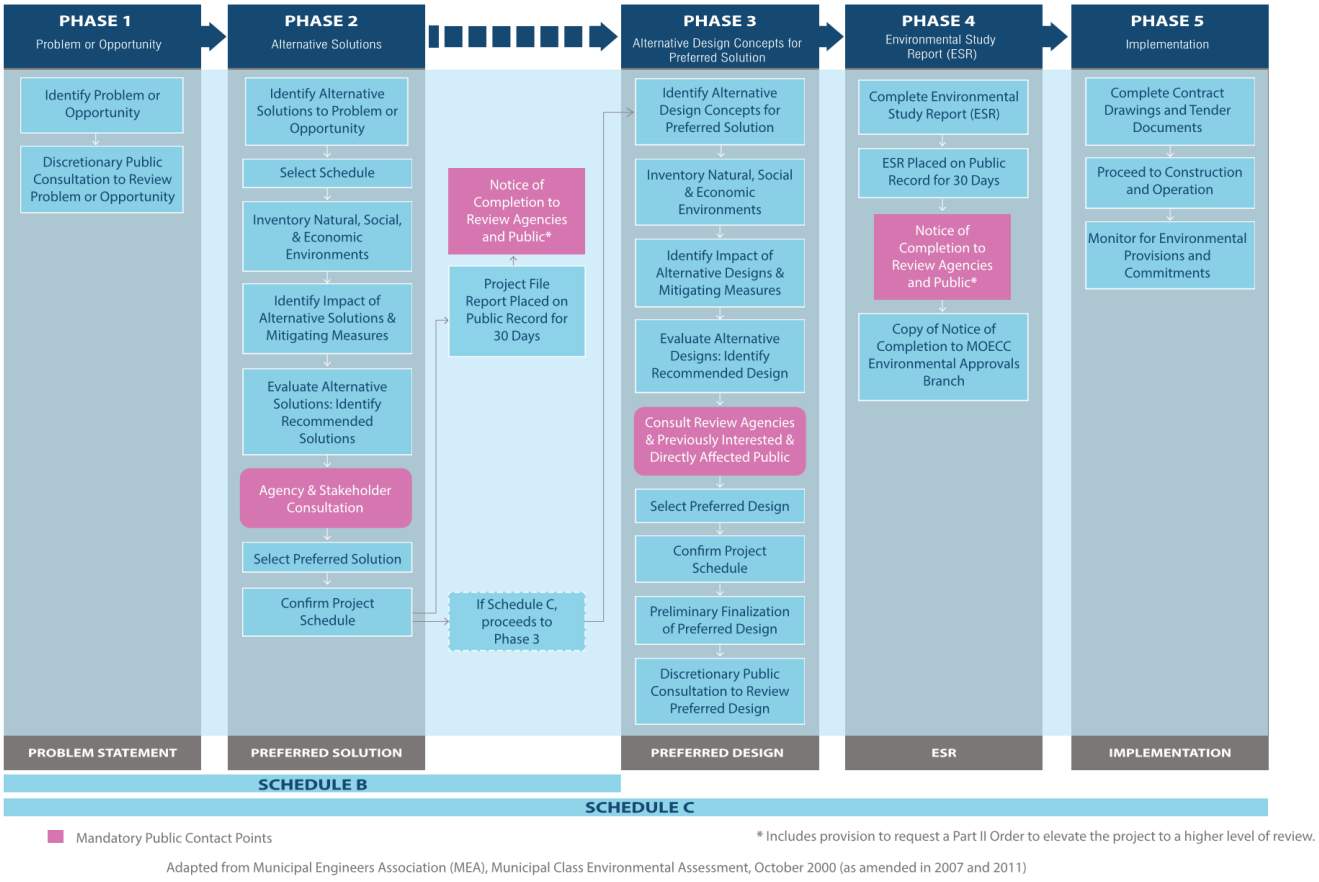


Figure 1-1 Municipal Environmental Assessment Process

The Master Plan would therefore become the basis for, and be used in support of, any future Schedule "B" and Schedule "C" projects identified within it. Schedule B projects require project-specific investigations and analyses and the filing of the Project File for public review, while Schedule C projects would have to fulfill Phases 3 and 4 of the MCEA process prior to filing an Environmental Study Report (ESR) for public review.

The City of Barrie Wastewater Collection System Master Plan demonstrates the methodology and rationale for identifying the required Schedule "A", "A+", "B" and "C" projects to accommodate and facilitate growth within the City of Barrie to the year 2041.

1.3 Public and Stakeholder Consultation

The Wastewater Master Plan falls under the requirement of a Schedule B project requiring Phase 1 and Phase 2. One requirement of Phase 2 is the need to consult with review agencies and the public once alternative solutions have been identified. Typically, consultation involves presenting the problem or opportunity that will be addressed, the environmental considerations and potential impacts of each alternative, and the approach used for evaluating the alternatives. The comments and the input from the public and other stakeholders are taken into consideration in the identification of the preferred alternative.

Consultation early and throughout the process is a key feature of environmental assessment planning. The purpose of the consultation process is to notify stakeholders of the project details and provide an opportunity for interested parties to review and submit comments related to the study. The following public and stakeholder consultation activities were completed throughout the Master Planning process. Refer to **Appendix A** for copies of all Notices, stakeholder contact lists and Public Information Centre material. This information is provided in accordance with the standards prescribed by the Class EA document, which outlines the guidelines for establishing contact with appropriate review agencies in relation to the nature of the project.

1.3.1 Notice of Study Commencement

A Notice of Study Commencement was issued to both the City of Barrie website, as well as in the newspaper. Notification was provided through the following means:

- By advertisement in the Barrie Examiner on August 10th and 12th, 2017;
- By posting to the City's website on August 10th and August 12th, 2017; and,
- Via e-mail to all agency contacts provided in the project contact list (**Appendix A**).

As a result, all relevant review agencies and the public were notified of the project being initiated, the problem and opportunity being addressed, and given the opportunity to provide comments.

1.3.2 Notice of Public Information Centre (PIC)

A Notice of Public Information Centre (PIC) was issued through both the City of Barrie website, as well as in the newspaper. Notification was provided through the following mediums:

- By advertisement in the Barrie Advance on October 18th and 25th, 2018;
- By posting to the City's website on October 18th and 25th, 2018; and,
- Via e-mail to all agency contacts provided in the project contact list (**Appendix A**).

As a result, all relevant review agencies and the public were notified of the Public Information Centre being held, the problem and opportunity being addressed, and given the opportunity to provide attend and provide comments and feedback. A record of the Notice of Public Information Centre is located in **Appendix A**.

1.3.3 Public Information Centre

A Public Information Centre was held on November 1st, 2018, at the Southshore Community Centre in the City of Barrie. A notice of the meeting was issued on October 18th and 25th on the City's website as well as in the Barrie Advance. The Notice was also circulated to review agencies, as well as Indigenous communities.

The Public Information Centre was a drop-in, open house format, beginning at 4:00PM and lasting 3-hours. It included a series of display boards describing each of the Master Plan processes. During this time, City staff, as well as members of the consultant team, were in attendance to discuss the Master Plan updates and address any questions from community residents.

The general purpose of the Public Information Centre was to present the findings of the Master Plan updates by providing the following information:

- Scope of the Master Plan process;
- Class EA Master Plan process;
- Growth projections;
- Review of the Water Supply System;
- Review of Water Distribution and Storage;
- Review of Wastewater Collection;
- Review of Wastewater Treatment;
- Recommendations from the Master Plans;
- An overview us Master Plan process time line and next steps; and,
- An opportunity for residents to provide comments and feedback on the Master Plan updates.

A total of 26 community members attended the Public Information Centre, and five comment sheets were submitted. A record of these documents is provided in **Appendix A.**

1.3.4 Agency and Public Comments and Responses

Table 1.1 presents a summary of comments received through consultation with regulatory agencies and members of the public during the Master Plan process. A copy of all notices and comments received during the study are provided in **Appendix A**.

Table 1.1 Summary of Comments

Review Agency	Comment	Response
Ministry of Tourism, Sport and Culture	All technical heritage studies and their recommendations are to be addressed and incorporated into the EA. Please advise MTCS whether any technical heritage studies will be completed for your EA project, and provide them to MTCS before using a Notice of Completion. If your screening has identified no known or potential cultural heritage resources, or no impacts to these resources, please include the completed checklists and supporting documentation in the EA report or file.	The Ministry of Tourism, Sport and Culture will be circulated on the Notice of Study Completion and kept informed of any technical heritage studies in support of the Master Plan updates. MTCS will be circulated of any studies prior to the Notice of Study Completion.

1.3.5 Notice of Study Completion

A Notice of Study Completion will be prepared and issued following approval of this Master Plan by City Council.

1.4 Master Plan Study Timeline

A review of key milestones to the Wastewater Collection System Master Plan Study Process is shown in **Table 1.2**.

Table 1.2 Master Plan Study Timelines

Milestone	Timeline	Description
Notice of Study Commencement	August 2017	A Notice of Study Commencement was issued on August 10th and 12th, 2017. The Notice reviewed the purpose of the study and the study process. Contact information for the City of Barrie Project Manager was provided.
Notice of PIC	October 2018	A Notice of Public Information Centre was issued on October 18th and 25th, 2018. The Notice identified the location, time, and purpose of the PIC. Contact information for the City of Barrie Project Manager was provided.
PIC	November 2018	A Public Information Centre was held on November 1st, 2018 at the Southshore Community Centre. The PIC was 3-hours in length, from 4:00PM to 7:00PM.
Master Plan Approval	TBA	Subject to approval by City Council.
Notice of Study Completion	TBA	Once the Master Plan has been reviewed and approved by City Council, a Notice of Study Completion will be issued.

2 Background and Context

2.1 City of Barrie Profile

2.1.1 City of Barrie

The City of Barrie is one of Ontario's fastest growing municipalities and is the largest urban centre within the Simcoe County area. It is a single-tier municipality located north of the City of Toronto, traversed by Highway 400 and is located on the shores of Lake Simcoe, specifically Kempenfelt Bay.

Lake Simcoe has been identified as a highly sensitive body of water due to the cold-water aquatic ecosystem that it supports. Accordingly, it is closely monitored with respect to phosphorous and nutrient loading. To protect and enhance the ecological integrity of Lake Simcoe, the Province introduced the *Lake Simcoe Protection Act* in 2008 to focus on addressing the most critical issues within the watershed.

This Master Plan has been developed to facilitate Barrie's current and projected growth to ensure that sufficient servicing can be provided to facilitate this growth to 2041. It is also important that the Lake Simcoe watershed be protected, as required under Provincial legislation.

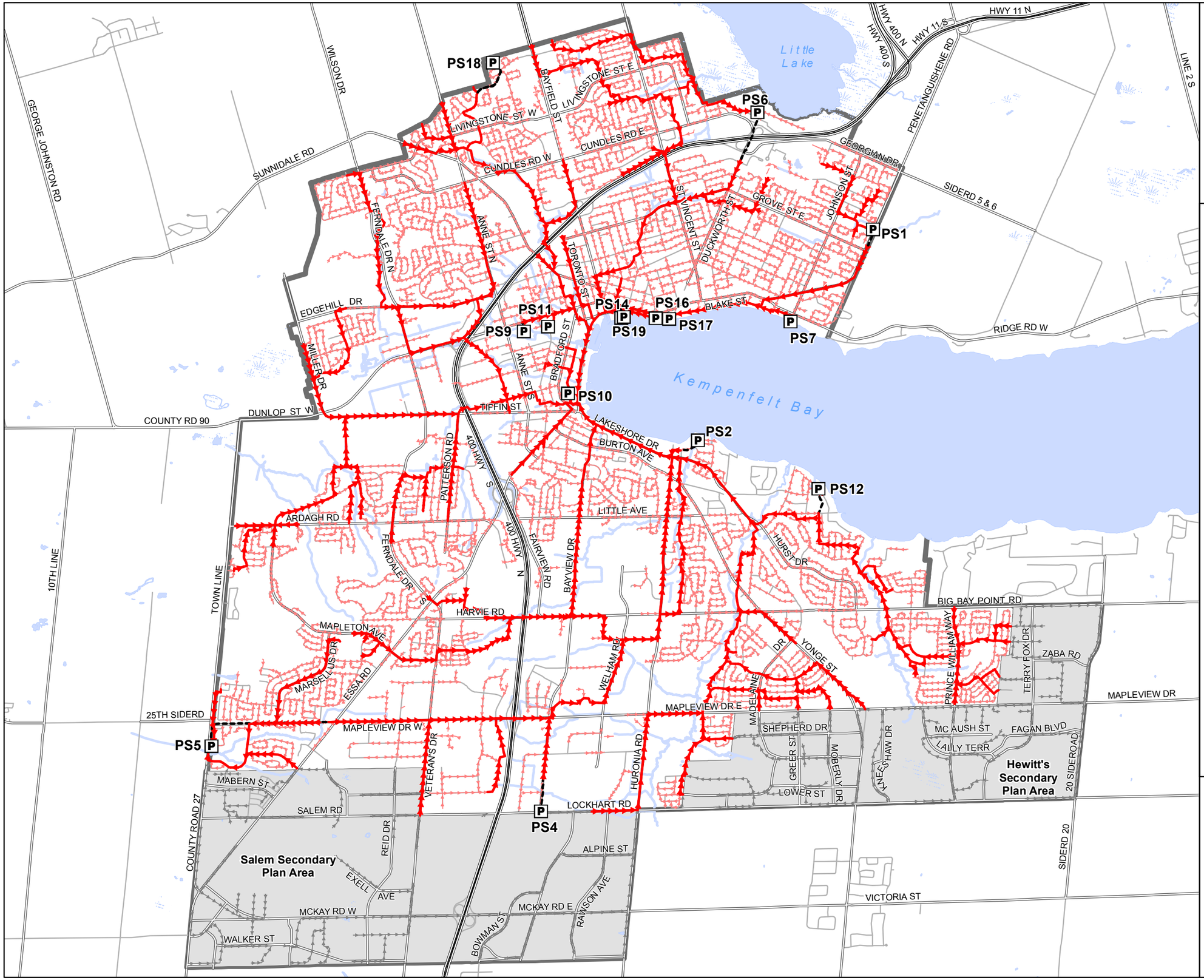
2.1.2 City of Barrie Demographic Statistics

According the 2016 Census Profile (Statistics Canada, 2017), the City boundary encompasses nearly 99 square kilometers and as of the 2016 census, has a population of 141,434 excluding undercount. This represents a growth rate of 3.9% from the 2011 census. The median age of residents in 2016 was 38.5 years, with those aged 15 to 64 years representing approximately 68% of the total population. The median total income of households in 2015 was $78,000, with a total labour force aged 15 years and older of 78,945 employments, representing a potential employment rate of 64.3%. English is the predominant mother tongue, spoken by 85% of the population (Source – Statistics Canada. 2016 Census)

2.1.3 Study Area Overview

The Study Area for this Master Plan includes the entire municipal jurisdiction as shown in **Figure 2-1 Master Plan Study Area**. This includes the "Annexed Lands" located within the southern portion of the City's municipal boundary. The "Annexed Lands" consist of two secondary plan areas – Salem Secondary Plan Area and the Hewitt's Secondary Plan Area. **Figure 2-1** also indicates the location of all existing pumping stations and sanitary sewers within the study area.

Figure 2-1
City of Barrie
Wastewater Collection System
Master Plan Study Area



- Pumping Stations
- Sanitary Trunk Sewer
- Forcemain
- Sanitary Sewer
- Future Annexed Lands Sewers
- Secondary Plan Boundaries
- City of Barrie Limits

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Kilometers

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2.1.4 History of Salem and Hewitt's Secondary Plans

In 2010, the *Barrie-Innisfill Boundary Adjustment Act* came into effect, extending the southern boundary of the City to include 2,293 hectares of land (the "Salem and Hewitts Secondary Plan Areas") previously located within the Town of Innisfill. The Salem and Hewitts Secondary Plan Areas are an important component to implementing the City of Barrie Growth Management Plan, and meeting Provincial population and employment targets as identified in the Growth Plan for the Greater Golden Horseshoe, 2017. Accordingly, the Salem and Hewitt's Secondary Plan Areas provide an opportunity for the City to accommodate and support this anticipated growth and change over the planning horizon.

2.1.5 Lake Simcoe Watershed

The Lake Simcoe watershed includes 3,400 square kilometres and crosses 20 municipal boundaries, including York and Durham Regions, Simcoe County, and the Cities of Kawartha Lakes, Barrie and Orillia. It is the largest body of water in Southern Ontario, other than the Great Lakes and has an important natural and cultural heritage role within the Province. Natural features within the Lake Simcoe Watershed include 18 major river systems, 4,225 kilometres of creek, stream and tributary channels and over 75 species of fish. Collectively, the watershed provides water resources to over 450,000 residents (Lake Simcoe Region Conservation Authority, 2016). Land use within the watershed is classified as 8% urban, and 36% agriculture. The lake itself is economically important, generating over $200-million of tourism revenue per annum. The watershed is managed by the Lake Simcoe Region Conservation Authority (LRSCA), an organization incorporated under the *Conservation Authorities Act* (1946, as amended).

2.2 Nottawasaga Watershed

The Nottawasaga Valley watershed includes an area of approximately 3,700 square kilometers, and includes lands within 18 municipalities located in the upper-tier municipalities of Simcoe, Dufferin and Grey County. It is generally located in an area bound by the Oak Ridges Moraine to the south, Niagara Escarpment to the west, Oro Moraine to the east, and Georgian Bay on Lake Huron to the north. The watershed encompasses all the water that drains along the Nottawasaga River, which receives water from many smaller tributaries including the Boyne River, Innisfill Creek, Mad River, Pine River and Willow Creek, among several others. The watershed is managed by the Nottawasaga Valley Conservation Authority (NVCA), and organization incorporated under the *Conservation Authorities Act* (1946, as amended).

2.3 Regulatory Framework

A fundamental purpose of updating the Master Plan is to comply with and meet regulatory requirements. These include various acts, regulations, guidelines and policies that govern water and wastewater supply, collection and treatment, as well as the pattern of development for which these systems will be expanded to service. Several of the key regulatory requirements impacting the Master Plan update are reviewed in the following sections.

2.3.1 Safe Drinking Water Act, 2002

The *Safe Drinking Water Act, 2002* provides the legislative framework for municipal drinking water systems. It establishes a set of province-wide standards, rules and regulations to ensure the population has access to safe and reliable drinking water. The Act specifies requirements for drinking water systems, testing services and the certification of system operators and water quality analysts including regulatory water quality standards and mechanisms for compliance.

2.3.2 Lake Simcoe Protection Act, 2008

The Lake Simcoe Protection Plan, 2009, established under the *Lake Simcoe Protection Act, 2008* sets out provincial targets and policies for reducing phosphorus, pathogens and other contaminants in Lake Simcoe and its watershed. Broadly, the Plan takes a comprehensive approach to improving environmental conditions in the Lake and its watershed by addressing a number of key environmental problems, including stresses from human activities and excessive levels of phosphorous that interfere with natural ecosystems and affect the amount and the quality of water available for human consumption.

Accordingly, the Lake Simcoe Phosphorus Reduction Strategy was introduced in 2010 to help meet the objectives of the Lake Simcoe Protection Plan and places specific limits on phosphorus discharge from existing water resource recovery facilities. Specific objectives of the Strategy include:

- Restoring the health of cold water fisheries;
- Improving and maintaining water quality;
- Reducing the amount of phosphorous entering the lake; and,
- Protecting and rehabilitating the ecological integrity of Lake Simcoe and its watershed.

Specific water quality targets established by the Lake Simcoe Protection Plan, 2009, are as follows:

- Reduce phosphorous loading to an estimated 44 tonnes per year;
- Phosphorous reductions are required to achieve a target for dissolved oxygen of 7mg/L;
- Reduce pathogen loading to eliminate beach closures; and
- Reduce contaminants to levels that achieve Provincial Water Quality Objectives or better (p. 26).

The plan recognizes that proper water and wastewater management is essential to meeting these targets by improving the quality of effluent water into Lake Simcoe.

2.3.3 Provincial Policy Statement, 2014

The Provincial Policy Statement (PPS), 2014, is issued by the Province from time to time under the authority of Section 3 of the *Planning Act*. The PPS contains provides policy direction on matters relating to land use planning and development and applies to any land use planning decisions made under the *Planning Act* by municipal councils, local boards, planning boards, provincial ministers, provincial government and agency officials, including the Ontario Municipal Board. Municipal planning decisions are to be consistent with the policies of the PPS.

The PPS includes policies relevant to water and wastewater infrastructure planning including the requirement that infrastructure be provided in a coordinated, efficient and cost-effective manner. Additional requirements under the 2014 PPS include:

- These systems are to be sustainable, feasible, financially viable and comply with all regulatory requirements, as well as protect human health and the natural environment (Section 1.6.6.1.b); and,
- That water and wastewater infrastructure will be integrated at all stages of land use planning and implementing processes (Section 1.6.6.1.d)

The 2014 PPS also states that settlement areas will be serviced by municipal water and wastewater systems, with intensification and redevelopment within these areas provided by municipal water services wherever feasible (Section 1.6.6.2).

2.3.4 Growth Plan for Greater Golden Horseshoe, 2017

The Growth Plan for the Greater Golden Horseshoe (the "Growth Plan") 2017, developed pursuant to the *Places to Grow Act, 2005*, and as an update to the Growth Plan for the Greater Golden Horseshoe, 2006, is a framework for implementing the Province's vision for building stronger, prosperous communities by better managing growth and includes policies for the provision of well-planned infrastructure and strategic investment decisions to support forecasted population and economic growth.

The Growth Plan establishes that municipal water and wastewater systems will be planned, designed, constructed or expanded through a comprehensive water or wastewater master plan, informed by watershed planning that takes into consideration the following:

- That effluent discharge will not negatively impact the quality and quantity of water (Section 3.2.6.3.c.i);
- That the preferred option for servicing growth and development will not exceed the assimilative capacity of the effluent receivers and sustainable water supply for servicing, ecological, and other needs (Section 3.2.6.3.c.ii); and,
- That the full life cycle costs of the system can be sustained over the long-term (Section 3.2.6.3.c.ii).

The Growth Plan further requires that municipalities that share an inland water source or receiving water body will co-ordinate their planning for potable water, stormwater, and wastewater systems based on watershed planning to ensure the quality and quantity of water is protected, improved, or restored (Section 3.2.4.6).

2.3.5 City of Barrie Official Plan (January 2018 Office Consolidation)

The City of Barrie Official Plan (the "Official Plan") provides direction for managing growth and change within the City. This includes the consideration of land use change, the provision of public works, and the responsibilities of local boards, the municipality, and the actions of private enterprises. Guiding principles of the Official Plan include:

- To guide, direct, and monitor the rate of growth to match the supply of land, municipal services and facilities with the needs of residents and employers, in accordance with the City's population, employment, intensification and density targets (Section 3.1.1.d);
- To direct growth to take advantage of existing services and infrastructure where possible, and to minimize the cost of infrastructure extension (Section 3.1.1.e);
- To protect, improve or restore the elements that contribute to the ecological health of the Lake Simcoe watershed, including, water quality, hydrology, key natural heritage features and their functions, and key hydrologic features and their functions;
- To ensure that adequate water supply, sewage collection, sewage treatment, electrical supply and stormwater management systems are provided to the residents of the City (Section 5.1.1.a); and,

- To ensure that servicing of development shall employ best management practices to ensure sensitivity to the natural environment and efficiency of City services and operations (5.1.1.e).

The City of Barrie Official Plan also states that infrastructure is to be provided in a coordinated, efficient and cost-effective manner to accommodate projected needs, and that it is integrated with planning for growth (Sections 5.1.1.g, 5.1.1.h).

3 Growth and Projections

3.1 Population and Employment Projections

As part of the City's Official Plan update and this Master Plan process, the City has prepared detailed growth forecasts to the 2041 planning horizon. The forecasts accommodate for both residential and employment growth are presented in **Table 3.1** City of Barrie Growth Forecasts. It is noted that these projections include the estimated 3% census population data undercount.

Table 3.1 City of Barrie Growth Forecasts, 2021-2071

Year	Residential Forecast	Employment Forecast	Total
2016	145,849	73,773	219,622
2021	167,598	83,433	251,031
2031	210,000	100,997	310,997
2041	253,000	128,996	381,996
2071	300,022	152,957	452,979

4 2013 Wastewater Collection System Master Plan

The City of Barrie completed the 2013 Wastewater Collection System Master Plan in 2013 in support of the Secondary Plans, Background Studies and Infrastructure Master Plans for Intensification and Annexed Lands. The study assessed future needs to service growth in Barrie in the annexed lands, greenfield and intensification areas within the pre-2010 City boundary. The Master Plan identified and evaluated the wastewater collection requirements of the Study Area for the Planning Period of 2017 to 2031, the Planning Period of 2031 to 2051 and Out To Boundary (OTB) as well as for the expansion of the wastewater collection system for implementation by the City of Barrie. The study completed in accordance with Class Environmental Assessment (MEA Class EA, June 2000 as amended 2011) and included Phases 1 and 2 of the Class EA process which are problem identification and alternative solutions.

4.1 2013 Wastewater Collection System Master Plan Recommendations and Status

The 2013 Wastewater Collection System Master Plan concluded with recommended upgrades to pumping stations, recommendations for decommissioning of specific existing pumping stations and new trunk sewers needed to service future growth. **Table 4.1** presents the 2013 Recommended Projects and their current status.

Table 4.1 2013 Wastewater Collection System Master Plan Recommendations and Current Status

Project ID	Description	Implementation Timeline	Current Status
21101-a	Holly Pumping Station upgrade to a rated capacity of 200L/s.	Completion in 2020	Project construction ongoing. City Project EN1143.
21101-b	Twin of Holly Pumping Station forcemain (1940m-350mm).	Completion in 2020	Project construction ongoing. City Project EN1143.
21102	McKay Road Trunk Sewer (1220m-525mm and 3050m-600mm).	Completion in 2021	Detailed design ongoing. City Project Z204.
21103	Huronia Trunk Sewer north of McKay Road.	Completion in 2021	Detailed design ongoing. City Project Z201.
22101	Hewitts Trunk Sewer Extension to Phase 1 and 3 boundary (1050m – 750mm).	Completion in 2024	Detailed design initiated. City Project EN1137.
21102	Hewitts Trunk Sewer within pre-2010 City Boundary (550m-825mm).	Project completed	Project completed.
23101	Decommissioning of Huronia Pumping Station (Pumping Station 3).	Project completed	Project completed.
23102	Trunk Sewer to connect SAP08023 to SAP21038 to enable	Project completed	Project completed.

Table 4.1 2013 Wastewater Collection System Master Plan Recommendations and Current Status

Project ID	Description	Implementation Timeline	Current Status
	decommissioning of Huronia Pumping Station (1140m-1050mm)		
23103a	Twin existing sewer on Bishop Street within pre-2010 City Boundary	2012-2021	Planned.
23103	Twin existing sewer on Patterson Road within Pre-2010 City Boundary	2012-2021	Planned.
21301	New pumping station at south end of west annexed lands (100L/s, first phase 50L/s).	2027-2031	Planned.
21302	Twin Forcemain for new pumping station at south end of west annexed lands (200m-250mm).	2027-2031	Planned.
22301	Hewitts Trunk Sewer Extension south of Phase 1 and 3 Boundary (580m-450mm).	2027-2031	Planned.
22302	New pumping station at east end of annexed lands (80L/s, first phase 40L/s).	2027-2031	Planned.
22303	Twin Forcemain for new pumping station at east end of annexed lands (730m-250mm).	2027-2031	Planned.
21104	Huronia Road trunk sewer from City southern boundary to McKay Road (640m-450mm).	Post 2031	Planned.
21402	Expansion to capacity of new pumping station at west annexed lands to rated capacity of 100L/s.	Post 2031	Planned.
22401	Expansion to capacity of new pumping station at east end of annexed lands to rated capacity of 80L/s.	Post 2031	Planned.
23401	Decommission Lockhart Pumping Station (PS4).	2027-2031	To be completed concurrent with transportation improvements, Salem reservoir recommendations and downstream sanitary

Table 4.1 2013 Wastewater Collection System Master Plan Recommendations and Current Status

Project ID	Description	Implementation Timeline	Current Status
			sewer on Lockhart east of Bayview.
23402	Morrow Road Sewer twinning (160m-300mm).	Post 2031	Planned.

In total, 19 projects were recommended in the 2013 Wastewater Collection System Master Plan at an estimated cost of $52.8M.

5 Study Area Description

Section 2.1.3 presented an overview and map of the Study Area. The following section provides additional information on the natural and social environment as well as a description of the existing wastewater collection system.

5.1 Natural and Social Environment Description

The natural and social environments include natural heritage, water resources and land use. The following sections provide information on key features.

5.1.1 Natural Heritage

The City of Barrie, in conjunction with the Lake Simcoe Region Conservation Authority and Nottawasaga Valley Conservation Authority completed a Natural Heritage Strategy for the City, including an update of Natural Heritage System policies and the associated schedule in the City of Barrie Official Plan. The primary objective of the Natural Heritage Strategy is to ensure that features of environmental significance are identified and policies developed to promote the preservation, conservation and rehabilitation of the Natural Heritage System in the City. Schedule F in the City's Official Plan presents the City's extensive natural heritage areas.

The City's Natural Heritage System includes three resource classifications as follows:

- Level 1: includes provincially significant wetlands, non-provincially significant wetlands greater than 0.5ha, significant woodlots greater than 10ha, significant habitat of endangered or threatened species, watercourses, minimum vegetation protection zones and connectivity linkages and lands identified as environmental protection through the site specific planning and development process;
- Level 2: significant valleylands, ANSIs, significant wildlife habitat including but not limited to core winter deer yards, colonial water-bird nesting sites, rare vegetation communities and significant areas of vernal pools, watercourses, significant vegetation zones and connectivity linkages and woodlots greater than 4ha but less than 10ha; and,
- Level 3: Regionally significant ANSIs, woodlots greater than 0.5ha but less than 4ha, woodlots within 30m of a Level 1 or Leve 2 feature, cultural thicket or cultural meadow communities contiguous with woodland or wetland patches and connectivity linkages.

Figure 5-1 was obtained from the City's Official Plan and shows the location of the City's natural heritage areas.

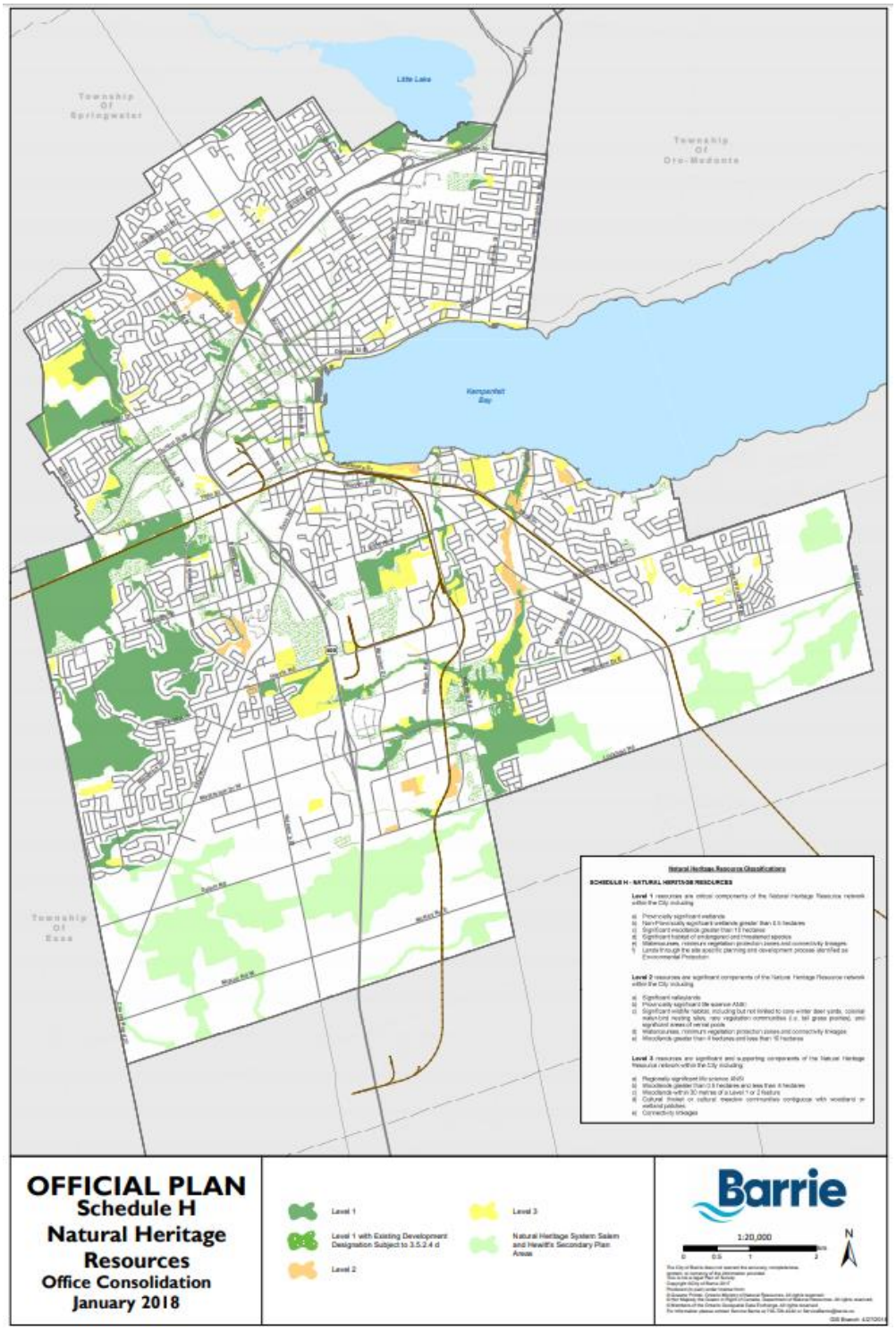


Figure 5-1 Natural Heritage Resources

5.1.2 Soils

The soils within the City of Barrie are an important consideration for the construction of new infrastructure.

Based on the Soils Map of Simcoe County, Soil Survey Report No. 29, the old City boundary predominantly contains the following soils classifications: Tioga sandy loam, Bondhead sandy loam, Dundonald sandy loam, Sargent sandy loam, and a mixture of Tioga loamy sand and Vasey sandy loam. These soil types have good drainage characteristics.

For the Annexed Area, the Soils Map indicates predominant soils to be Bondhead sandy loam, Tioga loamy sand, Tioga sandy loam, Dundonald sandy loam, Sargent sandy loam, a mixture of Tioga loamy sand and Vasey sandy loam, Alliston sandy loam, Guerin loam, Smithfield silty clay loam and muck. Typically, these soil types have good drainage characteristics, with the exception of Alliston sandy loam, Guerin loam, Smithfield silty clay loam and muck.

Conventional construction techniques may be used for the majority of soils identified within the City. Areas of deep sewers and where groundwater percolation is evident, additional attention such as dewatering may be required.

5.1.3 Watercourses and Water Features

Watercourses within the pre-2010 City boundary and Annexed Lands include Bear Creek, Bunker Creek, Dyments Creek, Georgian Creek, Hewitts Creek, Hotchkiss Creek, Huronia Creek, Kidds Creek, Lover's Creek, Sandy Cove Creek, Sophia Creek, Thorton Creek and Whiskey Creek. **Figure 5-2** indicates the location of these watercourses in the pre-2010 City boundary and Annexed lands and also shows overall topography.

Subwatersheds included within the Nottawasaga River Watershed include the Bear Creek and Thorton Creek Subwatersheds. The Nottawasaga Valley Conservation Authority (NVCA) manages all regulated areas within the Nottawasaga River Watershed and provides general guidelines for development for their Planning and Regulation Guidelines.

Subwatersheds included within the Lake Simcoe Watershed include Bunker Creek, Dyments Creek, Hewitts Creek, Hotchkiss Creek, Kidds Creek, Lover's Creek, Sandy Cove, Sophia Creek and Whiskey Creek Subwatersheds. The Lake Simcoe Valley Conservation Authority (LSRCA) manages all regulated areas within the Lake Simcoe Watershed and provides guidelines for development through their Comprehensive Stormwater Management Master Plan Guidelines.

The Annexed Area contains the following watercourses: Bear, Lover's, Hewitt's and Sandy Cove and Thornton Creeks. Key information on the watercourses within the Annexed lands is as follows:

- The south branch of Bear Creek originates within the Annexed Area, south of Salem Road and west of 5 Sideroad. The creek flows northwesterly to outlet into the Essa Drainage Area;
- Lover's Creek originates south of the Annexed Area, south of 10th Line and east of Highway 400. The creek flows northerly to outlet into Kempenfelt Bay, west of Coxmill Road;
- Hewitt's Creek originates south of the Annexed Area, south of Lockhart Road and east of Yonge Street. The creek flows northerly to outlet into Kempenfelt Bay, east of Crimson Ridge Road;
- Wells and Wellhead Protection Areas are identified in Schedule G of the City Official Plan; and,

- The headwaters of Sandy Cove Creek extend into the east limit of the annexed lands (west of Sideroad 20) and flow easterly into Lake Simcoe.

5.1.4 Topography

The topography of the pre-2010 City boundary and Annexed Area is generally rolling to steep slopes, especially in the specified creek regions. The rolling nature of the area will, in some cases, restrict options for servicing the lands by gravity. Routing of sewers will be evaluated to minimize sewer depth. Pumping Stations will be used where no other option exists.

5.1.5 Archaeological and Cultural Heritage

The 2013 Wastewater Master Plan included a Stage 1 Archaeological Assessment for the Secondary Plan area. The study assessed the archaeological potential in the annexed lands and included a Stage 1 assessment for three archaeological sites. These sites, Cleary (BbGw-10), Paisley (BbGw-14) and McDonald (BcGv1-11) were previously registered and are located within the annexed lands. The study also undertook an assessment of archaeological potential based on available information and concluded that approximately 61% of the annexed lands can be classified as having archaeological potential. **Figure 5-3** presents the areas identified as having archaeological potential.

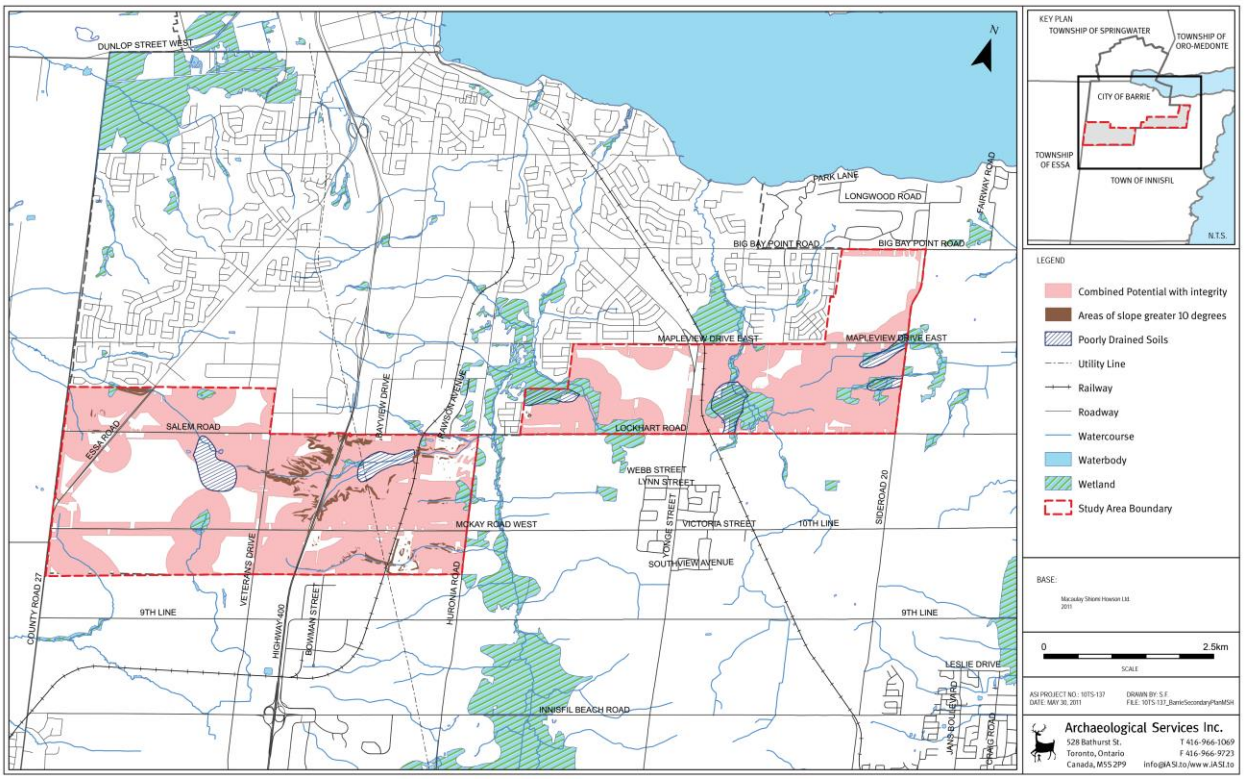
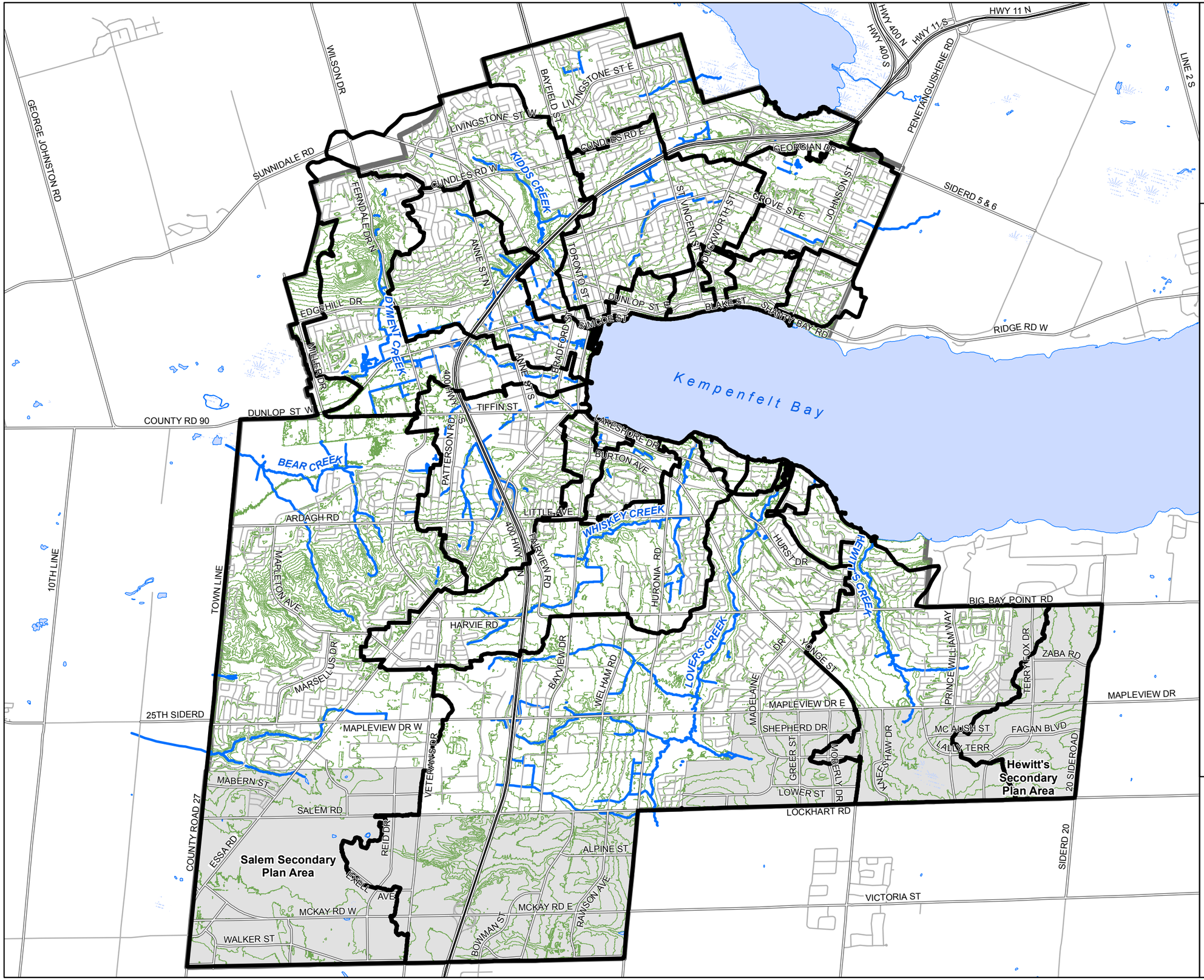


Figure 5-3 Areas of Archaeological Potential

Figure 5-2
City of Barrie
Watercourses



- Watershed Boundaries
- Watercourse
- Waterbody
- Wetland Area
- Secondary Plan Boundaries
- City of Barrie Limits

Elevation Contours

- 5m Contours

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Kilometers

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Updated: 4/4/2019

The archaeological assessment made the following recommendations:

- The three identified sites, Cleary, Paisley and McDonald, be subject to a Phase 3 archaeological assessment in order to fully identify the character, extent and significance of the archaeological deposits. The assessment would be completed in accordance with the Ministry of Tourism, Culture and Sports 2011 Standards and Guidelines for Consultant Archaeologists;
- A stage 3 archaeological assessment also be completed for the Lougheed site, as this site was identified as likely extending into the study area. This site is considered to be an archaeological resource of high heritage value;
- Stage 1 and 2 archaeological assessment were recommended for developments within the Study Area. These assessments would be conducted in accordance with the Ministry of Tourism, Culture and Sports 2011 Standards and Guidelines for Consultant Archaeologists; and,
- Should any archaeological resource be identified in the course of future, more extensive archaeological assessments of the study area, meaningful engagement with those Aboriginal groups who have an active interest in these resources and their treatment should be conducted during subsequent phases of the project.

In addition, the City of Barrie also completed a Stage 1 archaeological assessment for the City of Barrie Master Drainage Plan in 2018. The study identified areas of elevated archaeological potential and recommended that a detailed Stage 1 and 2 archaeological assessment when projects are proposed in the areas of elevated archaeological potential. **Figure 5-4** shows the location of areas identified as having elevated archaeological potential.

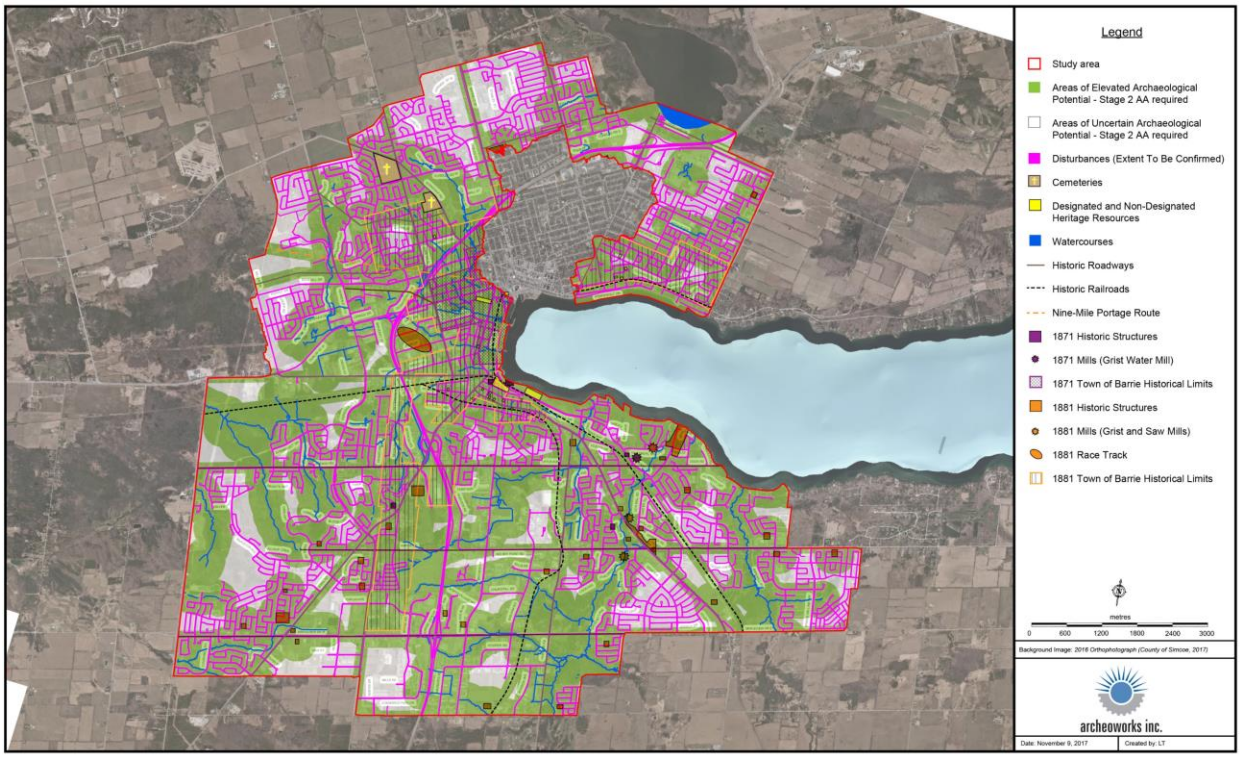


Figure 5-4 Areas of Elevated Archaeological Potential

Where sewer improvements of inflow and infiltration reduction projects are recommended and implemented through this Master Plan, a Stage 1 Archaeological Assessment should be completed as part of the preliminary design. It is noted that a completed Stage 1 Archaeological Assessment could identify the need for a Stage 2 archaeological assessment.

5.2 Existing Wastewater Collection System

The City of Barrie's existing wastewater collection system is presented in **Figure 5-5**. The current system is composed of local sanitary sewers, trunk sewers, sanitary pumping stations (SPSs) and the Wastewater Treatment Facility (WwTF). The system serves a mix of residential, commercial and industrial and institutional land uses for the entire urban area of Barrie of approximately 7,725ha.

There are some areas within the City which have been developed but are currently serviced by private septic systems. **Figure 5-6** identifies the location of these systems. The majority of septic systems shown in this figure may no longer be in use as municipal sanitary sewers are located on the roadway adjacent to the property. A review of the figure did identify a number of "clusters" of septic systems. Information on each cluster area is presented below:

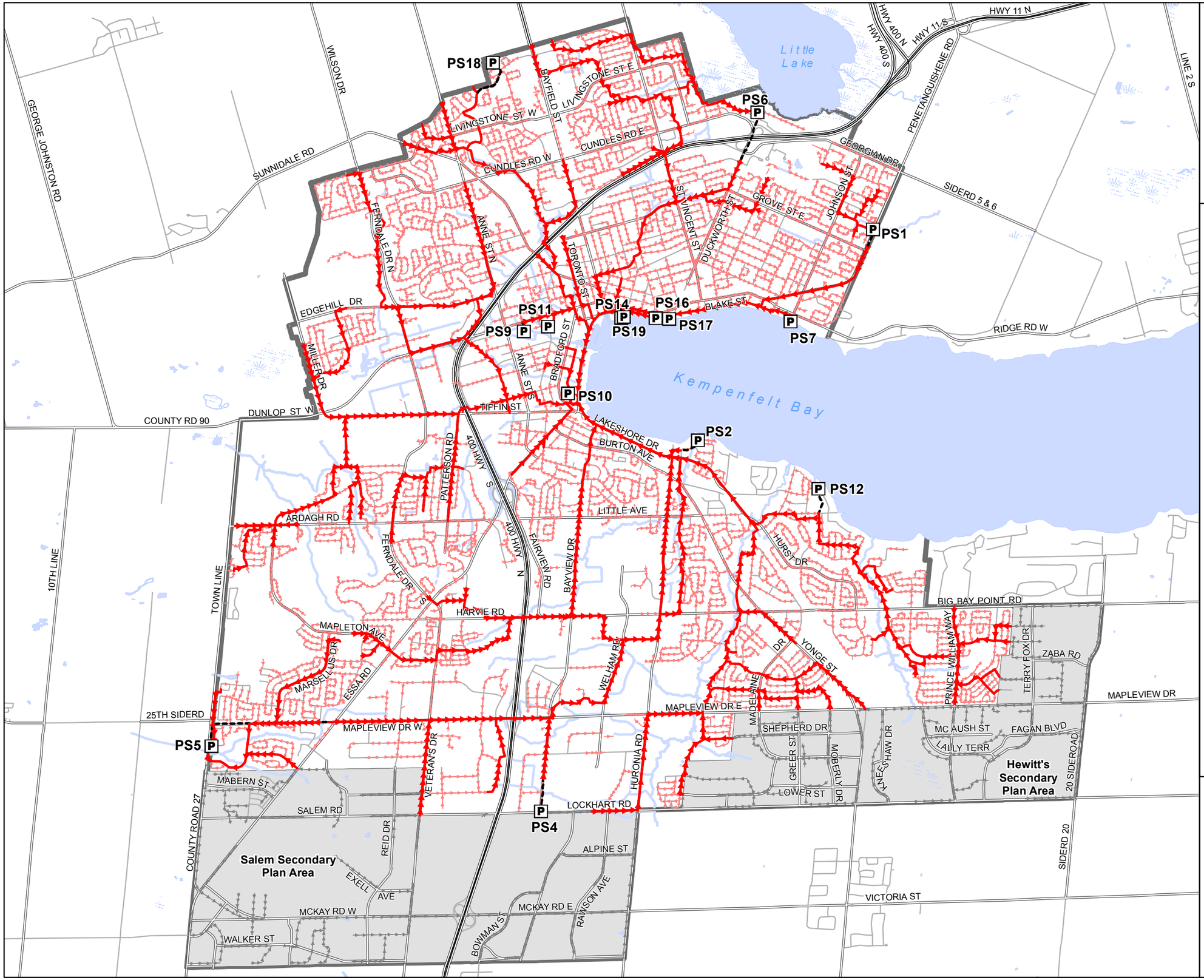
- There are a significant number of septic systems shown on Patterson Road, on the east side of Essa Road south of Mapleton and on the north side of Harvie east of Veterans Drive. It is expected that these systems are no longer in use as there are municipal sanitary sewers servicing these areas.
- There are a number of systems shown in the Painswick area on properties located on Merret Street, MacLaren, Garson and Foster Drive. Sanitary sewers have been proposed by the City for these streets.
- There are a number of systems shown in the Royal Oak area, east of Lovers Creek. The City has proposed sanitary sewers for this area.
- There are a number of systems shown in the vicinity of Bayshore Park on Cedar, Pine, Spruce, Walnut and Hickory. It is expected that these systems are no longer in use as there are existing sanitary sewers on these streets.
- There are a number of systems shown on Redfern Street south of Mapleview and west of Essa Road. It is recommended that the City consider new sanitary sewers for this area.
- It is also recommended that the City update its information on existing septic systems.

The total length of sewers in the City's collection system is approximately 540km, with 15 SPSs located throughout the City. Pipe materials for the local sewers include asbestos cement, concrete, HDPE, ductile iron, PVC and vitrified clay, with dates of construction ranging from 1952 to 2017. The City maintains a georeferenced wastewater collection system database which provided key information on the system elements including age, size, location and material.

5.2.1 Trunk Sewer System

The City's trunk sewer system collects wastewater from local sewers and conveys wastewater to the Barrie WwTF. The City defines trunk sewers as those having diameters of 450mm or greater. The City's trunk sewer range in diameter from 450mm to 1500mm. **Table 5.1** presents summary statistics for the City's trunk and sanitary sewer system.

Figure 5-5
City of Barrie
Existing Wastewater Collection System



- Pumping Stations
- Sanitary Trunk Sewer
- Forcemain
- Sanitary Sewer
- Future Annexed Lands Sewers
- Secondary Plan Boundaries
- City of Barrie Limits

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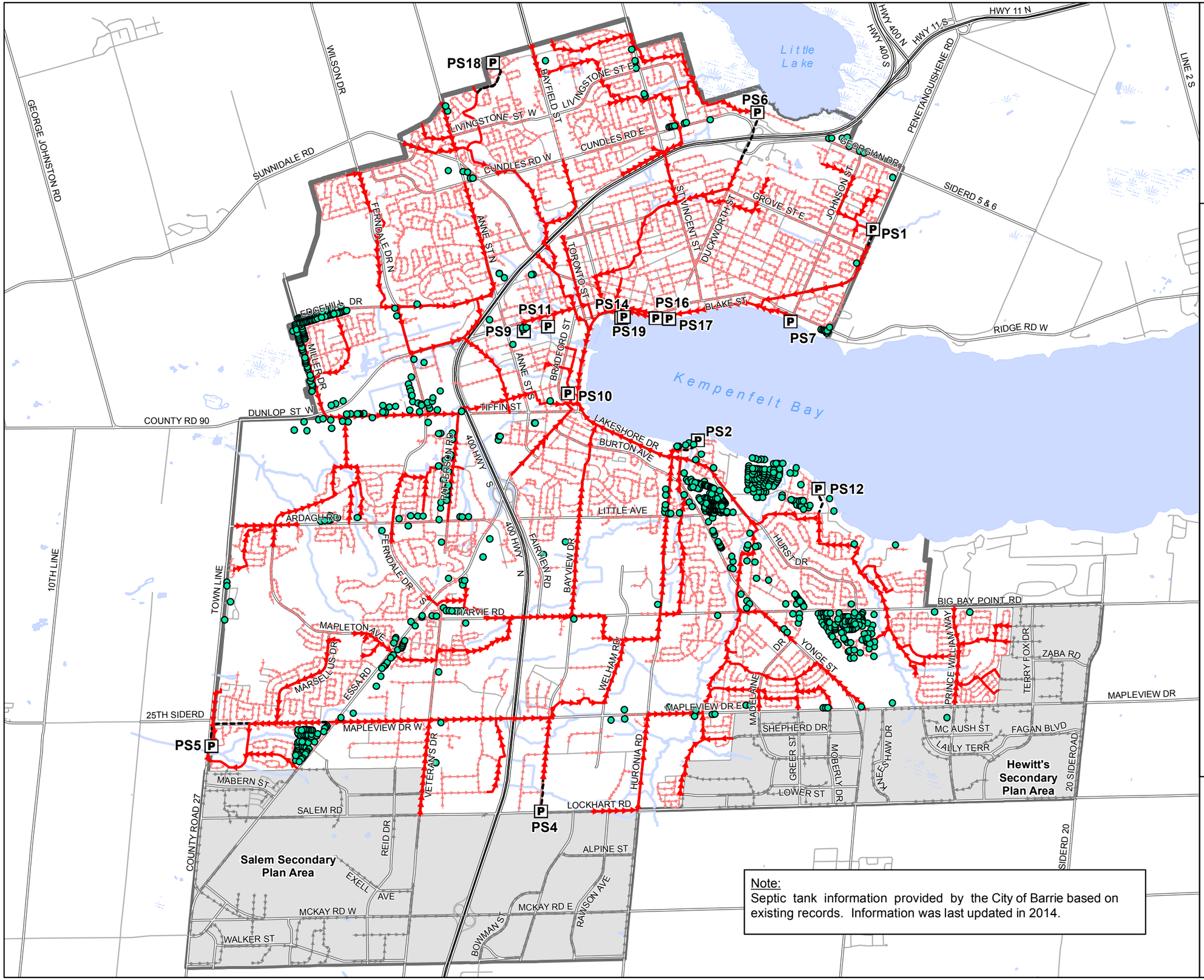
Kilometers

Updated: 4/4/2019



Note:
Septic tank information provided by the City of Barrie based on existing records. Information was last updated in 2014.

Figure 5-6
City of Barrie
Existing Septic Systems

- Active Septic Tanks
- Pumping Stations
- Sanitary Trunk Sewer
- Forcemain
- Sanitary Sewer
- Future Annexed Lands Sewers
- Secondary Plan Boundaries
- City of Barrie Limits

COLE

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Kilometers

Updated: 4/5/2019

Table 5.1 Model Sewer Statistics

Pipe Size Range (mm)	Pipe Length (km)
< 450	61.5
450-599	18.6
600 to 749	18.9
750 to 824	5.4
825 to 899	4.2
900 to 1049	2.6
1050 to 1199	6.7
Greater than 1200	4.0
Total	**122.1**

As part of the 2013 Wastewater Collection System Master Plan, a hydraulic model of the City's wastewater trunk sewer system was updated and utilized to determine future needs. This model was updated again as part of this Wastewater Collection System Master Plan. The updated model used for this study includes all trunk sewers as well as selected local sewers, where they were required for connectivity.

5.2.2 Pumping Stations

The City provided ECA documentation (Sanitary Sewage Collection System ECA) as well as drawings and/or design briefs for the majority of sewage pumping stations (SPS) in the City's wastewater collection system. The ECA for the Barrie WwTF was also provided, which documented the treatment facility influent pumping station (PS10). **Figure 5-7** shows the location and service area for each pumping station. **Table 5.2** presents a consolidated list of available and relevant information, including the rated capacity for each station.

Table 5.2 Pumping Station Information

Station	Number of Pumps	Rated Firm Capacity (L/s)1	Station Description and Data Reviewed
Grove Street Pumping Station (PS1)	2	157.8	• Station included in System Wide ECA. • Service area estimated to be 177.6ha. • Station discharges into a single 400mm diameter forcemain. • Station is equipped with an overflow to a storm detention pond or ditch. • Station contains two pumps, each with a nominal rated capacity of 157.8L/s at 10.0m TDH, 26kW. • Rectangular wet well with storage volume of 175m^3 • Station is equipped with 125 kW diesel generator set for standby power.

Table 5.2 Pumping Station Information

Station	Number of Pumps	Rated Firm Capacity (L/s)1	Station Description and Data Reviewed
			• Details on pumps, pump curves, pump settings, wet well and incoming sewers contained in Grove Street Sewage Pumping Station Design Brief (2003) and as-constructed drawings (1987). • Modelled peak flows (25-year design storm event) are estimated to be 53 L/s for existing conditions and 63 L/s for 2041 conditions.
Minets point Pumping Station (PS2)	2	61.3	• Station included in System Wide ECA. • Service area estimated to be 46.4ha. • Station discharges to a single 250mm diameter forcemain. • Station is not equipped with an engineered overflow. • Station contains two pumps, each with a nominal rated capacity of 61.3L/s at 60.0m TDH, 22kW. • Circular wet well with storage volume of 10.3m^3. • Station is equipped with 100 kW diesel generator set for standby power. • Details on pumps, pump curves, pumping settings, wet well and incoming sewers obtained from as-built drawings (1987). • Modelled peak flows (25-year design storm event) are estimated to be 22.1 L/s under existing conditions and 23.6 L/s under 2041 conditions.
Huronia Pumping Station (PS3)	3	91	• Station included in System Wide ECA. • Service area estimated to be 109.8ha. • Station discharges to a 400mm diameter forcemain. • Station is not equipped with an engineered overflow. Station is equipped with three pumps, each with a nominal rated capacity of 91L/s at 41.5m TDH, 66kW. • Rectangular wet well with storage volume of 65m^3. • Station is equipped with 150kW diesel generator set for standby power. • Details on pumps, wet well and incoming sewers obtained from as-constructed drawings (1988). • Station has recently been decommissioned.

Table 5.2 Pumping Station Information

Station	Number of Pumps	Rated Firm Capacity (L/s)1	Station Description and Data Reviewed
Lockhart Pumping Station (PS4)	2	51.4	• Station included in System Wide ECA. • Service area estimated to be 32.0ha. • Station discharges into a 200mm diameter forcemain. • Station is not equipped with an engineered overflow. • Station is equipped with two pumps, each with a nominal rated capacity of 51.4L/s at 17.5m TDH, 22kW. • Rectangular wet well with a storage volume of 18.9m^3. • Station is equipped with 70 kW diesel generator set for standby power. • Details on pumps, wet well and incoming sewers obtained from as-constructed drawings (1988). • Modelled peak flows (25-year design storm event) are estimated to be 26.6 L/s under existing conditions. • Station is planned to be decommissioned following construction of McKay Road Trunk Sewer prior to 2041.
Holly Pumping Station (PS5)	2	123.3 (existing) 200.9 (Upgraded Holly SPS)	• Station included in System Wide ECA. • Service area estimated to be 301.3ha. • Station discharges into a 325mm diameter forcemain. • Station is not equipped with an overflow. An overflow of the station may flood basements on Lougheed Road. • Station is equipped with two pumps, each with a nominal capacity of 123.3L/s at 33.75m TDH, 66kW. • Station is equipped with 200kW diesel generator set for standby power. • Details on existing pumps, wet well and incoming sewers obtained from as-constructed drawings (1994) and Condition Assessment Report (2010). • City has ongoing project to upgrade this station. Details on upgraded station including pumps, wet well and incoming sewers obtained from 90% design report (2017). Existing forcemain will also be twinned (400mm). • Upgraded pump station will be equipped with four pumps each with a nominal rated capacity of 67L/s.

Table 5.2 Pumping Station Information

Station	Number of Pumps	Rated Firm Capacity (L/s)1	Station Description and Data Reviewed
			• Upgraded pumping station will be equipped with two circular wet wells with a combined storage volume of 325m^3 and two emergency storage tanks with a combined storage volume of 829m^3. • Modelled peak flows (25-year design storm event) are estimated to be 67 L/s under existing conditions and 130 L/s under 2041 conditions.
Little Lake Pumping Station (PS6)	2	110	• Station included in System Wide ECA. • Service area estimated to be 165.0ha. • Station discharges to twin 450mm diameter forcemains. • Station is not equipped with an engineered overflow. • Station is equipped with two pumps, each with a nominal rated capacity of 110L/s at 46.66m TDH, 66kW. • Rectangular wet well with storage volume of 291m^3. • Station is equipped with 200 kW diesel generator set for standby power. • Details on pumps, wet well and incoming sewers obtained from as-constructed drawings (1997). • Modelled peak flows (25-year design storm event) are estimated to be 37 L/s under existing conditions and 42 L/s under 2041 conditions.
Johnson Beach Pumping Station (PS7)	1	unknown	• Station included in System Wide ECA. • Service area estimated to be 1.2ha. • Station discharges to a 100mm diameter forcemain. • Station is not equipped with an engineered overflow. • Station is equipped with one pump, with an unknown nominal rated capacity. • Station is not equipped with standby power. • ECA document provided (2009). • Modelled peak flows (25-year design storm event) are estimated to be 0.3 L/s under existing and 2041 conditions.
Perry Street Pumping Station (PS9)	2	7.3	• Station included in System Wide ECA. • Service area estimated to be 0.5ha.

Table 5.2 Pumping Station Information

Station	Number of Pumps	Rated Firm Capacity (L/s)1	Station Description and Data Reviewed
			• Station discharges to a 100mm diameter forcemain. • Station is equipped with two pumps, each with a nominal rated capacity of 7.3L/s at 9m TDH, 4kW. • Station is not equipped with standby power. • Station is not equipped with an engineered overflow. • Modelled peak flows (25-year design storm event) are estimated to be 0.2 L/s under existing and 2041 conditions.
Barrie WwTF Pumping Station (PS10)	5	2,025	• Station is included in the Barrie WwTF ECA. • Station includes five pumps, including one standby pump. Each pump has a nominal capacity of 34,650m^3/d. • Standby power for pumping station provided by Plant Emergency Standby Diesel Generator. Two Diesel Generators located in the Emergency Standby Generator Building, rated at approximately 1,400kW and 1,076kW, both are 3 phase 60hz 600/347V at 1800rpm. • Modelled peak flows (25-year design storm event) are estimated to be 1,736 L/s under existing conditions and 2,109 L/s under 2041 conditions. Peak flow estimates do not include recycle streams.
Innisfil Street Pumping Station (PS11)	1	unknown	• Station included in System Wide ECA. • Service area estimated to be 1.7ha. • Station discharges to a single 200mm diameter forcemain. • Station is equipped with one pump, with an unknown rated capacity. • Circular wet well with a storage volume of 0.4 m^3. • Station is not equipped with standby power. • Station is equipped with an overflow to Bunker`s Creek.
Tyndale Pumping Station (PS12)	2	10.6	• Station included in System Wide ECA. • Service area estimated to be 44.6ha.

Table 5.2 Pumping Station Information

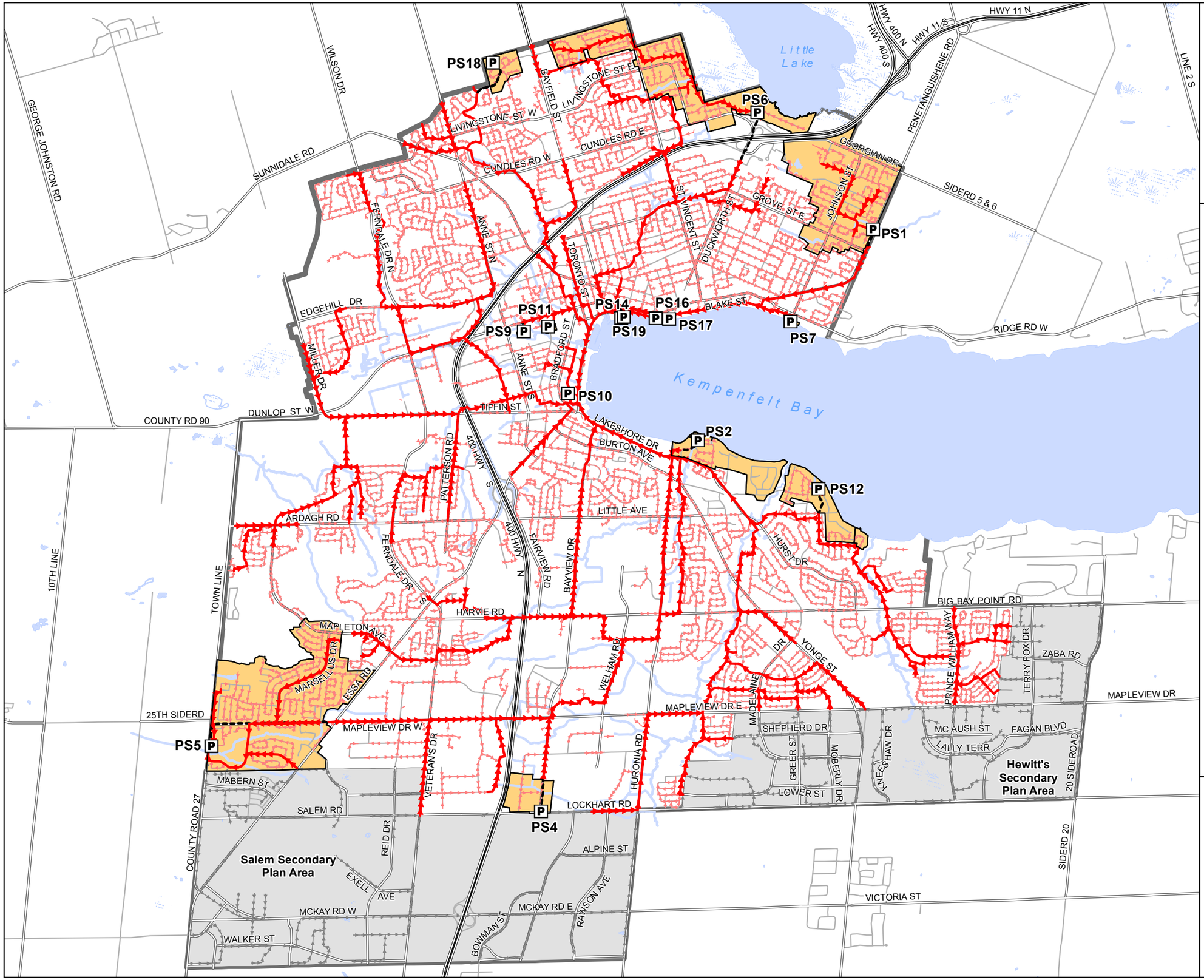
Station	Number of Pumps	Rated Firm Capacity (L/s)1	Station Description and Data Reviewed
			• Station discharges into a single 100mm diameter forcemain. • Station is equipped with two pumps, each with a nominal rated capacity of 10.6L/s at 16.1m TDH, 8kW. • Circular wet well with storage volume of Rectangular wet well with storage volume of 9.6 m^3. • Station is equipped with 45kW diesel generator set for standby power. • Station is not equipped with an engineered overflow. • Modelled peak flows (25-year design storm event) are estimated to be 10 L/s under existing conditions and 15 L/s under 2041 conditions.
Heritage Park Pumping Station (PS14)	2	3.9	• Station included in System Wide ECA. • Station services Heritage park washrooms. • Station discharges into a 60mm diameter forcemain. • Circular wet well with a storage volume of 2m^3. • Station is equipped with two pumps, each with a nominal rated capacity of 3.9L/s at 16.7m TDH, 4kW. • Station is not equipped with standby power. • Station is not equipped with an engineered overflow. • Modelled peak flows (25-year design storm event) are estimated as L/s for existing and 2041 conditions. • Modelled peak flows (25-year design storm event) are estimated to be 1.1 L/s under existing conditions and 2041 conditions.
Barrie Wall Pumping Station (PS16)	1	unknown	• Station included in System Wide ECA. • Pumping station pumps impacted groundwater from Barrier wall. • Station is equipped with one pump, with an unknown rated capacity. • Circular wet well with a storage volume of 1.4 m^3. • Station is not equipped with standby power. • Station is not equipped with an engineer overflow.

Table 5.2 Pumping Station Information

Station	Number of Pumps	Rated Firm Capacity (L/s)1	Station Description and Data Reviewed
			• Modelled peak flows (25-year design storm event) are estimated to be 0.9 L/s for existing and 2041 conditions.
Mooresgate Pumping Station (PS18)	2	20.7	• Station included in System Wide ECA. • Service area estimated to be 12.3ha. • Station discharges to 100mm diameter forcemain. • Station is equipped with two pumps, each with a nominal rated capacity of 12L/s at 20.7m TDH, 5kW. • Circular wet well with a storage volume of 1.8m^3. • Station is equipped with 60kW diesel generator set for standby power. • Station is not equipped with an engineered overflow. • Modelled peak flows (25-year design storm event) are estimated to be 8 L/s under existing conditions and 9 L/s under 2041 conditions.
Splash Pond Pumping Station (PS19)	2	8.7	• Station included in System Wide ECA. • Pumping station collects water services from the Heritage Park water facility and discharges into Lake Simcoe. • Station is equipped with two pumps, each with a nominal rated capacity of 8.7L/s at 4.5m TDH, 4kW. • Station is equipped with 350 kW diesel generator set for standby power.

All of the stations were represented in the updated hydraulic model. Detailed representations of PS1, PS2, PS3, PS4, PS4, PS5, PS6, PS10, PS12 and PS18 were included in the model as all information was available. Simplified representations for PS7, PS9, PS11, PS14, PS16 and PS19 were included in the model as key information for these stations was not available. It is recommended that the City collect the required information in future. It is also recommended that the City investigate the feasibility of eliminating PS9 (Perry PS) in future.

Figure 5-7
City of Barrie
Pumping Stations



5.2.3 Wastewater Treatment Facility Low Lift Pumping Station

The Barrie WwTF is located at 249 Bradford Street in the City of Barrie. The WwTF is a tertiary treatment plant that uses ultra violet disinfection to treat all sewage from the City of Barrie before discharging to Kempenfelt Bay. The facility receives domestic, commercial and industrial wastewater and provides a level of treatment to meet the water quality limits set for discharge of Lake Simcoe. The existing plant was recently expanded (2012) from a rated capacity of 57,100m³/d (660L/s) to 76,000m³/d (880L/s). The treatment system includes raw sewage pumping, influent works including screening and grit removal, primary clarification, aerobic digestion, secondary clarification, secondary effluent pumping, tertiary nitrification in rotating biological contactors (RBCs), chemically-assisted phosphorous removal, tertiary filtration and UV effluent disinfection. Treated effluent is discharged through a sewage outfall to Kempenfelt Bay. The Wastewater Treatment Plant Master Plan contains details of the treatment processes. For the Wastewater Collection System Master Plan, the raw sewage pumping station at the Barrie WwTF was included in the hydraulic model.

The following information for the raw sewage pumping station was obtained from the Barrie WwTF ECA (May 7th, 2013).

Raw Sewage Pumping Station

- Five raw sewage pumps, each rated at a nominal capacity of 34,560m³/d with an estimated firm peak flow capacity of 156,000m³/day (1806L/s);
- Two inlet channels complete with two automatic bar screens, peak flow of 55,000m³/d, each; and,
- Three inlet coarse grinder overflow channels complete with manually raked bar screens.

After entering the treatment plant, wastewater flows through coarse grinders to grind up any large objects to protect the lift pumps. Wastewater is then lifted up by the raw sewage pumps from the level of the incoming sewers to a higher elevation so that it may flow by gravity through the wastewater treatment facility.

It is noted that focus of the Wastewater Collection System Master Plan is on the wastewater system conveyance and pumping capacity. Integration with the Wastewater Treatment Master Plan allowed for considered of pumping capacity at the WwTF.

6 Existing Wastewater Collection System Performance

The following section presents the results of the assessment of the existing wastewater collection system performance. This Wastewater Collection System Master Plan included the collection of flow and rainfall data in the Barrie wastewater collection system to characterize existing flows, significant refinements to the City's wastewater collection system hydraulic model in PC-SWMM to predict flow responses in the system to specific rainfall events and assessment of collection system performance.

6.1 Flow and Rainfall Monitoring Results

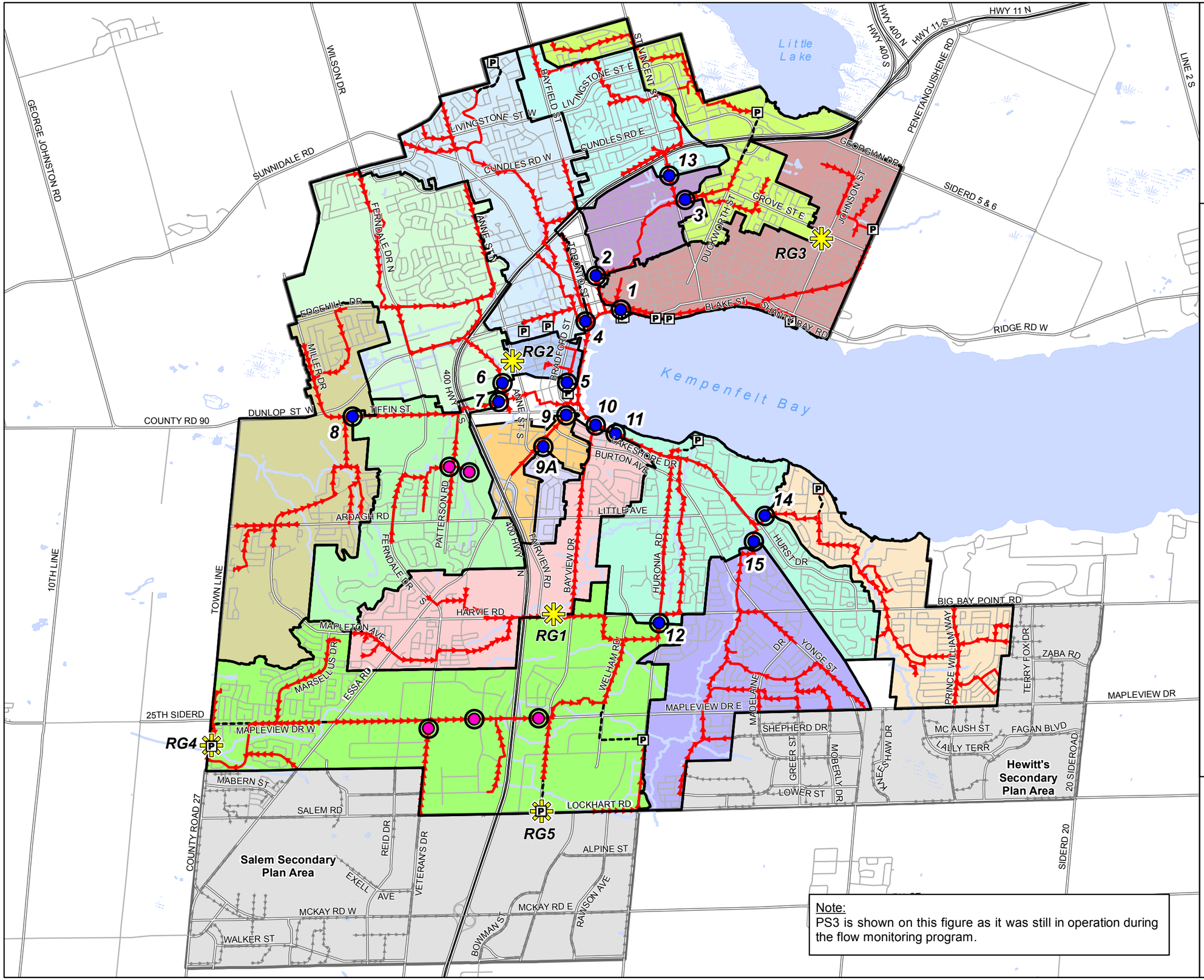
A sanitary flow monitoring program was conducted in 2017, consisting of the installation, calibration and maintenance of 15 flow monitors at strategic locations in the wastewater collection system for a period of 3-months. Accompanying rainfall data was collected across the City at five rainfall gauge locations.

Flow data was also collected by the City and was incorporated and considered in this Master Plan. The City collected flow, level and depth data at two sites in the sewer downstream of Bishop Drive on Alva Street from December to June 2017. The City also provided data collected at three sites on Mapleview Drive and Veterans Drive from June 2014 to July 2017.

The purpose of this monitoring program was to collect data for use in calibration of the updated and refined dynamic PC-SWMM model of the City's trunk sewer system, and identification of priority areas within the City for inflow and infiltration (I/I) reduction. Review of flow data was completed and key findings of the sewer and rainfall monitoring program is presented below.

Figure 6-1 presents the location and contributing area to each flow monitor, as well as the location of the City's rainfall gauges. **Table 6.1** Sanitary Sewer Flow Monitor Details presents information on each flow monitoring location. Over the course of the program, one site (Site 9) was relocated due to construction on Essa Road.

Figure 6-1
City of Barrie
Existing Flow and Rainfall Monitoring Locations



- City Flow Monitoring Locations
- Flow Monitoring Locations
- Pumping Stations
- Rain Gauges
- Sanitary Trunk Sewer
- Forcemain
- Future Annexed Lands Sewers
- Secondary Plan Boundaries
- City of Barrie Limits

Flow Monitoring Areas

Site ID, MH ID

- 1, SAL03240
- 2, SAN01001
- 3, SAN08001
- 4, SAC01034
- 5, SAI01079
- 6, SAI03004
- 7, SAI10002
- 8, SAI16009
- 9A, SAE01012
- 10, SAB01006
- 11, SAF01001
- 12, SAP29001
- 13, SAN05041
- 14, SAH01005
- 15, SAP14003
- 9, SAE03002

Note:
PS3 is shown on this figure as it was still in operation during the flow monitoring program.

COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Table 6.1 Sanitary Sewer Flow Monitor Details

Site ID	Maintenance Hole ID	Address	Monitoring Start Date	Monitoring End Date	Pipe Dia. (mm)
FM1	SAL03240	14 Lakeshore Drive	June 20, 2017	October 3, 2017	850
FM2	SAN01007	90 Bayfield Street	June 21, 2017	October 3, 2017	600
FM3	SAN08002	218 Grove Street, East	June 21, 2017	October 3, 2017	400
FM4	SAC02070	71 High Street	June 20, 2017	October 3, 2017	500
FM5	SAI01078	98 Ellen Street	June 22, 2017	October 3, 2017	600
FM6	SAI03002	77 Lorena Street	June 20, 2017	October 4, 2017	750
FM7	SAI10002	164 Brock Street	June 20, 2017	October 4, 2017	750
FM8	SAI16009	513 Tiffin Street	June 22, 2017	October 3, 2017	600
FM9	SAE01016	50 Essa Road	June 22, 2017	July 4, 2017	500
FM9A	SAE03002	Intersection of Innisfil Street and Holgate Street	July 12, 2017	October 4, 2017	300
FM10	SAB01006	166 Lakeshore Drive (Burton Ave / Essa Road)	June 20, 2017	October 4, 2017	600
FM11	SAF01002	248 Lakeshore Drive	June 22, 2017	October 4, 2017	1200
FM12	SAP29001	412 Huronia Road	June 21, 2017	October 5, 2017	750
FM13	SAN05041	338 St. Vincent Street	June 21, 2017	October 3, 2017	400
FM14	SAH01005	Hurst Trail	June 20, 2017	October 5, 2017	1000
FM15	SAP14002	261 Coxmill Road	June 20, 2017	October 5, 2017	1050

Over the course of the program, flow, depth and velocity measurements were taken at 5-minute increments at each location.

Flow data was also collected in a 250mm diameter sanitary sewer located west of the intersection of Morrow Road and Patterson Drive and in a 250mm diameter sanitary sewer on Bishop Drive north of Ardagh. Velocity, depth and flow data were collected at these locations for a 5-month period extending

from December 14th, 2017 to June 4th, 2018. Flow data was collected in the 450mm diameter sanitary sewer on Veterans Drive south of Mapleview Drive, in the 600mm diameter sanitary sewer on Mapleview Drive east of Veterans Drive and in the 600mm diameter Mapleview Drive sanitary sewer east of Bryne Drive. This data was collected from June 2014 to July 2017 and was provided by the City.

All collected data were reviewed in detail to select periods appropriate for use in model calibration and validation. The data review and selection of periods for use in calibration is described in the following section.

6.1.1 Data Analysis and Selection of Calibration Events

The data analysis methodology for dry weather flow included the following activities:

- Rainfall data recorded at the five rainfall stations were reviewed to define dry and wet weather periods. Days were defined as dry if no rainfall was recorded within the previous 72-hours;
- Dry weather periods were isolated for each sanitary flow monitoring location. Select dry weather days were combined to define a typical 24-hour dry weather flow pattern;
- Average, base and peak dry weather flow values were determined from the typical diurnal flow at each sanitary location;
- A constant rate of groundwater infiltration was defined for each flow monitoring location. As is common industry practice, this value was determined as 85% of the minimum night time dry weather flow. It is assumed that at this time the wastewater generation rate is minimal; and,
- Sanitary flow was calculated for each flow monitoring location based on the average dry weather flow less groundwater infiltration.

The data analysis methodology for wet weather flow included the following activities:

- Each flow monitoring site was assigned a rainfall gauge to facilitate analysis. To select the appropriate rain gauge, theissen polygons were used. Review of precipitation data indicates that, in particular for large rainfall events, rainfall characteristics were similar across the City and at rainfall gauges in close proximity to each other;
- Flow monitoring data was isolated for rainfall events, where the rainfall volume exceeded 10mm;
- The monitoring data were reviewed for quality and completeness for each identified period corresponding to wet weather events to determine if the data was suitable for use in analysis;
- Wet weather flow in the sanitary system was isolated by subtracting the typical dry weather flow time-series from the recorded flow time-series during and following a rainfall event until the measured flow returned to dry weather flow levels. The difference between the two curves represents the wet weather flow response that can be attributed to rainfall derived infiltration and inflow (RDII). RDII statistics, such as peak RDII rate and volume, were calculated for each rainfall event;
- The wet weather flow volume was divided by the total rainfall volume over the tributary area to determine the Volumetric Runoff Coefficient (Cv). The Cv value provides the percentage of

rainfall that becomes wet weather flow in the sanitary sewer. By considering a range of rainfall events, the average Cv value provides an indication of the typical wet weather response of a given area; and,

- The peak RDII rate is a measure of the peak flow response based on the maximum flow during a 5-minute time period in the event. Comparison of measured peak RDII rates with the City's design allowance for infiltration of 0.1L/s/ha allows areas to be identified where peak wet weather flows exceed the design allowance for infiltration and therefore, where capacity issues may exist.

6.2 Model Refinements

As part of the 2013 Wastewater Collection System Master Plan, a dynamic hydraulic model that utilized the PC-SWMM software was updated. This model was reviewed as part of this Wastewater Collection System Master Plan. A number of issues were identified as follows:

- The model represented trunk sewers and local sewers as per 2013 conditions;
- The model contained representation of major pumping stations only; and,
- Although a sub-catchment structure was developed as part of the study, it was not input into the model. Instead, flows were generated for each sub-catchment in a series of spreadsheets using population, land use, area, wastewater flow generation rates, the Harmon peaking factor and an I/I allowance and input into the model as constant flows. It is noted that adjustments were made to peaking factors for downstream sub-catchment inputs to reflect the fact that peaking factors decrease as population increases.

To address the above issues and update the model to represent 2017 conditions, a comprehensive dataset, including GIS data, was obtained from the City. Based on analysis and review of the received data, the following refinements were made:

- Trunk and sanitary sewer data were reviewed and updated to represent 2017 conditions;
- Representation of the current pumping stations was updated to reflect modifications made by the City as well as to add pumping curves and operational levels to allow for better representation of these stations. All of the City's pumping stations were represented in the model. For PS1, PS2, PS3, PS4, PS5, PS6, PS10, PS12 and PS18, detailed representations were included in the model. For PS7, PS9, PS11, PS14, PS16 and PS19, representation of the stations was simplified as key information was not available. It is recommended that the City collect the required information in future.
- The 2013 sub-catchment structure was reviewed and updated to reflect 2017 conditions. Updated sub-catchments were added as model elements. Key attribute data including population, land use and area were developed from GIS. Water demand data was also consolidated for each sub-catchment based on data developed as part of the Water Distribution System Master Plan;
- Wet weather flow generation functionality was added into the model with selection of the RTK approach for wet weather flow generation in response to rainfall events. RTK is a unit hydrograph approach that allows for prediction of a fast, medium and slow infiltration response to rainfall; and,

- The developed model was calibrated for both dry and wet weather conditions using flow and rainfall data collected in 2017.

6.3 Model Development and Calibration

Model calibration and validation of the model was conducted in accordance the WaPUG and CIWEM calibration and validation criteria, which were reviewed and adopted for this project. The WaPUG and CIWEN model calibration and validation criteria are considered to be industry best practice for the calibration and validation of a sanitary sewer hydraulic model. The following criteria were used for dry weather model calibration:

- Match modelled peak flows to measured peak flows within - 10% to +10%;
- Match modelled peak depths to measured peak depths within - 10% to +10%;
- Match daily flow volumes to measured daily flow volumes within - 10% to +10%; and,
- Match time of peak and time of trough to within 1-hour.

The following criteria were used for wet weather model calibration:

- Match modelled peak flows to measured peak flows within - 15% to +25%;
- Match modelled peak depths to measured peak depths within 100mm for unsurcharged sewers;
- Match modelled peak depths to measured peak depths within 0.5m in any surcharged sewer;
- Match modelled event volumes to measured event volumes within - 10% to +20%; and,
- Match the shape of the hydrograph.

Dry weather flow calibrations were completed with flow data collected at fourteen sites. In general, the dry weather flow calibration results showed the model to be well calibrated to observed flows as the above noted criteria were achieved for all but two sites. Volume criteria were achieved for all sites with the exception of FM10 and FM11 which were slightly below the desired criteria range. On the basis of the results, the model was considered to be sufficiently calibrated to accurately predict dry weather flows.

Wet weather flow calibrations were also completed with data collected at fourteen flow monitoring sites and the results compared against the wet weather flow calibration criteria. It was decided to focus on the larger rainfall events as the model would be used to assess system performance. In general, model calibration criteria were met at all sites. On the basis of calibration results, the model was considered to be sufficiently calibrated to reasonably predict wet weather flows. The calibrated model was further assessed through wet weather validation. Following calibration, the model was validated with an independent database. Following the completion of validation, the model was determined to be sufficiently validated. Based on the results of the calibration and validation, the model was deemed to be suitably calibrated to assess system performance.

It is noted that the model was calibrated and validated using flow and rainfall data collected over a three month period. This was a relatively short program to collect the data necessary. One of the rainfall events used in calibration had an estimated return period of 5 years. However, all other rainfall events had return periods less than that of a 2-year design storm event. As the capacity assessment was completed for a 25-year design storm event, model results are considered to be extrapolated. To improve confidence in the model results, a longer period of flow monitoring data collected would be beneficial. During a longer

period, flow data could be collected for a larger range of rainfall events. This type of flow data collection could be integrated into the implementation of the recommended projects.

6.4 Existing System Performance

Once the calibrated and validated, the model was used to assess dry and wet weather system performance. The following sections provide the results.

6.4.1 Existing Wastewater Collection System Dry Weather Flow System Performance

Figure 6-2 presents the system performance under peak dry weather flow conditions. In reviewing **Figure 6-2** the following was observed:

- There were no sewer capacity issues identified under dry weather flow conditions;
- The model predicted surcharge conditions in select pipes located directly upstream of SPSs. This is typical of flows upstream of pumping stations and is not believed to indicate sewer capacity issues; and,
- There were several sections of sewer where the freeboard (distance between the ground surface and peak hydraulic grade line) is less than 1.8m. A freeboard less than 1.8m is typically an indication of a risk of basement flooding. Further review of these sections identified that surcharge conditions are not predicted and that these are shallow sewers where the distance between the sewer obvert and the ground surface is less than 1.8m. These stretches included the trunk sewer along Ferndale Drive north of Edgehill Drive, through Arboretum Sunnidale Park and south of Dunlop Street and east of Mulcaster Street. As there is no surcharge, it was concluded that these trunk sewers were located in low lying areas and were designed as shallow trunk sewers. As a result, the model does predict that they operate as designed and do not represent a capacity issue.

On the basis of the above model results, the existing system has adequate capacity to convey existing peak dry weather flows.

6.4.2 Existing Wastewater Collection System Wet Weather Flow System Performance

To assess the performance of the system under wet weather flow conditions, rainfall to represent a series of design storm events were used. Rainfall hyetographs were constructed based on the City's IDF curves for a 2-year, 5-year, 10-year and 25-year storm event and used as input into the model.

The following sections present the results of the capacity assessment completed for existing conditions with these rainfall inputs.

6.4.2.1 2-Year Storm Existing System Performance

Figure 6-3 presents the existing system performance under a 2-year design storm rainfall event. A review of **Figure 6-3** identified the following:

- The model predicted surcharge conditions with a freeboard of less than 1.8m in the section of trunk sewer south of the Bear Creek Eco Park (between Ferndale Drive S and Elizabeth Street). In this trunk sewer, three maintenance holes had a predicted freeboard of less than 1.8m with surcharge conditions;

- The model predicted surcharge conditions of select pipes located directly upstream of SPSs. This is typical upstream of pumping stations and is not believed to indicate capacity issues;
- There are several stretches of sewer where the freeboard is less than 1.8m. Further review of these sections identified that surcharge conditions are not predicted. These stretches included the trunk sewer along Ferndale Drive north of Edgehill Drive, through Arboretum Sunnidale Park and south of Dunlop Street and east of Mulcaster Street. As there is no surcharge, it was concluded that these trunk sewers were located in low lying areas and were designed as shallow trunk sewers. As a result, the model does predict that they operate as designed and do not represent a capacity issue;
- Trunk sewer sections, with diameters greater than 375mm and where the d/D is greater than 0.7, include sanitary trunk sewers on Lakeshore Trunk Sewer south, on Bayfield, on Mapleview east of Essa, on Penetanguishine Road and on Tiffin from Miller to Patterson. The d/D for all of these sewers was greater than 0.7; and
- Sanitary sewers, with diameters of 375mm and less, where the d/D was greater than 0.5 include sanitary sewers on Mapleton and on White Oaks Road.

On the basis of the above results, the existing system generally has adequate capacity to convey existing peak wet weather flows resulting from a 2-year design storm event. A capacity constraint was identified in the trunk sewer south of the Bear Creek Eco Park between Ferndale Drive S and Elizabeth Street. It is noted that trunk and sanitary sewers were identified where the City's level of service is not met.

6.4.2.2 5-Year Storm Existing System Performance

Figure 6-4 presents the system performance under a 5-year design storm event. A review of **Figure 6-4** identified the following:

- The model predicted surcharging with a freeboard of less than 1.8m in the section of trunk sewer south of the Bear Creek Eco Park (between Ferndale Drive S and Elizabeth Street). In this trunk sewer, eight maintenance holes had a predicted freeboard of less than 1.8m with surcharge conditions. This area was also identified as a capacity constraint for the 2-year design storm event;
- The model predicted surcharging of select pipes located directly upstream of SPSs. This is typical of flows upstream of pumping stations and is not believed to indicate sewer capacity issues;
- There are several stretches of sewer where the freeboard is less than 1.8m. Further review of these sections identified that surcharge conditions are not predicted. These are shallow sewers, where the sewer obvert is within 1.8m of the ground surface. These stretches included the trunk sewer along Ferndale Drive north of Edgehill Drive, through Arboretum Sunnidale Park and south of Dunlop Street and east of Mulcaster Street. As there is no surcharge, it was concluded that these trunk sewers are located in low lying areas and were designed as shallow trunk sewers. As a result, the model does predict that they operate as designed and do not represent a capacity issue;
- Trunk sewer sections, with diameters greater than 375mm, where the d/D is greater than 0.7 include sections in the easement south of Tiffin, Lakeshore Drive south, on Bayfield, on Mapleview east of Essa, on Miller, on Penetanguishine Road and on Tiffin. The d/D for all of these sewers was greater than 0.7; and,

- Sanitary sewers, with diameters of 375mm and less, where the d/D was greater than 0.5 include sanitary sewers on Mapleton and on White Oaks Road.

On the basis of the above results, the existing system generally has adequate capacity to existing peak wet weather flows resulting from a 5-year design storm event. A capacity constraint was identified in the trunk sewer located south of the Bear Creek Eco-Park between Ferndale Drive South and Elizabeth Street. It is noted that trunk and sanitary sewers were identified where the City's level of service was not met.

6.4.2.3 10-Year Storm Existing System Performance

Figure 6-5 presents system performance under a 10-year design storm event. In reviewing **Figure 6-5** the following was observed:

- The model predicted surcharging with a freeboard of less than 1.8m in the section of trunk sewer south of the Bear Creek Eco Park (between Ferndale Drive S and Elizabeth Street). In this trunk sewer, eight maintenance holes had a predicted freeboard of less than 1.8m with surcharge conditions. This area was also identified as a capacity constraint for the 2-year and 5-year design storm events;
- The model predicted surcharging of select pipes located directly upstream of SPSs. This is typical of flows upstream of pumping stations and is not believed to indicate sewer capacity issues;
- There are several stretches of sewer where the freeboard is less than 1.8m. Further review of these sections identified that surcharge conditions are not predicted. These are shallow sewers, where the sewer obvert is within 1.8m of the ground surface. These stretches included the trunk sewer along Ferndale Drive north of Edgehill Drive, through Arboretum Sunnidale Park and south of Dunlop Street and east of Mulcaster Street. As there is no surcharge, it was concluded that these trunk sewers are located in low lying areas and were designed as shallow trunk sewers. As a result, the model does predict that they operate as designed and do not represent a capacity issue;
- Trunk sewer sections, with diameters greater than 375mm, were identified where the d/D was greater than 0.7. These sections were located on the easement south of Tiffin, on Lakeshore south of the WwTF, on Bayfield, on Mapleview east of Essa, on Miller, on Penetanguishine Road, and on Tiffin. The d/D for all of these sewers was greater than 0.7; and,
- Sanitary sewers, with diameters of 375mm and less, where the d/D was greater than 0.5 include sanitary sewers on Mapleton and on White Oaks Road.

On the basis of the above results, the existing system generally has adequate capacity to existing peak wet weather flows resulting from a 10-year design storm event. A capacity constraint was identified in the trunk sewer located south of the Bear Creek Eco-Park between Ferndale Drive South and Elizabeth Street. It is noted that trunk and sanitary sewers were identified where the City's level of service was not met.

6.4.2.4 25-Year Storm Existing System Performance

Figure 6-6 presents system performance under a 25-year design storm event. In reviewing **Figure 6-6** the following was observed:

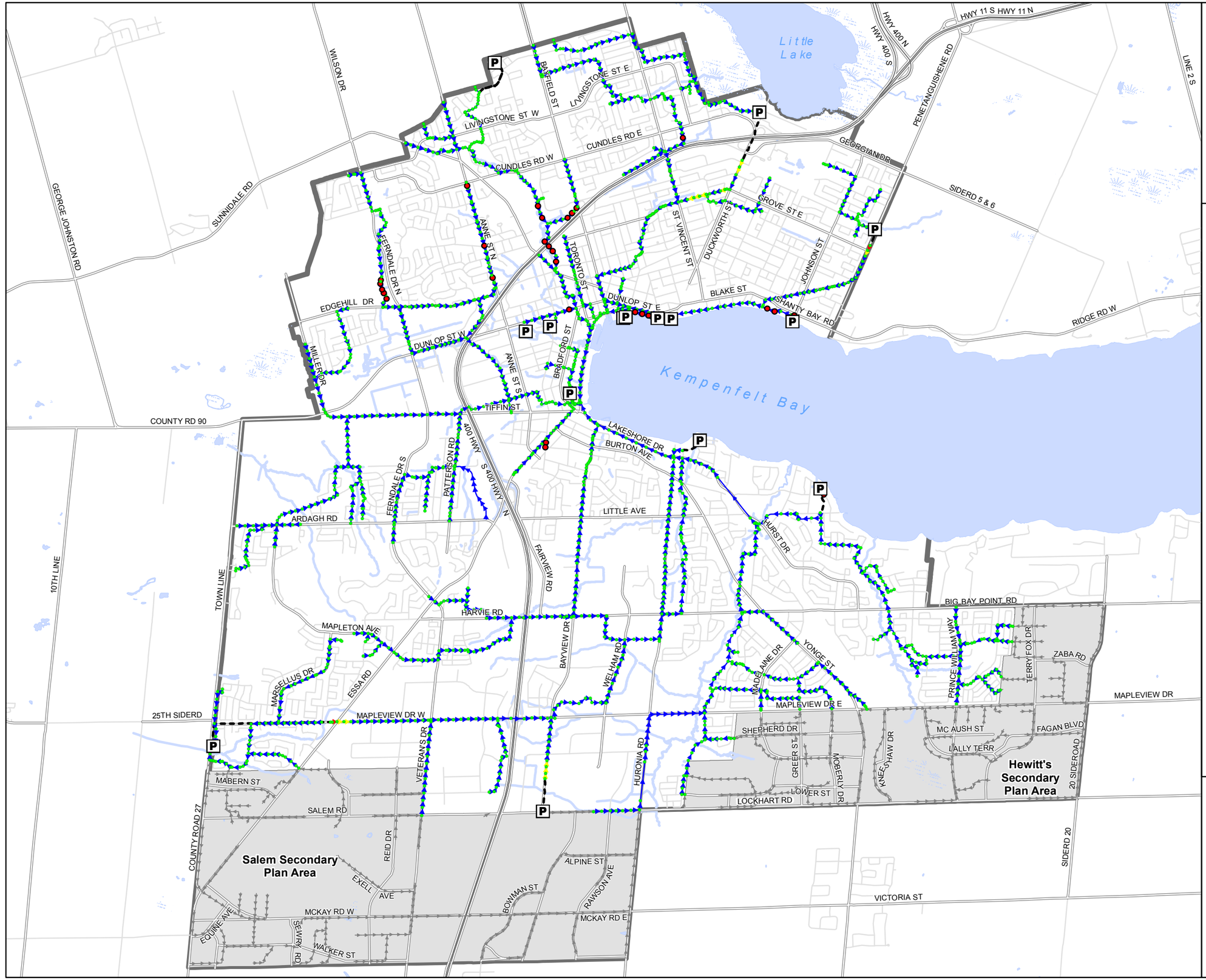
- The model predicted surcharging with a freeboard of less than 1.8m in the section of trunk sewer south of the Bear Creek Eco Park (between Ferndale Drive S and Elizabeth Street). In this trunk sewer, nine maintenance holes had a predicted freeboard of less than 1.8m with

surcharge conditions. This area was also identified as a capacity constraint for the 2-year, 5-year and 10-year design storm events;

- The model predicted surcharging of select pipes located directly upstream of SPSs. This is typical of flows upstream of pumping stations and is not believed to indicate sewer capacity issues;
- There are several stretches of sewer where the freeboard is less than 1.8m. Further review of these sections identified that surcharge conditions are not predicted. These are shallow sewers, where the sewer obvert is within 1.8m of the ground surface. These stretches included the trunk sewer along Ferndale Drive north of Edgehill Drive, through Arboretum Sunnidale Park and south of Dunlop Street and east of Mulcaster Street. As there is no surcharge, it was concluded that these trunk sewers are located in low lying areas and were designed as shallow trunk sewers. As a result, the model does predict that they operate as designed and do not represent a capacity issue; and,
- Trunk sewer sections, with diameter greater than 375mm, were identified where the d/D was greater than 0.7 included sections in the easement south of Tiffin, on Lakeshore south of the WwTF, on Bayfield, on Mapleview east of Essa, on Miller, on Penetanguishine Road, on Tiffin from Miller to Patterson and on Townline Road. The d/D for all of these sewers was greater than 0.7.
- Sanitary sewers, with diameters of 375mm and less, where the d/D was greater than 0.5 include sanitary sewers on Mapleton, Penvil Trail and on White Oaks Road.
- A review of the flow timeseries for the 25-year design storm event, shows that the peak flow reached the Barrie WwTF approximately 3 hours after the peak rainfall occurred. This quick response, indicates that there are direct connection or inflow sources within the system that allow stormwater to enter the sanitary sewer system.

On the basis of the above results, the existing system generally has adequate capacity to existing peak wet weather flows resulting from a 25-year design storm event. A capacity constraint was identified in the trunk sewer located south of the Bear Creek Eco-Park between Ferndale Drive South and Elizabeth Street. It is noted that trunk and sanitary sewers were identified where the City's level of service was not met.

Figure 6-2
City of Barrie
Existing Wastewater Collection System Performance
Peak Dry Weather Flow Conditions



- Pumping Stations
- Secondary Plan Boundaries
- City of Barrie Limits
- Forcemain
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

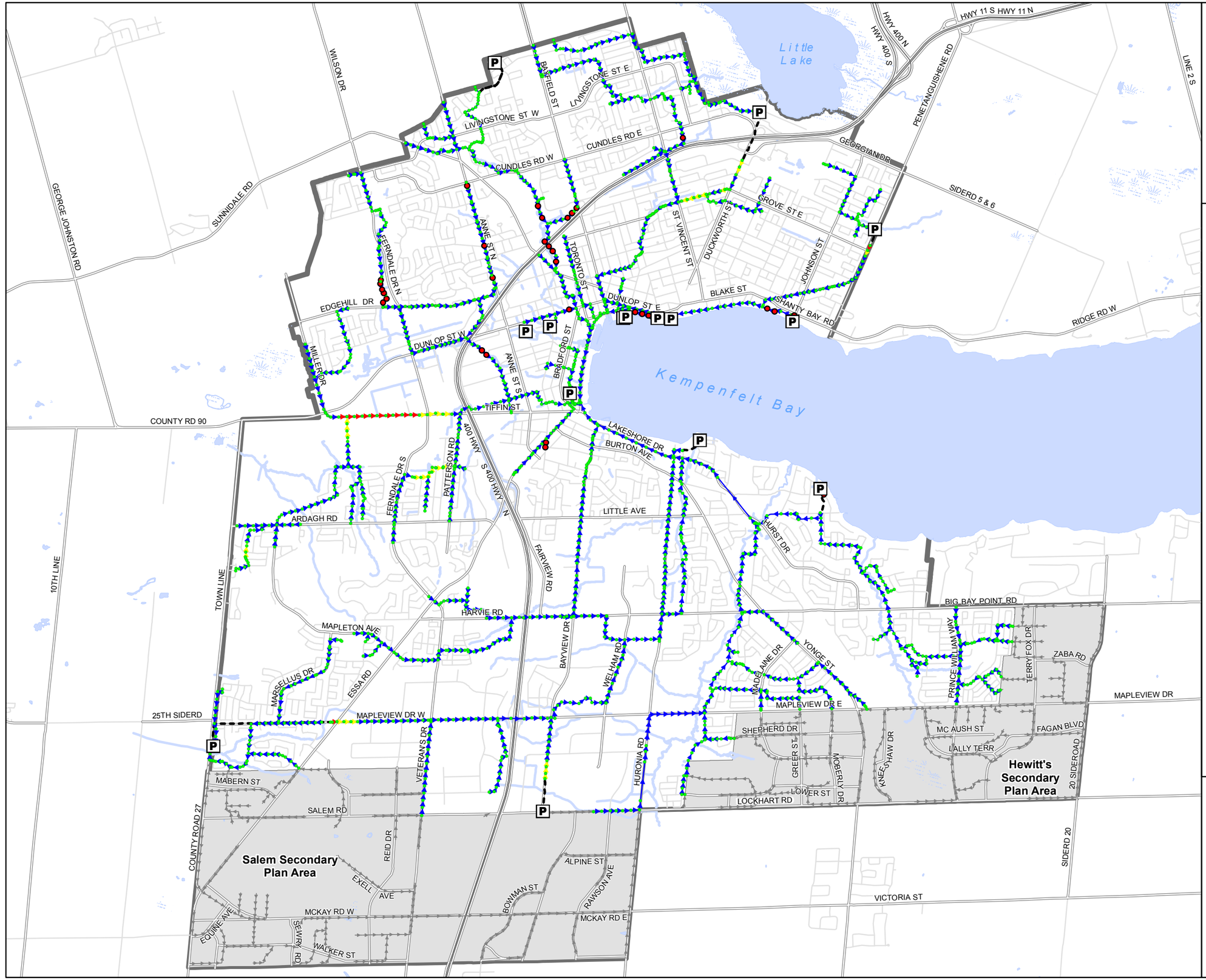
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 6-3
City of Barrie
Existing Wastewater Collection System Performance
Wet Weather Flow Conditions
(2 Year Storm Event)



- Pumping Stations
- Secondary Plan Boundaries
- Forcemain
- Future Annexed Lands Sewers
- City of Barrie Limits

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

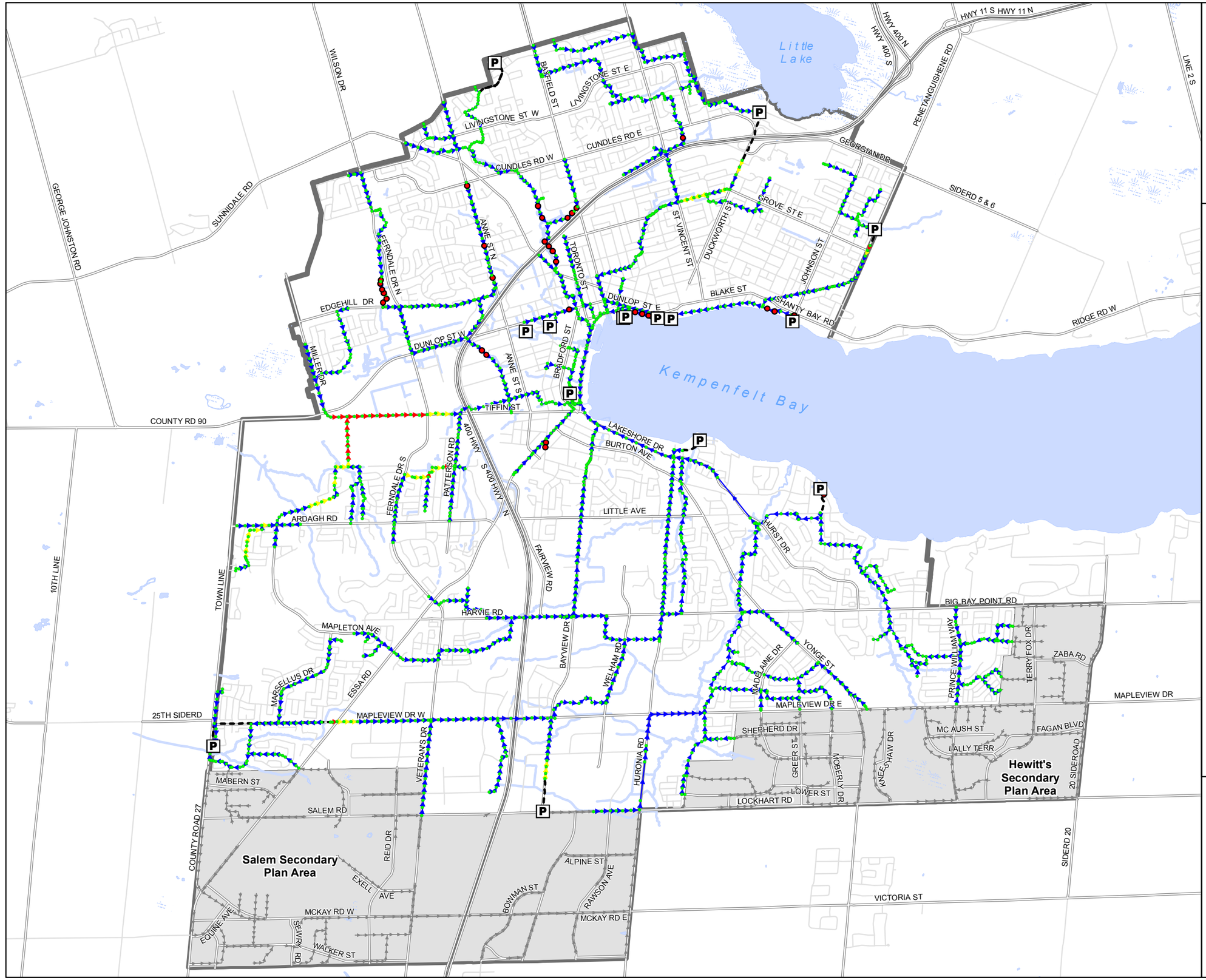
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 6-4
City of Barrie
Existing Wastewater Collection System Performance
Wet Weather Flow Conditions
(5 Year Storm Event)



- Pumping Stations
- Secondary Plan Boundaries
- City of Barrie Limits

Sanitary Collection System

- Forcemain
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

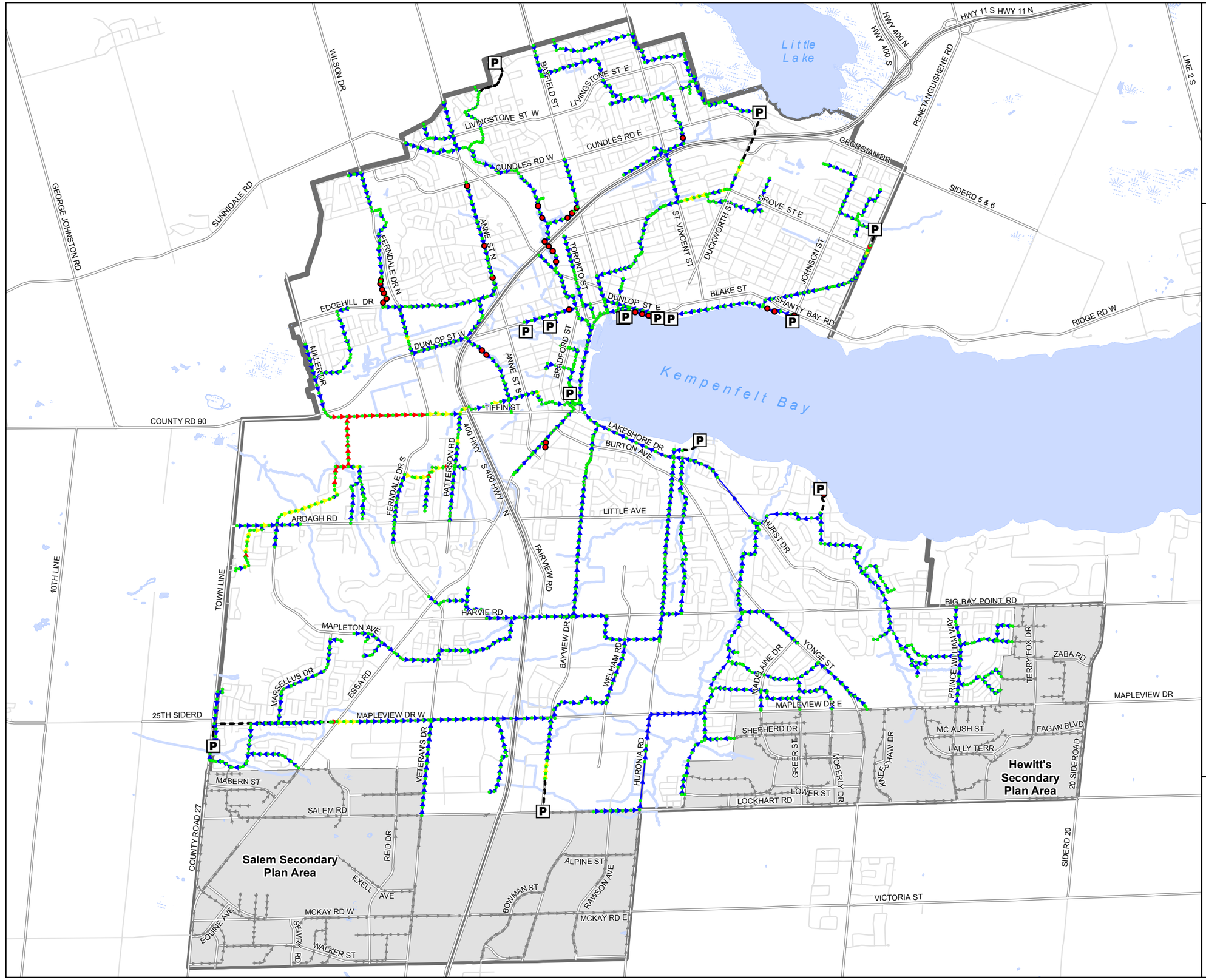
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 6-5
City of Barrie
Existing Wastewater Collection System Performance
Wet Weather Flow Conditions
(10 Year Storm Event)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

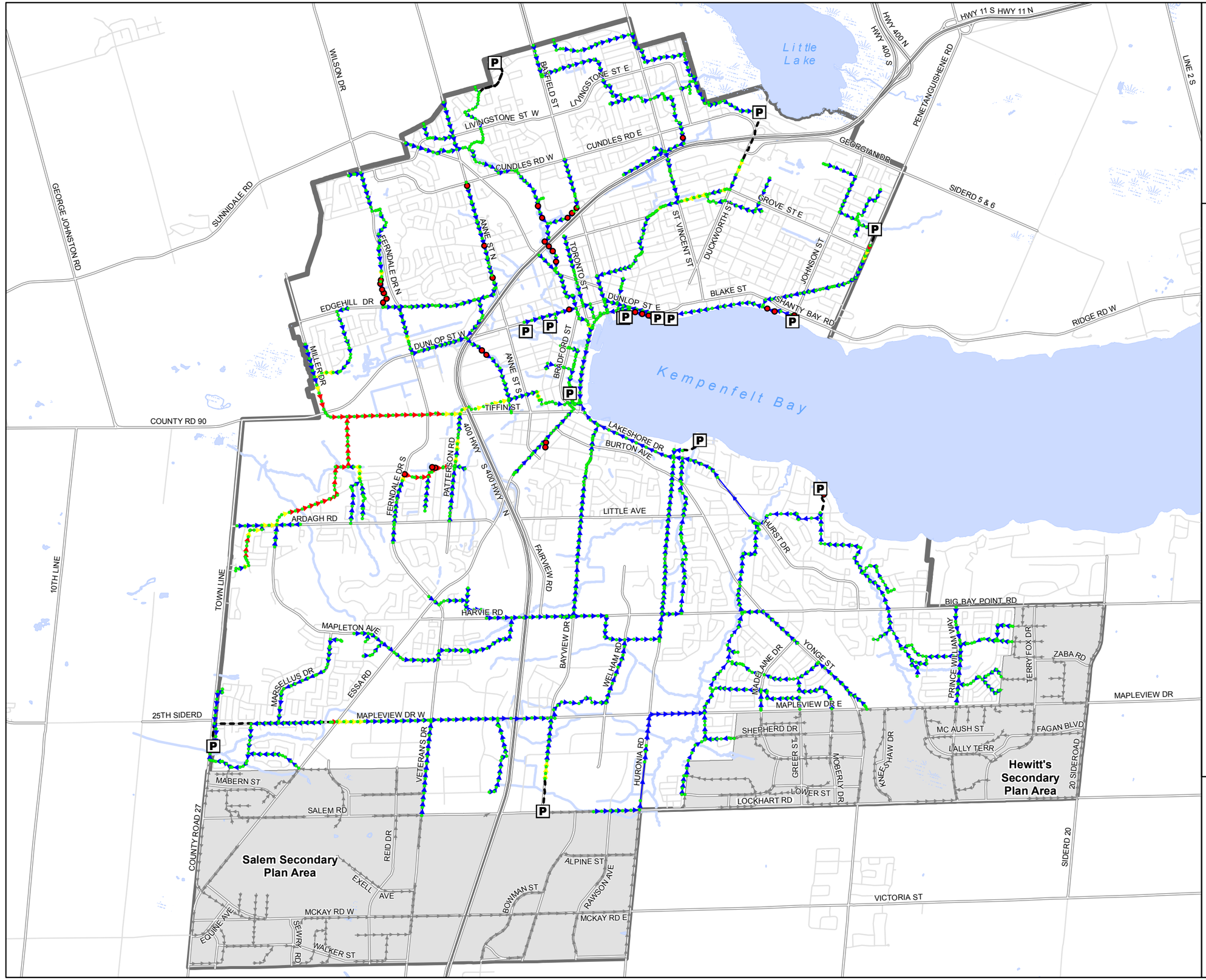
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 6-6
City of Barrie
Existing Wastewater Collection System Performance
Wet Weather Flow Conditions
(25 Year Storm Event)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

NewFreebrd25yr

- <= 1.8m
- > 1.8m

NewMaxFullDpth25yr

- < 0.5
- 0.5 - 0.7
- > 0.7

COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

6.4.3 Existing System Pump Station Capacity Assessment

The model was also utilized to assess the capacity of the existing pumping stations to pump peak flows within the system. **Table 6.2** presents a comparison of the station rated capacities with peak flows entering each station during peak dry conditions and wet weather conditions during a 2-year, 5-year, 10-year and 25-year design storm event. It is noted that the Barrie WwTF PS, located at the Barrie WwTF, is also included in **Table 6.2**. It should be noted that the Barrie WwTF PS receives flow from a number of recycle streams and that values shown in **Table 6.2** do not include any recycle stream flows.

Table 6.2 Modelled Peak Flow Conveyed to Pumping Stations for Design Events

Modelled Pumping Station	Station Firm Capacity (L/s)	Dry-Weather Flow (L/s)	2-Year Event	5-Year Event	10-Year Event	25-Year Event
Barrie WwTF (PS10)	2,205	1,508	1,573	1,628	1,637	1,736
Grove Street (PS1)	158	21	34	44	48	53
Minets Point (PS2)	61.3	11.5	14.4	17.1	19.0	22.1
Huronia (PS3)	91	6	12	19	22	26
Lockhart (PS4)	51	0.4	2	3	3	5
Holly (PS5)	123	34	43	56	61	67
Little Lake (PS6)	110	20	23	25	34	37
Tynedale (PS12)	11	3	6	8	9	10
Mooregate (PS18)	21	1	2	3	3	8

A review of **Table 6.2** indicates that all pumping stations have adequate firm capacity to pump the peak flow entering the station under existing conditions for peak dry weather flow conditions and wet weather flow conditions, up to and including the 25-year design storm event. As noted earlier, the values shown in **Table 6.2** for PS10 do not include any recycle stream flows. Details of requirements at PS10 are provided in the Wastewater Treatment Master Plan.

6.4.4 Existing Infiltration and Inflow Assessment

A key assessment completed to assess existing conditions was the assessment of infiltration and inflow within the City of Barrie wastewater collection system. Infiltration is defined groundwater and rainfall derived infiltration that enters sanitary sewers through cracks in maintenance and pipes. Inflow is defined as the rainfall that enters the sanitary sewer system through direct connections such as sump pumps, foundation drains, cross connections or connected roof leaders. Infiltration and inflow can contribute to

capacity issues in a trunk sewer system and results in increased flows entering the Barrie WwTF. As infiltration and inflow are "clean" stormwater, excessive infiltration and inflow can reduce the strength of wastewater received at the Barrie WwTF. The City completed an Infiltration and Inflow Study in 2009 and identified seven priority areas where measured inflow and infiltration exceeded the City's design allowance for infiltration of 0.1L/s/ha. Flow monitoring and rainfall data collected in 2017 was analyzed and compared against the maximum extraneous flow rate of 0.1L/s/ha, as defined in the City's Sanitary Sewage Collection System Policies and Design Guidelines. The following section highlights the analysis results, identifies priority areas and presents recommendations.

6.4.4.1 Summary of Results Identification of Priority Areas

The magnitude of infiltration and inflow into Barrie's wastewater collection system was assessed through detailed analysis of flow data collected at 15 sites in 2017. **Table 6.3** presents details on the locations where flow monitoring data was collected. Collected data was reviewed and analyzed to characterize groundwater infiltration flows, peak infiltration and inflow rates, and a Cv value. The Cv represents the percentage of rainfall that enters the sanitary sewer system. **Table 6.3** presents the measured groundwater infiltration (GWI), peak infiltration and inflow rate (I/I), and average Cv value at each site.

Table 6.3 Infiltration and Inflow Assessment Results

Flow Monitor ID (Maintenance Hole ID)	Contributing Area (Ha)	Groundwater Infiltration Rate (L/s/ha)	Peak I/I Rate (L/s/Ha) (Average Peak I/I Rate)	Average Cv Value (%)
FM1 (SAL03005)	538.0	0.02	0.12 (0.06)	0.4%
FM2 (SAN01001)	199.9	0.20	0.38 (0.31)	2.9%
FM3 (SAN08001)	351.4	0.02	0.32 (0.03)	3.0%
FM4 (SAC01034)	550.3	0.02	0.08 (0.06)	0.6%
FM5 (SAI01079)	65.4	N/A	N/A (N/A)	N/A
FM6 (SAI03003)	657.3	0.03	0.14 (0.08)	1.3%
FM7 (SAI10002)	542.8	0.03	0.12 (0.08)	1.2%
FM8 (SAI16037)	729.8	0.01	0.03 (0.03)	0.6%
FM9 (SAE01012)	164.4	N/A	N/A (N/A)	N/A
FM9A (SAE03002)	54.3	0.35	1.11 (0.67)	2.8%
FM10 (SAB01007)	521.9	0.05	0.03 (0.03)	0.6%
FM11 (SAF01001)	553.5	0.09	0.09 (0.08)	0.6%
FM12 (SAF01011)	1274.8	0.01	0.07 (0.05)	0.6%
FM13 (SAP33012)	332.0	0.05	0.08 (0.05)	1.4%
FM14 (SAH01005)	474.5	0.02	0.11 (0.06)	0.6%
FM15 (SAP14003)	580.7	0.02	0.10 (0.05)	0.7%
Notes:				

Table 6.3 Infiltration and Inflow Assessment Results

Flow Monitor ID (Maintenance Hole ID)	Contributing Area (Ha)	Groundwater Infiltration Rate (L/s/ha)	Peak I/I Rate (L/s/Ha) (Average Peak I/I Rate)	Average Cv Value (%)
• Cv (%) calculations and I/I rates were based on the total area contributing to each site. • No dry weather days were monitored at Site FM9. • Poor data quality at site FM5 did not allow for characterization of I/I.				

Key observations are as follows:

- Groundwater infiltration rates exceeded the City's maximum extraneous flow rate of 0.1L/s/ha for the areas monitored by FM2 and FM9A and approached the City's maximum extraneous flow rate in the area monitored by FM11. In the area upstream of FM2, it is possible that sanitary sewers or trunk sewers located beneath watercourses could be a source of I/I. As the maximum extraneous flow rate is intended to include both dry and wet weather flows, these three areas are identified as priority areas;
- Peak I/I rates exceeded the City's maximum extraneous flow rate of 0.1L/s/ha for the areas monitored by FM1 (0.12L/s/ha) FM2 (0.38L/s/ha), FM3 (0.32L/s/ha), FM6 (0.14L/s/ha), FM7 (0.12L/s/ha), FM9A (1.11L/s/ha), and FM14 (0.11L/s/ha). Of the above sites, peak I/I rates exceeded the 0.1L/s/ha threshold for more than one (rainfall event at FM2 and FM9A only;
- On the basis of the above, the areas monitored by FM2, FM9A and FM11 were identified as priority areas; and,
- Secondary priority areas were identified where the measured peak I/I rate exceeded the City's maximum extraneous flow rate of 0.1L/s/ha for one event. Secondary priority areas identified include the areas monitored by FM1, FM3, FM5, FM6, FM7 and FM14.

Annual estimates of I/I were also derived based on flow monitoring data and water use data. To develop the estimate of annual I/I, flow data collected in 2017 was compared against water use data collected for the same period. The average I/I flow per person in all of the monitored areas was 57.2L/d. Based on the 2017 City wide service area population, the average annual I/I was estimated to be 8,400m^3/d.

In 2009, the City completed a detailed Infiltration and Inflow Study and recommended a program of sewer system rehabilitation to reduce infiltration and inflow into the wastewater collection system. **Table 6.4** presents a comparison of the results for the 2009 high priority areas with the 2017 flow monitoring results.

Table 6.4 Comparison of 2009 and 2017 Priority Areas

2009 High Priority Area	Applicable 2017 Flow Monitoring Location	2017 Flow Monitoring Results	2017 Area Priority	Notes
G	Area included in FM8-SAI16009	Measured peak I/I rate of 0.03L/s/ha, modelled 25-Year	Not identified as priority or secondary priority.	Area monitored by FM8 includes a significant area

Table 6.4 Comparison of 2009 and 2017 Priority Areas

2009 High Priority Area	Applicable 2017 Flow Monitoring Location	2017 Flow Monitoring Results	2017 Area Priority	Notes
		storm event peak I/I rate of 0.09L/s/ha		located south of Area G.
J	Area included in FM1-SAL03240	Measured peak I/I rate of 0.12L/s/ha, modelled 25-Year storm event peak I/I rate of 0.19L/s/ha	Area identified as secondary priority.	Results are consistent.
L	Area included in FM1-SAL03240	Measured peak I/I rate of 0.12L/s/ha, modelled 25-Year storm event peak I/I rate of 0.19L/s/ha	Area identified as secondary priority.	Results are consistent.
N	Area included in FM1-SAL03240	Measured peak I/I rate of 0.12L/s/ha, modelled 25-Year storm event peak I/I rate of 0.19L/s/ha	Area identified as secondary priority.	Results are consistent.
O	Area included in FM1-SAL03240	Measured peak I/I rate of 0.12L/s/ha, modelled 25-Year storm event peak I/I rate of 0.19L/s/ha	Area identified as secondary priority.	Results are consistent.
P	Area included in FM5-SAI01079	Modelled 25-Year storm event peak I/I rate of 0.20L/s/ha	Area identified as secondary priority	Results are consistent.
Q	Area included in FM1-SAL03240	Measured peak I/I rate of 0.12L/s/ha, modelled 25-Year storm event peak I/I rate of 0.19L/s/ha	Area identified as secondary priority	Results are consistent.

Comparison of the 2017 flow data with the 2009 flow data identified consistent results. Based on the infiltration and inflow assessment, it is a recommended that the City move forward with a comprehensive program of sanitary sewer and maintenance hole rehabilitation as well as private property programs to address private property connections that allow stormwater to enter the sanitary sewer system. These programs would focus on sources such as connected roof leaders, sump pumps and foundation drains.

The following recommendations were identified:

- It is recommended that the City continue to implement sewer system rehabilitation as per the 2009 I/I Study recommendations;
- The City should undertake a specific I/I reduction study in Areas FM2, FM9A and FM11 to identify potential sources of I/I as a first priority. This study should include the collection of additional sanitary flow monitoring data for smaller catchments in order to refine the areas identified as having high rates of I/I. It is recommended flow monitors be installed in February/ March for a minimum duration of 6-months. This monitoring program will ensure that flows will be recorded for both the spring melt, and for large spring rainfall events. Monitoring during the spring melt will allow for significant inflow events, similar to the February 20th, 2018 event to be captured. These types of snowmelt events can result in substantial inflow due to precipitation falling on frozen ground. Should sufficient rainfall events to characterize local I/I not occur from March to June, it is recommended the program be extended until such events are captured. Based on the combined areas of the catchments monitored by FM2, FM9A and FM11, it is recommended that flow monitoring data be collected for a period of no less than six to eight months. It is not recommended that monitors be relocated periodically during this program in order for I/I to be characterized for each catchment using uniform events. However, should a flow meter show little or no response to wet weather, it may be worthwhile for it to be relocated to maximize the value of the data collected;
- Following the identification of localized high priority areas, it is recommended the City collect additional sewer information through CCTV inspection, maintenance hole inspection and smoke and dye testing. Where a sanitary or sanitary trunk sewer is located beneath a watercourse, CCTV inspection will identify if there are infiltration runners or gushers contributing to groundwater infiltration. These investigations should conclude with the development of a rehabilitation plan focused on removing sources of I/I from the system;
- As a secondary priority, the City should proceed with area specific I/I reduction studies in Area FM1, FM3, FM5, FM6, FM7 and FM14. These studies would be identical in scope to the I/I reduction studies completed for the priority area FM2 and FM9A and would include collection of additional CCTV inspection, maintenance hole inspection, and smoke and dye testing and the development a rehabilitation plans focused on removing identified sources of I/I from the system; and,
- The City should examine potential sources of I/I located on private property. The City's current by-laws do not allow for the connection of sump pumps, roof leaders or foundation drains to the sanitary sewer system. Programs to encourage residents to remove these sources could include rebates to disconnect connected roof drains, sump pumps and foundation drains and increased by-law enforcement can also be used as a tool to remove identified connections.

6.5 Summary of Existing Wastewater Collection System Performance Issues

On the basis of the analysis of existing system performance, the following issues were identified:

- The existing system generally has adequate capacity to handle existing peak wet weather flows resulting from a 25-year design storm event. A capacity constraint was identified in the trunk sewer located south of the Bear Creek Eco-Park between Ferndale Drive South and Elizabeth Street;
- A number of trunk sewers (greater than 375mm in diameter) and sanitary sewers (diameters of 375mm or smaller) were identified where the City's level of service criteria were not met. For trunk sewers, the level of service identifies that the d/D should be 0.7. For sanitary sewers, the level of service identifies that the d/D should be 0.5; and,
- Infiltration and inflow into the sanitary sewer system does exceed the City's maximum allowance for extraneous flows in specific areas. Three areas, monitored by FM2, FM9A and FM11, were identified as priority areas where groundwater infiltration rates and wet weather peak I/I exceeded the City's maximum allowance for extraneous flows. An additional six areas (FM1, FM3, FM5, FM6, FM7 and FM14) have been identified as secondary priority areas due to measured exceedances of the City's infiltration and inflow allowance.

7 Level of Service Requirements

Level of service criteria were developed for this Wastewater Collection System Master Plan that were used to assess performance and identify and size future needs. To develop these criteria, a review of the City's Sanitary Sewage Collection System Policies and Design Guidelines, criteria used in the 2013 Wastewater Collection System Master Plan, Ontario Ministry of Environment, Parks and Conservation (MECP) criteria, and criteria used in other jurisdictions were all reviewed and considered.

7.1 City of Barrie – Sanitary Sewage Collection Systems Policies and Design Guidelines

The City of Barrie Sanitary Sewage Collection Systems Policies and Design Guidelines were last updated in October 2017. The policies and guidelines relevant to the Wastewater Collection System Master Plan are as follows:

- It is the policy of the City of Barrie to provide, operate, and maintain, a system of sanitary sewage collection works of sufficient depth and capacity to accommodate urban sanitary sewage, to standards consistent with current engineering practice such that the system will function both effectively and efficiently;
- The system will eventually service the entire land area identified in the Official Plan and approved by the City. Expansions to the existing serviced area will progress logically from the extremities of the existing system toward the City boundary;
- Appropriate cost sharing arrangements for system oversizing and expansion will be undertaken when necessary;
- The City will endeavor to enhance the public health by providing sanitary sewage collection works where and when feasible and appropriate;
- The City will, in general, give preference to new urban development within the City that can be readily serviced by a municipal sanitary sewage collection system;
- The sanitary sewage collection system will be designed, constructed and operated with a view toward achieving the least overall cost to the municipal taxpayers; and,
- The current City of Barrie Sanitary Sewage Collection System Design Guidelines outline the minimum acceptable sanitary servicing levels and were developed to assist developers, consulting engineers and other designers in designing sanitary sewage collection works that will meet the requirements of the City of Barrie.

Specific criteria to be used in sanitary sewer design are presented in **Table 7.1**.

Table 7.1 City of Barrie Sanitary Sewer Design Flow Criteria

Criteria	Sanitary Sewer Design Flow Criteria
Residential Land Use	
Average Flow	Calculated based on estimated population and 225Lpcd (excluding infiltration).
Peak Factor	Harmon Formula, M=1+14/(4+P 0.5), where P is the population in thousands. M must be not less than two and not greater than four. The Babbit equation is also accepted.

Table 7.1 City of Barrie Sanitary Sewer Design Flow Criteria

Criteria	Sanitary Sewer Design Flow Criteria
Infiltration / Extraneous Flow	Calculated based on tributary area and a maximum allowance for extraneous flow of 0.1L/s/ha. This value can be increased based on flow monitoring and sewer modelling where infrastructure can carry flows from existing developments.
Peak Flow	Calculated as the average flow times the peak factor plus the extraneous flow.
Commercial and Institutional Land Use	
Average Flow	Should be based on actual records. Where actual records are not available or the specific land use is not known, a value of 28m^3/ha/d is to be used.
Peak Factor	Should be based on actual records. Where records are not available, a peak factor of two should be used.
Infiltration / Extraneous Flow	Calculated based on tributary area and a maximum allowance for extraneous flow of 0.1L/s/ha. This value can be increased based on flow monitoring and sewer modelling where infrastructure can carry flows from existing developments.
Peak Flow	Calculated as the average flow times the peak factor plus the extraneous flow.
Industrial Land Use	
Average Flow	Should be based on actual records. Where these are not available, a value of 35m^3/ha/d is to be used for general industry, a value of 55m^3/ha/d is to be used for heavy industry and a value of 50m^3/ha/d is to be used where there is a mix of general and heavy industry.
Peak Factor	Should be based on actual records. Where records are not available, a peak factor of two should be used.
Infiltration / Extraneous Flow	Calculated based on tributary area and a maximum allowance for extraneous flow of 0.1L/s/ha. This value can be increased based on flow monitoring and sewer modelling where infrastructure can carry flows from existing developments.
Peak Flow	Calculated as the average flow times the peak factor plus the extraneous flow.

In addition to the above table, the City has also identified the following sanitary sewer design criteria in the Sanitary Sewage Collection System Policies and Design Guidelines document:

- A minimum pipe diameter of no less than 200mm. Sanitary sewers with a diameter of 200m,m, can only be used in residential areas;
- The flow velocity is to be equal to or greater than 0.6L/s (without infiltration and inflow) and less than or equal to 3.0m/s;
- A minimum slope of 0.4% for sanitary sewers with diameters between 200mm and 375mm and a minimum slope of 0.3% for sanitary sewers with a diameter greater than 375mm;

- For trunk sewers with a diameter greater than 375mm, sewers should be upsized when flows exceed 85% of the full flow capacity under future peak flow conditions including inflow and infiltration. This is considered equivalent to a trunk sewer depth ratio (d/D) of 0.7; and,
- For local sewers with a diameter of 375mm or less, sewers should be upsized when flows exceed 50% of the full flow capacity under future peak flow conditions including inflow and infiltration. This is considered equivalent to a local sanitary sewer depth ratio (d/D) of 0.5.

The City prohibits the discharge of foundation drainage into the sanitary sewer system. Currently, the City suggests four options for on-lot foundation drainage including the installation of sump pumps with discharge to the ground surface, sump pump with discharge of foundation drain flow to a storm sewer extension at surface or sub-surface, gravity drain or sump pump discharge to a foundation drain collector (3rd pipe) or sump pump with discharge to boulevard (retrofit fit only). It is noted that the first option, installation of sump pump with discharge to the ground surface, allows foundation drainage to infiltrate into the ground surface. It is noted that there is a risk that the foundation drainage may enter the sanitary sewer system through cracks in the sanitary sewer lateral sewer where sump pump discharge locations are in close proximity to the sanitary lateral sewer. Any foundation drainage entering the sanitary sewer system will contribute to infiltration and inflow in the system. The provision of a storm sewer extension or lateral, constructed to the property line or the construction of a foundation drain collector (3rd pipe) system would allow for the second and third options to be more readily adopted. This should be considered, particularly in areas where surficial soils have poor hydraulic conductivity where foundation drainage discharged to surface by sump pump is more likely to enter the sanitary sewer system.

7.2 Review of 2013 Wastewater Master Plan Criteria

The 2013 Wastewater Collection System Master Plan utilized the City of Barrie's Sanitary Sewer Flow Criteria listed in **Table 7.1** along with land use designation information in the Barrie Industrial area and proposed or in effect zoning information in Barrie North and Barrie South.

In addition, the 2013 Wastewater Collection System Master Plan defined that capacity had been reached if the following criteria were exceeded:

- The peak HGL reached within 3.0m of the manhole rim elevation;
- The peak flow rate exceeded the full-flow pipe design capacity;
- Analysis results identified that the conduit was surcharged at the upstream end and the HGL was steeper than the conduit slope;
- The peak flow velocity exceeded 2.5m/s; and,
- The peak flow velocity was less than 0.75m/s.

7.3 MECP Sewage Design Guidelines

The MOECC, now MECP (Ministry of Environment, Conservation and Parks), provided updated wastewater design criteria as part of the MOECC Sewage Design Guidelines (2008). The MECP provided wastewater design guidelines for a range of non-residential lands uses ranging from trailer parks with water hook ups to hospitals. **Table 7.2** presents the MECP design guidelines for the land uses that are most applicable to the City of Barrie.

Table 7.2 MECP Sewage Guidelines Sanitary Sewer Design Flow Criteria

Land Use	Flow Calculations
Residential (domestic flow exclusive of extraneous flows)	Average Flow of 225-450Lpcd Peak flow calculated using Harmon or Babbit formula plus allowance for infiltration
Commercial- shopping centres	2.5-5.0L/d/m^2
Hospitals	900-1800L/d/bed
Schools	70-140L/d/student
Commercial Areas	28m^3/ha/d
Industrial	Industry specific

7.4 Criteria Used in Other Jurisdictions

A review of design criteria utilized by other municipalities was also completed to ensure that values selected in this study are reasonable and consistent with other jurisdictions. **Table 7.3** presents a comparison of flow generation criteria used in other similar jurisdictions. **Table 7.4** presents a comparison of hydraulic performance criteria used in other jurisdictions in other similar jurisdictions.

Table 7.3 Wastewater Design Criteria Used in Other Jurisdictions

Jurisdiction (Master Plan Document)	Per Capita Residential Wastewater Generation Rate	Industrial Lands Wastewater Generation Rate	Commercial Lands Wastewater Generation Rate	Institutional Lands Wastewater Generation Rate	Inflow and Infiltration Allowance for New Development
Halton Region (Sustainable Halton Master Plan, 2011)	275 Lpcd	410L/emp/d	260L/emp/d	135L/emp/d	0.286L/s/ha
Niagara Region (Water and Wastewater Master Plan, 2016)	275Lpcd	275L/emp/d	275L/emp/d	275L/emp/d	0.286L/s/ha
Peel Region (Water and Wastewater Master Plan, 2012)	302.8Lpcd	302.8Lpcd	302.8Lpcd	302.8Lpcd	0.2L/s/ha
City of Guelph (Water and Wastewater	290Lpcd	-	-	-	0.1L/s/ha

Table 7.3 Wastewater Design Criteria Used in Other Jurisdictions

Jurisdiction (Master Plan Document)	Per Capita Residential Wastewater Generation Rate	Industrial Lands Wastewater Generation Rate	Commercial Lands Wastewater Generation Rate	Institutional Lands Wastewater Generation Rate	Inflow and Infiltration Allowance for New Development
Servicing Master Plan, 2008)					
Region of Waterloo (Sanitary Servicing Master Plan, 2015)	350Lpcd	350L/emp/d	350L/emp/d	350L/emp/d	0.15L/s/ha
City of Surrey, British Columbia (Design Criteria Manual, 2016)	350Lpcd	350L/emp/d	350L/emp/d	350L/emp/d	0.13L/s/ha

Table 7.4 Wastewater Hydraulic Performance Criteria Used in Other Jurisidictions

Jurisdiction (Master Plan Document)	Hydraulic Performance Criteria
Niagara Region (Water and Wastewater Master Plan, 2016)	• Sanitary trunk sewer improvement was triggered if the predicted peak hydraulic gradeline reached the pipe obvert. • New sanitary sewers were sized at d/D of 0.7 for 2041 conditions.
Peel Region (Water and Wastewater Master Plan, 2012)	• Sanitary trunk sewer system performance assessed using a 5-year design storm event to identify required projects. Projects were identified if the sewer was surcharged and the maximum hydraulic grade line was within 1.8m of the ground surface, indicating a risk of basement flooding. • Master Plan recommended inflow and infiltration reduction works to reduce inflow and infiltration in the system by the 2031, such by 2031, a 25-year design storm would result in the same peak flows as the 5-year design storm event under existing conditions.
City of Waterloo (Sanitary Servicing	• Target level of service is that the ratio of maximum depth to full depth (d/D) of 1 is acceptable provided that the water level remains 1.8m or more below the ground surface.

Table 7.4 Wastewater Hydraulic Performance Criteria Used in Other Jurisidictions

Jurisdiction (Master Plan Document)	Hydraulic Performance Criteria
Master Plan, 2015)	• Scenario analyses were completed for a 25-year 3-hour distribution Chicago design storm event.
City of Surrey, British Columbia (Design Criteria Manual, 2016)	• Existing local sewers are assessed as having excess capacity if the peak flow is less than 0.7 times the theoretical full flow capacity of the sewer. • Existing trunk and interceptor sewers are assessed as having excess capacity if the peak flow is less than 0.837 times the theoretical full flow capacity of the trunk or interceptor sewer.

In general, the rates used in the above jurisdictions compare well with the City of Barrie's criteria. It is noted that Barrie's wastewater generation rate for residential lands is slightly lower than rates used elsewhere but is within the range identified by the MECP. In addition, it is also noted that Barrie's maximum extraneous flow allowance of 0.1L/s/ha is generally lower than rates used in other jurisdictions but is consistent with rates used by the City of Guelph.

A review of the hydraulic performance criteria utilized by other municipalities, indicates that the City of Barrie's criteria of requiring a d/D for trunk sewers of 0.7 tends towards a more conservative approach that taken by other municipalities. It is noted that where municipalities have extraneous flow issues, it is not uncommon to utilize a design storm approach in the development of a target level of service. The use of a 25-year design storm is generally considered to be an appropriate approach.

The City prohibits the discharge of foundation drainage into the sanitary sewer system. Currently, the City suggests four options for on-lot foundation drainage including the installation of sump pumps with discharge to the ground surface, sump pump with discharge of foundation drain flow to a storm sewer extension at surface or sub-surface, gravity drain or sump pump discharge to a foundation drain collector (3rd pipe) or sump pump discharging pipe to boulevard (retrofit fit only). It is noted that the first option, installation of sump pump with discharge to the ground surface, allows foundation drainage to infiltrate into the ground surface. It is noted that there is a risk that the foundation drainage may enter the sanitary sewer system through cracks in the sanitary sewer lateral sewer where sump pump discharge locations are in close proximity to the sanitary lateral sewer. Any foundation drainage entering the sanitary sewer system will contribute to infiltration and inflow in the system.

7.5 Design Criteria for 2018 Wastewater Collection System Master Update

On the basis of the above sections, design criteria for sanitary sewers were selected for the Wastewater Collection System Master Plan. These selected criteria are consistent with the City's Sanitary Sewage System Policies and Guidelines. **Table 7.5** presents a summary of key design rates that were applied in this study.

Table 7.5 City of Barrie Sanitary Sewer Design Flows

Sanitary Flow	L/cap/day	Peaking Factor	Peak I/I Allowance (L/s/ha)
Residential	225	Harmon or Babbit Peaking Factors	0.1
Industrial, Commercial and Institutional	225	2	0.1

In addition to the sanitary sewer design flows identified above, the following system performance criteria were adopted:

- During peak dry weather flow and wet weather conditions, no surcharge condition of sanitary trunk sewers should occur. In addition, the peak depth ratio (d/D) should be 0.7 or less for trunk sewers with diameters greater than 0.7 and the d/D should be 0.5 or less for sanitary sewers with diameter of 375mm or less;
- Where new sanitary sewers are identified, they are to be sized such that d/D at peak flow conditions is 0.7 or less;
- All pumping stations should have sufficient firm capacity to pump peak incoming flows as a result of a 25-year design storm event;
- All pumping stations should have sufficient wet well storage to provide storage of peak flows for a 1-hour period;
- If storage is considered in the wastewater collection system, storage is to be sized to control peak flows resulting from a 25-year design storm event; and,
- Velocities are to be maintained within the minimum and maximum range of 0.6m/s to 3.0m/s.

In addition to the above criteria, process wastewater flows were also included for all non-residential lands within the City. For all lands identified as non-residential (industrial, commercial and institutional) in the City's land use information, an additional flow allowance of 28m^3/d/ha was used to calculate the process wastewater contribution. Wet weather flows for all existing developed areas, were generated using the calibrated model. For new development areas, a peak I/I allowance of 0.1 L/s/ha was used to generate wet weather flows in the model.

Two further scenarios were created to assess future condition, including scenarios for 2041 high flows and for 2071 conditions. For the 2041 high flow scenario, input flows were calculated using the following criteria:

- Per capita residential and employment flow of 225Lpcd with a peaking factor of four;
- Peak I/I allowance for new development areas of 0.1L/s/ha; and,
- For lands identified as non-residential (industrial, commercial and institutional) in the City's land use information, an additional allowance of 28m^3/d/ha was used to calculate the process wastewater contribution.

For the high flow scenario and for the 2071 condition scenario, the following system performance criteria were adopted for the 25-year design storm event;

- During a 25-year design storm event, the peak depth ratio (d/D) should be less 0.7. Minor surcharge conditions were considered acceptable in low lying areas;
- Where new sanitary sewers were identified, they were sized such that d/D at peak flow conditions was 0.7 or less;
- All pumping stations were to have sufficient firm capacity to pump peak incoming flows as a result of a 25-year design storm event;
- All pumping stations should have sufficient wet well storage to provide storage of peak flows for a 1-hour period;
- If storage is considered in the wastewater collection system, storage is to be sized to control peak flows resulting from a 25-year design storm event; and,
- Velocities are to be maintained within the minimum and maximum range of 0.6m/s to 3.0m/s.

8 Future Growth and Needs Assessment

This section provides identifies areas of future growth and where additional capacity and system needs are required to service future growth.

8.1 Future Growth Populations and Areas

As part of the City's Official Plan update and this Master Plan process, the City has prepared detailed growth forecasts to the 2041 planning horizon. The forecasts accommodate for both residential and employment growth (See **Table 3.1** City of Barrie Growth Forecasts, City of Barrie Growth Forecasts, 2016 – 2071).

The City also provided a breakdown of growth between urban growth centre, intensification, other built boundary, greenfield within City of Barrie former municipal boundary and annexed lands. **Table 8.1** Breakdown of Residential Growth provides a breakdown of residential growth for the years 2021, 2026, 2031, 2036 and 2041 while **Table 8.2** presents a similar breakdown for employment growth.

Table 8.1 Breakdown of Residential Growth

Residential Growth Area	2016	2021	2026	2031	2036	2041	2071
Urban Growth Centre	4,569	5,805	8,343	13,354	15,820	17,640	20,245
Intensification Nodes / Corridor	6,448	7,524	9,108	11,978	16,081	24,484	53,359
Other Built Boundary	125,283	125,983	126,687	129,056	131,721	133,332	147,231
Greenfield within City of Barrie former municipal boundary	9,228	11,076	14,251	14,990	21,934	26,542	27,403
Annexed Lands	318	17,207	30,814	40,621	45,449	51,002	51,784
Total	145,847	167,598	189,203	210,000	231,005	253,000	300,022

Table 8.2 Breakdown of Employment Growth

Employment Growth Area	2016	2021	2026	2031	2036	2041	2071
Urban Growth Centre	6,707	7,090	8,292	10,000	11,752	13,812	19,843
Intensification Nodes / Corridor	14,452	15,646	16,602	17,248	19,300	23,127	32,380

Table 8.2 Breakdown of Employment Growth

Employment Growth Area	2016	2021	2026	2031	2036	2041	2071
Other Built Boundary	49,187	50,941	52.893	53,929	56,476	60,367	66,534
Greenfield within City of Barrie former municipal boundary	3,328	6,446	8,017	8,543	10,807	13,248	14,353
Annexed Lands	99	3,310	7,518	11,277	14,992	18,442	19,847
Total	73,772	83,433	93,332	100,997	113,327	128,996	152,957

The City provided a further breakdown of projected residential and employment population broken by traffic zone. To assess growth in individual sub-catchments, traffic zones were intersected with the traffic zones and residential and employment populations were determined for each sub-catchment. **Figure 8-1** presents the location of all traffic zones and the extents of model subcatchments. **Appendix B** provides the residential and employment lands population forecasts by traffic zone and by sewershed area.

8.2 System Capacity Assessment and Identification of System Deficiencies

8.2.1 Existing System Evaluation

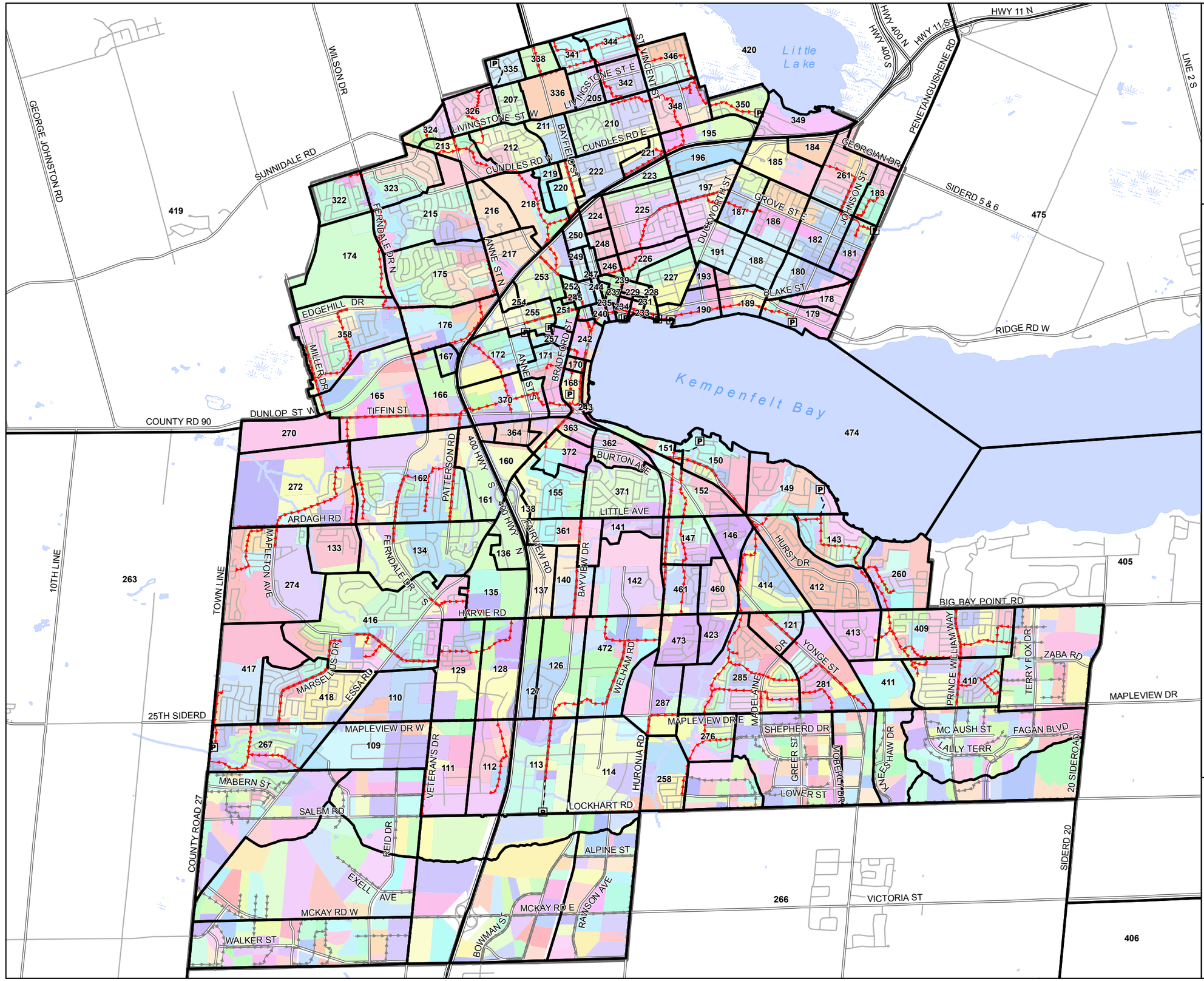
A capacity assessment for existing sewers within the pre-2010 municipal boundary was conducted to identify sections of the sanitary collection system with insufficient capacity to convey peak flows in future. All planning phases (2021, 2026, 2031, 2036 and 2041) were evaluated using the sanitary sewer design criteria and performance criteria identified in **Section 7**. The following sections present details of this analysis.

8.2.1.1 2021 Planning Phase

Figure 8-2 presents the performance of the existing system with additional flows representing 2021 growth conditions. This figure presents system performance as a result of a 25-year design storm event. A review of **Figure 8-2** identified the following:

- The model predicted surcharge conditions with a freeboard of less than 1.8m in the section of trunk sewer south of the Bear Creek Eco Park (from Ferndale Drive S to Patterson Road). In this trunk sewer, nine maintenance holes had a predicted freeboard of less than 1.8m with surcharge conditions;
- The trunk sewer on Tiffin Street, between Ferndale Drive and Boulton Court, is predicted to be surcharged. However the freeboard is greater than 1.8m;

Figure 8-1
City of Barrie
Traffic Zones and Wastewater Collection System Model Subcatchments



- Trunk sewers, with diameters greater than 375mm, where the d/D was greater than 0.7 were identified in the easement south of Tiffin, on Hurst Road, on Lakeshore Drive south of the WwTF, on Miller, on Penetanguishene Road, on Summerset and on Tiffin;
- Sanitary sewers, with diameters of 375mm or less, where the d/D was greater than 0.5 were identified on Duckworth, Mapleton, Penvil Trail and on White Oaks Road; and,
- Pumping Stations PS1, PS2, PS6, and PS12 have single forcemains. Twin forcemains are needed.

8.2.1.2 2026 Planning Phase

Figure 8-3 presents the performance of the existing system with additional flows representing 2026 growth conditions. This figure presents system performance as a result of the 25-year design storm event. A review of **Figure 8-3** identified the following:

- The model predicted surcharge conditions with a freeboard of less than 1.8m in the section of trunk sewer south of the Bear Creek Eco Park (from Ferndale Drive S to Patterson Road). In this trunk sewer, nine maintenance holes had a predicted freeboard of less than 1.8m with surcharge conditions; and,
- The trunk sewer on Tiffin Street, between Ferndale Drive and Boulton Court, is predicted to be surcharged. However the freeboard is greater than 1.8m;
- Trunk sewers, with diameters greater than 375mm, where the d/D was greater than 0.7 were identified on Dock Road, in an easement south of Tiffin, on Hurst Road, on Lakeshore Drive south of the WwTF, on Lakeshore Drive south of Bayfield, on Lovers Creek trunk sewer, on Miller, on Penetanguishene Road, on Summerset and on Tiffin;
- Sanitary sewers, with diameters of 375mm or less, where the d/D was greater than 0.5 were identified on Duckworth, Mapleton, Penvil Trail and on White Oaks Road; and,
- Pumping Stations PS1, PS2, PS6, and PS12 have single forcemains. Twin forcemains are needed.

8.2.1.3 2031 Planning Phase

Figure 8-4 presents the performance of the existing system with additional flows representing 2031 growth conditions. This figure presents system performance as a result of the 25-year design storm. A review of **Figure 8-4** identified the following:

- The model predicted surcharge conditions with a freeboard of less than 1.8m in the section of trunk sewer south of the Bear Creek Eco Park (from Ferndale Drive S to Patterson Road). In this trunk sewer, nine maintenance holes had a predicted freeboard of less than 1.8m with surcharge conditions; and,
- The trunk sewer on Tiffin Street, between Ferndale Drive and Boulton Court, is predicted to be surcharged. However the freeboard is greater than 1.8m;
- Trunk sewers, with diameters greater than 375mm, where the d/D was greater than 0.7 were identified on Dock Road, in an easement south of Tiffin, on Hurst Road, on Lakeshore Drive south of the WwTF, on Lakeshore Drive south of Bayfield, on Lovers Creek trunk sewer, on Miller, on Penetanguishene Road, on Summerset and on Tiffin;
- Sanitary sewers, with diameters of 375mm or less, where the d/D was greater than 0.5 were identified on Duckworth, Mapleton, Penvil Trail and on White Oaks Road; and,

- Pumping Stations PS1, PS2, PS6, and PS12 have single forcemains. Twin forcemains are needed.

8.2.1.4 2036 Planning Phase

Figure 8-5 presents the performance of the existing system with additional flows representing 2036 growth conditions. This figure presents system performance as a result of the 25-year design storm event. A review of **Figure 8-5** identified the following:

- The model predicted surcharge conditions with a freeboard of less than 1.8m in the of trunk sewer south of the Bear Creek Eco Park as well as on Patterson Road. In this area, 12 maintenance holes had a predicted freeboard of less than 1.8m with surcharge conditions;
- Several sections of trunk sewer are predicted to be under surcharge conditions. However all of these sections have a freeboard greater than 1.8m from the surface. These areas are located on Tiffin Street between Cross Street and Dunlop Street W, on Boulton Court and on Ester Drive;
- The model predicted surcharge conditions in the trunk sewer immediately upstream of the Barrie WwTF. However, the freeboard is greater than 1.8m;
- Trunk sewers, with diameters greater than 375mm, were identified where d/D was greater than 0.7 on Bradford, on Dock Road, in an easement south of Tiffin, on Hurst Road, on Lakeshore Drive south of the WwTF, on Lakeshore Drive south of Bayfield, on the Lovers Creek trunk sewer, on Mapleview east of Veterans, on Mapleview east of Essa, on Mapleview east of Huronia, on Miller, on Penetanguishene Road, on Summerset, on Tiffin, on Townline Road, and in the trunk sewer from industrial area to the WwTF;
- Sanitary sewers, with diameters of 375mm or less, where the d/D was greater than 0.5 were identified on Duckworth, Mapleton, Mary, Penvil Trail and on White Oaks Road; and,
- Pumping Stations PS1, PS2, PS6, and PS12 have single forcemains. Twin forcemains are needed.

8.2.1.5 2041 Planning Phase

Figure 8-6 presents the performance of the existing system with additional flows representing 2041 growth conditions. This figure presents system performance as a result of the 25-year design storm event. A review of **Figure 8-6** identified the following:

- There are two clusters in the trunk sewer system where the surcharge conditions are predicted with a freeboard of less than 1.8m. These sections are located south of Bear Creek Eco Park (12 maintenance holes) and upstream of the Barrie WwTF (37 maintenance holes). Predicted surcharge conditions in the trunk sewer upstream of the Barrie WwTF is the result of the backwater condition of the WwTF;
- Several additional sections of trunk sewer are predicted to be under surcharge conditions. However the freeboard in all of these sections is greater than 1.8m. The trunk sewer sections are located on Tiffin Street between Cross Street and Dunlop Street W, on Boulton Court, on Ester Drive and on Lakeshore Drive south of the Barrie WwTF; and,
- Trunk sewer sections, with diameters greater than 375mm, where the d/D was greater than 0.7 were identified on Bayfield, on Bayview, on Bradford, on Capps Drive, on Crimson Ridge, on Dock Road, in an easement south of Tiffin, on Hurst Road, on Lakeshore Drive south to WwTF, on Lakeshore Drive south of Bayfield, in the Lovers Creek trunk sewer, on Mapleview east of Veterans, on Mapleview east of Essa, on Mapleview east of Huronia, on Miller, on

Penetanguishene Road, on Summerset, on Tiffin, on Townline Road, in the trunk sewer from industrial area to WwTF, on Turner and on Victoria;

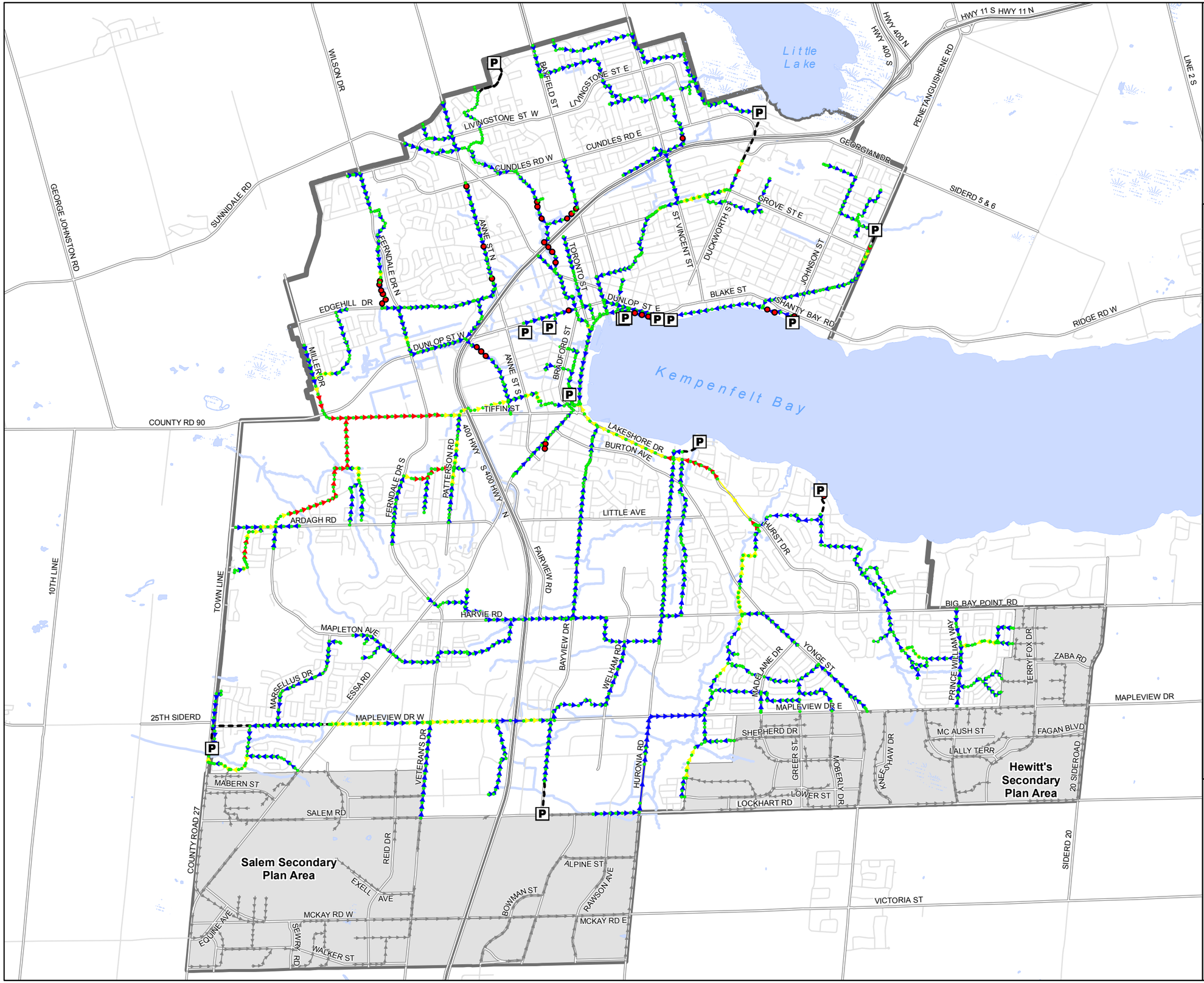
- Sanitary sewers, with diameters of 375mm or less, where the d/D was greater than 0.5 were identified on Duckworth, in the Lovers Creek sewer, Maple, Mapleton, Mary, Penvil Trail, Tynedale, Veterans Drive, Victoria and on White Oaks Road;
- Pumping Station PS1 does have not sufficient wet well storage to provide one hour of storage at peak flow conditions. An additional storage volume of 95 m^3 is needed; and,
- Pumping Stations PS1, PS2, PS6, and PS12 have single forcemains. Twin forcemains are needed.

8.2.1.6 2071 Planning Phase

Figure 8-7 presents the performance of the existing system with additional flows representing 2071 growth conditions. This figure presents system performance as a result of the 25-year design storm event. A review of **Figure 8-7** identified the following:

- There are two clusters in the trunk sewer system where the surcharge conditions are predicted with a freeboard of less than 1.8m. These sections are located south of Bear Creek Eco Park (12 maintenance holes) and upstream of the Barrie WwTF (37 maintenance holes). Predicted surcharge conditions in the trunk sewer upstream of the Barrie WwTF is the result of the backwater condition of the WwTF;
- Several additional sections of trunk sewer are predicted to be under surcharge conditions. However the freeboard in all of these sections is greater than 1.8m. The trunk sewer sections are located on Tiffin Street between Cross Street and Dunlop Street W, on Boulton Court, on Ester Drive and on Lakeshore Drive south of the Barrie WwTF;
- Trunk sewer sections, with diameters greater than 375mm, were the d/D was greater than 0.7 were identified on Bayfield, Bayview, Bradford, Capps Drive, on Crimson Ridge, on Dock Road, in an easement south of Tiffin, on Hurst Road, on Lakeshore Drive south to WwTF, on Lakeshore Drive south of Bayfield, in the Lovers Creek trunk sewer, on Mapleview east of Veterans, on Mapleview east of Essa, on Mapleview east of Huronia, on Miller, on Penetanguishene Road, on Summerset, on Tiffin, on Townline Road, in the trunk sewer from industrial area to WwTF, on Turner and on Victoria;
- Sanitary sewers, with diameters of 375mm or less, where the d/D was greater than 0.5 were identified on Duckworth, in the Lovers Creek sewer, Maple, Mapleton, Mary, Miller, Penvil Trail, Townline Road, Tynedale, Veterans Drive, Victoria and on White Oaks Road;
- Pumping Station PS1 does have not sufficient wet well storage to provide one hour of storage at peak flow conditions. An additional storage volume of 95 m^3 is needed;
- Pumping Station PS12 does not have adequate firm capacity to pump peak flows resulting from a 25-year design storm event. An increase to a firm capacity of 15 L/s is needed; and,
- Pumping Stations PS1, PS2, PS6, and PS12 have single forcemains. Twin forcemains are needed.

Figure 8-2
Existing Barrie Wastewater Collection System Performance with 2021 Wet Weather Conditions (25-Year Storm)



- Pumping Stations
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers
- Forcemain

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

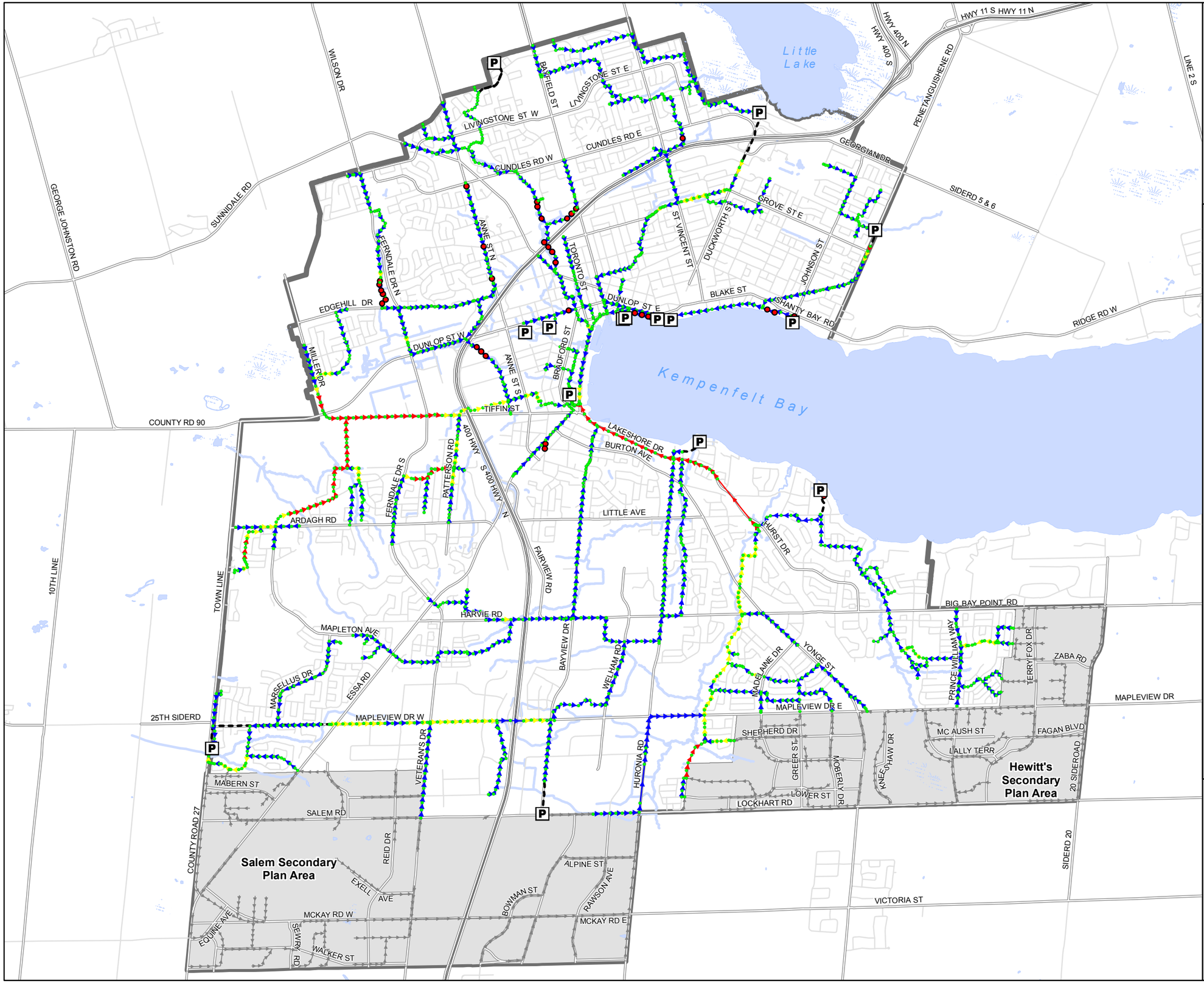
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 8-3
Existing Barrie Wastewater Collection System Performance with 2026 Wet Weather Conditions (25-Year Storm)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

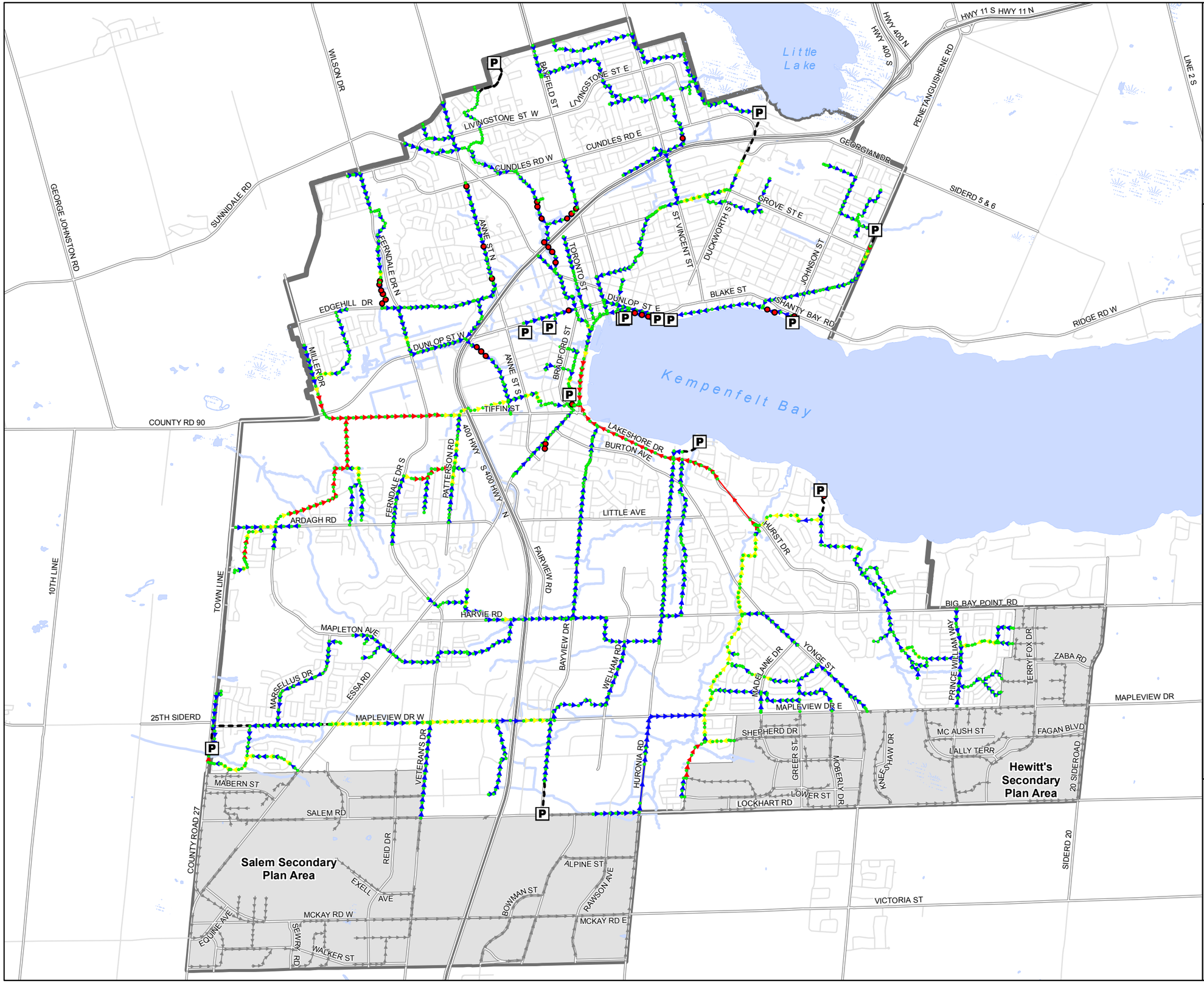
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 8-4
Existing Barrie Wastewater Collection System Performance with 2031 Wet Weather Conditions (25-Year Storm)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

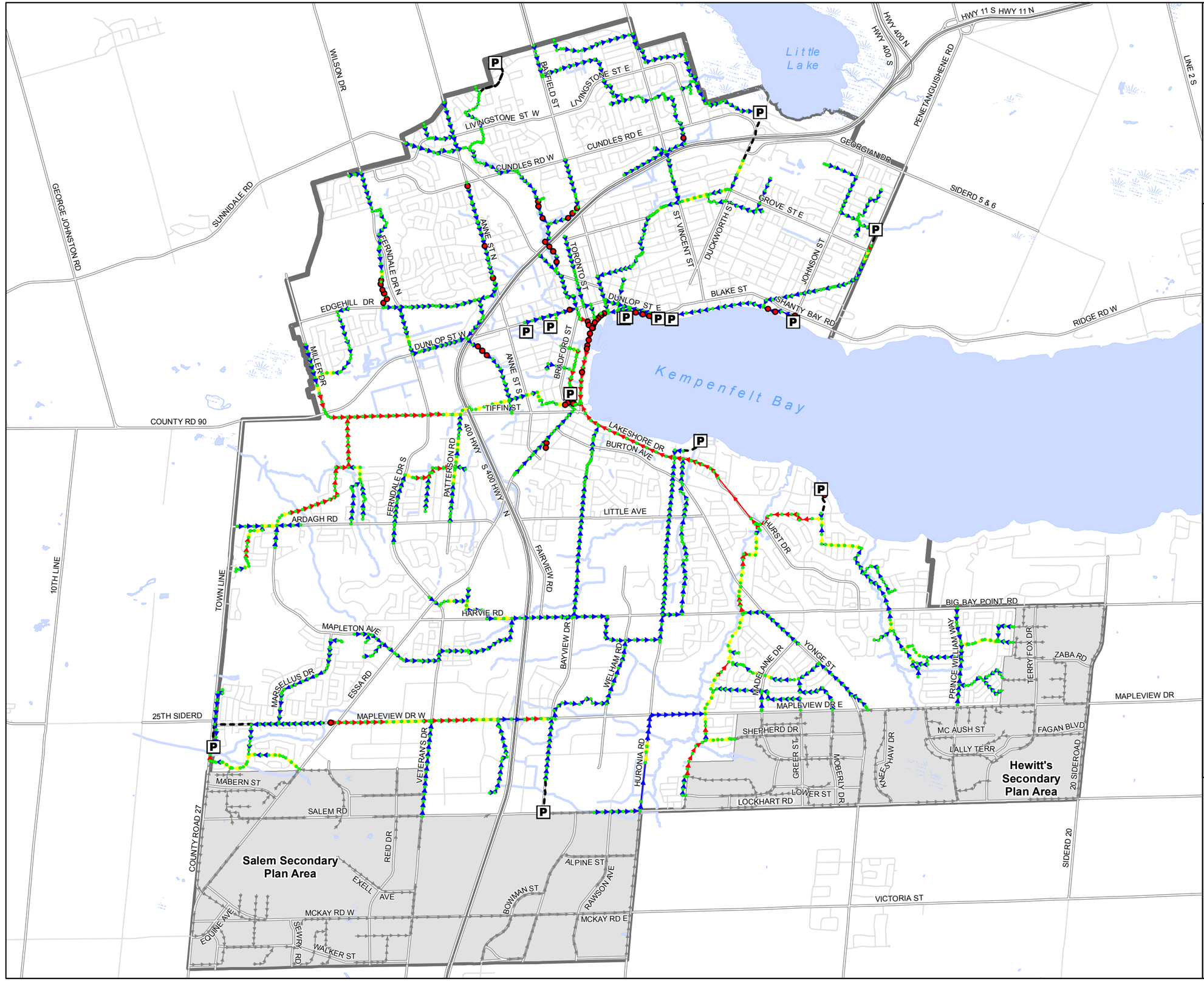
COLE

0 0.25 0.5 1 1.5 2
Kilometers

N

Updated: 4/5/2019

Figure 8-5
Existing Barrie Wastewater Collection System Performance with 2036 Wet Weather Conditions (25-Year Storm)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

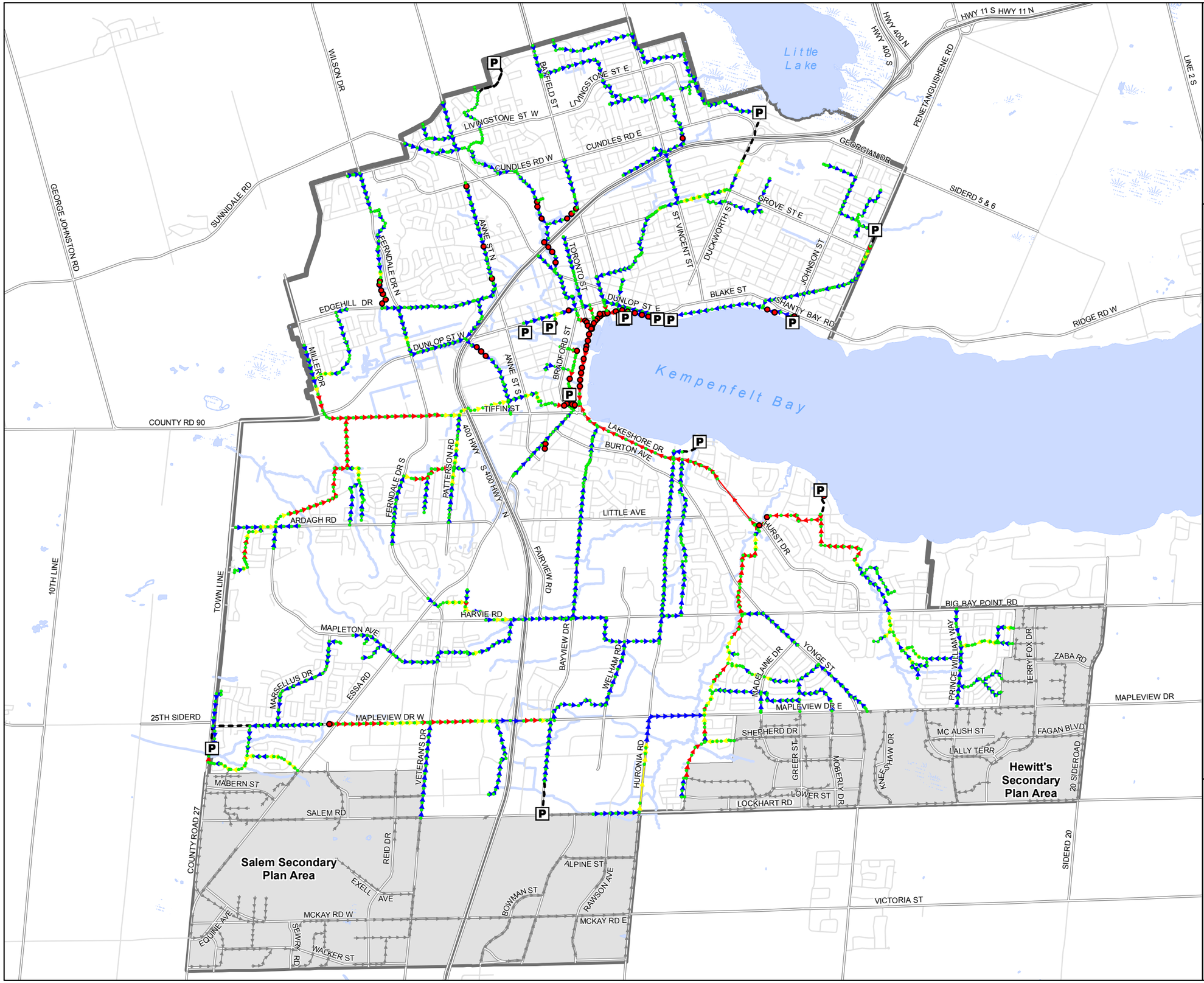
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 8-6
Existing Barrie Wastewater Collection System Performance with 2041 Wet Weather Conditions (25-Year Storm)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

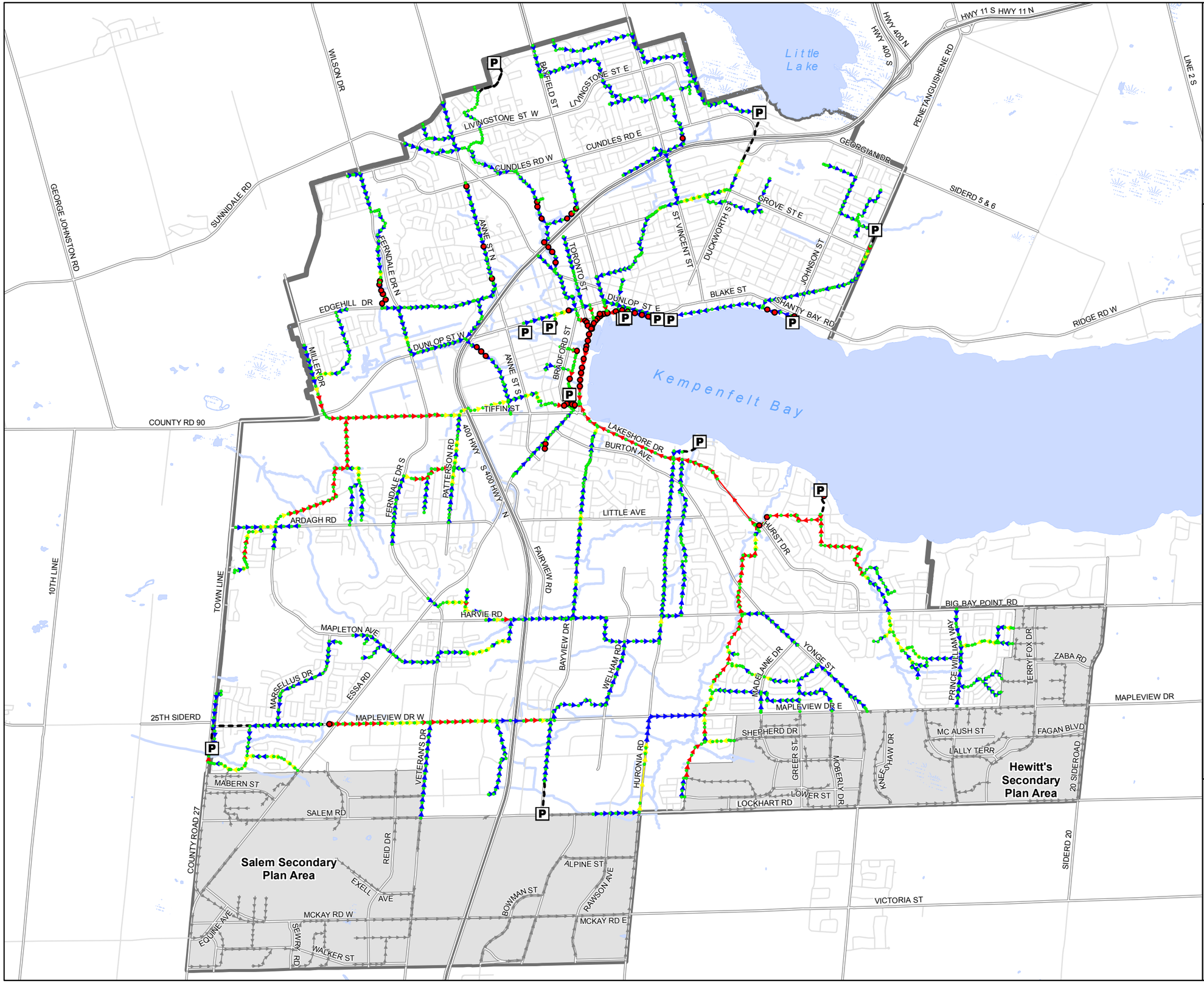
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 8-7
Existing Barrie Wastewater Collection System Performance with 2071 Wet Weather Conditions (25-Year Storm)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

8.2.2 Evaluation of Existing Pumping Stations

The capacity of existing pump stations to convey future flows was also evaluated for the various planning horizons. For this analysis, peak modelled flows corresponding to the 25-year design event were compared against the firm capacity of each station. **Table 8.3** presents the results. The station firm capacity represents the current available capacity at each station while the 2017 Existing, 2021, 2026, 2031, 2036 and 2041 values represent the required capacity in the time period. It is noted that the Huronia PS has already been decommissioned and the Lockhart PS is planned to be decommissioned. In addition, the Holly PS is currently being expanded and the station firm capacity is being increased. The values shown in **Table 8.3** correspond to the post-construction firm capacity.

Table 8.3 Pumping Station Capacity Assessment (2017-2041)

Modelled Pumping Station	Station Firm Capacity (L/s)	2017 Existing Peak Flow Entering Station (L/s)	2021 Peak Flow Entering Station (L/s)	2026 Peak Flow Entering Station (L/s)	2031 Peak Flow Entering Station (L/s)	2036 Peak Flow Entering Station (L/s)	2041 Peak Flow Entering Station (L/s)
Barrie WwTF (PS10)	2,205	1,736	1,910	1,963	2,057	2,061	2,109
Grove Street (PS1)	158	53	52	54	54	57	63
Minets Point (PS2)	61.3	22.1	22.2	22.3	22.6	22.9	23.6
Huronia (PS3)	91	Decommissioned					
Lockhart (PS4)	51	5	Planned to Be Decommissioned				
Holly (PS5)	200.9	67	81	95	108	120	130
Little Lake (PS6)	110	37	37	40	40	41	42
Tynedale (PS12)	11	10	**15**	**15**	**16**	**16**	**16**
Mooregate (PS18)	21	8	8.5	8.5	8.7	8.9	9.1

It is noted that the influent flow to PS10 does not include any recycle streams. For PS10, the Wastewater Treatment Master Plan contains a detailed examination of future needs.

The results presented above indicated that all SPSs, with the exception of Tynedale SPS (PS12), have sufficient firm capacity to convey peak flows associated with the 25-year design event through to the year 2041. PS12 will require a pump capacity increase in the planning phase 2021.

9 Problem Statement

Based on a detailed review of the performance of the existing wastewater collection system, and anticipated servicing requirements to service future growth, it was determined that additional wastewater collection system capacity will be required to service future growth.

The updated wastewater collection system model identified sections of trunk sewer within the pre-2010 City limits that have existing capacity constraints during wet-weather. Furthermore, the model was applied to evaluate servicing for the Annexed lands. All servicing strategies were assessed in accordance with the system performance criteria outlined in **Section 7.5**.

10 Alternatives Development and Evaluation

This section presents the development of alternatives to provide the wastewater collection system capacity necessary to provide servicing for growth to the year 2041, evaluation criteria and methodology that were used to evaluate alternatives and the evaluation of alternatives. This section concludes with the selection of a recommended preferred alternative.

10.1 Alternative Descriptions

A total of four alternatives were developed to provide the wastewater servicing capacity to service growth in Barrie to the year 2041. All alternatives were assessed and sized to meet the system performance criteria identified in **Section 7.5**.

10.1.1 Alternative 1 – Do Nothing

The "Do Nothing" alternative would involve allowing growth to proceed as per the City of Barrie growth plans without provision of any additional improvements or servicing to provide growth.

10.1.2 Alternative 2 – Limit Growth

This alternative would involve reduced growth than is outlined in the City's planning projections. The result of the implementation of this alternative is limited growth such that the requirements for infrastructure upgrades are minimal.

10.1.3 Alternative 3 - Water Conservation and I/I Reduction

This alternative considers the implementation of City-wide programs to reduce flows to the wastewater collection system while still allowing growth to occur. Flows to the wastewater collection system would be reduced through enhanced water conservation and demand management as well as implementation of a comprehensive infiltration and inflow reduction measures.

To assess the performance of these measures, the wastewater collection system model was modified to reasonably account for implementation of these programs. To account for the success of a water conservation program, a system wide reduction in wastewater generation rates was applied. This approach is consistent with the Water Distribution System Master Plan. Wastewater generation rates were reduced uniformly to correspond with the lowest observed water demand rates in the City, which occur in Zone 1.

RTK values were also reduced to account for the success of an aggressive infiltration and inflow reduction program.

It is noted that the RTK approach allows for infiltration response to be characterized as fast (R1 value, medium or slow. The model generates and combines three hydrographs to determine an overall response. To account for the success of an aggressive I/I reduction program, the fast infiltration response hydrograph was reduced by 50%. The aggressive I/I reduction program would consist of inspection and testing to identify sources of I/I. This type of program is more likely to identify and repair inflow sources or fast response sources. As a result, reduction of the fast response by 50% reasonably represents what would be achieved by an aggressive I/I reduction program.

10.1.4 Alternative 4 – Upgrade and Expansion of Existing System

This alternative considers the implementation of improvements and expansion of the wastewater collection system to address exiting capacity issues and to accommodate future growth. Additionally, this alternative will result in the expansion of the wastewater collection system to accommodate planned development in the Annexed Lands. **Table 10.1** presents the system improvements required to provide servicing for growth to the year 2041.

Table 10.1 Alternative 4 Improvements

Item Location	Description Length of Sewer (m)
Holly Street	Upgrade Holly Street Pumping Station (PS5) and twin 1,940m of existing forcemain from Holly Street PS.
McKay Road	Construct 4,261m of new 525 / 600mm diameter trunk sewer on McKay Road.
Huronia Road	Construct 1,425m of new 750mm diameter trunk sewer and 640m of new 525mm diameter trunk sewer on Huronia Road.
Hewitt's Trunk (outside pre-2010 boundary)	Construct 1,190m of new 525mm diameter trunk sewer extension of Hewitt's Trunk Sewer.
West Annexed Lands	Construct new PS in west annexed lands (capacity of 100 L/s) and new 250mm diameter twin forcemain.
East Annexed Lands	Construct new East Annex Pumping Station (capacity of 80 L/s) and new 250mm diameter twin forcemain.
Mapleview Drive East	Construct 1,578m of new 525mm diameter trunk sewer from East Annex PS forcemain discharge to Hewitt's Creek Trunk Sewer.
Lakeshore Road South	Twin 1050mm diameter trunk sewer.
South of Bear Creek Eco Park	Replace 250mm diameter trunk sewer with 375mm diameter pipe.
Trunk sewer improvements	Various improvements within the City's trunk sewer system (diameters greater than 375mm) to meet the City's level of service requirements.
Local sewer improvements	Various improvements within the local sewer system (diameters 375mm or less) to meet the City's level of service requirements.
Tynedale PS (PS12) Improvement	Pump replacement to provide sufficient firm capacity.
Twin Forcemains	Twin existing forcemains for PS1, PS2, PS6 and PS12.
PS1 Improvements	Provide 95m^3 of additional wet well storage to meet City's level of service.

Table 10.1 Alternative 4 Improvements

Item Location	Description Length of Sewer (m)
Inflow and Infiltration Reduction	Program consisting of flow monitoring, field investigation, condition assessment, remediation and rehabilitation of City's sewer system to identify required rehabilitation efforts necessary to reduce inflow and infiltration in primary and secondary areas. Also include private property programs to address sources on private property. A successful program would delay or eliminate the need for sewer improvements.

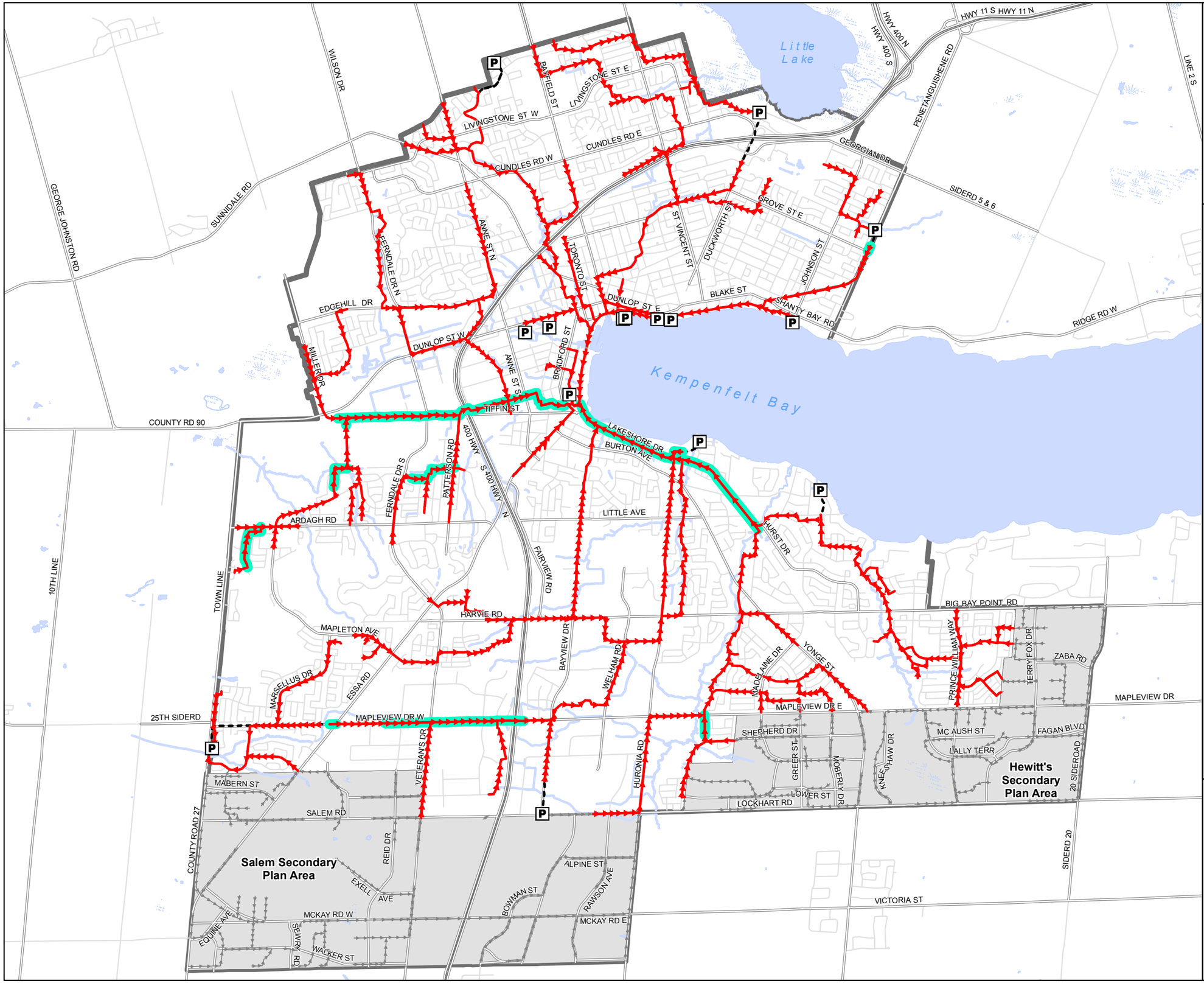
In addition to the above trunk sewer improvements, storage is also needed to equalize flows into the Barrie WwTF. As an alternative to an equalization storage facility at the Barrie WwTF, distributed equalization storage tanks located throughout the Annexed lands area was assessed. However, review of the flows in the annexed lands identified that insufficient flow volumes were available in the annexed lands to allow for equalization of flows into the Barrie WwTF. The equalization storage facility will reduce surcharge conditions in the trunk sewers located upstream of the Barrie WwTF. Details of the equalization storage facility are contained in the Wastewater Treatment Master Plan.

In addition to the system improvements identified for growth, a significant number of improvements were identified to meet the City's level of service criteria for the existing system. These improvements are located throughout the City with a significant number of improvements needed in South Barrie. A detailed list of improvements is provided in **Appendix C**. **Figure 10-1** presents the location of improvements needed to meet growth and level of service criteria for sewers greater than 375mm in diameter. **Figure 10.2** presents the location of improvements needed to meet level of service criteria for sewers with diameters of 375mm or less.

10.2 Evaluation Methodology and Criteria

The developed alternatives were evaluated using the four overarching criteria representing the natural environment, social and cultural environment, technical environment and economic environment. Evaluation criteria were developed and a comparative evaluation was completed to select a preferred alternative. **Table 10.2** presents a detailed description of the evaluation criteria.

Figure 10-1
City of Barrie
Location of System Improvements
(Sanitary Sewers >375mm Diameter)



- Sewer Upgrades
- Forcemain
- Sanitary Trunk Sewer
- Pumping Stations
- Secondary Plan Boundaries
- Future Annexed Lands Sewers
- City of Barrie Limits

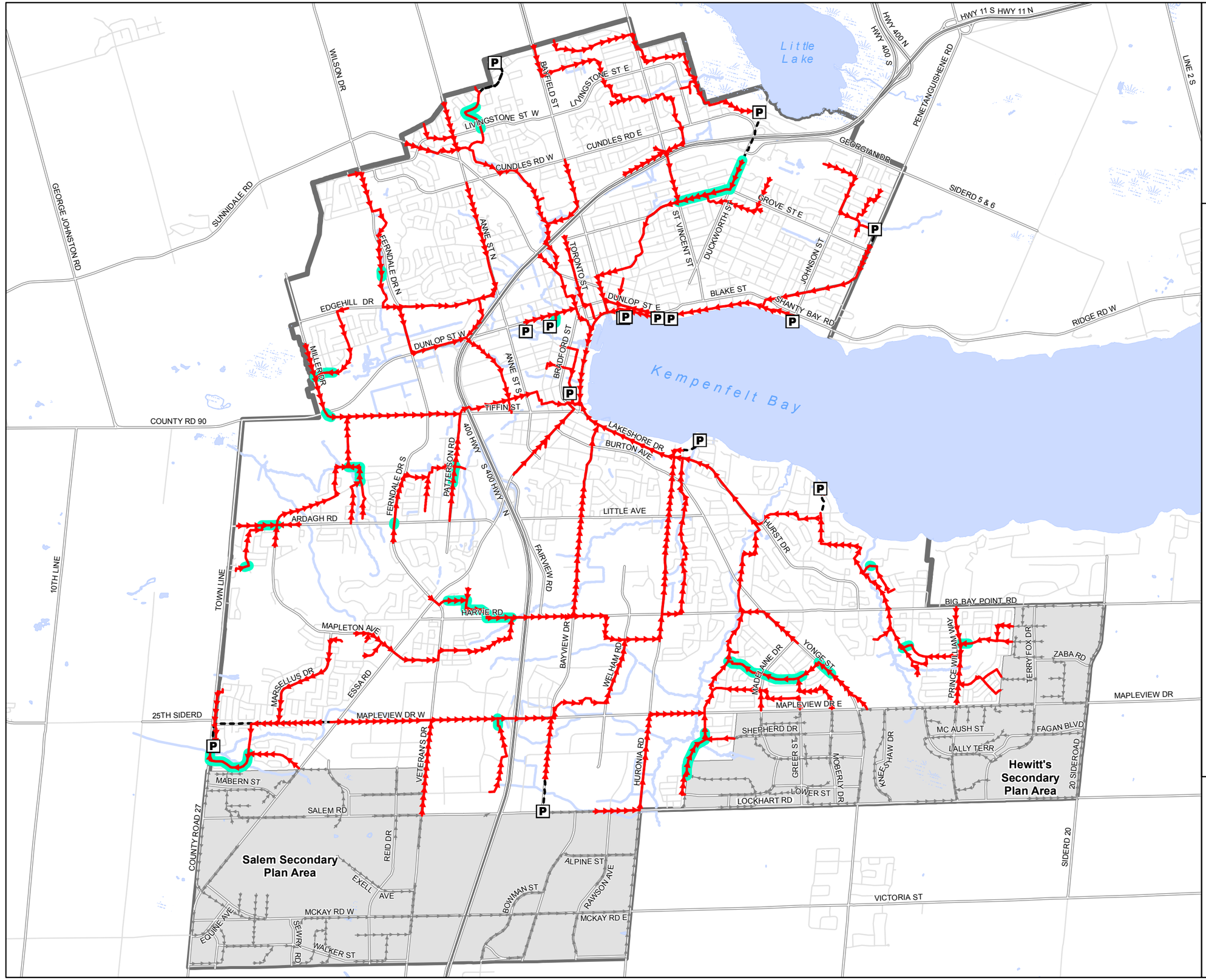
COLE

0 0.25 0.5 1 1.5 2
Kilometers

N

Updated: 4/5/2019

Figure 10-2
City of Barrie
Location of System Improvements
(Sanitary Sewers <=375mm Diameter)



- Sewer Upgrades
- Forcemain
- Sanitary Trunk Sewer
- Pumping Stations
- Secondary Plan Boundaries
- Future Annexed Lands Sewers
- City of Barrie Limits

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Kilometers

Updated: 4/5/2019

Table 10.2 Detailed Description of Alternative Evaluation Criteria

Category	Evaluation Criteria
Natural Environmental	• Potential impacts on natural areas including woodlands, woodlots and terrestrial resources. • Potential impacts on water resources including wetlands and watercourses. • Potential impact on groundwater quality, surface water quality, erosion or flood potential.
Social and Cultural Environment	• Compliance with Provincial Legislation and City of Barrie Policies. • Potential long-term impact to residents, community facilities and public parks. • Potential impacts on land use planning. • Potential impacts on institutions or businesses. • Potential construction impacts including traffic, noise, dusty and visual distraction. • Potential impacts on archaeological resources and built heritage resources. • Potential impacts on First Nations heritages sites.
Technical	• Ability for alternative to meet system performance criteria • Ability to maximize use of existing infrastructure • Potential impacts on operation of existing wastewater infrastructure including Barrie WwTF and pumping stations. • Potential to phase the infrastructure to best service growth. • Constructability (potential for encountering difficulties during construction) • The ability of the alternative to adequately mitigate potential adverse effects associated with climate change events such as extreme weather events.
Economic / Financial	• Requirement for easements for construction of new infrastructure. • Capital cost of the proposed improvements. • Increase in annual operating and maintenance costs.

The above criteria were included in an evaluation matrix used to conduct a comparative assessment between the four alternatives. This approach allowed for the most appropriate alternative to be selected based on the greatest technical merit, lowest impact on the environment and lowest overall costs.

The evaluation was based on a qualitative assessment of the individual impacts documented.

10.3 Alternative Evaluation

Table 10.3 presents the evaluation matrix for the alternatives for the City's Wastewater Collection Master Plan. The colour coding used in **Table 10.3** to represent alternatives evaluated against each criteria area presented below.

Low impact, "most preferred"
Low to moderate impact, "preferred"
Impact can be mitigated, "less preferred"
Significant impacts, "least preferred"

Table 10.3 Alternatives Evaluation

Alternative / Criteria	Alternative 1 Do Nothing	Alternative 2 Limit Growth	Alternative 3 Water Conservation and I/I Reduction	Alternative 4 – Wastewater System Expansion
Natural Environment				
Potential impacts on terrestrial resources	Minimal impacts on terrestrial resources such as woodlots and woodlands are anticipated as no new infrastructure would be constructed.	Minimal impacts on terrestrial resources such as woodlots and woodlands are anticipated as no new infrastructure would be constructed.	Minimal impacts on terrestrial resources such as woodlots and woodlands are anticipated as no new infrastructure would be constructed.	Any impacts on terrestrial resources such as woodlots and woodlands can be mitigated through good construction practices and site selection. The City's Official Plan requires that the servicing of development employs best management practices to ensure sensitivity to the natural environment. All new wastewater infrastructure to be constructed within municipal servicing easements or road right of ways.
Potential impacts on water resources including	Alternative will have significant impacts on water resources including	Alternative will have minimal impacts on water resources including wetlands and	Alternative will have minimal impact on water resources as implementation	Alternative will have minimal impact on water resources as extension of

Table 10.3 Alternatives Evaluation

Alternative / Criteria	Alternative 1 Do Nothing	Alternative 2 Limit Growth	Alternative 3 Water Conservation and I/I Reduction	Alternative 4 – Wastewater System Expansion
wetlands and watercourses	wetlands, watercourses and Lake Simcoe as no wastewater servicing will be provided for future growth.	watercourses as minimal new development will occur.	of I/I reduction program will likely target repairs to trunk and sanitary sewers. Some of these sections may be located in sensitive natural heritage areas. Any impacts can be mitigated through best practices for design and construction.	Hewitts Creek trunk sewer will be located within the
Impacts on groundwater and surface water quality, erosion potential and flood potential	Alternative could significantly impact groundwater and surface water quality as no servicing will be provided for new growth areas.	Alternative will have minimal impacts.	Alternative will have minimal impacts.	Potential temporary impact on groundwater resources during construction. Any impact can be mitigated through good construction practices.
Social / Cultural Environment				
Compliance with Provincial Legislation and City of Barrie Official Plan Policies	Alternative does not meet requirements of Provincial Policy Statement and City of Barrie Official Plan policies for servicing.	Alternative does not meet requirements of Provincial Policy Statement and City of Barrie Official Plan policies as planned growth will not proceed.	Alternative meets requirements of Provincial Policy Statement and City of Barrie Official Plan policies for servicing.	Alternative meets requirements of Provincial Policy Statement and City of Barrie Official Plan policies for servicing.
Long Term impacts on residents,	Alternative will impact on existing residents,	Alternative will limit future growth of community and	Alternative will have minimal impacts on	Alternative will have minimal impacts on

Table 10.3 Alternatives Evaluation

Alternative / Criteria	Alternative 1 Do Nothing	Alternative 2 Limit Growth	Alternative 3 Water Conservation and I/I Reduction	Alternative 4 – Wastewater System Expansion
community facilities and parks	community facilities and parks as no additional servicing will be provided.	limit ability of municipality to upgrade and improve existing community facilities and parks.	residents, community facilities and parks.	residents, community facilities and parks.
Potential impacts on institutions or businesses	Alternative will impact businesses and institutions as no additional servicing will be provided.	Alternative will impact on institutions and businesses as minimal growth will be allowed to occur.	Alternative will require businesses and institutions to reduce water use potentially through replacement of inefficient fixtures.	Potential temporary impact on businesses located on Mapleview Drive during construction of East Annex Pumping Station forcemain. Good construction practices can be implemented to mitigate any impact.
Potential impacts on land use planning	No impacts anticipated on land use planning.	Significant impacts on land use planning.	No impacts anticipated on land use planning.	No impacts anticipated on land use planning.
Potential construction impacts (noise, dust, traffic and visual distraction)	Alternative has no potential construction impacts.	Alternative has no potential construction impacts.	Alternative has no potential construction impacts.	Potential construction impacts can be mitigated through best practice design and construction.
Potential Impacts on First Nations	No anticipated impacts for this alternative.	No anticipated impacts for this alternative.	No anticipated impacts for this alternative.	Any potential impacts will be mitigated through completion of Stage 3 archaeological

Table 10.3 Alternatives Evaluation

Alternative / Criteria	Alternative 1 Do Nothing	Alternative 2 Limit Growth	Alternative 3 Water Conservation and I/I Reduction	Alternative 4 – Wastewater System Expansion
				assessment and implementation of recommendations.
Technical Environment				
Ability of Alternative to Meet System Performance Criteria	Alternative will not provide sufficient capacity to service planned growth. System performance criteria will not be met.	Alternative will allow for sufficient capacity to service limited growth. System performance criteria will be met.	Alternative will not provide sufficient capacity to service planned growth on its own. Water conservation and I/I reduction programs can be included in the preferred alternative as implementation measures.	Alternative will provide sufficient capacity to service planned growth. System performance criteria will be met.
Ability to Maximize Use of Existing Infrastructure	Alternative will maximize use of existing infrastructure.	Alternative will maximize use of existing infrastructure.	Alternative will maximize use of existing infrastructure.	Alternative will maximize use of existing infrastructure.
Potential Impacts on operation of existing wastewater infrastructure	Alternative will significantly impact operation of existing wastewater infrastructure as no additional wastewater servicing capacity will be provided.	Alternative will not impact operation of existing wastewater infrastructure.	Alternative will maximize the capacity of the existing infrastructure through demand management techniques.	Alternative will allow for improvements to existing infrastructure. New wastewater storage facility will provide operational flexibility.
Potential for Phasing	No opportunities for phasing.	No opportunities for phasing.	Alternative can be phased to maximize potential	Alternative can be phased based on growth requirements.

Table 10.3 Alternatives Evaluation

Alternative / Criteria	Alternative 1 Do Nothing	Alternative 2 Limit Growth	Alternative 3 Water Conservation and I/I Reduction	Alternative 4 – Wastewater System Expansion
			reductions in wastewater generated.	
Constructability	No anticipated impacts.	No anticipated impacts.	Implementation of alternative will require a significant effort to engage public in water conservative and I/I reduction initiatives.	Alternative will involve construction of McKay Road trunk sewer under Highway 400 and several watercourse crossings.
Ability of alternative to mitigate impacts of climate change	Alternative will not have any ability to mitigate impacts of climate change.	Alternative will not have any ability to mitigate impacts of climate change.	Alternative will limited ability to mitigate impacts of climate change.	New infrastructure can be sized to mitigate climate change impacts.
Economic Environment				
Easements	Easements will not be required.	Easements will not be required.	Easements will not be required.	Easements may be required. Majority of infrastructure will be constructed within existing easements of municipal right of ways.
Capital Cost				
Increased Operations and Maintenance Costs	Significant increase in annual operations and maintenance costs associated with addressing spills and bypasses.	No increase in annual operations and maintenance anticipated.	Additional operations and maintenance costs associated with maintaining data collection networks needed to support demand	No net change in annual operations and maintenance costs anticipated as two new pumping stations will be built and two existing pumping stations

Table 10.3 Alternatives Evaluation

Alternative / Criteria	Alternative 1 Do Nothing	Alternative 2 Limit Growth	Alternative 3 Water Conservation and I/I Reduction	Alternative 4 – Wastewater System Expansion
			management initiatives.	will be decommissioned.

Based on the evaluation of alternatives, Alternative 4 was selected as the most preferred alternative due to the following:

- Alternative 4 - Expand Wastewater System would meet relevant provincial and municipal policies including Greater Golden Horseshoe Growth Plan, the Provincial Policy Statement and the City of Barrie Official Plan;
- Any natural environment impacts associated with construction of new infrastructure can be mitigated through good construction practices and best practice design;
- Alternative 4 would not impact on current and future land use planning;
- Construction impacts associated with dust, noise, traffic and visual distraction can be mitigated through good construction practices;
- Any impacts on First Nations and archaeological resources can be mitigated through the implementation of recommendations from the Stage 1 Archaeological Assessment;
- Alternative 4 fully meets the level of service and system performance requirements;
- Alternative 4 can be phased to match development over time;
- Alternative 4 would have constructability challenges including a crossing of Highway 400. These challenges can be mitigated through best practice design and construction;
- This alternative can be designed to mitigate the potential impacts of climate change through integration of resiliency and redundancy in into the design of new infrastructure;
- Annual operations and maintenance costs are not anticipated to increase as two existing pumping stations will be decommissioned and two new pumping stations will be constructed; and,
- The majority of required infrastructure will be constructed within municipal right of ways or existing easements.

11 Recommended Preferred Alternative

This section presents additional information on the sizing, costs and approval requirements for individual projects within the preferred alternative.

11.1 Recommended Projects, EA Schedules, Phasing and Costs

Table 11.1 contains a summary of recommended projects and provides details on their location, sizing, estimated, Class EA Schedule and required phasing. Implementation of the recommended projects can be phased to match growth requirements. **Figure 11-1** presents the location of recommended projects needed for growth. Details on cost estimates are contained in **Appendix C**. **Appendix C** also contains detailed cost and phasing information. On meeting the service requirements of the City of Barrie based on projected wastewater flows to 2041 and 2071, the recommended approach for implementation for the implementation of the preferred alternative is presented in **Table 11.1**.The findings of the Master Plan will be used as baseline information to determine the City of Barrie's development cost charges. **Appendix C** includes a summary of the projects proposed in the Master Plan and the percentage of each project allocated to growth.

Table 11.1 Recommended Projects

Project ID	Description	Estimated Project Cost	Class EA Schedule	Phasing
21101-a	Upgrade of the Holly Pumping Station to provide a firm capacity of 200L/s.	$6,639,000	B	Ongoing, Required in 2021
21101-b	Twin existing Holly PS Forcemain with installation of 1,940m of 350mm diameter forcemain from Holly PS along County Road 27 and Mapleview Drive East to SAP.	$2,936,000	B	Ongoing, Required in 2021
21102	Construct 1,213m of new 525mm and 3,050m of 600 mm diameter trunk sewer from MH702 to MH 798 on McKay Road.	$25,687,000	A+	2021
21103 and 21104	Construct 1,425m of new 750mm diameter trunk sewer along Huronia Road from MH798 to SAP08007 (Project 21103) and 640m of new 525mm diameter trunk sewer along Huronia Road from MH 789 to MH 798 (Project 21104).	$15,583,000	A+	2021
21301	New West Annex Pumping station with capacity of 100L/s. (One duty and one standby pump, each rated to 50L/s).	$11,967,000	B	2024-2031

Table 11.1 Recommended Projects

Project ID	Description	Estimated Project Cost	Class EA Schedule	Phasing
21302	New forcemain for West Annex Pumping Station, Twin 578 of 250mm diameter forcemain from West Annex Pumping Station to MH673.	$2,226,000	A+	2024-2031
22102	Mapleview East Trunk sewer from East Annex Pumping Station Discharge Location to Hewitt's Creek Trunk Sewer, 1530m – 525mm	$3,119,000	A+	2021
22101	Extension to existing Hewitt's Trunk Sewer, 1050m-525mm, from MH 68 to MH SAH09099.	$2,587,000	A+	2021
22301	Extension to existing Hewitt's Trunk Sewer, 575m-450mm, from Lockhart Road to MH 68.	$905,000	A+	2021
22302	New East Annex Pumping Station with capacity of 80 L/s. (One duty and one standby pump, each rated to 50L/s).	$11,967,000	B	2026-2031
22303	New twin forcemain for East Annex Pumping Station, 730m of 250mm diameter forcemain from East Annex Pumping Station to MH 201 along Mapleview Drive.	$2,811,000	A+	2026-2031
23401	Decommission existing Lockhart Pumping Station (PS4) and construct 750m of 300mm sanitary sewer to Lockhart Road	$930,000	A+	Post 2031
21402	Second phase of West Annex Pumping Station. Add pump at rated capacity of 50L/s.	$350,000	A+	Post 2031
21401	Second phase of East Annex Pumping Station. Add pump at rated capacity of 40L/s.	$350,000	A+	Post 2031
21303	Construct 552mm of 450mm from West Annex PS forcemain discharge to Project 21102	$959,000	A+	2024-2031

Table 11.1 Recommended Projects

Project ID	Description	Estimated Project Cost	Class EA Schedule	Phasing
	Construct new 525mm diameter sanitary sewer from Holly PS to Lougheed	$367,000	A+	2019-2023
WC2019-01	Inflow and infiltration monitoring, investigation, condition assessment, remediation and rehabilitation of sanitary sewer system and private property program to address sources on private property. Program to begin with Priority areas FM2, FM9A and FM11 followed by Secondary Priority Areas.	$10,000,000	-	2021
WC2019-02	Tiffin Street Sanitary Sewer replacement, 114m-600mm	$196,000	A+	Post 2031
WC2019-03	Stunden Lane Sanitary Sewer replacement, 281m – 525mm	$709,000	A+	Post 2031
WC2019-04	Twin Lakeshore South Trunk Sewer, 3175m – 1050mm	$24,619,000	A+	Post 2031
WC2019-05	Easement south of Tiffin Street replacement, 707m - 750mm	$1,455,000	A+	Post 2031
WC2019-06	Mapleview Drive West sanitary sewer replacement, 2259m – 675mm	$4,876,000	A+	Post 2031
WC2019-07	Brock Street sanitary sewer replacement, 16009m – 900mm	$3,756,000	A+	Post 2031
WC2019-08	Kierland Road sanitary sewer replacement, 446m – 600mm	$671,000	A+	Post 2031
WC2019-09	Patterson Road sanitary sewer replacement, 10m – 300mm	$15,000	A+	Post 2031
WC2019-10	Tiffin Street sanitary sewer replacement, 1352m – 900mm	$3,717,000	A+	2021
WC2019-11	Tiffin Street sanitary sewer replacement, 240m – 900mm	$639,000	A+	2021
WC2019-12	Sanitary sewer downstream of Minets Points Pumping Station forcemain discharge replacement, 220m – 375mm	$325,000	A+	2021

Table 11.1 Recommended Projects

Project ID	Description	Estimated Project Cost	Class EA Schedule	Phasing
WC2019-13	Mapleview Drive east of Holly Street forcemain discharge sanitary sewer replacement, 28m – 525mm	$52,000	A+	2021
WC2019-14	Penvil Trail sanitary sewer replacement, 737m -375mm, 212m-450mm and 64m – 300mm	$904,000	A+	2021
WC2019-15	Replace existing 840m-250mm diameter sanitary sewer with new 375mm diameter sanitary sewer from MH SAI13075 to MH SAI11024 (south of Bear Eco Creek Park).	$1,198,000	A+	2021
WC2019-16	Ardagh Sanitary sewer replacement, 220m – 300mm	$249,000	A+	2021
WC2019-17	Morrow Road sanitary sewer replacement, 595m – 375mm	$730,000	A+	2021
WC2019-18	Monitoring and assessment of Penetanguishene Road sanitary sewer downstream of PS1 to confirm need for sewer replacement	$100,000	-	2021
WC2019-19	Monitoring and assessment of Lougheed Road sanitary sewer to confirm need for sewer replacement	$100,000	-	2021
WC2019-20	Monitoring and assessment of Montserrand Street sanitary sewer downstream of PS1 to confirm need for sewer replacement	$100,000	-	2021
WC2019-21	PS 1 improvements, increase wet well storage by 95 m^3	$628,000	-	Post 2031
WC2019-22	Twin 253m – 400mm diameter forcemain from PS1	$713,000	A+	2021
WC2019-23	Twin 343m- 250mm diameter forcemain from PS2	$487,000	A+	2021
WC2019-24	Pump replacement to provide sufficient firm capacity to handle peak flows. (PS12)	$254,000	A+	2031
WC2019-25	Twin forcemain for PS12, 375m-100mm diameter	$483,000	A+	2021

In addition to the projects listed in **Table 11.1**, an equalization storage facility is proposed at the Barrie WwTF. This facility would provide equalization storage for wet weather flow control and for operational flexibility. The Wastewater Treatment Master Plan contains details on the size, cost, and Class EA schedule for this project.

The findings of this Master Plan will be used as baseline information to determine the City of Barrie's development cost charges. Included in Appendix C is a summary of the projects proposed in this Master Plan and the percentage of each project allocated to growth.

With regard to the improvement projects identified for the existing system, it should be noted that these improvements were identified as required to provide the City's level of service (d/D<0.7 for sewers with diameters greater than 375mm and d/D<0.5 for sewers with diameters of 375mm or less) for a 25-year storm event. The location of these improvements is shown in **Figure 10-1** and **Figure 10-2** while cost estimates are provided in **Appendix C**. We recommend that the City undertake additional flow monitoring and analysis as part of design to confirm that these improvements are needed. Needed improvements could be considered as part of future road reconstruction or underground sewer or watermain replacement projects.

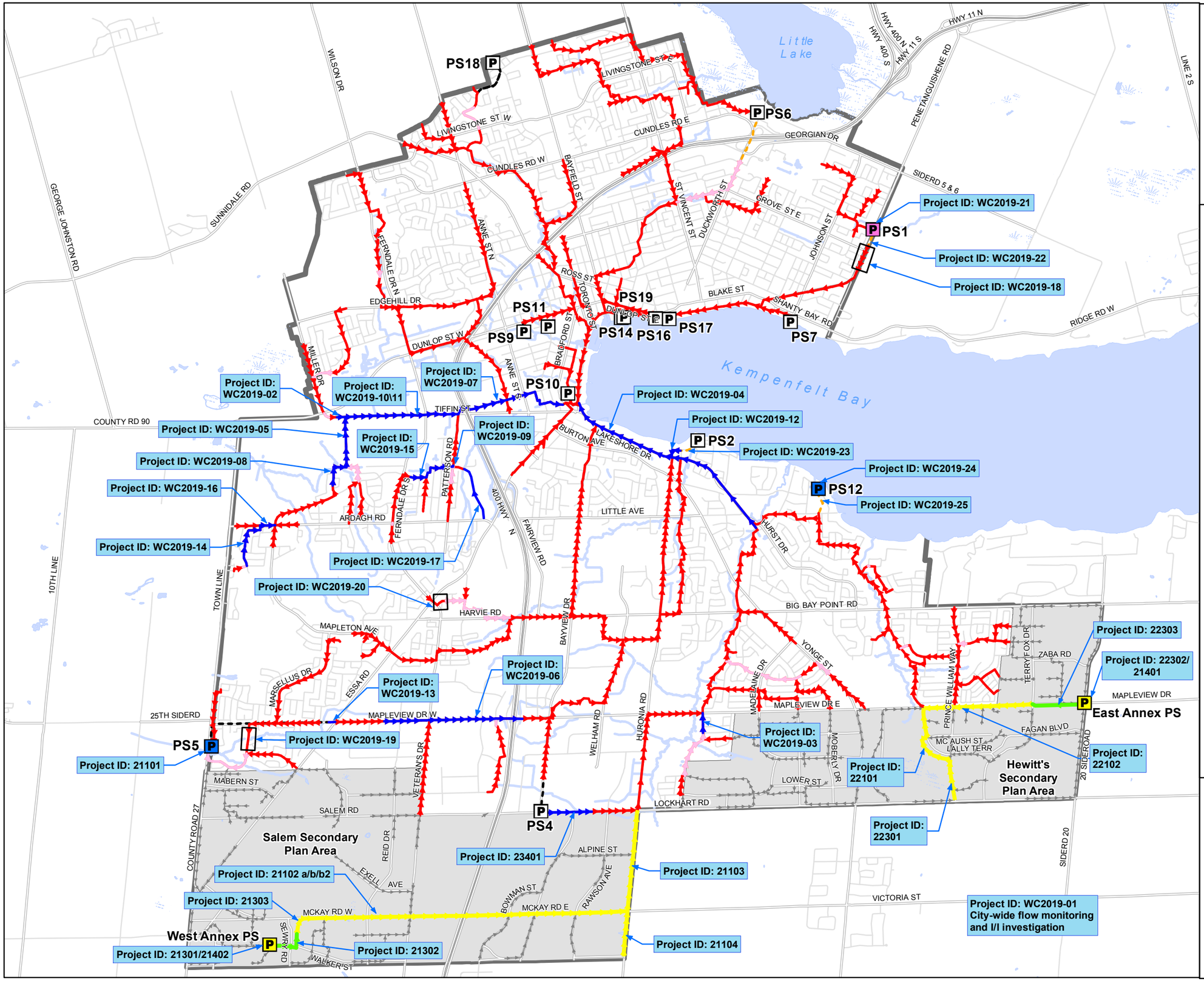
11.2 Preferred Alternative Performance

The performance of the preferred alternative was tested using the hydraulic model with several different scenarios. These included the following:

- 2041 growth projections;
- 2071 growth projections; and,
- High flow scenario that considered 2041 growth, process wastewater for existing and future industrial, commercial and institutional lands within the City and a higher peaking factor for wastewater flows. For all lands identified as industrial, commercial or institutional in the City's land use information, an additional flow allowance of 28m^3/d/ha was used to calculate the process wastewater contribution. A peaking factor of 4 was applied to all contributing areas. Sanitary sewers are normally designed with the Harmon Peaking Factor which is a function of population. The Harmon Peaking Factor is intended to be conservative for design purposes and for a small area, a value of 4 can be calculated. Actual flow monitoring data shows much smaller peaking factors. For this study, measured peaking factors ranged from 1.38 to 2.2. For the high flow scenario, the peaking factor was increased to introduce additional conservatism.

Figures 11-2, 11-3 and **11-4** present the results of these analyses and identify sanitary trunks sewers where the City's design criteria is exceeded. These figures also show where surcharge conditions are predicted.

Figure 11-1
City of Barrie
Preferred Alternative



- New Sanitary Trunk Sewer
- Infrastructure Upgrades for Growth
- Infrastructure Upgrades for Existing Conditions
- New Forcemain
- Forcemain Twinning
- Forcemain
- Sanitary Trunk Sewer
- Future Annexed Lands Sewers
- Pumping Stations
- Pumping Stations Capacity Upgrades for Growth
- Pumping Station Wet Well Upgrade
- New Pumping Stations
- Monitioring and Assessment Project
- Secondary Plan Boundaries
- City of Barrie Limits

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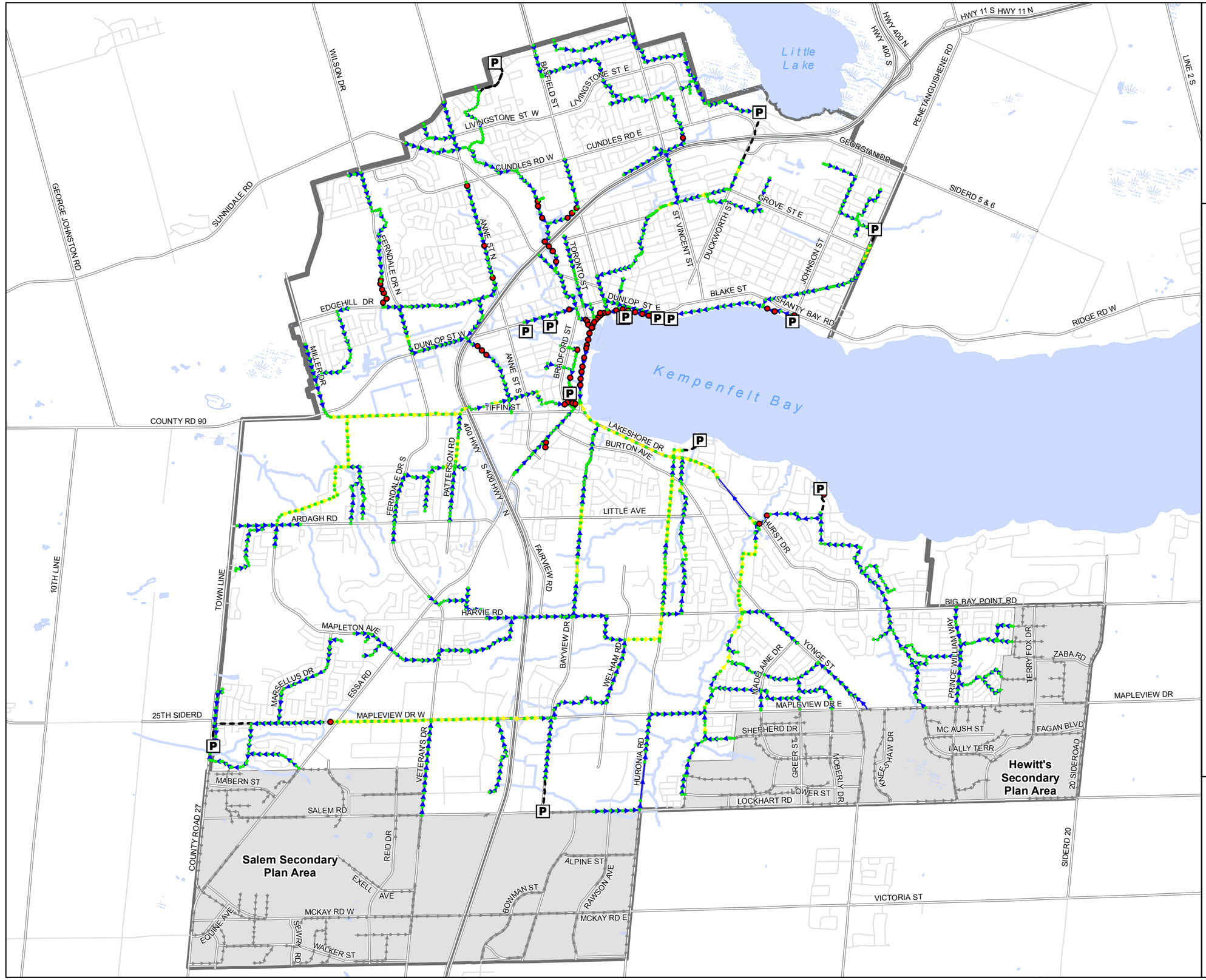
Updated: 7/17/2019

Figure 11-2
City of Barrie
Preferred Alternative
Performance - 2041 Wet Weather Conditions (25-Year Storm)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

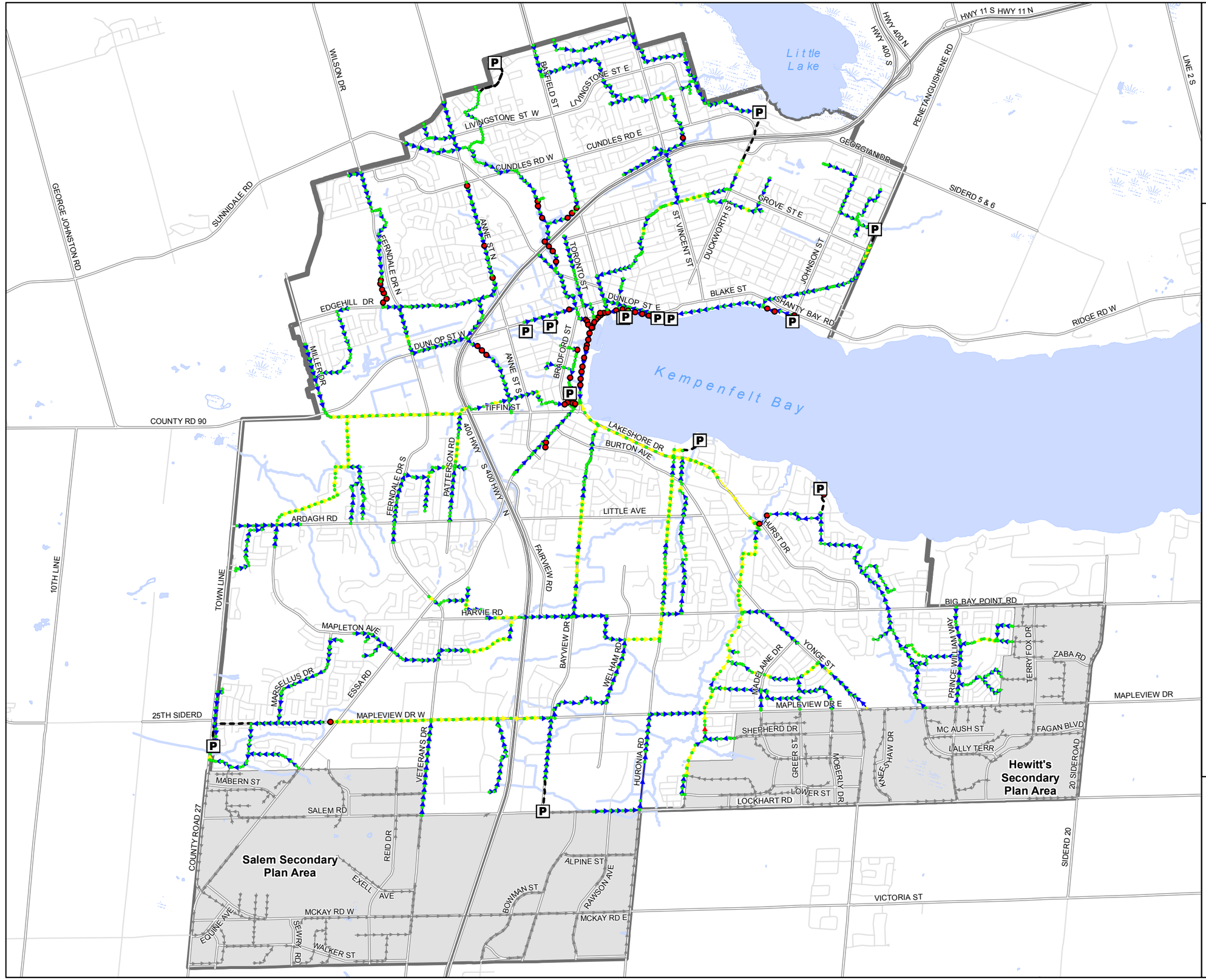
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 11-3
City of Barrie
Preferred Alternative
Performance - 2041 Wet Weather
High Flow Scenario
(25-Year Storm)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

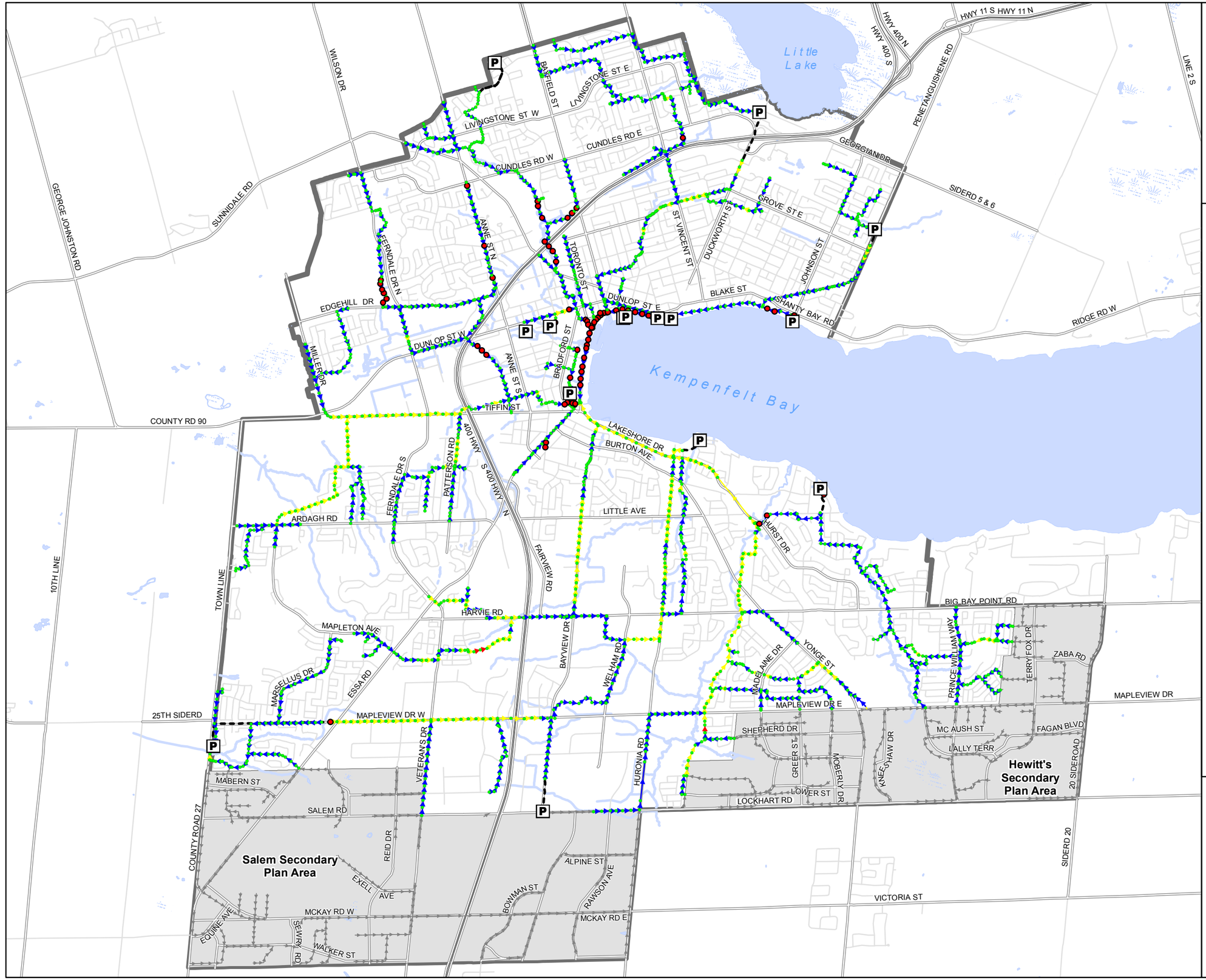
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 11-4
City of Barrie
Preferred Alternative
Performance - 2071 Wet Weather Conditions (25-Year Storm)



Pumping Stations
Forcemain
Secondary Plan Boundaries
City of Barrie Limits
Future Annexed Lands Sewers

Freeboard (m)
- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)
- < 0.5
- 0.5 - 0.7
- > 0.7

COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

11.3 Recommended Projects

The following sections provide further details on the recommended projects.

Holly Street Pumping Station and Forcemain (21101a and 21101b)

This project will increase the firm capacity of the Holly Street Pumping Station to 200 L/s and construct 1940m of twin 400mm diameter forcemain on County Road 27 and Mapleview Drive. This project is ongoing.

McKay Road Trunk Sewer (Project 21102)

The McKay Road Trunk Sewer is planned to extend from west of Veterans Drive to Huronia Road and will discharge into the Huronia Road Trunk Sewer. This project involves the construction of 1,213m of new 525mm diameter sanitary sewer and 3,048m of new 600mm diameter sanitary sewer along McKay Road. This sewer will discharge to the 750mm trunk sewer on Huronia Road (21103). The proposed McKay Road Trunk Sewer will cross Highway 400.

Huronia Trunk Sewer (Project 21103 and 21104)

The Huronia Road Trunk Sewer is planned to extend from MH798 at McKay Road to the MH SAP08007 at Lockhart Road. Flows will be conveyed to the existing 975mm diameter sanitary trunk sewer on Huronia Road north of Lockhart Road. This project consists of the construction of 1,425m of new 750mm diameter sanitary sewer along Huronia Road and will discharge into the existing 975mm trunk sewer on Huronia Road at Lockhart Road. Project 21104 will extent the Huronia Road Trunk Sewer to the City of Barrie limits and will involve construction of 640m of 525mm diameter sanitary sewer from MH789 to MH798 at McKay Road.

Annexed Lands West Station Pumping Station and Forcemain (Project 21301/21302)

Construction of new pump station and forcemain to service development in the south-west annexed lands. This project includes the construction of a new pumping station with a capacity of 100 L/s to service growth and construction of 200m of twin 250mm diameter forcemain from the West Annex Pumping Station to MH673.

Mapleview East Trunk Sewer (Project 22102)

The Mapleview East Trunk sewer will extend from the East Annex Pumping Station forcemain discharge location to the Hewitt's Trunk Sewer. The proposed trunk sewer will discharge into the Hewitt's Creek Trunk Sewer. The project consists of the construction of 1530m of new 525mm diameter sanitary sewer.

Hewitt's Trunk Sewer Extension (Project 22101)

The Hewitt's Trunk Sewer Extension will extend from MH68 to MH SAH09099 and will extend along Hewitt's Creek outside of the City's 2010 limit. This proposed trunk sewer will discharge into Hewitt's Trunk Sewer Extension. This project consists of the construction of 1050m-525mm diameter sanitary sewer.

Hewitt's Trunk Sewer Extension Phase 2 (Project 22301)

Phase 2 of the Hewitt's Trunk Sewer Extension will extend from MH68 to the southern City limit at Lockhart Road. This project will result in the construction of 575m of 450mm sanitary sewer to service new growth in the south Hewitts land.

Annexed Lands East Station Capacity and Forcemain (Project 22302/22303)

Construction of new pump station and forcemaim to service development in the east annexed lands. This project includes the construction of a new pumping station with a capacity of 80 L/s to service growth and construction of 730m of 250mm diameter forcemain from the East Annex Pumping Station to MH201 along Mapleview Road.

Decommission Lockhart PS (Project 23401)

This project will decommission the existing Lockhart PS (PS4) and construct 750m of new 300mm diameter sanitary sewer from the Lockhart PS to Huronia Road.

Annexed Lands West Station Capacity Increase (Project 21402)

This project includes the installation of a third pump (50L/s) at the West Annexed Lands pumping station to provide a station firm capacity of 100L/s.

Annexed Lands East Station Capacity Increase (Project 22401)

This project includes the installation of a third pump (50L/s) at the East Annexed Lands pumping station to provide a station firm capacity of 80L/s.

MacKay Road Sanitary Sewer (Project 21303)

This project includes the construction of a new 450mm diameter sanitary sewer on McKay Road from the West Annex Pumping Station forcemain discharge to Project 21102 on McKay Road. This project will include construction of 552m of new 450mm diameter sanitary sewer.

City Inflow and Infiltration Reduction Program (WC2019-01)

This project will be a long term project that will include flow monitoring, field investigation, condition assessment, remediation and rehabilitation of existing maintenance holes and sanitary sewers. A private property program is also recommended to address sources identified on private property.

Tiffin Street Sanitary Sewer Replacements (WC2019-02, WC2019-10 and WC2019-11)

This project is a sewer replacement project needed to support growth and to meet the City's design criteria. These projects include replacement of 114m of existing 450mm diameter sanitary sewer with a new 600mm diameter sanitary sewer, replacement of 1352m of existing 600mm diameter sanitary sewer with a new 900mm diameter sanitary sewer and replacement of 240m of existing 750mm diameter sanitary sewer with a new 900mm diameter sanitary sewer.

Stunden Lane Sanitary Sewer Replacement (WC2019-03)

This project is a sewer replacement project needed to support growth and to meet the City's design criteria. This project includes replacement of 281m of existing 375mm diameter sanitary sewer with a new 525mm diameter sanitary sewer.

Lakeshore South Twin Trunk Sewer (WC2019-04)

This project will provide additional capacity in the Lakeshore South Trunk Sewer to accommodate future growth flows through the construction of a new twin 1050mm diameter trunk sewer. The project includes construction of 3,175m of new 1050mm diameter sanitary trunk sewer.

Easement South of Tiffin Street Replacement (WC2019-05)

This project is a sewer replacement project needed to support growth and to meet the City's design criteria. This project includes replacement of 707m of existing 600mm diameter sanitary sewer with a new 750mm diameter sanitary sewer.

Mapleview Drive West Replacement (WC2019-06)

This project is a sewer replacement project needed to support growth and to meet the City's design criteria. This project includes replacement of 2259m of existing 525mm and 600mm diameter sanitary sewer with a new 675mm diameter sewer from Veterans Drive to Highway 400.

Brock Street Sewer Replacement (WC2019-07)

This project is a sewer replacement project needed to support growth and to meet the City's design criteria. This project includes replacement of 1609m of existing 750mm diameter sanitary sewer with a new 900mm diameter sanitary sewer and replacement of 199m of existing 825mm diameter sanitary sewer with a new 900mm diameter sanitary sewer.

Keirland Road Sewer Replacement (WC2019-08)

This project is a sewer replacement project needed to support growth and to meet the City's design criteria. This project includes replacement of 446m of existing 525mm diameter sanitary sewer with a new 600mm diameter sanitary sewer.

Patterson Road Sewer Upgrade (WC2019-09)

This project will upsize the existing 10m section of sewer on Patterson Road from a 250mm diameter to a 300mm diameter. Increasing the capacity of this sewer will provide sufficient capacity to meet the City's level of service criteria.

Minets Point Sewer Replacement (WC2019-12)

This project is a sewer replacement project needed to support growth and to meet the City's design criteria. This project includes replacement of 220m of existing 250mm diameter sanitary sewer with a new 375mm diameter sanitary sewer from the Minets Point Pumping Station forcemain discharge to Lakeshore Road.

Mapleview Drive East of Holly Sewer Replacement (WC2019-13)

This project will upsize the existing 28m section of sewer on Mapleview Drive West immediately downstream of the Holly Pumping Station forcemain discharge. The existing 450mm diameter sanitary would be replaced with a new 525mm diameter sanitary sewer. Increasing the capacity of this sewer will provide sufficient capacity to meet the City's level of service criteria.

Penvil Trail Sewer Replacement (WC2019-14)

This project is a sewer replacement project needed to support growth and to meet the City's design criteria. This project includes replacement of 737m of existing 250mm diameter sanitary sewer with a new 375mm diameter sanitary sewer, replacement of existing 212m of existing 375mm diameter sanitary sewer with a new 450mm diameter sanitary sewer and replacement of 64m of existing 250mm diameter sanitary sewer with a new 300mm diameter sanitary sewer.

Sewer Upgrade South of Bear Eco Creek Park (WC2019-15)

This project will upsize the existing section of sewer south of Bear Eco Creek Park from Ferndale Drive to Patterson Road. Increasing the capacity of this sewer will provide sufficient capacity to meet the City's level of service criteria. This project consists of replacement of 840m of existing 250mm diameter sanitary sewer with a new 375mm diameter sanitary sewer.

Ardagh Street Sewer Replacement (WC2019-16)

This project is a sewer replacement project needed to support growth and to meet the City's design criteria. This project includes replacement of 220m of existing 250mm diameter sanitary sewer with a new 300mm diameter sanitary sewer on Ardagh Street from Essa Road to Morrow Road.

Morrow Road Sewer Replacement (WC2019-17)

This project is a sewer replacement project needed to support growth and to meet the City's design criteria. This project includes replacement of 595m of existing 250mm diameter sanitary sewer with a new 300mm diameter sanitary sewer on Morrow Road from Ardagh Street to the new Morrow Road sanitary sewer constructed in 2017.

Monitoring and Assessment to Identify Needs on Penetanguishene Road, Lougheed Road, Montserrand Road and Duckworth Street (WC2019-18, WC2019-19, WC2019-20 and WC2019-21)

These projects will monitor and assess flows in the Penetanguishene Road sanitary sewer, Lougheed Road sanitary sewer, Montserrand Road sanitary sewer and Duckworth Street sanitary sewer to confirm whether an upgrade is required.

Pumping Station Improvements, PS1 (WC2019-22)

This provide will provide an additional 95m^3 in wet well storage at Grove Street Pumping Station (PS1). Completion of this project will provide one hour of wet well storage at peak flow.

Pumping Station Forcemain Improvements, PS1 (WC2019-23)

This provide will twin the existing 400mm diameter forcemain for a distance of 253m. Completion of this project will provide a redundant forcemain for this station.

Pumping Station Forcemain Improvements, PS2 (WC2019-24)

This provide will twin the existing 250mm diameter forcemain for a distance of 343m. Completion of this project will provide a redundant forcemain for this station.

Pumping Station Improvements, PS12 (WC2019-25)

This project will increase the firm capacity of the Tynedale Pumping Station (PS12) from 10 L/s to 15 L/s through replacement of the existing pumps.

Pumping Station Forcemain Improvements, PS12 (WC2019-26)

This provide will twin the existing 100mm diameter forcemain for a distance of 375m. Completion of this project will provide a redundant forcemain for this station.

System Improvement Projects

A total of 55 sanitary sewers (diameters greater than 375) and 85 sanitary sewers (diameters of 375mm of less or) were identified as not meeting the City's level of service during peak wet weather flow (25-year storm). It is recommended that the City consider implementation of these projects as part of the capital works program. Implementation could be completed as part of road, watermain construction or sewer rehabilitation projects. It is also recommended that the City confirm the need for these upgrades through site specific flow monitoring and capacity assessment before proceeding.

11.4 Capacity at City of Barrie Municipal Boundary

An analysis was completed to assess the ability of the Barrie wastewater collection system to accept wastewater flows from adjacent municipalities in the future. The analysis considered future flow conditions in 2041 and 2071 and the recommended wastewater collection system in 2041 and 2071. The details of the analysis and findings are contained in **Appendix D**. The analysis considered a total of 15 potential locations and concluded that up to 300 L/s could be accepted into the City of Barrie wastewater collections system at a total of nine locations. It is recommended that the City undertake flow data collection in any sewer being considered for accepting flows from a neighbouring municipality as well as confirmation modelling and analysis before proceeding.

12 Conclusions and Recommendations

Analyses presented in this report have identified a number of required projects to support future growth as well as improvements to the existing sewer system needed to meet the City's level of service for a 25-year design storm event. All projects were sized using the developed wastewater collection system model.

With the incorporation of the recommended projects, existing capacity issues within the pre-2010 City boundary have been resolved and sanitary servicing has been provided to the Annexed Lands in accordance with the City's level of service criteria.

In the above assessment, Master Plan Schedule A+ and B projects have been identified where the Municipal Class EA requirements have been satisfied. It is recognized that under the Master Plan level of detail, some projects may have additional requirements. These costs will be further developed and refined during subsequent phases of implementation of the recommended projects.

It is also noted that all system assessments were completed using the City's design allowance for infiltration and inflow of 0.1L/s/ha for all new development areas. To ensure that this allowance is not exceeded for any specific development, the City is encouraged to consider requiring developers to complete flow monitoring to demonstrate that the design criteria is met. The City may wish to alter future subdivision agreements to add this requirement.

APPENDIX A

Public and Agency Consultation

Ministry of Tourism, Culture and Sport

Heritage Program Unit
Programs and Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7
Tel: 416 314 7147
Fax: 416 212 1802

Ministère du Tourisme, de la Culture et du Sport

Unité des programmes patrimoine
Direction des programmes et des services
401, rue Bay, Bureau 1700
Toronto ON M7A 0A7
Tél: 416 314 7147
Téléc: 416 212 1802

Ontario

October 17, 2017 (EMAIL ONLY)

Mr. Tom Reeve, P. Eng.
Senior Infrastructure Planning Program Coordinator
City of Barrie
70 Collier Street, Box 400
Barrie, ON L4M 4T5
E: Tom.Reeve@barrie.ca

RE: MTCS file #: 0007579
Proponent: City of Barrie
Subject: Notice of Commencement
Master Plan Updates for Water Supply, Distribution and Storage, Wastewater Collection and Wastewater Treatment
Location: City of Barrie, Ontario

Dear Mr. Reeve:

Thank you for providing the Ministry of Tourism, Culture and Sport (MTCS) with the Notice of Commencement for your project. MTCS's interest in this Environmental Assessment (EA) project relates to its mandate of conserving Ontario's cultural heritage, which includes:

- Archaeological resources, including land-based and marine;
- Built heritage resources, including bridges and monuments; and,
- Cultural heritage landscapes.

Under the EA process, the proponent is required to determine a project's potential impact on cultural heritage resources. The recommendations below are for a Schedule B Municipal Class EA project, as described in the notice of study commencement. If any municipal bridges may be impacted by this project, we can provide additional screening documentation as formulated by the Municipal Engineers Association in consultation with MTCS. Realizing that this is in part a Master Plan Update, developing or reviewing inventories of known and potential cultural heritage resources within the study area can identify specific resources that may play a significant role in guiding the evaluation of alternatives for subsequent project-driven EAs.

While some cultural heritage resources may have already been formally identified, others may be identified through screening and evaluation. Aboriginal communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Aboriginal communities includes a discussion about known or potential cultural heritage resources that are of value to these communities. Municipal Heritage Committees, historical societies and other local heritage organizations may also have knowledge that contributes to the identification of cultural heritage resources.

Archaeological Resources
Your EA project may impact archaeological resources and you should screen the project with the MTCS *Criteria for Evaluating Archaeological Potential* and *Criteria for Evaluating Marine Archaeological Potential* to determine if an archaeological assessment is needed. MTCS archaeological sites data are available at *archaeology@ontario.ca*. If your EA project area exhibits archaeological potential, then an

archaeological assessment (AA) should be undertaken by an archaeologist licenced under the *OHA*, who is responsible for submitting the report directly to MTCS for review.

Built Heritage and Cultural Heritage Landscapes
The MTCS *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* should be completed to help determine whether your EA project may impact cultural heritage resources. The Clerk for the City of Barrie can provide information on property registered or designated under the *Ontario Heritage Act*. Municipal Heritage Planners can also provide information that will assist you in completing the checklist. The draft *MTO Ontario Heritage Bridge Guidelines for Provincially Owned Bridges* screening criteria have also been established for cultural heritage evaluation of bridges under the Class EA for Provincial Transportation Facilities.

A Cultural Heritage Evaluation Report (CHER) is used to determine the cultural heritage value or interest of a potential Provincial Heritage Property. If potential or known heritage resources exist, MTCS recommends that a Heritage Impact Assessment (HIA), prepared by a qualified consultant, should be completed to assess potential project impacts. Our Ministry's *Info Sheet #5: Heritage Impact Assessments and Conservation Plans* outlines the scope of HIAs. Please send the HIA to MTCS for review, and make it available to local organizations or individuals who have expressed interest in review.

Environmental Assessment Reporting
All technical heritage studies and their recommendations are to be addressed and incorporated into EA projects. Please advise MTCS whether any technical heritage studies will be completed for your EA project, and provide them to MTCS before issuing a Notice of Completion. If your screening has identified no known or potential cultural heritage resources, or no impacts to these resources, please include the completed checklists and supporting documentation in the EA report or file.

Thank you for consulting MTCS on this project: please continue to do so through the EA process, and contact me for any questions or clarification.

Sincerely,

Dan Minkin
Heritage Planner
dan.minkin@ontario.ca

Public Information Centre

City of Barrie Water and Wastewater Master Plan Update – Class Environmental Assessment (EA)

Welcome!

1. Please sign in at the Front Desk.
2. Feel free to review the boards and participate in the exercises.
3. Complete a comment sheet.
4. Staff are available to answer questions.

PROJECT INTRODUCTION

Purpose of the Project

The City of Barrie is undertaking an update to the 2013 Water and Wastewater Master Plans which were approved by Council on December 2, 2013. The existing plans have a horizon of 2031 with a long term outlook to 2051. These plans can be reviewed at www.barrie.ca and by clicking on City Hall > Growth Management > Growth Management Documents & Resources**.**

This update is to identify the future water and wastewater servicing needs of the City. They include:

- **Wastewater Treatment Master Plan**
- **Water Supply Master Plan**
- **Wastewater Collection Master Plan**
- **Water Distribution and Storage Master Plan**

This project has been developed to facilitate Barrie's current and projected growth to ensure that sufficient servicing can be provided to 2041, as required by the Provincial Growth Plan, and to the year 2071. It will also ensure regulatory compliance, and meet regulatory requirements and policies that govern water and wastewater supply, collection and treatment, and patterns of development.

Study Timeline

Purpose of this Event

The purpose of this Public Open House is to provide an opportunity to gain public input and feedback on the water and wastewater servicing alternatives. Following this open house, the Study Team will address the public input and feedback received into the final Master Plan deliverables.

PROJECT BACKGROUND

Infrastructure & Servicing Needs

The City of Barrie is one of Ontario's fastest growing municipalities, and is the largest urban centre in the Simcoe County area. The current Master Plans have a 2031 horizon with a preliminary outlook to 2051.

Updates to the Master Plans are required in order for the City to comply with the 2017 Provincial Growth Plan to accommodate Barrie's projected growth, and to ensure that sufficient servicing can be provided to the 2041 horizon.

However, to better anticipate long-term servicing needs, projections have been forecasted to the year 2071. This allows the City to identify constraints well in advance of the next update. Master Plans are scheduled to be updated on a 5-year cycle.

In 2016

145,800 called the City of Barrie home

73,800 people worked in the City of Barrie

Policy Framework

Various laws, regulations, guidelines, and policies govern water and wastewater supply, collection, and treatment, as well as development patterns for which those systems will be expanded to service. Several of the key regulatory requirements impacting this project include:

- *Safe Drinking Water Act, 2002*
- *Ontario Water Resources Act, R.S.O 1990*
- *Ontario Environmental Protection Act, R.S.O 1990*
- *Lake Simcoe Protection Act, 2008*
- Provincial Policy Statement, 2014
- Growth Plan for the Greater Golden Horseshoe, 2017
- City of Barrie Official Plan (January 2018 Office Consolidation)

By 2031...

210,000 people will call the City of Barrie home

101,000 people will work in the City of Barrie

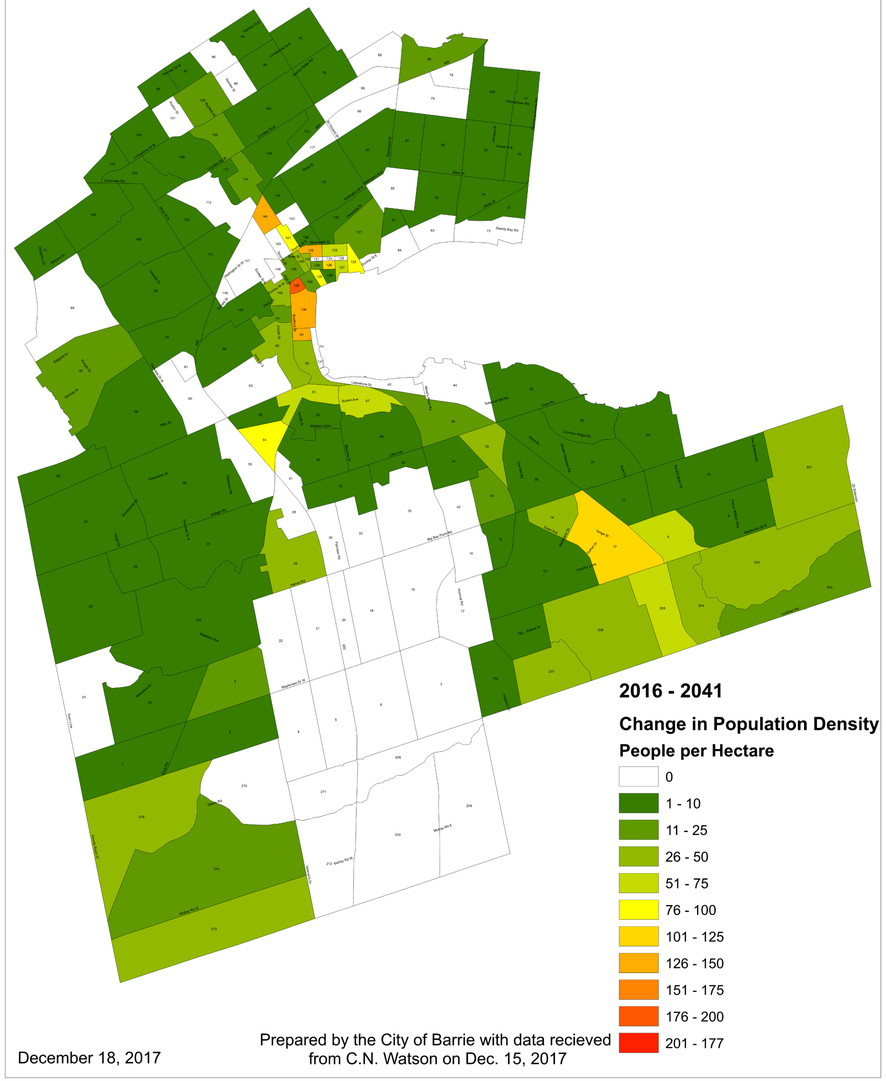
By 2041...

253,000 people will call the City of Barrie home

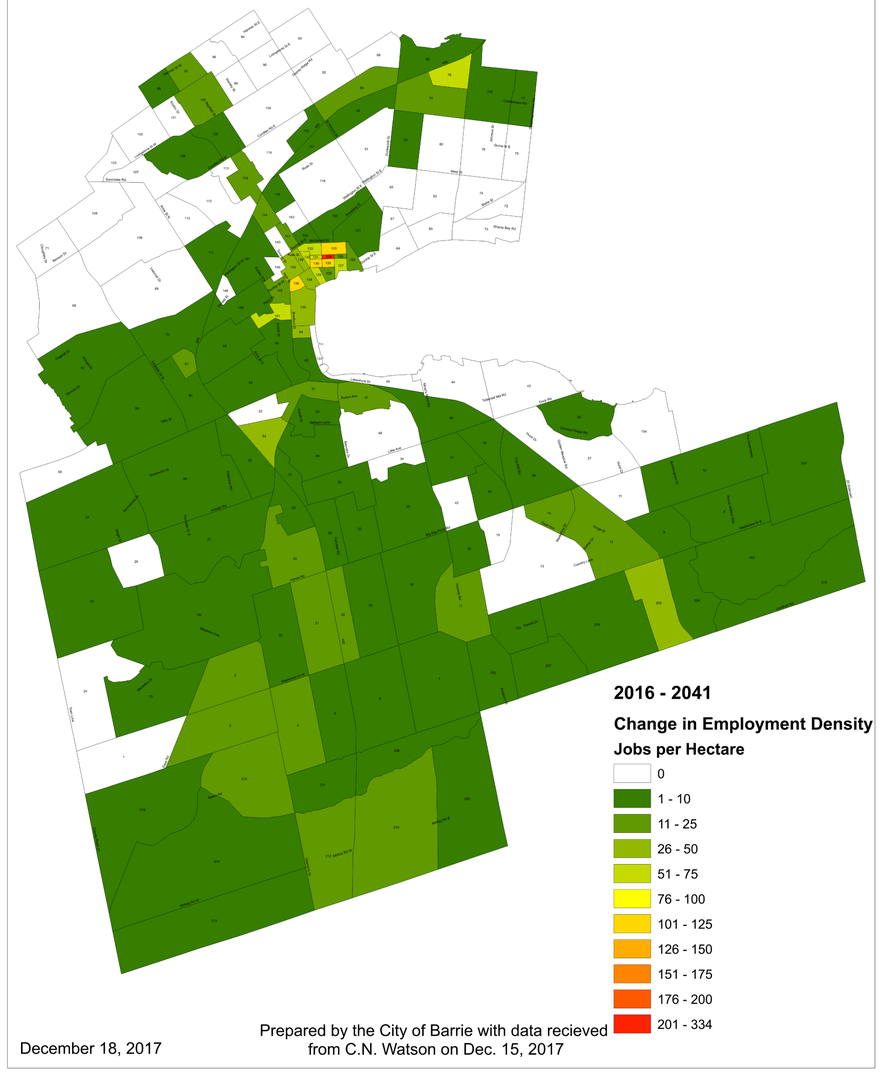
129,000 people will work in the City of Barrie

PROJECTED GROWTH

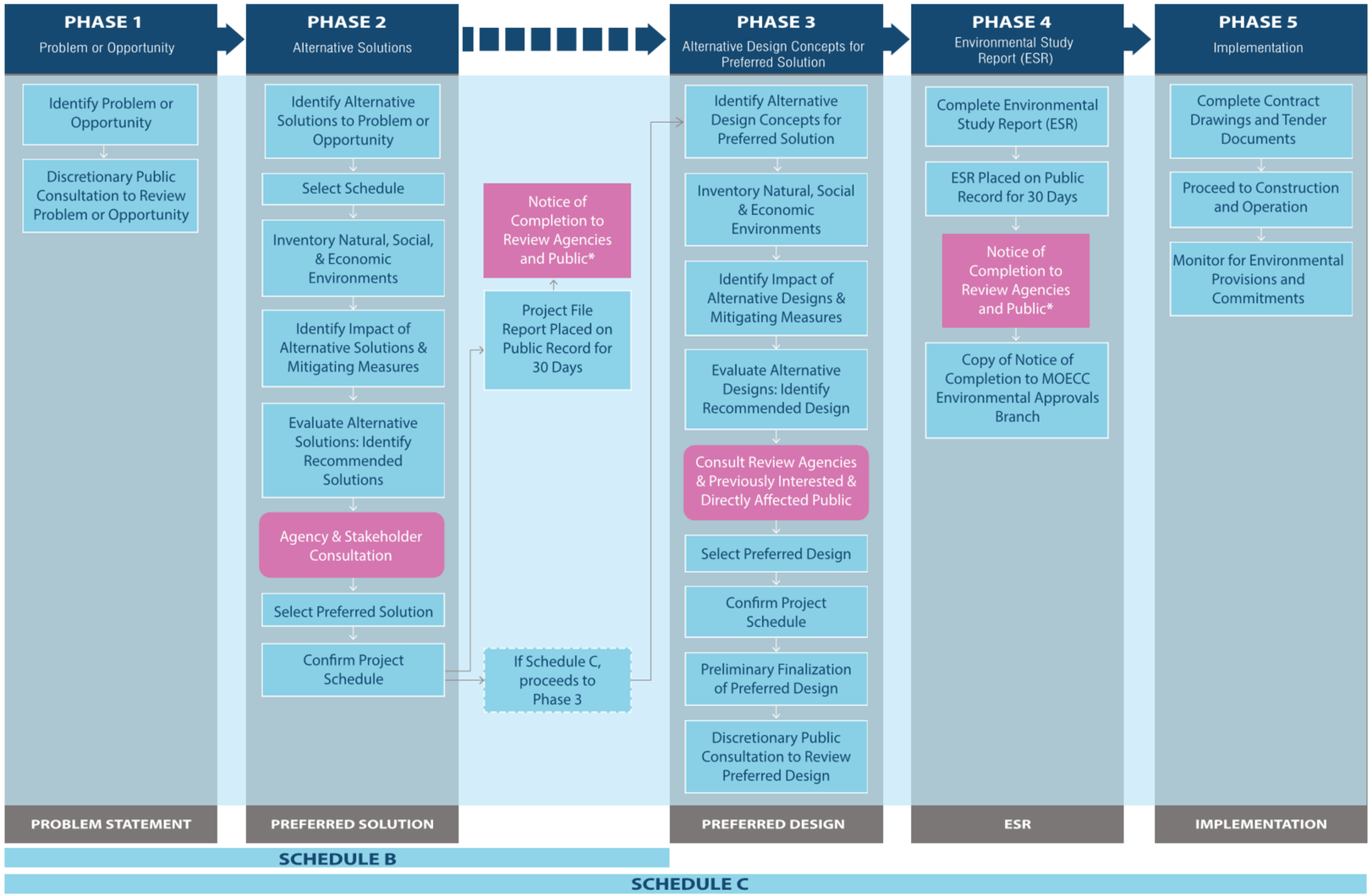
Residential Growth



Non-Residential Growth



MUNICIPAL CLASS EA PROCESS



Adapted from Municipal Engineers Association (MEA), Municipal Class Environmental Assessment, October 2000 (as amended in 2007 and 2011)

The 2013 Master Plan and these updated Master Plans will be completed using <u>Approach 2</u> of the Class EA Master Planning Process

EA Project Schedules

Projects undertaken by the City as a result of this Master Plans Update are assigned to various project 'Schedules' according to their anticipated level of environmental impact.

Schedule A projects are limited in scale and have minimum adverse environmental effects. These projects are pre-approved and include a number of maintenance and operational activities.

Schedule A+ projects are pre-approved, however, the public is to be advised prior to project implementation.

Schedule B projects have the potential for some adverse environmental effects and require public consultation. These projects generally include improvements and minor expansions to existing facilities.

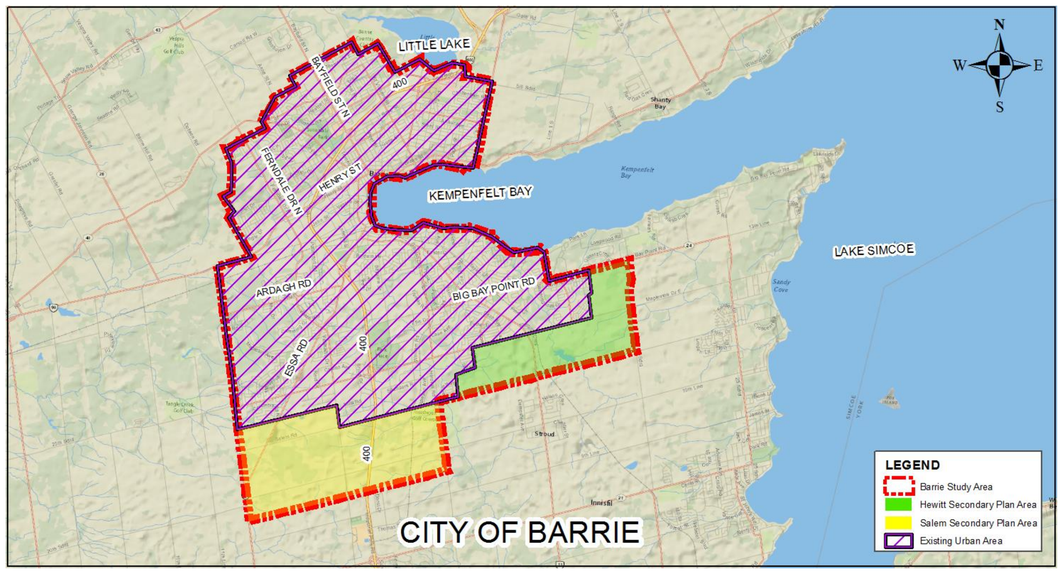
Schedule C projects have the potential for significant environmental effects and require public consultation. These projects generally include the construction of new facilities and major expansions to existing facilities.

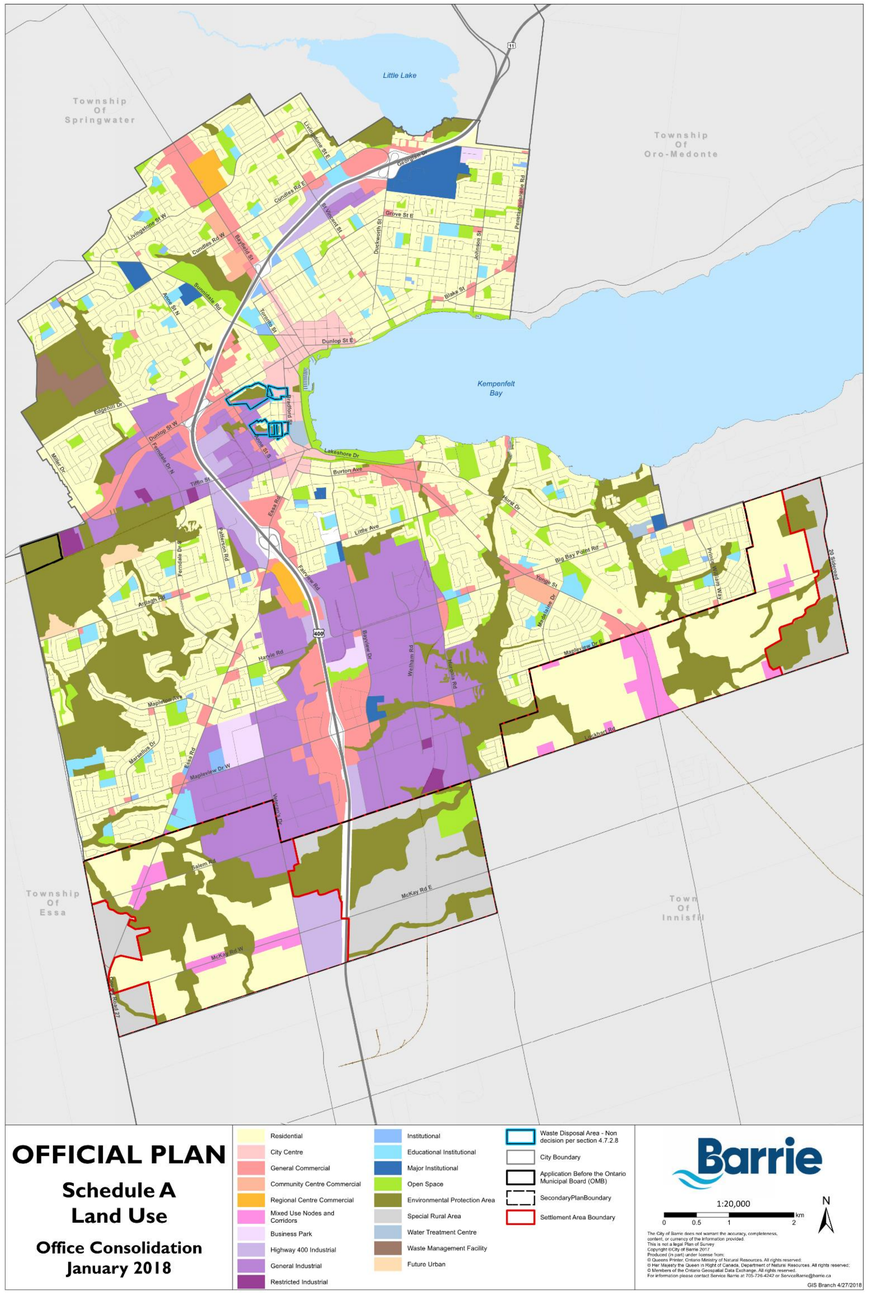
STUDY AREA

The Study Area for this project encompasses the entire City. This includes the Secondary Plan Areas located along the southern border of the City's boundary.

The City is located on the shores of Lake Simcoe and on the western extent of Kempenfelt Bay. The City boundary encompasses nearly 100 square kilometres, and as of the 2016 census, is home to about 145,800 residents. In 2010, an additional 2,293 hectares of land were annexed to the City of Barrie from the Town of Innisfil – allowing the City to accommodate a growing population.

This Project has been undertaken to facilitate Barrie's current and projected growth and to ensure that sufficient servicing can be provided to facilitate this growth to 2041. It is also important that the Lake Simcoe watershed be protected, as required under Provincial legislation.





WE WANT YOUR INPUT!

The City wants to understand if there are any mitigating measures you would like to see included in the detailed design and construction of this project.

Please use the dots to answer the questions. Use the sticky notes to provide comments.

QUESTION	YES	NO	Not Applicable
Are you concerned about light pollution from the new booster station?			
Are you concerned about changes to recreational space?			
Are you concerned about the visual impacts of the new booster station?			
Please provide your comments (and property address) here			

Wastewater Collection Master Plan

PROBLEM AND ALTERNATIVES

Based on a detailed review of the performance of the existing wastewater collection system, and anticipated servicing requirements to accommodate future growth, it was determined that **additional wastewater collection capacity is required to accommodate long-term growth in the City of Barrie**.

Design Criteria

The City of Barrie Sanitary Sewage Collection Systems Policies and Design Guidelines were updated in October 2017. These new Design Guidelines informed the Service Levels used in the Wastewater Collection System Master Plan Update:

- During peak dry weather flow conditions, the depth of flow should not exceed 70% of the full pipe depth. No surcharging should occur.
- During a 25-year design storm event, a minimum freeboard to ground surface of 1.8m should be maintained.
- Pumping stations should have sufficient firm capacity to pump peak incoming flows during a 25-year design storm event, and sufficient wet well storage to provide storage of peak flows for a 1-hour period.

Updates from 2013 Master Plan

The City has moved forward on the immediate term recommendations from the 2013 Master Plan, which includes seven capital projects. As part of this Master Plan all projects identified in the 2013 Master Plan have been confirmed with timing adjustments per the new growth projections.

LIST OF ALTERNATIVES

A list of alternative solutions to address the problem statement were identified in the early stages of the project.

1. Do Nothing
Under this alternative, the wastewater collection system will continue to operate as it currently does.

2. Limit Growth
This alternative involves restricting population growth within the City to minimise the impacts on existing infrastructure and resources. Lower growth rates would ensure the sufficiency of the existing infrastructure for a longer period of time and would delay any need for expansion.

3. Water Conservation and Inflow/Infiltration Reduction
This alternative considers the implementation of City-wide programs to reduce flows to the wastewater collection system while still allowing growth to occur. Flows to the wastewater collection system would be reduced through enhanced water conservation and demand management as well as implementation of infiltration and inflow reduction measures.

4. Upgrade and Expansion of Existing System
This alternative considers the implementation of improvements and expansion of the wastewater collection system, including both sewers and pumping stations, to address existing capacity issues and to accommodate future growth. This alternative will also accommodate planned growth in the Secondary Plan Areas.

What is Inflow and Infiltration?

Inflow and Infiltration (I/I) is a term used to describe the ways in which stormwater and groundwater enter the sanitary collection system.

The term ‘inflow’ refers to water from rainfall and snow melt that is designed to enter the collection system.

The term ‘infiltration’ refers to unwanted water entering the collection system through different ways, as shown on the diagram to the left.

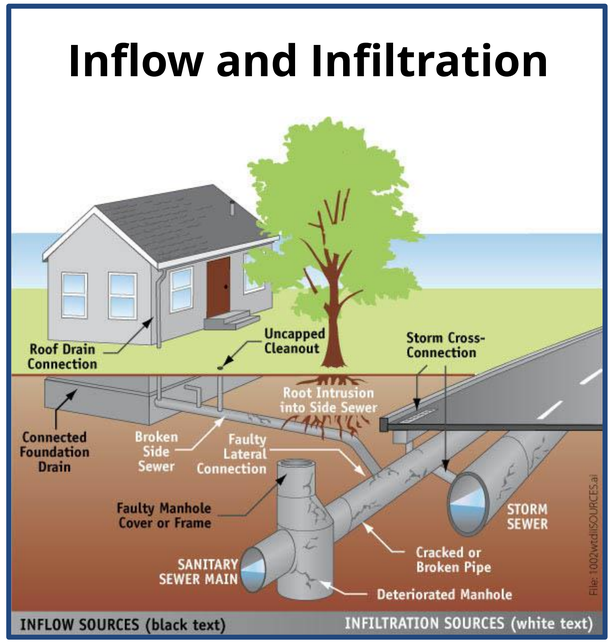


Image courtesy of Tuscarawas County

LONG-LIST ALTERNATIVES SCREENING

Pass or fail criteria were used for the screening of the long-list of alternatives as follows:

1. **Complexity** – A pass is given to any alternative that could be feasibly implemented with minimal impact to plant operations, City operations/activities and poses minimal risks to health and safety.
2. **Compatibility with the current policies and regulations** – A pass is given to any alternative that complies with Provincial and City policy related to growth and development.
3. **Addresses the problem statement** – A pass is given to an alternative that provides a solution to any of the constraints identified in the problem statement.

Alternative	Complexity	Policy and Regulation Compatibility	Addresses the Problem Statement
Do Nothing	✓	✗	✗
Limit Growth	✗	✗	✗
Upgrade and Expansion of Existing System	✓	✓	✓
Water Conservation and Inflow/Infiltration Reduction	✓	✓	✓

The screening process concluded that Alternatives 3 and 4 warranted further evaluation.

EVALUATION OF ALTERNATIVES

The alternatives were evaluated using the following criteria, which are based on the triple-bottom line approach outlined in the Class EA process and were established in consultation with the City of Barrie.

1. **Natural Environment:** Refers to any potential impact to natural areas or features, groundwater quality, surface water, erosion, and flood control.
2. **Social & Cultural Environment**: Refers to any potential impact to residents, built-up areas, and regulatory requirements.
3. **Technical:** Refers to system operation, ability to measure performance, future expansion, ability to provide consistent and efficient servicing, and phasing of required infrastructure.
4. **Constructability:** Ease of construction and requirements for new construction easements.
5. **Cost:** Refers to the capital cost, operating cost, and phasing (implementation).

Evaluation Criteria	Inflow and Infiltration	System Expansion
Natural Environment		
Social and Cultural Environment		
Technical		
Constructability		
Cost		

Key
Low Impact / “Most Preferred”
Low to Moderate Impact / “Preferred”
Moderate Impact / “Less Preferred”
High Impact / “Least Preferred”

**the colour assigned to each alternative/criteria indicates a ranking*

MANAGING WET-WEATHER FLOWS

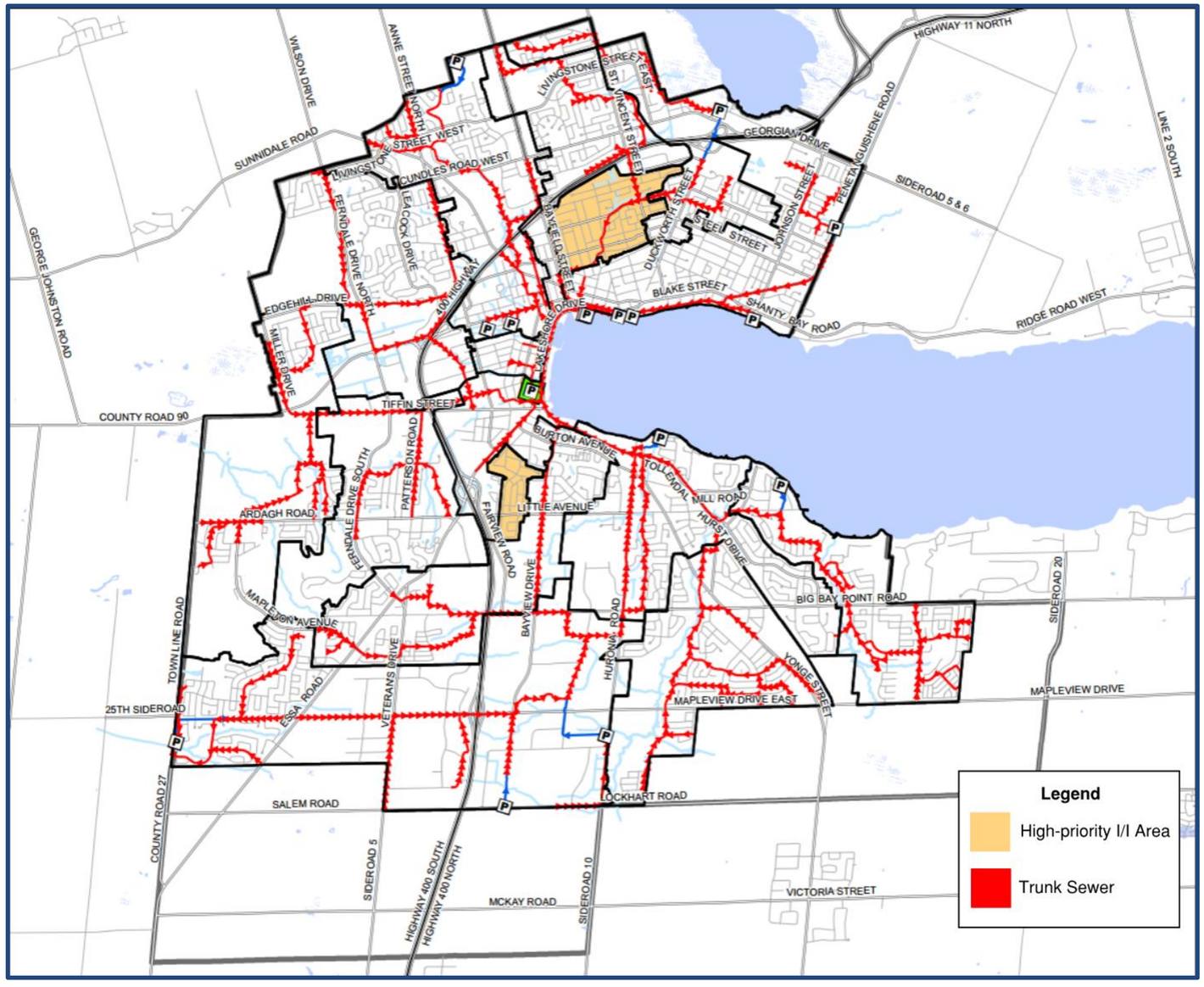
Inflow and Infiltration

Inflow
Directly connected stormwater sources.

Infiltration Groundwater entering collection system through sewer system defects.

Wet-Weather Flows

- Elevated wastewater flows during wet-weather events can result in capacity issues in local collection as well as downstream at the WwTF.
- Sanitary sewer flow data collected in 2017 identified two of the highest areas in the City that contribute excessive inflow and infiltration to the collection system during wet-weather events.
- Priority areas were identified by comparing observed wet-weather inflows from the 2017 monitoring period to the City's current design value of **0.1 L/s/ha**
- It is recommended that an aggressive inflow and infiltration reduction program be undertaken in these areas. These program could then be expanded to other areas of the City.



WE WANT YOUR INPUT!

The City wants to understand if there are any issues with wastewater collection at your residence and/or workplace.

Please use the dots to answer the questions. Use the sticky notes to provide comments.

QUESTION	YES	NO	Not Applicable
Do you have a sump pump that turns on during heavy rainfall and is connected to the sewer system?			
Has your neighbourhood experienced any odours related to the sewer system?			
Has your basement ever flooded due to sewage back-up during heavy rainfall (i.e. not from a leak through a wall or window)?			
Please provide your comments (and property address) here			

NEXT STEPS

Conclusions

- The Master Plans each identify a series of projects that are required to meet the growing water and wastewater needs in the City of Barrie.
- This study has used a long-term vision to understand the future conditions and requirements of the City.

Next Steps

Winter 2018 – Master Plan Reports

- These documents summarize the overall EA process and will be available for public review and comment. People who have expressed an interest to be kept informed of the project will be notified directly. There will be an opportunity to meet with project staff individually to discuss concerns.

Winter 2019 – Master Plan Approval

- Following the public comment period, the new Master Plans will be presented to Council. Members of the public will have an opportunity to make a deputation to Council as a registered delegate.
- If Council approves the Master Plan, the City will issue a Notice of Completion. The public will have a minimum 30-day period to appeal.

More Information

Visit **www.barrie.ca** to find out more!

Contact Information

Tom Reeve

Senior Infrastructure Planning Program Coordinator

City of Barrie

70 Collier Street, Box 400

Barrie, ON L4M 4T5

Tel: (705) 739-4220 Ext. 4465

Fax: (705) 739-4247

Email: Tom.Reeve@barrie.ca

CITY OF BARRIE
WATER AND WASTEWATER MASTER PLAN UPDATE
PUBLIC INFORMATION CENTRE – NOVEMBER 1ST, 2018
PLEASE SIGN IN

NAME (Please Print)		CONTACT INFORMATION				PHONE	EMAIL
First	Last	Street #	Street Name	City/Town	Postal Code	Number	Address
HUGH	JOHNSTON	27	CLAPPERTON ST.	BARRIE	L4M 3E6	705-722-4500	HJOHNSTON@PRATTDEVELOPMENT.CA
Sandra	Beardsall	19	Callaghan Dr	Barrie	L4N 6E8	(705)721-500	sandug98@hotmail.com
Sarah	Michieli	23	Callaghan Dr	Barrie	L4N 6E8	(705)279-2728	sarahgailvc@hotmail.com
HAMID	ARMAKI	2145	AVENUE Rd.	TO	M5M 4B2	416-568-4696	
Maccia & May	Morelli	160	Cheltenham Rd.	Barrie	L4M 6S5	705-720-1495	
DON	BUCKLES	61	MACLAREN	BARRIE	L4N 5T4	705 627 2705	
BARRY	COPPING	81	JANICE DR	BARRIE	L4N 5N5	705 7399948	
ANDREW	COPELAND	21	CALLAGHAN DR	BARRIE	L4N 6E8	705 722 9646	

CITY OF BARRIE
WATER AND WASTEWATER MASTER PLAN UPDATE

PUBLIC INFORMATION CENTRE – NOVEMBER 1ST, 2018

PLEASE SIGN IN

NAME (Please Print)		CONTACT INFORMATION				PHONE	EMAIL
First	Last	Street #	Street Name	City/Town	Postal Code	Number	Address
STEVE	BISHOP	2851	JOHN ST. SUITE ONE	MARKHAM	L3R 5R7	416-895-1061	sbishop@nadg.com
Ron	Gemmell	40	PEACOCK	BARRIE	L4N 3R8	705-722-8975	RGEMMELL@ROGERS.COM
BRIAN	Goodred	213	Owen St	Barrie	L4M 3S3	705-331-5717	goodredplanninggroup@gmail.com
Tony	Desroches	33	Florence Park	Barrie	L4N 6H9	905-955-2405	tdesroches@townofbwg.com
AL	STEDMAN	6 ROSEDALE DR. VAUGHAN, ON			L4K 4R3	4164561111	ASTEDMAN@SCHAEFFERS.COM
Cathy	Copeland.	21	Callaghan Dr.		L4N6E8.	7057229646.	catsdoop@hotmail.com.
Leslie	Warren	7	Greenwich		L4N 7Y8	9056042665	[illegible]
Doug	Beardsall	19	Callaghan Dr		L4N 6E8	(705) 721-5010	sandug98@hotmail.com

CITY OF BARRIE
WATER AND WASTEWATER MASTER PLAN UPDATE
PUBLIC INFORMATION CENTRE – NOVEMBER 1ST, 2018
PLEASE SIGN IN

NAME (Please Print)		CONTACT INFORMATION				PHONE	EMAIL
First	Last	Street #	Street Name	City/Town	Postal Code	Number	Address
JAMES	ORR	3	Ranell Crescent	Collingwood	L9Y 4J6	705-351-2139	james.orr@rjburnside.com
Alan	Villalobos	27	Black Cherry Cres	Barrie	L4N 9K9	647 5230057	alanvc@gmail.com
Rick	Newlove	101	Big Bay Pt. Rd.			730-1999	rickenewlove@duncor.ca
RON	TAYLOR	210	REMPVIEW LANE		L4W3W9		RON.N.TAYLOR@gmail.com
Jason	Rayner	7	Templeton CRes	Barrie	L4N 6G1	705-796-0329	jrayner74@hotmail.com
Bryan	Richards		Eligroup	Barrie		705/790-6317	bryan@eligroup.ca
Barry	Green	150	Dunlop St. E (Unit 1604)	Barrie	L4M 6H1	7057371512	b.green@rogers.com

CITY OF BARRIE
WATER AND WASTEWATER MASTER PLAN UPDATE
PUBLIC INFORMATION CENTRE – NOVEMBER 1ST, 2018
PLEASE SIGN IN

NAME (Please Print)		CONTACT INFORMATION				PHONE	EMAIL
First	Last	Street #	Street Name	City/Town	Postal Code	Number	Address
Sarah	Long	70	Buchanan St.	Barrie	L4M6B4	(705)790-4400	Sarah.long@barrie.ca
CHARLOTTE	LeBOEUF	22	FLORENCE ST	BARRIE	L4N 1X7		
Nolan	Fleet	70	BuchananSt	Barrie	L4M6B4	705-627-5837	nolan_fleet@hotmail.com

Water and Wastewater Master Plans

Public Information Centre
Tuesday, November 1st, 2018
4:00 p.m. to 7:00 p.m.
Southshore Community Center (205 Lakeshore Drive, Barrie, ON)

COMMENT SHEET

Personal information on this form is collected under the authority of the Environmental Assessment Act, Chap. E18, Section 7, and will be used in the development of a Drainage Master Plan. Questions about this collection should be directed to the Director of Engineering, P.O. Box 400, 70 Collier Street, Barrie, Ontario, L4M 4T5, (705) 726-4242.

Please print all responses

NAME OF RESPONDENT: Sandra Greene

REPRESENTING (Agency, Municipality, Property Owner, Tenant, etc.):

ADDRESS (Including Postal Code & Telephone Number):

Street Address: 13 Callaghan Dr. **Unit/Apt:**

Postal Code: L4N 6E8 **Telephone Number:** 705-205-7771

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Please list below any concerns or comments you have related to the Water and Wastewater Master Plans below

Which Master Plan do your comments apply:

- ☐ Water Supply
- ☐ Water Storage and Distribution
- ☐ Wastewater Treatment
- ☐ Wastewater Collection
- ☒ All of the above

I want to reject Proposal #4 for the Anne St pumping station. Proposal 4 will severly effect my property value. I use that green space all the time to throw the ball, exercise with friends, play with kids & dogs. Option 1 would be my choice.

The reason I bought my house in this neighbourhood was because of the green space in my "backyard". My actual backyard has a severe slope and makes it nearly unusable. The green space is what my neighbours and I use as a safe play area. The local school even uses it for tobogganing in the winter. Please use OPTION 1. Thanks

Are you satisfied with the level of detail of the information presented herein, at the Public Information Centre, and provided on the City website (http://www.barrie.ca/eastudies)?

☐	☒	☐	☐	☐
Poor (Much Improvement Required)	**Marginal** (Some Improvement Required)	**Good**	**Very Good**	**Excellent**

Please add a comment in support of your level of satisfaction below:

I found it very hard to find plan on site. I couldn't attend the public meeting due to work.

Do you wish to be informed of future Public Information Centers and of staff recommendation for the Preferred Alternative Solution?

☒ Yes ☐ No

Signature: L Reeve Date: Nov 13/18

Please submit this comment sheet by **Friday, December 1st, 2018** to:

Tom Reeve, P. Eng.
City of Barrie
Engineering Department
70 Collier Street, P.O. Box 400
Barrie, ON
L4M 4T5

Tel: (705) 739-4220 ext. 4465
Fax: (705) 739-4247

E-mail: Tom.Reeve@barrie.ca

Thank you for your comments

Water and Wastewater Master Plans

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Southshore Community Center (205 Lakeshore Drive, Barrie, ON)

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Please print all responses

NAME OF RESPONDENT: ANDREW & CATHY COPELAND

REPRESENTING (Agency, Municipality, Property Owner, Tenant, etc.):
PROPERTY OWNER

ADDRESS (Including Postal Code & Telephone Number):

Street Address: 21 CALLAGHAN DR BARRIE ONT **Unit/Apt:** —

Postal Code: L4N 6E8 **Telephone Number:** 705 722 9646

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Which Master Plan do your comments apply:

- [x] Water Supply
- [x] Water Storage and Distribution
- [ ] Wastewater Treatment
- [ ] Wastewater Collection
- [ ] All of the above

ANNE ST RESERVOIR + OPTION 4/ impacts public safety property value, and negative impact on neighborhood. Option 1 or 2 can achieve the objective of the project, and maintain the integrity and value of the neighborhood

Water and Wastewater Master Plans

Please see visual support document attached.

Are you satisfied with the level of detail of the information presented herein, at the Public Information Centre, and provided on the City website (http://www.barrie.ca/eastudies)?

☐	☐	☐	☐	☐
Poor (Much Improvement Required)	**Marginal** (Some Improvement Required)	**Good**	**Very Good**	**Excellent**

Please add a comment in support of your level of satisfaction below:

Do you wish to be informed of future Public Information Centers and of staff recommendation for the Preferred Alternative Solution?

☒ Yes ☐ No

Signature: _____ Date: Nov 1/18

Please submit this comment sheet by **Friday, December 1st, 2018** to:

Tom Reeve, P. Eng.
City of Barrie
Engineering Department
70 Collier Street, P.O. Box 400
Barrie, ON
L4M 4T5

Tel: (705) 739-4220 ext. 4465
Fax: (705) 739-4247

E-mail: Tom.Reeve@barrie.ca

Thank you for your comments

Anne Street Reservoir Project

Property Owner: 21 Callaghan Dr, Barrie, ON, L4N6E8

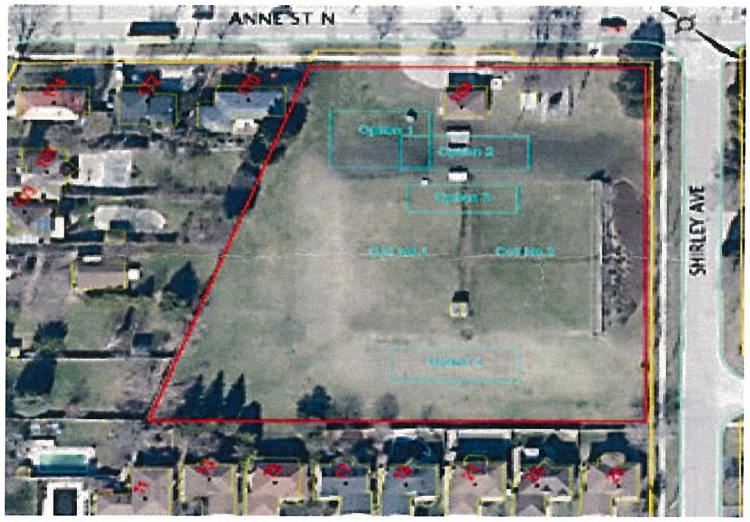
Concern: Public safety, Property Values, Neighborhood impacts

Hello

We reached out to Tom Reeve (Senior Infrastructure Planning Program Coordinator) who was able to provide us the scope of the project. We are concerned with the preliminary selection of option 4, and the impacts to our property value, public safety, and change to a 30-year tradition in our neighborhood.

We believe Option 1 or 2 would be the ideal solution to achieve the project objective to install larger pumps, and maintain the integrity and value of the neighborhood.

Scope: There will be some more information at the Public Information Centre but the main change proposed on the property is that a new pump station building is needed. The existing building on the Anne Street side houses some large pumps for distributing water but it isn't big enough for the new pumps required. Overall the property will still be a green space on top of a reservoir but a number of options for building location are being considered (see the map below). ***The preliminary preferred alternative is Option 4 due to some constraints on the Anne Street side of the property.***



Public Safety – Only safe access to the area for the public is right by option 4 proposal. As per the aerial view, the front option already has existing buildings, and Shirley avenue side has a garden and steep slopes until this entrance. Owners, including myself have pools and time from time balls, toys, etc will go over the fence and a building will add to the risk of children getting hurt. We are concerned about people hanging out behind a build at night since it will be away from the road, and out of sight from authorities.

Property Values – The first picture on the left is from 21 Callaghan backyard deck, and the proposed building will be in a direct view of the green space. We paid a premium at the time of purchase to back on to a green space, and the view will have an impact on future value if selling the property.

The distance from our house or fence to the bottom of the hill is the shortest distance, compared to the other properties surrounding the area. Note: There is no option or proposal on the North side of the property where the distance between the hill and houses are close to 200 feet away (picture on the right)

Another concern will be the lighting around the building will affect the night view, and potential impacts to sleeping habits depending on the strength of the light.

Option 1 or 2 – Has the required space to build a building without impacting any of the surrounding properties, and option 2 could hide the new building behind an existing structure.

Neighborhood Impacts: For 30 years, owners have taken their kids to play soccer, toboggan, football, school walks, and walk their dogs in the green space. Building a pump station in the middle of this area will have a negative impact to a long-standing traditions and family fun for our neighborhood.

Water and Wastewater Master Plans

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Please print all responses

NAME OF RESPONDENT: JAMES ORR

REPRESENTING (Agency, Municipality, Property Owner, Tenant, etc.):
HEWITT'S LANDOWNERS GROUP, PRATT, DORSAY

ADDRESS (Including Postal Code & Telephone Number):

Street Address: 3 RONELL CRES **Unit/Apt:**

Postal Code: L9Y 4J6 **Telephone Number:** 705-351-2139

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Which Master Plan do your comments apply:

- [x] Water Supply
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- [ ] Wastewater Treatment
- [x] Wastewater Collection
- [ ] All of the above

THERE ARE UPDATES REQUIRED TO ADDRESS:

1) SANITARY TRIB AREA TO HEWITT'S PUMP STATION
2) WATER DISTRIBUTION SYSTEM IN SALEM WEST
3) SANITARY CATCHMENTS IN SALEM WEST.

BURNSIDE & OTHER CONSULTANTS WILL PROVIDE ANY AND ALL UPDATES TO THE CITY / WSP TO INFORM THIS PROCESS.

THANK YOU FOR PREPARING THE PIC AND WE LOOK FORWARD TO CONTINUED CO-OPERATION IN DELIVERY OF THE CITY'S CAPITAL INFRASTRUCTURE.

PLEASE KEEP US INFORMED ON ANY UPDATES MOVING FORWARD.

Are you satisfied with the level of detail of the information presented herein, at the Public Information Centre, and provided on the City website (http://www.barrie.ca/eastudies)?

☐	☐	☐	☑	☐
Poor (Much Improvement Required)	**Marginal** (Some Improvement Required)	**Good**	**Very Good**	**Excellent**

Please add a comment in support of your level of satisfaction below:

Do you wish to be informed of future Public Information Centers and of staff recommendation for the Preferred Alternative Solution?

☑ Yes ☐ No

Signature: Jane Abra Date: NOVEMBER 1, 2018

Please submit this comment sheet by **Friday, December 1st, 2018** to:

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City of Barrie
Engineering Department
70 Collier Street, P.O. Box 400
Barrie, ON
L4M 4T5

Tel: (705) 739-4220 ext. 4465
Fax: (705) 739-4247

E-mail: Tom.Reeve@barrie.ca

Thank you for your comments

Water and Wastewater Master Plans

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Please print all responses

NAME OF RESPONDENT: Jason Rayner

REPRESENTING (Agency, Municipality, Property Owner, Tenant, etc.):
Property owner

ADDRESS (Including Postal Code & Telephone Number):

Street Address: 7 Templeton CR. **Unit/Apt:**

Postal Code: L4N 6G1 **Telephone Number:** 705-7960329

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Option 4 for the pumping station will cause all kinds of issues in the Community including ruining Greenspace, become eyesore, destroy family activities lower Property value (Big time)

Are you satisfied with the level of detail of the information presented herein, at the Public Information Centre, and provided on the City website (http://www.barrie.ca/eastudies)?

☐	☐	☐	☐	☒
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☐ Yes ☒ No

Signature: _____ Date: NOV-1-2018

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City of Barrie
Engineering Department
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Barrie, ON
L4M 4T5

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Please print all responses

NAME OF RESPONDENT: ROB TAYLOR

REPRESENTING (Agency, Municipality, Property Owner, Tenant, etc.):

ADDRESS (Including Postal Code & Telephone Number):

Street Address: 210 KEMPVIEW WAY **Unit/Apt:**

Postal Code: L4N 3W9 **Telephone Number:** 705-726-2471

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Which Master Plan do your comments apply:

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- ☒ Wastewater Treatment →
- ☐ Wastewater Collection
- ☐ All of the above

Interested in water runoff and silting of Lake Simcoe affecting creeks and streams and fish habitat -

Are you satisfied with the level of detail of the information presented herein, at the Public Information Centre, and provided on the City website (http://www.barrie.ca/eastudies)?

☐	☐	☐	☑	☐
Poor (Much Improvement Required)	**Marginal** (Some Improvement Required)	**Good**	**Very Good**	**Excellent**

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☑ Yes ☐ No

Signature: _____ Date: _____

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L4M 4T5

Tel: (705) 739-4220 ext. 4465
Fax: (705) 739-4247

E-mail: Tom.Reeve@barrie.ca

Thank you for your comments

FIRST NATIONS AND MÉTIS								
FN	Alderville First Nation	Chief	James	Masden		P.O. Box 46 11696 Second Line Alderville, ON K0K 2X0	(905) 352-3000	jbmarsden@aldervillle.ca
FN	Algonquins of Ontario Consultation Office	Ms.	Janet	Stavinga	Executive Director	31 Riverside Drive, Suite 101 Pembroke, ON K8A 8R6	(613) 735-3759 ext. 202	jstavinga@nrtco.net
FN	Barrie Friendship Centre	Ms.	Samantha	Kinoshameg	Executive Director	175 Bayfield Street Barrie, ON L4M 3B4	(705) 721-7689 ext. 202	executivedirector@bnfc.ca
FN	Beausoleil First Nation	Chief	Mary	McCue-King		11 O'Gemaa Miikaan Christian Island, ON L9M 0A9	(705) 247-2239	bfnchief@chimnissing.ca
FN	Chippewas of Georgina Island	Chief	Donna	Big Canoe		R.R. #2 Box N-13 Sutton West, ON L0E 1R0	(705) 437-1337	donna.bigcanoe@georginaisland.com
FN	Chippewas of RAMA First Nation	Chief	Rodney	Noganosh		5884 Rama Road, Suite 200 Rama, ON L3V 6H6	(705) 325-3611 ext. 1240	chief@ramafirstnation.ca
FN	Curve Lake First Nation	Chief	Phyllis	Williams		Government Services Building 22 Winookeedaa Road Curve Lake, ON K0L 1R0		-
FN	Georgian Bay Métis Council	Mr.	David	Dusome	President	355 Cranston Crescent, P.O. Box 4 Midland, ON L4R 4K6	(705) 526-6335	-
FN	Hiawatha First Nation	Chief	Laurie	Carr		123 Paudash Street Hiawatha, ON K0L 2G0		chiefcarr@hiawathafn.ca
FN	Métis Nation of Ontario - Métis Consultation Unit	Sir or Madam				Métis Nation of Ontario Head Office 500 Old St. Patrick, Unit D	(613) 725-422	consultations@metisnation.org

						Ottawa, ON K1N 9G4		
FN	Mississauga's of Scugog Island First Nation	Chief	Kelly	LaRocca		Administration Building 22521 Island Road Port Perry, ON L9L 1B6		klarocca@scugogfirstnation.com
FN	Moose Deer Point First Nation	Chief	Barron	King		c/o Government Services P.O. Box 119 MacTier, ON P0C 1H0		chief@moosedeerpoint.com
FN	Moon River Métis Council		Tony	Muscat	President	820 Muskoka Road South Gravenhurst ON P1P 1K2	(705) 689-3941	moonrivermetiscouncil@outlook.com
FN	Wahta Mohawk First Nation	Chief	Philips	Franks		2664 Muskoka Road #38 P.O. Box 260 Bala, ON P0C 1A0	(705) 762-2354	-
FN	William Treaties First Nation		Karry	Sandy McKenzie	Williams Treaties First Nations Process Coordinator			inquiries@williamstreatiesfirstnations.ca
EXTERNAL AGENCIES								
UT	Bell Canada	Mr.	Robert	McKay	Network Manager	136 Bayfield Street Barrie ON L4M 3B1		-
UT	Bell Canada	Ms.	Angela	Taylor	Manager, Access Network Facilities	136 Bayfield Street, 2nd Floor Barrie ON L4M 3B1		-
UT	Enbridge				Municipal Notices	500 Consumers Road Toronto ON M2J 1P8		-
UT	Hydro One Networks Inc.	Ms.	Rossella	Fazio	Manager, Transmission Lines Sustainment Investment Planning	483 Bay Street North Tower, 15th Floor Toronto ON M5G 2P5	(416) 345-6411	rossella.fazio@HydroOne.com

UT	Innisfil Hydro Distribution Systems Ltd.	Mr.	John N.	Aseerwatham	Engineering Manager	7251 Yonge Street Innisfil ON L9S 0J3	(705) 431-6870	johna@innisfilhydro.com
UT	PowerStream	Mr.	Mark	Henderson	VP Asset Management & C.O.O.	161 Cityview Boulevard Vaughan ON L4H 0A9		mhenderson@barriehydro.com
UT	PowerStream				Engineering Clerk	161 Cityview Boulevard Vaughan ON L4H 0A9		engineeringadmin@powerstream.ca
UT	Rogers Cable In.c	Mr.	Doug	Washburn	Planning Manager	1 Sperling Drive, P.O. Box 8500 Barrie ON L4M 6B8		-
FP	Ministry of Environment and Climate Change	Mr.	Rob	Dobos	Manager, Environmental Assessment Section Environmental Protection Branch - Ontario Region	867 Lakeshore Road Burlington ON L7R 4A6	(905) 336-4953	rob.dobos@canada.ca
FP	Ministry of Environment and Climate Change	Ms.	Cindy	Hood	District Manager	54 Cedar Pointe Drive Barrie ON L4N 5R7	(705) 739-6441	-
FP	Ministry of Environment and Climate Change	Mr.	Dan	Orr	Manager, Technical Support Section	Central Region 5775 Yongew Street, 8th Floor North York ON M2M 4J1	(416) 326-3740	-
FP	Ministry of Environment and Climate Change		Chunmei	Liu	EA & Planning Coordinator	Central Region 5775 Yongew Street, 8th Floor North York ON M2M 4J1	(416) 326-4886	-
FP	Ministry of Environment and Climate Change		Halyna	Perun	Director, Legal Services Branch	135 St Clair Avenue West, 10th Floor Toronto ON M4V 1P5		-
FP	Ministry of Environment and Climate Change				Project Review Unit, Environmental	135 St Clair Avenue West, 10th Floor		-

					Approvals Branch	Toronto ON M4V 1P5		
FP	Fisheries Protection Program - Department of Fisheries and Oceans					867 Lakeshore Road Burlington ON L7R 4A6		-
FP	Indigenous and Northern Affairs Canada				Environmental Assessment Unit	25 St. Clair Avenue East, 8th Floor, Toronto ON M4T 1M2		EACoordination_ON@aandc-aadnc.gc.ca
FP	Ministry of Indigenous Relations and Reconciliation	Ms.	Rachael	Manson-Smith	Manager, Ministry Partnerships Unit	Toronto ON M4T 1M2	(416) 325-7032	mma.ea.review@ontario.ca
FP	Ministry of Agricultre, Food and Rural Affairs	Ms.	Jocelyn	Beatty	Rural Planner	Elora Resource Cetnre 6484 Wellington Road 7 Elora ON N0B 1S0	(519) 846-3405	jocelyn.beatty@ontario.ca
FP	Ministry of Agricultre, Food and Rural Affairs	Mr.	Ray	Vilaitis	Rural Planner	95 Dundas Street RR#3 Brighton ON K0K 1H0	(613) 475-1630	-
FP	Ministry of Agricultre, Food and Rural Affairs	Mr.	John	Turney	Policy Advisor	1 Stone Road W, 3rd Floor Guelph ON N1G 4Y2	(519) 826-3100	-
FP	Ministry of Economic Development and Growth	Mr.	John	Bullen	Manager, Cabinet Office and Policy Support Unit	900 Bay Street, 6th Floor Hearst Block Toronto ON M7A 2E1	(416) 325-0186	john.bullen@ontario.ca
FP	Ministry of Economic Development and Growth	Mr.	Michael	Helfinger	Senior Policy Advisor, Cabinet Office Liaison and Policy Support Unit	900 Bay Street, 6th Floor Hearst Block Toronto ON M7A 2E1	(416) 325-6519	michael.helfinger@ontaro.ca
FP	Ministry of Economic Development and Growth	Mr.	Brad	Duguid	Minister of Economic Development, Employment and Infrastructure	900 Bay Street, 6th Floor Hearst Block Toronto ON M7A 2E1	(416) 325-6900	-

FP	Ministry of Energy	Mr.	Andrea	Pastori	Cabinet Liaison and Strategic Policy Branch Coordinator, Strategic Policy and Analytics Branch, Strategic, Network and Agency Policy Division	77 Grenville Street, 6th Floor Toronto ON M7A 2C1	(416) 327-7276	andrea.pastori@ontario.ca
FP	Infrastructure Ontario	Mr.	Peter	Reed	Director, Land Use Planning	1 Dundas Street. W., Suite 2000 Toronto ON M5G 2L5	(416) 578-6740	peter.reed@infrastructureontario.ca
FP	Infrastructure Ontario	Mr.	Tate	Kelly	Planning Coordinator	1 Dundas Street. W., Suite 2000 Toronto ON M5G 2L5	(416) 327-1925	tate.kelly@infrastructureontario.ca and noticereview@infrastructureontario.ca
FP	Infrastructure Ontario	Ms.	Lisa	Myslicki	Environmental Advisory	1 Dundas Street. W., Suite 2000 Toronto ON M5G 2L5	(416) 212-3768	-
FP	Ministry of Municipal Affairs	Mr.	Victor	Doyle	Manager, Planning Innovation Section - Provincial Policy Branch	77 Bay Street, 13th Floor Toronto ON M5G 2E5	(416) 585-6109	victor.doyle2ontario.ca
FP	Ministry of Municipal Affairs and Housing	Mr.	Mark	Christie	Manager Community Planning and Development, Eastern Municipal Services Office	77 Bay Street, 3rd Floor Toronto ON M5G 2E5	(416) 585-6063	mark.christie@ontario.ca
FP	Ministry of Natural Resources and Forestry	Ms.	Kim	Benner	District Planner, Midhurst District	Kemptville District 2284 Nursery Road Midhurst ON K0G 1J0	(705) 725-7534	kim.benner@ontario.ca
FP	Ministry of Natural Resources and Forestry	Mr.	Ken	Mott	District Planner, Midhurst District	Kemptville District 2284 Nursery Road Midhurst ON K0G 1J0	(705) 725-7546	Ken.mott@ontario.ca

FP	Ministry of Natural Resources and Forestry	Ms.	Katherine	Woeller	District Planner, Midhurst District	Kemptville District 2284 Nursery Road Midhurst ON K0G 1J0	(705) 725-7546	-
FP	Ministry of Natural Resources and Forestry	Ms.	Alison	MacKenzie	Director, Legal Services Branch	Legal Services Branch, 99 Wellesley St. West Toronto ON M7A 1W3		-
FP	Ministry of Tourism, Culture & Sport	Ms.	Laura	Hatcher	Team Lead - Hertiage Land Use Planning	Culture Division 401 Bay Street, Suite 1700 Toronto ON M7A 0A7		
FP	Ministry of Tourism, Culture & Sport	Ms.	Karla	Barboza	Team Lead - Heritage Program Unit	Culture Division 401 Bay Street, Suite 1700 Toronto ON M7A 0A7	(416) 314-7120	karla.barboza@ontaro.ca
FP	Ministry of Tourism, Culture & Sport	Ms.	Rosi	Zirger	Heritage Planner	401 Bay Street, Suite 1700 Toronto ON M7A 0A7	(416) 314-7159	rosi.zirger@ontario.ca
FP	Ministry of Tourism, Culture & Sport	Mr.	Dan	Minkin	Heritage Planner	401 Bay Street, Suite 1700 Toronto ON M7A 0A7	(416) 314-7159	dan.minkin@ontario.ca
FP	Ministry of Tourism, Culture & Sport	Mr.	Chris	Rosati	Manager, Central Region	400 University Avenue, 2nd Floor	416-314-6682	christopher.rosati@ontario.ca
FP	Ministry of Transportation	Mr.	Rob	Vandenberg	Senior Project Engineer	Toronto ON M7A 2R9		
FP	Ministry of Transportation	Mr.	Glenn	Higgins	Team Leader	777 Bay Street, 30th Floor, Suite 3000 Toronto ON M7A 2J8	(416) 585-7336	Glenn.Higgins@ontario.ca
FP	Ministry of Transportation	Mr.	Peter	Dorton	Senior Project Manager	MTO Central Region 159 Sir William Hearst Ave., 7th Floor Toronto ON M3M 0B7	416.235.4280	peter.dorton@ontario.ca

FP	Ministry of Transportation	Mr.	John	van Voorst	Drainage Engineer	Not provided	Not provided	Not provided
FP	Ministry of Transportation	Ms.	Olga	Garces	Area Manager, York & Simcoe	Central Region 159 Sir William Hearst Avenue, 4th Floor North York ON M3M 0B7	9416) 235-5533	-
FP	Ministry of Transportation				Director, Legal Services Branch	1201 Wilson Avenue, Building B 1st Floor Toronto ON M3M 1J8		-
FP	Ministry of Transportation	Mr.	Jason	White	Manager, Engineering Office - Central Region	Central Region 159 Sir William Hearst Avenue, 5th Floor North York ON M3M 0B7	(416) 235-5575	jason.white@ontario.ca
FP	Ontario Clean Water Agency	Mr.	M.	Tracey		100 Woodland Drive Wasaga Beach ON L0L 2P0		-
FP	Ontario Growth Secretariat	Mr.	Andrew	Theoharis	Manager, Growth Policy	777 Bay Street, 4th Floor, Suite 428	416-325-7335	andrew.theoharis@ontario.ca
FP	Ministry of Health and Long Term Care	Mr.	Tony	Amalfa	Manager, Environmental Health Policy and Programs	Toronto ON M5G 2E5	416-327-7624	tony.amalfa@ontario.ca
FP	CN Rail	Mr.	Stefan	Linder	Manager, Public Works Design and Construction	4 Welding Way off Administration Road	905-669-3264	stefan.linder@cn.ca
FP	Service Ontario				Ministry of Health Secretary	Vaughan ON L4K 1B9		-
CA	Nottawasaga Valley Conservation Authority	Mr.	Glenn	Switzer	Director, Engineering and Technical Services	John Hix Conservation Administration Centre Tiffin Conservation Area	(705) 424-1479 ext.232	gswitzer@nvca.on.ca

						8195 8th Line Utopia ON L0M 1T0		
CA	Lake Simcoe Region Conservation Authority	Mr.	Charles	Burgess	Senior Planning Coordinator	120 Bayview Parkway Newmarket ON L3Y 3W3	(905) 895-1281	cburgess@lsrca.on.ca
CA	Lake Simcoe Region Conservation Authority	Mr.	Tom	Hogenbirk	Manager, Engineering and Technical Serivces	120 Bayview Parkway Newmarket ON L3Y 3W3	(905) 895-1281	t.hogenbirk@lsrca.on.ca
CA	Lake Simcoe Region Conservation Authority	Ms.	Melinda	Bessey	Development Planner	120 Bayview Parkway Newmarket ON L3Y 3W3	(905) 895-1281	m.bessey@lsrca.on.ca
MUN	Springwater Township	Mr.	John	Dayley	Clerk	2231 Nursey Road Minesing ON L0L 1Y2	(705) 728-4784	-
MUN	Springwater Township	Mr.	Brad	Sokach	Planning & Works	2231 Nursey Road Minesing ON L0L 1Y2	(705) 728-4784 ext. 2034	-
MUN	Town of Innisfil	Mr.	Andrew	Campbell	CEO and President - InnServices Utilities Inc.	2101 Innisfil Beach Road Innisfil ON L9S 1A1		acampbell@innservices.com
MUN	Town of Innisfil	Mr.	Tim	Cane	Manager of Land Use Planning	2101 Innisfil Beach Road Innisfil ON L9S 1A1		-
MUN	Simcoe County	Ms.	Deborah Korolnek	Korolnek	General Manager, Engineering, Planning & Environmental Division	Administration Centre 1110 Highway 26 Midhurst ON L9X 1N6	(705) 726-9300	-
INTERNAL								
MUN	Environmental Advisor Committee		Mike	McCann				
MUN	Environmental Advisor Committee	Chair	Peter	Bursztyn		11 Kenny Crescent, Barrie ON L4N6CY		
MUN	Environmental Advisor Committee	Vice Chair	Alan			333 St. Vincent St., Barrie ON L4M 3Y3		
MUN	Environmental Advisor Committee		Stepan	Bollinger		6 Forestwood Lane, Barrie ON L4N 7S5		

MUN	Environmental Advisor Committee		Clinton	Reynolds		83 Burton Avenue, Barrie, ON L4N 2R5		
MUN	Environmental Advisor Committee		Gerald	Poisson		27 William Street, Barrie, ON L4N 3J4		
MUN	Environmental Advisor Committee		Wayne	Wilson		62 Eugenia Street, Barrie, ON L4M 1R1		
MUN	City of Barrie - Legislative & Court Services	Ms.	Dawn	McAlpine	Director of Legislative & Court Services	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5	(705) 739-4220 ext. 4421	Dawn.McAlpine@barrie.ca
MUN	City Of Barrie - Engineering	Mr.	Walter	Fischer	Supervisor of Parks Planning & Development	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5	(705) 739-4220 ext. 5101	Walter.Fischer@barrie.ca
MUN	City Of Barrie - Engineering	Ms.	Clare	Maher	Landscape Architectural Planner	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5		clare.maher@barrie.ca
MUN	City of Barrie - Road, Parks & Fleet	Mr.	Kevin	Rankin	Forestry Supervisor	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5		kevin.rankin@barrie.ca
MUN	City of Barrie - Road, Parks & Fleet	Ms.	Jenna	Webb	Parks & Forestry Technician	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5		jenna.webb@barrie.ca
MUN	City of Barrie - Waste Water Operations		Sandy	Coulter	Manager of Waste Water Operations	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5	(705) 739-4220 ext. 5231	sandy.coulter@barrie.ca
MUN	City of Barrie - Recreation	Ms.	Barb	Roth	Director of Recreation Services	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5	(705) 739-4220 ext. 4510	Barb.Roth@barrie.ca
MUN	City of Barrie - Facilities & Transit	Mr.	Rick	Pews	Director of Facilities & Transit	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5	(705) 739-4220 ext. 4510	
MUN	City of Barrie - Planning		Andrea	Bourrie	Director of Planning Services	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5		andrea.bourrie@barrie.ca
MUN	City of Barrie - Planning		Merwan	Kalyaniwalla	Manager of Planning Policy	70 Collier Street, P.O. Box 400	(705) 739-4220 ext. 4314	Merwan.Kalyaniwalla@barrie.ca

						Barrie ON L4M 4T5		
MUN	City of Barrie - Planning	Ms.	Stacey	Forfar	Manager of Growth Planning	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5		-
MUN	City of Barrie - Traffic	Mr.	Steve	Rose	Manager of Traffic & Parking Services	165 Ferndale Drive, P.O. Box 400 Barrie ON L4M 4T5		-
MUN	City of Barrie - Finance	Mr.	Craig	Millar	Director of Finance	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5	(705) 739-4220 ext. 4428	Craig.Millar@barrie.ca
MUN		Mr.	John	Thompson	Director of Environmental Services	70 Collier Street, P.O. Box 400 Barrie ON L4M 4T5	(705) 739-4220 ext. 4802	john.thompson@barrie.ca
EMER	Ontario Provincial Police	Mr.	Andy	Mayo	Staff Sargeant	20 Rose Street Barrie ON L4M 2T2	(705) 726-6484	-
EMER	Ontario Provincial Police	Mr.	Scott	Couse	Highway Safety Division	20 Rose Street Barrie ON L4M 2T2		-
EMER	City of Barrie - Fire	Mr.	Bill	Boyes	Fire Chief	155 Dunlop Street West, P.O. Box 400 Barrie ON L4M 4T5	(705) 739-4220 ext. 3256	bill.boyes@barrie.ca
EMER	City of Barrie - Fire	Mr.	David	Lalonde	Fire Prevention Officer	155 Dunlop Street West, P.O. Box 400 Barrie ON L4M 4T5	(705) 739-4220 ext. 3221	Sue.Dawson@barrie.ca
EMER	City of Barrie Police Department	Ms.	Kimberly	Greenwood	Police Chief	29 Sperling Drive Barrie ON L4M K9	(705) 725-7025	info@barrie.ca
SB	Simcoe County District School Board	Ms.	Holly	Spapek	Senior Planner	1170 Mighway 26 Midhurst ON L0L 1X0	(705) 728-7570	
SB	Simcoe Muskoka Catholic District School Board	Ms.	Jennifer	Sharpe	Planner	46 Alliance Blvd. Barrie ON L4M 5K3	(705) 722-3555	jsharpe@smcdsb.on.ca
OTHERS								

IG	A Channel Barrie				Station Manager	3 Beacon Road Barrie ON L4N 9J9	(705)734.3300	
IG	Albarrie	Mr.	Peter J.	Koetsier	Vice President, Administration	85 Morrow Road Barrie ON L4N 3V7	(705)737-0551	peter_koetsier@albarrie.com
IG	Canadian Home Builders Association - Simcoe County	Ms.	Sheila	Missa	Exective Director	P.O. Box 305 Barrie ON L4M 4T5		
IG	Ducks Unlimited	Mr.	William	Jones	Ontario Development Manager	740 Huronia Road, Unit 1 Barrie ON L4N 6C6	(705) 721-4444	w_jones@ducks.ca
IG	Greater Barrie Chamber of Commerce	Ms.	Sybil	Goruk	Executive Director	97 Toronto Street Barrie ON L4N 1V1		-
IG	Ontario Realty Corporation	Mr.	Anton	Pojasok	Vice President, Professional Services	1 Dundas Street W. Toronto ON M5G 2L5	(416) 327-3937	
IG	Simcoe Muskoka District Health - Barrie Office	Dr.	Charles	Gardner	Medical Officer of Health	15 Sperling Drive Barrie ON L4M 6K9		-
IG	Simcoe Muskoka District Health - Barrie Office	Ms.	Sherry	Diaz	Public Health Nurse	15 Sperling Drive Barrie ON L4M 6K9		-
IG	Tourism Barrie	Ms.	Kathleen	Trainor	Executive Director	205 Lakeshore Drive Barrie ON L4N 7Y9	(705) 739-9444 ext. 103	-
IG	Simcoe County Heavy Construction Association					c/o BCA 200 Brock Barrie ON L4N 5K3		-
GENERAL PUBLIC								
GP	NA	Mr.	Ron	Gemmell	Retired (former Manager of Environmental Services)	NP	NP	hrgemmell@rogers.com
STAKEHOLDERS								
SH	Downtown Barrie BIA	Mr.	Criag	Stevens		50 Dunlop St. E., Suite 204 Barrie ON L4M 6J9		cstevens@downtownfire.ca

SH	Transition Barrie / Living Green Barrie	Mr.	Mike	Fox				mcfox@sympatico.ca
SH	Barrie Downtown Neighbourhoods Association	Ms.	Caroline	Smith	Chair		(705) 735 1939	cstolinee.smith@reogrees.fom
SH	Annexed Land Holders Group	Mr.	Al	Steedman				asteedman@schaeffers.com
SH	Annexed Land Holders Group	Mr.	Barry	Green				b.green@rogers.com
SH	Annexed Land Holders Group	Mr.	Bryan	Richardson				bryan.richardson@rjburnside.com
SH	Annexed Land Holders Group	Mr.	Darren	Steedman				dsteedman@dggroup.ca
SH	Annexed Land Holders Group	Mr.	Don	Pratt				dpratt@prattdevelopment.ca
SH	Annexed Land Holders Group	Mr.	Eric	Lawton				ericlawton@rogers.com
SH	Annexed Land Holders Group	Mr.	Hugh	Johnston				hjohnston@prattdevelopment.ca
SH	Annexed Land Holders Group	Mr.	Jamie	Shapiro				jaime.shapiro@securekey.com
SH	Annexed Land Holders Group	Mr.	John	Tjeerdsma				john.tjeerdsma@tjconsulting.com
SH	Annexed Land Holders Group	Mr.	Katy	Schofield				katy@greatgulf.com
SH	Annexed Land Holders Group	Mr.	Keith	MacKinnon				kmackinnon@KLMPlanning.com
SH	Annexed Land Holders Group	Mr.	Mark	Resnick				markres@greatgulf.com
SH	Annexed Land Holders Group	Mr.	Paolo	Sacilotto				psacilotto@dggroup.ca
SH	Annexed Land Holders Group	Mr.	Ray	Dhuamel				rduhamel@jonesconsulting.com

APPENDIX B

Planning Projections

City Of Barrie
Residential Forecast Summary, 2016-2071
Scenario 3 (Made in Barrie Scenario)

Development Location	Forecast Period	Low-Density [1]	Medium-Density [2]	High-Density [3]	Total Households	Population (Excluding Net Census Undercount) [4]	Population (Including Net Census Undercount)
Urban Growth Centre	2016	336	214	2,078	2,628	4,431	4,569
	2021	384	249	2,710	3,343	5,629	5,805
	2026	433	310	4,036	4,779	8,090	8,343
	2031	433	401	6,848	7,682	12,950	13,354
	2036	433	401	8,260	9,094	15,342	15,820
	2041	433	401	9,320	10,154	17,106	17,640
	2046	433	401	9,778	10,612	17,902	18,457
	2051	433	401	10,080	10,914	18,450	19,026
	2056	433	401	10,258	11,092	18,787	19,373
	2061	433	401	10,431	11,265	19,117	19,714
	2066	433	401	10,568	11,402	19,388	19,993
	2071	433	401	10,692	11,526	19,632	20,245
Intensification Nodes/Corridors	2016	746	575	1,627	2,948	6,253	6,448
	2021	750	817	1,952	3,519	7,296	7,524
	2026	750	1,178	2,356	4,284	8,833	9,108
	2031	750	1,934	2,857	5,541	11,616	11,978
	2036	750	2,864	3,754	7,369	15,594	16,081
	2041	750	4,431	6,226	11,407	23,743	24,484
	2046	750	5,143	9,463	15,356	30,969	31,935
	2051	750	5,672	11,847	18,269	36,326	37,460
	2056	750	6,027	13,752	20,529	40,440	41,702
	2061	750	6,374	15,635	22,759	44,496	45,884
	2066	750	6,704	17,431	24,885	48,365	49,874
	2071	750	6,952	19,061	26,763	51,744	53,359
Other Built Boundary	2016	30,667	7,680	5,529	43,876	121,493	125,283
	2021	31,073	7,928	6,346	45,346	122,172	125,983
	2026	31,179	8,126	7,006	46,311	122,854	126,687
	2031	31,285	8,544	7,510	47,339	125,151	129,056
	2036	31,367	8,544	7,740	47,650	127,736	131,721
	2041	31,471	8,544	8,118	48,133	129,297	133,332
	2046	31,758	8,544	8,403	48,705	131,945	136,061
	2051	31,938	8,544	8,688	49,170	134,431	138,625
	2056	32,079	8,544	8,973	49,596	136,642	140,905
	2061	32,193	8,544	9,258	49,995	138,759	143,088
	2066	32,301	8,544	9,543	50,388	140,842	145,236
	2071	32,398	8,544	9,828	50,770	142,777	147,231
Greenfield Area within City of Barrie Former Municipal Boundary	2016	1,947	471	471	2,889	8,949	9,228
	2021	2,069	857	819	3,744	10,743	11,078
	2026	2,106	1,310	1,954	5,370	13,820	14,251
	2031	2,160	1,362	2,194	5,716	14,537	14,990
	2036	2,497	1,504	5,268	9,269	21,270	21,934
	2041	2,574	1,504	7,798	11,876	25,739	26,542
	2046	2,592	1,504	7,813	11,909	25,913	26,722
	2051	2,601	1,504	7,828	11,933	26,071	26,885
	2056	2,608	1,504	7,843	11,955	26,213	27,031
	2061	2,610	1,504	7,858	11,972	26,336	27,158
	2066	2,612	1,504	7,873	11,989	26,459	27,285
	2071	2,614	1,504	7,888	12,006	26,574	27,403
Annexed Area	2016	129	-	-	129	308	318
	2021	3,459	1,429	686	5,574	16,687	17,207
	2026	5,484	3,053	1,882	10,419	29,882	30,814
	2031	6,279	4,599	3,553	14,431	39,392	40,621
	2036	6,814	5,277	4,200	16,291	44,074	45,449
	2041	7,587	5,830	4,972	18,389	49,459	51,002
	2046	7,587	5,830	5,047	18,464	49,585	51,132
	2051	7,587	5,830	5,122	18,539	49,712	51,263
	2056	7,587	5,830	5,197	18,614	49,838	51,393
	2061	7,587	5,830	5,272	18,689	49,965	51,524
	2066	7,587	5,830	5,347	18,764	50,091	51,654
	2071	7,587	5,830	5,422	18,839	50,217	51,784
City of Barrie	2016	33,825	8,940	9,705	52,470	141,435	145,847
	2021	37,735	11,279	12,513	61,527	162,527	167,598
	2026	39,952	13,977	17,234	71,163	183,478	189,203
	2031	40,907	16,840	22,962	80,709	203,646	210,000
	2036	41,860	18,591	29,222	89,673	224,015	231,005
	2041	42,814	20,710	36,434	99,959	245,345	253,000
	2046	43,119	21,422	40,504	105,046	256,315	264,308
	2051	43,308	21,951	43,566	108,826	264,991	273,258
	2056	43,456	22,306	46,023	111,786	271,921	280,404
	2061	43,572	22,653	48,454	114,680	278,674	287,368
	2066	43,682	22,983	50,762	117,428	285,146	294,042
	2071	43,781	23,231	52,891	119,904	290,945	300,022

Source: Watson & Associates Economists Ltd., 2017

1. Includes single and semi-detached .

2. Includes all townhomes and apartments in duplexes.

3. Includes low-rise and high-rise apartments

4. Net Census population undercount estimated at approximately 3%.

City of Barrie Growth Update 2017 - Made in Barrie Scenario 2041-2051															
Traffic Zone	Population 2041 (Including Census Undercount)	Low Density	Medium Density	High Density	Total Households	Population 2046 (Including Census Undercount)	Low Density	Medium Density	High Density	Total Households	Population 2051 (Including Census Undercount)	Low Density	Medium Density	High Density	Total Households
1	2717	784	95	83	962	2999	793	136	149	1078	3213	798	166	201	1165
2	94	4	3	45	52	270	4	37	95	136	397	4	61	132	197
3	838	0	301	20	321	903	0	314	39	353	957	0	324	53	377
4	10	3	2	1	6	10	3	2	1	6	10	3	2	1	6
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	1	0	1	0	0	1	0	1	0	0	1	0	1
7	10	2	3	0	5	10	2	3	0	5	10	2	3	0	5
8	3711	888	179	44	1111	3784	893	179	49	1121	3807	896	179	54	1129
9	2965	0	475	1001	1476	2965	1	475	1001	1477	2984	1	475	1001	1477
10	5114	1181	186	215	1582	5213	1190	186	225	1601	5291	1198	186	235	1619
11	790	257	3	14	274	808	259	3	16	278	827	261	3	18	282
12	12037	471	242	5803	6516	12283	476	283	5868	6627	12519	477	312	5917	6706
13	5401	1276	211	174	1661	5538	1292	211	190	1693	5657	1304	211	206	1721
14	1275	156	25	560	741	1490	156	41	659	856	1651	156	53	733	942
15	702	187	28	12	227	725	190	28	15	233	747	192	28	18	238
16	1319	258	150	14	422	1355	262	150	18	430	1377	264	150	22	436
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	6	2	0	0	2	6	2	0	0	2
19	5	1	1	0	2	5	1	1	0	2	5	1	1	0	2
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	1435	281	137	32	450	1456	282	137	32	451	1462	282	137	32	451
23	6134	1310	622	151	2083	6250	1321	622	163	2106	6347	1332	622	175	2129
24	1666	442	35	40	517	1715	448	35	45	528	1742	450	35	50	535
25	3275	791	118	37	946	3325	798	118	44	960	3429	803	118	51	972
26	1147	270	36	22	328	1173	273	36	24	333	1190	275	36	26	337
27	4223	569	532	550	1651	4487	572	575	615	1762	4719	574	606	664	1844
28	2388	0	642	397	1039	2540	0	672	440	1112	2654	0	693	471	1164
29	0	0	0	0	0	192	0	0	113	113	325	0	0	191	191
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	8	1	0	3	4	65	1	11	19	31	107	1	19	31	51
32	837	161	123	9	293	857	163	123	11	297	872	164	123	13	300
33	38	10	4	1	15	38	10	4	1	15	38	10	4	1	15
34	469	113	64	8	185	483	115	64	10	189	502	116	64	12	192
35	0	1	0	0	1	0	1	0	0	1	0	1	0	0	1
36	1748	496	26	34	556	1780	499	26	37	562	1815	501	26	40	567
37	3591	970	89	132	1191	3673	980	89	142	1211	3761	987	89	152	1228
38	1612	335	165	145	645	2275	336	198	473	1007	2767	337	223	717	1277
39	1675	153	414	28	595	1882	155	441	105	701	2075	156	461	162	779
40	2163	346	337	88	771	2298	349	358	122	829	2414	351	374	148	873
41	1739	404	145	147	696	1973	408	160	244	812	2150	411	171	318	900
42	859	172	126	6	304	880	174	126	8	308	887	174	126	10	310
43	1340	277	101	126	504	1351	278	101	127	506	1392	279	101	128	508
44	875	189	19	145	353	891	190	19	146	355	898	191	19	147	357
45	27	2	3	7	12	27	2	3	7	12	27	2	3	7	12
46	1566	139	329	247	715	1950	139	376	399	914	2264	139	412	510	1061
47	2560	230	336	609	1175	2802	230	350	725	1305	2970	230	361	802	1393
48	2186	657	76	71	804	2319	663	91	100	854	2416	666	102	123	891
49	2026	421	183	178	782	2165	426	183	238	847	2263	429	183	281	893
50	1035	143	53	179	375	1124	143	63	211	417	1192	143	71	234	448
51	2288	92	142	981	1215	2531	92	158	1099	1349	2708	92	170	1179	1441
52	363	91	34	37	162	369	91	34	37	162	372	91	34	37	162
54	2392	31	826	64	921	2407	32	826	70	928	2422	32	826	75	933
55	0	0	0	0	0	153	0	30	43	73	259	0	50	74	124
56	6226	1255	342	756	2353	6355	1270	342	770	2382	6461	1277	342	784	2403
57	2884	513	294	139	946	2906	515	294	141	950	2928	517	294	143	954
58	76	0	0	45	45	561	0	0	331	331	921	0	0	543	543
59	838	162	1	159	322	1018	162	8	255	425	1161	162	14	326	502
60	15	9	1	0	10	15	9	1	0	10	15	9	1	0	10
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	1153	7	5	704	716	1161	7	5	708	720	1169	7	5	710	722
63	126	24	11	22	57	128	24	11	22	57	128	24	11	22	57
64	932	6	3	575	584	945	6	3	581	590	954	6	3	585	594
65	2032	199	119	772	1090	2135	199	119	828	1146	2237	199	119	865	1183
66	105	1	0	59	60	426	1	0	248	249	665	1	0	389	390
67	5114	1096	428	242	1766	5195	1105	430	254	1789	5360	1110	432	265	1807
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	4989	1141	309	301	1751	5103	1153	309	313	1775	5187	1160	309	325	1794
70	694	16	28	336	380	843	16	28	420	464	945	16	28	479	523
71	1679	477	70	31	578	1716	481	70	35	586	1749	485	70	39	594
72	1078	174	94	277	545	1094	175	94	278	547	1106	175	94	279	548
73	447	100	14	100	214	451	100	14	100	214	451	100	14	100	214
74	1079	213	87	160	460	1096	214	87	161	462	1102	214	87	162	463
75	1279	327	65	67	459	1307	330	65	70	465	1332	333	65	73	471
76	1921	525	82	46	653	1971	530	82	51	663	1994	532	82	56	670
77	1723	248	239	188	675	1746	250	239	190	679	1783	251	239	192	682
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	1709	501	83	43	627	1748	505	83	47	635	1766	506	83	51	640
81	1548	268	56	279	603	1768	270	77	362	709	1919	270	92	424	786
82	1048	338	33	80	451	1070	340	33	82	455	1077	340	33	84	457
83	241	68	7	36	111	245	68	7	36	111	245	68	7	36	111
84	950	112	20	449	581	986	112	20	463	595	1001	112	20	471	603
85	1081	301	70	73	444	1323	302	114	136	552	1492	302	146	184	632
86	806	57	8	353	418	793	57	8	353	418	865	57	8	353	418
87	227	65	7	31	103	240	66	8	34	108	253	67	9	36	112
88	200	48	27	2	77	203	48	27	2	77	203	48	27	2	77
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	270	55	12	92	159	273	55	12	92	159	273	55	12	92	159
91	1808	468	113	209	790	2081	471	130	326	927	2284	474	143	414	1031
92	1327	307	70	88	465	1356	310	70	91	471	1383	313	70	94	477
93	1689	467	82	29	578	1729	472	82	34	588	1774	477	82	39	598
94	1374	297	147	78	522	1412	302	147	83	532	1453	307	147	88	542
95	1630	439	62	40	541	1673	444	62	45	551	1708	448	62	50	560
96	718	124	101	35	260	732	125	101	36	262	736	125	101	37	263
97	49	0	0	29	29	163	0	0	96	96	242	0	0	143	143
98	692	84	101	113	298	694	84	101	113	298	714	84	101	113	298
99	812	171	79	23	273	826	172	79	24	275	829	172	79	25	276
100	750	0	86	307	393	750	0	86	307	393	752	0	86	307	393
101	1269	201	197	41	439	1290	202	197	42	441	1298	203	197	43	443
102	1558	454	36	29	519	1599	458	36	34	528	1629	461	36	39	536
103	760	222	10	13	245	779	224	10	15	249	795	226	10	17	253
104	3210	929	115	53	1097	3293	938	116	63	1117	3358	943	117	73	1133
105	859	37	63	386	486	864	37	63	386	486	865	37	63	386	486
106	2222	504	31	317	852	2263	507	31	320	858	2283	509	31	323	863
107	1216	292	111	16	419	1246	295	111	19	425	1265	297	111	22	430
108	2447	722	105	45	872	2523	732	105	55	892	2588	739	105	65	909
109	3478	878	317	55	1250	3561	887	317	64	1268	3620	893	317	73	1283
110	547	172	11	17	200	562	174	11	19	204	575	175	11	21	207
111	1332	151	150	261	562	1338	152	150	262	564	1392	153	150	263	566
112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
113	918	90	68	294	452	971	90	73	312	475	1002	90	76	325	491
114	566	0	171	65	236	737	0	171	166	337	864	0	171	239	410
115	243	38	49	11	98	246	38	49	11	98	247	38	49	11	98
116	1720	384	155	113	652	1785	388	160	124	672	1832	390	164	133	687
117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
118	538	104	36	118	258	662	104	40	182	326	752	104	43	229	376
119	2553	628	172	297	1097	2603	632	172	301	1105	2639	634	172	305	1111
120	1315	176	79	360	615	1347	177	79	370	626	1368	177	79	378	634
121	1928	223	152	574	949	2184	223	194	652	1069	2390	223	226	711	1160
122	746	5	4	431	440	781	5	4	451	460	802	5	4	463	472
123	651	10	11	414	435	694	10	11	437	458	724	10	11	453	474
124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
126	335	0	0	211	211	337	0	0	211	211	338	0	0	211	211
127	602	0	0	404	404	609	0	0	405	405	611	0	0	406	406
128	33	1	1	16	18	33	1	1	16	18	33	1	1	16	18
129	316	1	1	178	180	315	1	1	178	180	316	1	1	178	180
130	73	1	1	43	45	73	1	1	43	45	73	1	1	43	45
131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
132	71	0	0	44	44	74	0	0	46	46	78	0	0	48	48
133	860	10	7	498	515	888	10	7	513	530	905	10	7	522	539
134	541	19	12	262	293	547	19	12	262	293	547	19	12	262	293
135	766	3	3	431	437	792	3	3	445	451	807	3	3	453	459
136	3511	41	17	2028	2086	3539	41	17	2039	2097	3560	41	17	2046	2104
137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
138	233	2	2	132	136	245	2	2	139	143	255	2	2	144	148
139	489	12	7	246	265	552	12	7	282	301	595	12	7	306	325
140	388	44	48	81	173	436	44	53	99	196	472	44	57	111	212
141	650	19	129	173	321	721	19	143	192	354	772	19	153	207	379
142	444	83	50	83	216	581	83	61	143	287	681	83	70	187	340
143	290	37	15	58	110	294	37	15	58	110	294	37	15	58	110
144	2062	45	16	1113	1174	2169	45	16	1176	1237	2255	45	16	1223	1284
145	485	6	2	267	275	494	6	2	272	280	502	6	2	275	283
146	58	2	1	27	30	58	2	1	27	30	58	2	1	27	30
147	1314	163	140	320	623	1332	164	140	320	624	1335	164	140	320	624
148	26	1	4	7	12	26	1	4	7	12	26	1	4	7	12
149	1446	192	67	458	717	2297	192	111	883	1186	2928	192	145	1199	1536
150	9112	1723	1040	423	3186	9463	1743	1072	489	3304	9717	1754	1097	543	3394
151	156	0	0	92	92	156	0	0	92	92	156	0	0	92	92
152	986	277	12	16	305	1007	279	12	17	308	1004	279	12	18	309
153	957	278	13	17	308	987	282	13	21	316	1010	284	13	25	322
154	1396	366	20	36	422	1427	369	20	39	428	1457	372	20	42	434
155	2313	454	251	60	765	2363	459	251	65	775	2404	462	251	70	783
201	6258	1247	581	148	1976	6279	1247	581	160	1988	6299	1247	581	172	2000
202	6709	1157	767	316	2240	6728	1157	767	327	2251	6749	1157	767	338	2262
203	2247	194	358	358	910	2252	194	358	361	913	2257	194	358	364	916
204	2357	158	500	269	927	2362	158	500	272	930	2367	158	500	275	933
205	4342	43	520	1668	2231	4343	43	520	1668	2231	4343	43	520	1668	2231
206	7142	1539	421	315	2275	7169	1539	421	330	2290	7195	1539	421	345	2305
207	2481	335	452	45	832	2486	335	452	48	835	2491	335	452	51	838
208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
209	10	5	0	0	5	10	5	0	0	5	10	5	0	0	5
210	12	5	0	0	5	12	5	0	0	5	12	5	0	0	5
211	12	5	0	0	5	12	5	0	0	5	12	5	0	0	5
212	3	1	0	0	1	3	1	0	0	1	3	1	0	0	1
213	7571	1393	700	426	2519	7593	1393	700	440	2533	7618	1393	700	454	2547
214	6010	952	731	392	2075	6024	952	731	401	2084	6040	952	731	410	2093
215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
216	5849	553	800	1035	2388	5859	553	800	1040	2393	5867	553	800	1045	2398
Total	**252,964**	**42,815**	**20,710**	**36,434**	**99,959**	**264,307**	**43,120**	**21,422**	**40,504**	**105,046**	**273,254**	**43,309**	**21,951**	**43,565**	**108,825**

*Source: Watson & Associates Ltd., 2017

**Census Undercount estimated at approximately 3%.

City of Barrie Growth Update 2017 - Made in Barrie Scenario 2056-2061										
Traffic Zone	Population 2056 (Including Census Undercount)	Low Density	Medium Density	High Density	Total Households	Population 2061 (Including Census Undercount)	Low Density	Medium Density	High Density	Total Households
1	3389	803	186	245	1234	3560	808	206	289	1303
2	495	4	78	162	244	588	4	94	191	289
3	996	0	331	64	395	1031	0	337	75	412
4	10	3	2	1	6	10	3	2	1	6
5	0	0	0	0	0	0	0	0	0	0
6	0	0	1	0	1	0	0	1	0	1
7	10	2	3	0	5	10	2	3	0	5
8	3828	899	179	59	1137	3844	900	179	64	1143
9	3000	1	475	1001	1477	3016	1	475	1001	1477
10	5355	1203	186	245	1634	5410	1206	186	255	1647
11	844	263	3	20	286	866	265	3	22	290
12	12709	478	332	5959	6769	12889	479	351	5998	6828
13	5774	1314	211	222	1747	5878	1322	211	238	1771
14	1774	156	61	792	1009	1898	156	69	850	1075
15	762	193	28	21	242	774	193	28	24	245
16	1390	265	150	26	441	1406	265	150	30	445
17	0	0	0	0	0	0	0	0	0	0
18	7	2	0	0	2	7	2	0	0	2
19	5	1	1	0	2	5	1	1	0	2
20	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0
22	1465	282	137	32	451	1474	282	137	32	451
23	6431	1340	622	187	2149	6531	1346	622	199	2167
24	1770	452	35	55	542	1798	454	35	60	549
25	3525	807	118	58	983	3594	810	118	65	993
26	1206	276	36	28	340	1218	277	36	30	343
27	4899	574	627	704	1905	5050	574	648	743	1965
28	2740	0	707	497	1204	2824	0	721	523	1244
29	423	0	0	249	249	521	0	0	306	306
30	0	0	0	0	0	0	0	0	0	0
31	141	1	25	41	67	172	1	30	51	82
32	884	164	123	15	302	893	164	123	17	304
33	38	10	4	1	15	39	10	4	1	15
34	519	117	64	14	195	535	118	64	16	198
35	0	1	0	0	1	0	1	0	0	1
36	1848	503	26	43	572	1883	505	26	46	577
37	3836	993	89	162	1244	3913	998	89	172	1259
38	3155	338	239	914	1491	3538	338	255	1107	1700
39	2227	157	474	208	839	2359	157	486	254	897
40	2506	352	385	170	907	2597	353	396	192	941
41	2297	413	179	378	970	2424	414	186	437	1037
42	891	174	126	12	312	900	174	126	14	314
43	1428	280	101	129	510	1454	281	101	130	512
44	909	192	19	148	359	922	193	19	149	361
45	27	2	3	7	12	27	2	3	7	12
46	2496	139	436	596	1171	2723	139	460	682	1281
47	3084	230	368	853	1451	3193	230	375	904	1509
48	2490	668	109	143	920	2571	670	116	163	949
49	2343	431	183	314	928	2419	433	183	347	963
50	1235	143	76	250	469	1281	143	81	266	490
51	2829	92	178	1232	1502	2940	92	186	1282	1560
52	372	91	34	37	162	374	91	34	37	162
54	2434	32	826	79	937	2442	32	826	83	941
55	341	0	64	100	164	424	0	78	126	204
56	6551	1282	342	798	2422	6642	1286	342	812	2440
57	2949	519	294	145	958	2965	519	294	147	960
58	1215	0	0	714	714	1505	0	0	883	883
59	1272	162	18	383	563	1383	162	22	440	624
60	15	9	1	0	10	15	9	1	0	10
61	0	0	0	0	0	0	0	0	0	0
62	1173	7	5	711	723	1178	7	5	712	724
63	128	24	11	22	57	130	24	11	22	57
64	959	6	3	587	596	965	6	3	589	598
65	2304	199	119	887	1205	2353	199	119	909	1227
66	859	1	0	502	503	1054	1	0	615	616
67	5495	1114	433	275	1822	5606	1118	434	285	1837
68	0	0	0	0	0	0	0	0	0	0
69	5259	1165	309	337	1811	5348	1170	309	349	1828
70	1024	16	28	524	568	1098	16	28	568	612
71	1780	488	70	43	601	1814	491	70	47	608
72	1115	175	94	280	549	1127	175	94	281	550
73	451	100	14	100	214	456	100	14	100	214
74	1107	214	87	163	464	1115	214	87	164	465
75	1354	336	65	76	477	1383	338	65	79	482
76	2010	532	82	61	675	2036	532	82	66	680
77	1811	252	239	194	685	1832	252	239	196	687
78	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0
80	1786	507	83	55	645	1808	508	83	59	650
81	2034	270	102	474	846	2150	270	112	524	906
82	1082	340	33	86	459	1098	340	33	88	461
83	245	68	7	36	111	249	68	7	36	111
84	1009	112	20	476	608	1020	112	20	481	613
85	1615	302	168	222	692	1751	302	190	260	752
86	925	57	8	353	418	960	57	8	353	418
87	265	68	10	38	116	274	68	11	40	119
88	203	48	27	2	77	205	48	27	2	77
89	0	0	0	0	0	0	0	0	0	0
90	273	55	12	92	159	273	55	12	92	159
91	2448	477	151	485	1113	2619	480	159	556	1195
92	1412	316	70	97	483	1436	319	70	100	489
93	1814	481	82	44	607	1854	484	82	49	615
94	1490	311	147	93	551	1519	312	147	98	557
95	1738	450	62	55	567	1765	451	62	60	573
96	741	125	101	38	264	742	125	101	39	265
97	304	0	0	179	179	363	0	0	213	213
98	732	84	101	113	298	737	84	101	113	298
99	832	172	79	26	277	836	172	79	27	278
100	754	0	86	307	393	754	0	86	307	393
101	1308	204	197	44	445	1319	205	197	45	447
102	1663	464	36	44	544	1698	467	36	49	552
103	807	227	10	19	256	819	228	10	21	259
104	3419	948	117	83	1148	3491	953	117	93	1163
105	866	37	63	386	486	868	37	63	386	486
106	2303	511	31	326	868	2329	512	31	329	872
107	1281	298	111	25	434	1301	299	111	28	438
108	2656	745	105	75	925	2716	751	105	85	941
109	3688	899	317	82	1298	3745	904	317	91	1312
110	587	176	11	23	210	598	177	11	25	213
111	1431	153	150	264	567	1463	153	150	265	568
112	0	0	0	0	0	0	0	0	0	0
113	1025	90	78	335	503	1050	90	80	345	515
114	964	0	171	297	468	1061	0	171	354	525
115	248	38	49	11	98	249	38	49	11	98
116	1872	392	167	141	700	1901	392	170	149	711
117	0	0	0	0	0	0	0	0	0	0
118	821	104	45	267	416	895	104	47	305	456
119	2668	636	172	309	1117	2697	638	172	313	1123
120	1378	177	79	382	638	1393	177	79	386	642
121	2539	223	249	754	1226	2688	223	271	797	1291
122	818	5	4	471	480	833	5	4	479	488
123	740	10	11	462	483	759	10	11	472	493
124	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0
126	338	0	0	211	211	339	0	0	211	211
127	611	0	0	406	406	613	0	0	406	406
128	33	1	1	16	18	33	1	1	16	18
129	317	1	1	178	180	317	1	1	178	180
130	73	1	1	43	45	73	1	1	43	45
131	0	0	0	0	0	0	0	0	0	0
132	79	0	0	49	49	82	0	0	50	50
133	915	10	7	527	544	927	10	7	532	549
134	548	19	12	262	293	548	19	12	262	293
135	818	3	3	458	464	829	3	3	463	469
136	3577	41	17	2050	2108	3590	41	17	2053	2111
137	0	0	0	0	0	0	0	0	0	0
138	260	2	2	147	151	264	2	2	149	153
139	619	12	7	320	339	642	12	7	333	352
140	495	44	60	119	223	523	44	63	127	234
141	817	19	161	218	398	858	19	169	229	417
142	756	83	75	223	381	832	83	80	258	421
143	294	37	15	58	110	297	37	15	58	110
144	2321	45	16	1261	1322	2386	45	16	1298	1359
145	504	6	2	276	284	507	6	2	277	285
146	58	2	1	27	30	58	2	1	27	30
147	1336	164	140	320	624	1339	164	140	320	624
148	26	1	4	7	12	26	1	4	7	12
149	3422	192	167	1453	1812	3915	192	188	1706	2086
150	9916	1763	1112	591	3466	10125	1771	1127	638	3536
151	157	0	0	92	92	157	0	0	92	92
152	1010	279	12	19	310	1012	279	12	20	311
153	1026	284	13	29	326	1037	284	13	33	330
154	1483	374	20	45	439	1509	376	20	48	444
155	2446	465	251	75	791	2477	467	251	80	798
201	6321	1247	581	184	2012	6341	1247	581	196	2024
202	6767	1157	767	349	2273	6786	1157	767	360	2284
203	2262	194	358	367	919	2267	194	358	370	922
204	2372	158	500	278	936	2377	158	500	281	939
205	4343	43	520	1668	2231	4344	43	520	1668	2231
206	7220	1539	421	360	2320	7246	1539	421	375	2335
207	2496	335	452	54	841	2501	335	452	57	844
208	0	0	0	0	0	0	0	0	0	0
209	10	5	0	0	5	10	5	0	0	5
210	12	5	0	0	5	12	5	0	0	5
211	12	5	0	0	5	12	5	0	0	5
212	3	1	0	0	1	3	1	0	0	1
213	7643	1393	700	468	2561	7668	1393	700	482	2575
214	6056	952	731	419	2102	6072	952	731	428	2111
215	0	0	0	0	0	0	0	0	0	0
216	5875	553	800	1050	2403	5885	553	800	1055	2408
Total	**280,399**	**43,457**	**22,306**	**46,023**	**111,786**	**287,355**	**43,573**	**22,653**	**48,454**	**114,680**

City of Barrie Growth Update 2017 - Made in Barrie Scenario 2066-2071										
Traffic Zone	Population 2066 (Including Census Undercount)	Low Density	Medium Density	High Density	Total Households	Population 2071 (Including Census Undercount)	Low Density	Medium Density	High Density	Total Households
1	3740	813	226	331	1370	3887	818	240	369	1427
2	681	4	110	220	334	745	4	122	238	364
3	1068	0	343	86	429	1100	0	348	97	445
4	10	3	2	1	6	10	3	2	1	6
5	0	0	0	0	0	0	0	0	0	0
6	0	0	1	0	1	0	0	1	0	1
7	10	2	3	0	5	10	2	3	0	5
8	3861	901	179	69	1149	3878	902	179	74	1155
9	3032	1	475	1001	1477	3047	1	475	1001	1477
10	5471	1209	186	265	1660	5523	1212	186	275	1673
11	884	267	3	24	294	902	269	3	26	298
12	13070	480	371	6036	6887	13215	481	384	6065	6930
13	5988	1330	211	254	1795	6086	1337	211	270	1818
14	2014	156	77	905	1138	2118	156	83	957	1196
15	789	193	28	27	248	802	193	28	30	251
16	1422	265	150	34	449	1439	265	150	38	453
17	0	0	0	0	0	0	0	0	0	0
18	7	2	0	0	2	7	2	0	0	2
19	5	1	1	0	2	5	1	1	0	2
20	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0
22	1478	282	137	32	451	1479	282	137	32	451
23	6610	1352	622	211	2185	6689	1358	622	223	2203
24	1831	456	35	65	556	1861	458	35	70	563
25	3665	812	118	72	1002	3728	814	118	79	1011
26	1233	278	36	32	346	1248	279	36	34	349
27	5208	574	667	782	2023	5342	574	682	820	2076
28	2909	0	735	548	1283	2966	0	745	565	1310
29	616	0	0	361	361	696	0	0	408	408
30	0	0	0	0	0	0	0	0	0	0
31	200	1	35	60	96	227	1	39	68	108
32	901	164	123	19	306	913	164	123	21	308
33	39	10	4	1	15	39	10	4	1	15
34	553	119	64	18	201	569	120	64	20	204
35	0	1	0	0	1	0	1	0	0	1
36	1916	507	26	49	582	1945	509	26	52	587
37	3994	1003	89	182	1274	4071	1008	89	192	1289
38	3899	338	270	1293	1901	4221	338	281	1459	2078
39	2493	157	498	298	953	2607	157	507	340	1004
40	2681	354	406	213	973	2751	355	414	233	1002
41	2561	415	193	494	1102	2682	416	198	547	1161
42	908	174	126	16	316	918	174	126	18	318
43	1482	282	101	131	514	1507	283	101	132	516
44	932	194	19	150	363	940	195	19	151	365
45	27	2	3	7	12	27	2	3	7	12
46	2936	139	483	763	1385	3128	139	501	839	1479
47	3290	230	382	947	1559	3376	230	387	983	1600
48	2648	672	123	182	977	2722	674	128	200	1002
49	2498	435	183	378	996	2567	437	183	407	1027
50	1322	143	86	279	508	1353	143	90	291	524
51	3041	92	193	1324	1609	3123	92	198	1362	1652
52	377	91	34	37	162	377	91	34	37	162
54	2455	32	826	87	945	2466	32	826	91	949
55	501	0	92	149	241	559	0	102	167	269
56	6740	1290	342	826	2458	6828	1294	342	840	2476
57	2975	519	294	149	962	2989	519	294	151	964
58	1782	0	0	1045	1045	2036	0	0	1193	1193
59	1487	162	25	494	681	1587	162	28	545	735
60	15	9	1	0	10	15	9	1	0	10
61	0	0	0	0	0	0	0	0	0	0
62	1182	7	5	713	725	1185	7	5	714	726
63	130	24	11	22	57	130	24	11	22	57
64	970	6	3	591	600	976	6	3	593	602
65	2408	199	119	926	1244	2446	199	119	940	1258
66	1235	1	0	722	723	1404	1	0	820	821
67	5725	1122	435	295	1852	5829	1126	436	305	1867
68	0	0	0	0	0	0	0	0	0	0
69	5424	1175	309	361	1845	5499	1179	309	373	1861
70	1170	16	28	609	653	1233	16	28	645	689
71	1845	494	70	51	615	1877	497	70	55	622
72	1135	175	94	282	551	1141	175	94	283	552
73	456	100	14	100	214	456	100	14	100	214
74	1122	214	87	165	466	1127	214	87	166	467
75	1404	340	65	82	487	1429	342	65	85	492
76	2053	532	82	71	685	2076	532	82	76	690
77	1854	252	239	198	689	1872	252	239	200	691
78	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0
80	1826	509	83	63	655	1848	509	83	67	659
81	2262	270	121	571	962	2362	270	128	615	1013
82	1106	340	33	90	463	1115	340	33	92	465
83	249	68	7	36	111	249	68	7	36	111
84	1030	112	20	485	617	1037	112	20	489	621
85	1873	302	211	297	810	1971	302	224	332	858
86	1003	57	8	353	418	1039	57	8	353	418
87	283	68	12	42	122	289	68	12	44	124
88	205	48	27	2	77	205	48	27	2	77
89	0	0	0	0	0	0	0	0	0	0
90	273	55	12	92	159	273	55	12	92	159
91	2771	482	167	623	1272	2909	483	173	686	1342
92	1466	322	70	103	495	1493	325	70	106	501
93	1892	487	82	54	623	1926	490	82	59	631
94	1547	313	147	103	563	1572	314	147	108	569
95	1785	452	62	65	579	1816	453	62	70	585
96	747	125	101	40	266	753	125	101	41	267
97	419	0	0	246	246	469	0	0	275	275
98	751	84	101	113	298	759	84	101	113	298
99	839	172	79	28	279	844	172	79	29	280
100	754	0	86	307	393	756	0	86	307	393
101	1330	206	197	46	449	1338	207	197	47	451
102	1730	469	36	54	559	1758	471	36	59	566
103	835	229	10	23	262	847	230	10	25	265
104	3557	958	117	103	1178	3622	963	117	113	1193
105	868	37	63	386	486	868	37	63	386	486
106	2344	513	31	332	876	2361	513	31	335	879
107	1315	300	111	31	442	1334	301	111	34	446
108	2780	757	105	95	957	2856	762	105	105	972
109	3805	908	317	100	1325	3859	912	317	109	1338
110	613	178	11	27	216	626	179	11	29	219
111	1491	153	150	266	569	1518	153	150	267	570
112	0	0	0	0	0	0	0	0	0	0
113	1069	90	82	354	526	1090	90	84	362	536
114	1154	0	171	408	579	1240	0	171	457	628
115	249	38	49	11	98	252	38	49	11	98
116	1931	392	173	157	722	1963	392	174	164	730
117	0	0	0	0	0	0	0	0	0	0
118	964	104	49	341	494	1023	104	50	375	529
119	2728	640	172	317	1129	2761	641	172	321	1134
120	1404	177	79	390	646	1414	177	79	394	650
121	2813	223	289	836	1348	2923	223	305	872	1400
122	845	5	4	484	493	855	5	4	489	498
123	772	10	11	479	500	784	10	11	485	506
124	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0
126	340	0	0	211	211	341	0	0	211	211
127	613	0	0	406	406	614	0	0	406	406
128	33	1	1	16	18	33	1	1	16	18
129	318	1	1	178	180	319	1	1	178	180
130	73	1	1	43	45	74	1	1	43	45
131	0	0	0	0	0	0	0	0	0	0
132	85	0	0	51	51	86	0	0	52	52
133	934	10	7	536	553	943	10	7	540	557
134	549	19	12	262	293	549	19	12	262	293
135	839	3	3	467	473	846	3	3	471	477
136	3603	41	17	2056	2114	3614	41	17	2059	2117
137	0	0	0	0	0	0	0	0	0	0
138	267	2	2	151	155	271	2	2	153	157
139	661	12	7	343	362	679	12	7	353	372
140	543	44	65	134	243	564	44	67	142	253
141	892	19	175	240	434	933	19	181	254	454
142	903	83	85	292	460	971	83	89	324	496
143	297	37	15	58	110	297	37	15	58	110
144	2452	45	16	1334	1395	2508	45	16	1366	1427
145	510	6	2	278	286	513	6	2	279	287
146	58	2	1	27	30	58	2	1	27	30
147	1342	164	140	320	624	1343	164	140	320	624
148	26	1	4	7	12	26	1	4	7	12
149	4385	192	208	1946	2346	4805	192	223	2167	2582
150	10329	1777	1141	685	3603	10506	1779	1153	731	3663
151	158	0	0	92	92	158	0	0	92	92
152	1014	279	12	21	312	1015	279	12	22	313
153	1057	284	13	37	334	1069	284	13	41	338
154	1536	378	20	51	449	1560	380	20	54	454
155	2516	469	251	85	805	2549	471	251	90	812
201	6362	1247	581	208	2036	6383	1247	581	220	2048
202	6805	1157	767	371	2295	6824	1157	767	382	2306
203	2273	194	358	373	925	2279	194	358	376	928
204	2383	158	500	284	942	2388	158	500	287	945
205	4344	43	520	1668	2231	4344	43	520	1668	2231
206	7273	1539	421	390	2350	7298	1539	421	405	2365
207	2507	335	452	60	847	2512	335	452	63	850
208	0	0	0	0	0	1	0	0	0	0
209	10	5	0	0	5	10	5	0	0	5
210	12	5	0	0	5	12	5	0	0	5
211	12	5	0	0	5	12	5	0	0	5
212	3	1	0	0	1	3	1	0	0	1
213	7691	1393	700	496	2589	7715	1393	700	510	2603
214	6087	952	731	437	2120	6102	952	731	446	2129
215	0	0	0	0	0	0	0	0	0	0
216	5893	553	800	1060	2413	5902	553	800	1065	2418
Total	**294,034**	**43,683**	**22,983**	**50,762**	**117,428**	**300,012**	**43,782**	**23,231**	**52,891**	**119,904**

City of Barrie
Employment Forecast Summary, 2016-2071
Scenario 3 (Made in Barrie Scenario)

Area	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Employment Total
Built Boundary							
U.G.C.							
2016	7	503	3,882	1,845	146	323	6,707
2021	7	503	3,982	2,011	188	399	7,090
2026	7	503	4,563	2,373	284	562	8,292
2031	7	503	5,324	2,855	432	879	10,000
2036	7	503	6,183	3,468	521	1,070	11,752
2041	7	503	7,338	4,118	614	1,232	13,812
2046	7	503	8,439	4,637	645	1,293	15,524
2051	7	503	9,246	5,027	665	1,332	16,780
2056	7	503	9,811	5,297	677	1,357	17,652
2061	7	503	10,346	5,558	689	1,380	18,483
2066	7	503	10,851	5,797	698	1,400	19,256
2071	7	503	11,226	5,982	707	1,418	19,843
Intensification Nodes/Corridors							
2016	25	589	9,619	3,556	206	456	14,452
2021	25	589	10,438	3,834	246	514	15,646
2026	25	633	10,938	4,078	313	615	16,602
2031	25	737	11,167	4,144	386	789	17,248
2036	25	751	12,227	4,676	530	1,091	19,300
2041	25	768	14,116	5,648	854	1,716	23,127
2046	25	792	15,163	6,022	1,115	2,236	25,353
2051	25	805	15,935	6,317	1,308	2,623	27,013
2056	25	812	16,607	6,581	1,456	2,920	28,401
2061	25	817	17,283	6,844	1,602	3,212	29,783
2066	25	822	17,943	7,103	1,742	3,492	31,127
2071	25	827	18,574	7,355	1,863	3,736	32,380
Other Built Boundary							
2016	10	11,022	14,024	11,253	4,009	8,869	49,187
2021	10	11,230	15,215	11,698	4,149	8,639	50,941
2026	10	11,802	15,981	12,189	4,304	8,607	52,893
2031	10	12,097	16,727	12,399	4,174	8,522	53,929
2036	10	12,451	17,698	13,170	4,292	8,855	56,476
2041	10	13,062	19,040	14,256	4,657	9,342	60,367
2046	10	13,345	19,448	14,561	4,750	9,524	61,638
2051	10	13,654	19,775	14,819	4,840	9,704	62,802
2056	10	13,865	20,101	15,030	4,919	9,863	63,788
2061	10	14,059	20,427	15,236	4,995	10,017	64,744
2066	10	14,230	20,754	15,436	5,070	10,167	65,667
2071	10	14,377	21,080	15,621	5,140	10,306	66,534
Total Built Boundary							
2016	42	12,114	27,525	16,654	4,361	9,649	70,345
2021	42	12,322	29,635	17,543	4,583	9,552	73,677
2026	42	12,938	31,482	18,640	4,901	9,784	77,787
2031	42	13,337	33,218	19,398	4,992	10,190	81,177
2036	42	13,705	36,108	21,314	5,343	11,016	87,528
2041	42	14,333	40,494	24,022	6,125	12,290	97,306
2046	42	14,640	43,050	25,220	6,510	13,053	102,515
2051	42	14,962	44,956	26,163	6,813	13,659	106,595
2056	42	15,180	46,519	26,908	7,052	14,140	109,841
2061	42	15,379	48,056	27,638	7,286	14,609	113,010
2066	42	15,555	49,548	28,336	7,510	15,059	116,050
2071	42	15,707	50,880	28,958	7,710	15,460	118,757
Old Barrie Greenfield Areas							
2016	3	965	1,169	242	295	653	3,328
2021	3	2,307	1,942	1,070	368	756	6,446
2026	3	2,905	2,318	1,341	488	962	8,017
2031	3	3,075	2,581	1,410	489	985	8,543
2036	3	3,503	3,612	1,485	725	1,479	10,807
2041	3	4,108	4,614	1,743	925	1,855	13,248
2046	3	4,205	4,715	1,770	932	1,870	13,495
2051	3	4,308	4,789	1,792	938	1,882	13,712
2056	3	4,374	4,860	1,810	943	1,892	13,882
2061	3	4,435	4,933	1,827	948	1,901	14,047
2066	3	4,490	5,006	1,844	952	1,909	14,204
2071	3	4,535	5,079	1,861	957	1,918	14,353
Annexed Area							
2016	0	59	6	1	10	23	99
2021	0	592	603	357	575	1,183	3,310
2026	0	1,523	1,797	1,068	1,033	2,097	7,518
2031	0	2,479	3,005	1,791	1,327	2,675	11,277
2036	0	3,728	4,293	2,370	1,505	3,096	14,992
2041	0	5,124	5,227	2,744	1,782	3,565	18,442
2046	0	5,248	5,341	2,794	1,785	3,579	18,747
2051	0	5,374	5,423	2,837	1,789	3,588	19,011
2056	0	5,463	5,503	2,879	1,794	3,597	19,236
2061	0	5,545	5,584	2,917	1,798	3,606	19,450
2066	0	5,618	5,665	2,954	1,803	3,615	19,655
2071	0	5,681	5,746	2,989	1,807	3,624	19,847
City of Barrie Total							
2016	45	13,138	28,700	16,897	4,667	10,325	73,772
2021	45	15,221	32,180	18,970	5,526	11,491	83,433
2026	45	17,366	35,597	21,049	6,422	12,843	93,322
2031	45	18,891	38,804	22,599	6,808	13,850	100,997
2036	45	20,936	44,013	25,169	7,573	15,591	113,327
2041	45	23,565	50,335	28,509	8,832	17,710	128,996
2046	45	24,093	53,106	29,784	9,227	18,502	134,757
2051	45	24,644	55,168	30,792	9,540	19,129	139,318
2056	45	25,017	56,882	31,597	9,789	19,629	142,959
2061	45	25,359	58,573	32,382	10,032	20,116	146,507
2066	45	25,663	60,219	33,134	10,265	20,583	149,909
2071	45	25,923	61,705	33,808	10,474	21,002	152,957

Source: Watson & Associates Economists Ltd.

2041 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
1	0	16	114	115	94	190	529
2	0	961	768	412	4	6	2,151
3	0	726	672	101	29	59	1,587
4	0	879	803	157	0	0	1,839
5	0	402	2,191	272	0	0	2,865
6	0	1,766	905	110	0	0	2,781
7	0	1,345	580	111	0	0	2,036
8	0	17	54	280	127	259	737
9	0	0	0	0	104	207	311
10	0	43	68	184	177	357	829
11	0	17	3	0	26	56	102
12	0	22	1,045	175	421	841	2,504
13	0	10	47	118	188	378	741
14	0	4	599	72	45	89	809
15	0	5	3	6	25	49	88
16	0	43	126	73	46	93	381
17	0	370	475	402	0	0	1,247
18	3	1,196	548	89	0	0	1,836
19	0	59	973	291	0	0	1,323
20	0	247	648	68	0	0	963
21	0	286	2,974	137	0	0	3,397
22	0	713	514	116	51	99	1,493
23	0	40	220	101	211	429	1,001
24	0	6	5	321	58	118	508
25	0	6	25	111	115	229	486
26	0	3	7	0	40	81	131
27	0	19	155	43	145	294	656
28	0	392	735	101	83	167	1,478
29	0	4	696	21	0	0	721
30	0	253	160	46	0	0	459
31	0	0	289	8	0	1	298
32	0	113	129	220	29	59	550
33	0	660	284	21	1	3	969
34	0	0	2	0	16	33	51
35	0	869	572	96	0	0	1,537
36	0	3	20	118	61	122	324
37	0	13	52	15	126	251	457
38	0	7	500	68	57	114	746
39	0	1	74	16	58	117	266
40	0	11	70	0	74	152	307
41	0	5	134	32	61	122	354
42	0	38	62	78	30	60	268
43	0	7	17	1	47	94	166
44	0	2	204	33	30	61	330
45	0	0	262	46	1	2	311
46	0	130	589	42	54	112	927
47	0	12	325	26	89	179	631
48	0	6	134	68	75	155	438
49	0	10	112	59	70	143	394
50	0	7	57	261	37	72	434
51	0	34	317	47	81	159	638
52	0	7	8	0	13	25	53
54	0	0	930	59	84	168	1,241
55	0	842	243	665	0	0	1,750
56	0	24	106	129	217	433	909
57	0	5	0	231	102	202	540
58	0	105	30	2	3	5	145
59	3	680	969	111	29	59	1,851
60	0	649	339	24	0	1	1,013
61	0	50	576	37	0	0	663
62	0	0	151	7	40	81	279
63	0	1,044	570	21	4	9	1,648
64	0	4	183	38	33	66	324
65	0	178	237	225	71	143	854
66	25	1,082	799	110	3	8	2,027
67	0	15	47	90	179	360	691
68	0	0	0	48	0	0	48
69	0	91	36	197	172	353	849
70	0	213	818	313	24	49	1,417
71	0	15	4	43	59	117	238
72	0	12	146	5	38	76	277
73	0	4	5	0	16	30	55
74	0	6	69	111	40	74	300
75	0	21	20	11	45	91	188
76	0	22	71	28	67	135	323
77	0	0	19	82	59	122	282
78	0	0	49	3,824	0	0	3,873
79	0	0	25	3,838	0	0	3,863
80	0	11	21	198	61	119	410
81	0	6	221	222	56	108	613
82	0	4	17	8	36	74	139
83	0	0	36	7	10	16	69
84	0	0	31	6	32	67	136
85	0	26	12	0	39	75	152
86	0	0	89	4	29	56	178

2041 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
87	0	4	0	25	8	16	53
88	0	6	6	0	7	14	33
89	0	13	761	859	0	0	1,633
90	0	308	525	505	9	19	1,366
91	0	25	177	170	61	127	560
92	0	3	77	150	48	93	371
93	0	8	6	0	58	119	191
94	0	0	7	55	49	96	207
95	0	4	30	12	57	113	216
96	0	4	12	1	26	49	92
97	0	60	909	60	2	3	1,034
98	0	0	107	46	24	49	226
99	0	0	16	66	28	58	168
100	0	123	3,430	229	27	52	3,861
101	0	0	1	0	46	88	135
102	0	6	8	98	55	109	276
103	0	1	6	2	25	54	88
104	1	25	9	58	112	226	431
105	0	63	989	117	30	59	1,258
106	0	2	40	177	80	157	456
107	0	10	81	129	43	85	348
108	0	14	19	47	87	171	338
109	0	4	104	60	120	244	532
110	0	0	6	89	20	38	153
111	0	0	32	5	46	93	176
112	0	0	0	0	0	0	0
113	0	6	11	1	31	65	114
114	0	12	1,353	203	20	40	1,628
115	0	6	318	516	8	17	865
116	0	13	39	33	61	120	266
117	6	49	137	5	0	0	197
118	0	1	9	61	19	38	128
119	0	4	24	216	87	183	514
120	0	4	118	56	46	93	317
121	0	5	75	3	69	134	286
122	0	0	149	36	25	52	262
123	0	0	116	931	22	46	1,115
124	0	0	106	995	0	0	1,101
125	0	0	74	2	0	0	76
126	3	117	486	102	12	23	743
127	0	4	371	89	21	42	527
128	0	21	180	20	1	2	224
129	0	0	258	3	11	22	294
130	0	42	679	20	3	5	749
131	0	4	219	0	0	0	223
132	0	7	304	7	2	5	325
133	0	15	262	187	31	60	555
134	0	116	276	13	19	37	461
135	0	5	70	640	27	54	796
136	0	31	396	122	122	244	915
137	0	0	0	0	0	0	0
138	0	11	236	13	8	17	285
139	4	20	600	220	17	34	895
140	0	4	18	71	14	28	135
141	0	18	377	76	23	46	540
142	0	8	29	14	16	31	98
143	0	2	36	25	11	19	93
144	0	0	152	30	72	144	398
145	0	8	130	306	18	33	495
146	0	5	0	5	2	4	16
147	0	33	323	674	47	91	1,168
148	0	7	236	23	1	2	269
149	0	34	312	20	51	101	518
150	0	52	602	308	318	641	1,921
151	0	58	1,292	265	5	11	1,631
152	0	52	22	10	36	69	189
153	0	8	0	94	32	67	201
154	0	0	11	105	48	98	262
155	0	82	151	303	79	161	776
201	0	0	35	243	219	437	934
202	0	0	91	153	235	469	948
203	0	0	61	77	78	157	373
204	0	0	0	0	82	164	246
205	0	0	1,287	97	152	303	1,839
206	0	0	53	148	250	500	951
207	0	0	47	78	87	174	386
208	0	286	190	70	0	0	546
209	0	722	481	178	0	1	1,382
210	0	1,465	979	364	0	1	2,809
211	0	282	173	59	0	1	515
212	0	1,034	544	154	0	0	1,732
213	0	0	300	378	265	530	1,473
214	0	53	113	477	210	420	1,273
215	0	1,276	672	188	0	0	2,136
216	0	6	201	80	204	408	899
Total	**45**	**23,565**	**50,337**	**28,509**	**8,832**	**17,710**	**128,998**

2046 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
1	0	16	115	118	106	211	566
2	0	984	786	419	10	19	2,218
3	0	743	685	102	32	62	1,624
4	0	900	824	159	0	0	1,883
5	0	411	2,256	277	0	0	2,944
6	0	1,810	927	111	0	0	2,848
7	0	1,378	591	112	0	0	2,081
8	0	17	55	284	130	264	750
9	0	0	0	0	104	209	313
10	0	43	69	186	184	365	847
11	0	17	3	0	27	57	104
12	0	22	1,068	180	431	861	2,562
13	0	10	48	120	193	388	759
14	0	4	620	80	53	104	861
15	0	5	3	6	25	51	90
16	0	44	129	74	46	95	388
17	0	379	485	409	0	0	1,273
18	3	1,224	560	90	0	0	1,877
19	0	60	991	296	0	0	1,347
20	0	254	658	69	0	0	981
21	0	293	3,026	139	0	0	3,458
22	0	730	527	119	51	99	1,526
23	0	40	246	104	218	439	1,047
24	0	6	5	328	59	119	517
25	0	6	26	113	114	233	492
26	0	3	7	0	40	81	131
27	0	19	155	45	152	315	686
28	0	402	735	104	89	177	1,507
29	0	4	850	27	7	13	901
30	0	259	161	47	0	0	467
31	0	0	294	11	2	5	312
32	0	115	132	224	29	61	561
33	0	677	291	21	1	3	993
34	0	0	2	0	17	34	53
35	0	890	585	98	0	0	1,573
36	0	3	20	120	62	126	331
37	0	13	53	15	127	257	465
38	0	7	500	77	80	160	824
39	0	1	74	17	66	131	289
40	0	11	71	0	79	162	323
41	0	5	134	32	69	139	379
42	0	39	64	79	30	62	274
43	0	7	17	1	47	95	167
44	0	2	211	33	31	63	340
45	0	0	271	47	1	2	321
46	0	131	595	50	68	137	981
47	0	12	337	55	98	196	698
48	0	6	134	72	80	162	454
49	0	10	140	61	74	152	437
50	0	7	63	271	40	79	460
51	0	34	362	79	88	177	740
52	0	7	8	0	14	26	55
54	0	0	940	59	83	168	1,250
55	0	863	248	678	5	11	1,805
56	0	24	107	130	222	444	927
57	0	5	0	235	101	204	545
58	0	108	30	2	20	39	199
59	3	694	986	113	35	72	1,903
60	0	664	350	27	0	1	1,042
61	0	51	609	51	0	0	711
62	0	0	164	9	40	82	295
63	0	1,068	591	21	4	9	1,693
64	0	4	208	45	33	66	356
65	0	181	252	250	76	150	909
66	25	1,108	822	121	15	30	2,121
67	0	15	47	92	180	362	696
68	0	0	0	49	0	0	49
69	0	93	36	200	175	357	861
70	0	217	945	323	29	60	1,574
71	0	15	4	44	59	122	244
72	0	12	151	5	39	76	283
73	0	4	5	0	16	31	56
74	0	6	71	113	40	76	306
75	0	21	20	11	45	92	189
76	0	22	72	28	69	138	329
77	0	0	19	83	62	121	285
78	0	0	50	3,944	0	0	3,994
79	0	0	25	3,959	0	0	3,984
80	0	11	21	202	63	125	422
81	0	6	273	228	63	123	693
82	0	4	17	8	37	75	141
83	0	0	36	7	10	17	70
84	0	0	35	10	35	68	148
85	0	26	12	0	47	92	177
86	0	0	89	4	27	55	175

2051 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
1	0	16	116	120	113	224	589
2	0	1,008	798	425	14	28	2,273
3	0	761	694	103	33	67	1,658
4	0	923	838	160	0	0	1,921
5	0	421	2,309	282	0	0	3,012
6	0	1,856	945	111	0	0	2,912
7	0	1,411	599	113	0	0	2,123
8	0	17	56	288	132	265	758
9	0	0	0	0	104	210	314
10	0	43	70	188	185	370	856
11	0	17	3	0	28	58	106
12	0	22	1,086	184	437	878	2,607
13	0	10	49	122	197	396	774
14	0	4	635	86	58	116	899
15	0	5	3	6	25	52	91
16	0	45	132	75	46	97	395
17	0	389	493	414	0	0	1,296
18	3	1,254	568	91	0	0	1,916
19	0	61	1,005	301	0	0	1,367
20	0	261	667	70	0	0	998
21	0	300	3,068	141	0	0	3,509
22	0	748	538	120	51	99	1,556
23	0	40	265	106	219	445	1,075
24	0	6	5	334	61	121	527
25	0	6	27	115	118	241	507
26	0	3	7	0	41	83	134
27	0	19	156	46	164	331	716
28	0	412	735	106	93	186	1,532
29	0	4	967	32	11	23	1,037
30	0	266	162	48	0	0	476
31	0	0	297	13	3	8	321
32	0	118	135	228	30	62	573
33	0	694	297	21	1	3	1,016
34	0	0	2	0	18	35	55
35	0	911	595	99	0	0	1,605
36	0	3	20	122	64	128	337
37	0	13	54	15	132	262	476
38	0	7	500	83	96	194	880
39	0	1	74	18	73	146	312
40	0	11	72	0	84	168	335
41	0	5	134	32	74	151	396
42	0	40	65	80	31	62	278
43	0	7	17	1	49	97	171
44	0	2	216	33	31	63	345
45	0	0	278	48	1	2	329
46	0	132	600	56	79	160	1,027
47	0	12	346	76	103	207	744
48	0	6	134	75	82	170	467
49	0	10	161	63	79	159	472
50	0	7	68	279	42	85	481
51	0	34	395	102	95	189	815
52	0	7	8	0	14	26	55
54	0	0	947	59	85	170	1,261
55	0	884	252	689	9	18	1,852
56	0	24	108	131	225	448	936
57	0	5	0	239	104	204	552
58	0	111	30	2	33	64	240
59	3	708	1,000	113	40	82	1,946
60	0	682	359	29	0	1	1,071
61	0	52	633	61	0	0	746
62	0	0	174	11	41	82	308
63	0	1,093	608	21	4	9	1,735
64	0	4	226	50	33	67	380
65	0	185	262	269	78	157	951
66	25	1,136	839	129	24	46	2,199
67	0	15	47	93	184	375	714
68	0	0	0	50	0	0	50
69	0	96	36	203	179	366	880
70	0	221	1,042	332	32	67	1,694
71	0	15	4	45	60	123	247
72	0	12	154	5	39	77	287
73	0	4	5	0	16	31	56
74	0	6	73	115	40	77	311
75	0	21	20	11	47	95	194
76	0	22	73	28	70	139	332
77	0	0	19	84	63	125	291
78	0	0	51	4,049	0	0	4,100
79	0	0	25	4,064	0	0	4,089
80	0	11	21	205	63	127	427
81	0	6	312	233	68	132	751
82	0	4	17	8	38	75	142
83	0	0	36	7	10	17	70
84	0	0	37	13	35	69	154
85	0	26	12	0	52	103	193
86	0	0	89	4	31	61	185

2046 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
87	0	4	0	25	9	16	54
88	0	6	6	0	7	14	33
89	0	13	769	876	0	0	1,658
90	0	316	542	515	10	19	1,402
91	0	25	181	173	74	145	598
92	0	3	79	153	48	96	379
93	0	8	6	0	59	121	194
94	0	0	7	56	49	100	212
95	0	4	31	12	58	117	222
96	0	4	12	1	26	51	94
97	0	61	960	78	6	11	1,116
98	0	0	107	47	24	49	227
99	0	0	16	67	28	59	170
100	0	125	3,620	302	27	52	4,126
101	0	0	1	0	45	89	135
102	0	6	8	100	56	114	284
103	0	1	6	2	27	54	90
104	1	25	9	59	115	230	439
105	0	65	1,043	138	30	61	1,337
106	0	2	41	180	81	159	463
107	0	10	83	131	44	86	354
108	0	14	19	48	88	176	345
109	0	4	106	61	124	249	544
110	0	0	6	91	20	39	156
111	0	0	33	5	45	94	177
112	0	0	0	0	0	0	0
113	0	6	11	1	35	67	120
114	0	12	1,554	232	26	52	1,876
115	0	6	326	526	9	17	884
116	0	13	40	34	63	124	274
117	6	50	141	5	0	0	202
118	0	1	9	62	22	46	140
119	0	4	24	220	90	185	523
120	0	4	131	61	47	94	337
121	0	5	77	8	78	152	320
122	0	0	170	46	28	55	299
123	0	0	132	1,054	25	49	1,260
124	0	0	106	995	0	0	1,101
125	0	0	87	2	0	0	89
126	3	117	568	115	12	24	839
127	0	4	426	100	21	43	594
128	0	21	211	23	1	2	258
129	0	0	295	3	11	22	331
130	0	42	799	23	3	5	872
131	0	4	258	0	0	0	262
132	0	7	357	9	3	5	381
133	0	15	301	215	31	63	625
134	0	116	317	15	19	38	505
135	0	5	77	721	28	55	886
136	0	31	416	140	124	247	958
137	0	0	0	0	0	0	0
138	0	11	275	17	8	17	328
139	4	20	703	257	18	39	1,041
140	0	4	21	75	16	31	147
141	0	18	377	84	25	51	555
142	0	8	29	14	20	41	112
143	0	2	37	25	11	19	94
144	0	0	152	32	74	151	409
145	0	8	150	345	18	34	555
146	0	5	0	5	2	4	16
147	0	33	334	687	48	94	1,196
148	0	7	243	23	1	2	276
149	0	34	382	25	81	161	683
150	0	52	634	318	331	665	2,000
151	0	58	1,512	298	5	11	1,884
152	0	53	22	10	36	70	191
153	0	8	0	96	35	67	206
154	0	0	11	107	51	99	268
155	0	83	155	310	82	164	794
201	0	0	36	247	219	440	942
202	0	0	93	156	235	470	954
203	0	0	62	78	79	158	377
204	0	0	0	0	82	165	247
205	0	0	1,316	99	152	304	1,871
206	0	0	54	151	250	501	956
207	0	0	48	79	88	174	389
208	0	293	194	71	0	0	558
209	0	740	491	181	0	1	1,413
210	0	1,500	1,000	371	0	1	2,872
211	0	289	177	60	0	1	527
212	0	1,059	556	157	0	0	1,772
213	0	0	307	386	265	532	1,490
214	0	54	115	486	210	422	1,287
215	0	1,307	687	191	0	0	2,185
216	0	6	205	81	205	410	907
Total	**45**	**24,093**	**53,106**	**29,784**	**9,227**	**18,502**	**134,757**

2051 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
87	0	4	0	25	9	19	57
88	0	6	6	0	7	14	33
89	0	13	776	890	0	0	1,679
90	0	324	555	523	10	19	1,431
91	0	25	184	175	80	159	623
92	0	3	81	156	49	98	387
93	0	8	6	0	60	126	200
94	0	0	7	57	52	102	218
95	0	4	32	12	60	119	227
96	0	4	12	1	26	51	94
97	0	62	998	91	8	17	1,176
98	0	0	107	48	24	50	229
99	0	0	16	68	28	59	171
100	0	127	3,757	358	27	52	4,321
101	0	0	1	0	46	90	137
102	0	6	8	101	57	115	287
103	0	1	6	2	27	56	92
104	1	25	9	60	120	233	448
105	0	67	1,083	153	30	61	1,394
106	0	2	41	183	81	159	466
107	0	10	85	133	44	88	360
108	0	14	19	49	90	182	354
109	0	4	108	62	124	253	551
110	0	0	6	92	20	39	157
111	0	0	33	5	47	99	184
112	0	0	0	0	0	0	0
113	0	6	11	1	35	70	123
114	0	12	1,702	254	30	61	2,059
115	0	6	332	535	9	17	899
116	0	13	40	34	65	128	280
117	6	51	144	5	0	0	206
118	0	1	9	63	26	53	152
119	0	4	24	223	92	188	531
120	0	4	141	64	48	96	353
121	0	5	79	12	84	167	347
122	0	0	186	53	28	56	323
123	0	0	143	1,146	26	50	1,365
124	0	0	106	995	0	0	1,101
125	0	0	97	2	0	0	99
126	3	117	628	125	12	24	909
127	0	4	466	108	21	43	642
128	0	21	234	25	1	2	283
129	0	0	322	3	11	22	358
130	0	42	886	25	3	5	961
131	0	4	286	0	0	0	290
132	0	7	396	11	3	5	422
133	0	15	329	236	32	64	676
134	0	116	347	16	19	38	536
135	0	5	82	782	29	56	954
136	0	31	431	155	124	249	990
137	0	0	0	0	0	0	0
138	0	11	303	20	9	18	361
139	4	20	778	286	21	42	1,151
140	0	4	24	78	16	34	156
141	0	18	377	89	27	54	565
142	0	8	29	14	24	47	122
143	0	2	38	25	11	19	95
144	0	0	152	34	78	158	422
145	0	8	164	375	18	35	600
146	0	5	0	5	2	4	16
147	0	33	343	698	47	95	1,216
148	0	7	249	23	1	2	282
149	0	34	434	29	103	205	805
150	0	52	656	326	341	681	2,056
151	0	58	1,675	323	5	11	2,072
152	0	54	22	10	36	70	192
153	0	8	0	97	36	70	211
154	0	0	11	109	52	102	274
155	0	84	158	314	86	166	808
201	0	0	37	251	220	441	949
202	0	0	94	158	236	472	960
203	0	0	63	79	79	158	379
204	0	0	0	0	83	166	249
205	0	0	1,335	100	152	304	1,891
206	0	0	55	153	251	504	963
207	0	0	49	80	87	173	389
208	0	301	197	72	0	0	570
209	0	758	499	184	0	1	1,442
210	0	1,535	1,014	377	0	1	2,927
211	0	297	180	61	0	1	539
212	0	1,084	565	159	0	0	1,808
213	0	0	312	393	266	533	1,504
214	0	55	117	494	211	423	1,300
215	0	1,338	698	194	0	0	2,230
216	0	6	208	82	204	411	911
Total	**45**	**24,644**	**55,168**	**30,792**	**9,540**	**19,129**	**139,318**

2056 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
1	0	16	117	122	120	238	613
2	0	1,024	810	429	18	34	2,315
3	0	773	703	104	35	69	1,684
4	0	939	852	161	0	0	1,952
5	0	427	2,361	286	0	0	3,074
6	0	1,889	962	111	0	0	2,962
7	0	1,433	607	114	0	0	2,154
8	0	17	57	291	132	268	765
9	0	0	0	0	105	210	315
10	0	43	70	189	186	374	862
11	0	17	3	0	28	60	108
12	0	22	1,104	187	444	892	2,649
13	0	10	50	123	200	405	788
14	0	4	649	91	63	124	931
15	0	5	3	6	26	54	94
16	0	46	135	76	47	98	402
17	0	395	500	419	0	0	1,314
18	3	1,274	576	91	0	0	1,944
19	0	62	1,019	304	0	0	1,385
20	0	265	676	71	0	0	1,012
21	0	304	3,110	143	0	0	3,557
22	0	760	549	121	51	99	1,580
23	0	40	281	108	224	451	1,104
24	0	6	5	339	62	124	536
25	0	6	28	116	125	246	521
26	0	3	7	0	42	84	136
27	0	19	157	47	170	345	738
28	0	419	735	108	96	191	1,549
29	0	4	1,061	37	15	30	1,147
30	0	270	163	48	0	0	481
31	0	0	300	15	5	10	330
32	0	120	138	230	31	62	581
33	0	706	303	21	1	3	1,034
34	0	0	2	0	18	36	56
35	0	926	605	100	0	0	1,631
36	0	3	20	123	66	130	342
37	0	13	55	15	134	267	484
38	0	7	500	89	110	221	927
39	0	1	74	19	77	156	327
40	0	11	73	0	86	176	346
41	0	5	134	32	79	161	411
42	0	41	66	81	31	62	281
43	0	7	17	1	50	100	175
44	0	2	221	33	32	64	352
45	0	0	285	49	1	2	337
46	0	133	605	62	88	175	1,063
47	0	12	353	93	109	216	783
48	0	6	134	77	86	176	479
49	0	10	178	65	81	165	499
50	0	7	72	287	43	87	496
51	0	34	419	119	99	198	869
52	0	7	8	0	14	26	55
54	0	0	953	59	85	169	1,266
55	0	900	256	698	12	24	1,890
56	0	24	109	132	227	460	952
57	0	5	0	242	104	207	558
58	0	112	30	2	42	85	271
59	3	718	1,014	113	44	89	1,981
60	0	693	368	31	0	1	1,093
61	0	53	656	70	0	0	779
62	0	0	180	11	41	82	314
63	0	1,109	623	21	4	9	1,766
64	0	4	239	53	33	67	396
65	0	187	270	283	80	162	982
66	25	1,154	855	137	30	60	2,261
67	0	15	47	94	190	383	729
68	0	0	0	51	0	0	51
69	0	97	36	205	180	367	885
70	0	224	1,123	339	35	72	1,793
71	0	15	4	45	60	125	249
72	0	12	157	5	39	78	291
73	0	4	5	0	16	31	56
74	0	6	75	116	40	78	315
75	0	21	20	11	48	96	196
76	0	22	74	28	70	140	334
77	0	0	19	85	64	127	295
78	0	0	52	4,131	0	0	4,183
79	0	0	25	4,147	0	0	4,172
80	0	11	21	208	63	127	430
81	0	6	344	239	71	142	802
82	0	4	17	8	39	75	143
83	0	0	36	7	10	17	70
84	0	0	38	15	35	69	157
85	0	26	12	0	56	114	208
86	0	0	89	4	33	63	189

2061 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
1	0	16	118	124	126	250	634
2	0	1,037	822	433	21	41	2,354
3	0	783	712	105	35	72	1,707
4	0	953	866	162	0	0	1,981
5	0	433	2,413	290	0	0	3,136
6	0	1,918	980	111	0	0	3,009
7	0	1,455	615	115	0	0	2,185
8	0	17	58	294	133	268	770
9	0	0	0	0	105	212	317
10	0	43	71	190	188	378	870
11	0	17	3	0	30	61	111
12	0	22	1,121	190	451	905	2,689
13	0	10	51	125	206	410	802
14	0	4	664	96	65	133	962
15	0	5	3	6	27	54	95
16	0	47	138	77	48	99	409
17	0	400	508	423	0	0	1,331
18	3	1,293	584	92	0	0	1,972
19	0	63	1,033	307	0	0	1,403
20	0	269	685	72	0	0	1,026
21	0	308	3,152	145	0	0	3,605
22	0	772	560	122	51	102	1,607
23	0	40	297	110	227	459	1,133
24	0	6	5	344	63	126	544
25	0	6	29	117	127	252	531
26	0	3	7	0	42	84	136
27	0	19	158	48	175	354	754
28	0	426	735	110	97	199	1,567
29	0	4	1,154	42	18	36	1,254
30	0	274	164	48	0	0	486
31	0	0	303	17	6	12	338
32	0	121	141	232	31	64	589
33	0	716	309	21	1	3	1,050
34	0	0	2	0	19	37	58
35	0	940	615	101	0	0	1,656
36	0	3	20	124	66	131	344
37	0	13	56	15	137	274	495
38	0	7	500	95	122	250	974
39	0	1	74	20	85	164	344
40	0	11	74	0	89	183	357
41	0	5	134	32	84	169	424
42	0	42	67	82	31	63	285
43	0	7	17	1	51	101	177
44	0	2	226	33	32	65	358
45	0	0	292	50	1	2	345
46	0	134	610	68	96	191	1,099
47	0	12	360	110	112	220	814
48	0	6	134	79	89	181	489
49	0	10	195	67	83	170	525
50	0	7	75	294	45	90	511
51	0	34	443	134	103	206	920
52	0	7	8	0	14	26	55
54	0	0	959	59	84	172	1,274
55	0	914	260	708	15	30	1,927
56	0	24	110	133	231	463	961
57	0	5	0	245	104	207	561
58	0	113	30	2	51	106	302
59	3	727	1,028	113	49	97	2,017
60	0	703	377	33	0	1	1,114
61	0	54	679	79	0	0	812
62	0	0	186	11	41	83	321
63	0	1,125	638	21	4	9	1,797
64	0	4	251	56	34	67	412
65	0	189	278	296	83	166	1,012
66	25	1,170	872	145	37	73	2,322
67	0	15	47	95	195	391	743
68	0	0	0	52	0	0	52
69	0	98	36	207	184	374	899
70	0	226	1,203	347	38	77	1,891
71	0	15	4	45	62	128	254
72	0	12	160	5	40	78	295
73	0	4	5	0	16	32	57
74	0	6	77	117	40	79	319
75	0	21	20	11	48	97	197
76	0	22	75	28	71	142	338
77	0	0	19	86	64	128	297
78	0	0	53	4,209	0	0	4,262
79	0	0	25	4,225	0	0	4,250
80	0	11	21	211	63	128	434
81	0	6	376	244	77	150	853
82	0	4	17	8	38	77	144
83	0	0	36	7	10	17	70
84	0	0	39	17	35	71	162
85	0	26	12	0	63	124	225
86	0	0	89	4	34	67	194

2056 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
87	0	4	0	25	9	19	57
88	0	6	6	0	7	14	33
89	0	13	783	903	0	0	1,699
90	0	329	568	532	10	19	1,458
91	0	25	187	177	86	171	646
92	0	3	83	157	50	100	393
93	0	8	6	0	62	127	203
94	0	0	7	58	53	104	222
95	0	4	33	12	62	122	233
96	0	4	12	1	26	52	95
97	0	63	1,033	104	11	21	1,232
98	0	0	107	49	25	51	232
99	0	0	16	69	28	59	172
100	0	128	3,889	411	27	52	4,507
101	0	0	1	0	47	91	139
102	0	6	8	102	57	118	291
103	0	1	6	2	27	57	93
104	1	25	9	61	121	239	456
105	0	67	1,120	168	30	62	1,447
106	0	2	41	185	81	162	471
107	0	10	87	135	45	89	366
108	0	14	19	50	95	184	362
109	0	4	110	63	127	258	562
110	0	0	6	93	20	41	160
111	0	0	33	5	50	100	188
112	0	0	0	0	0	0	0
113	0	6	11	1	36	71	125
114	0	12	1,828	274	34	68	2,216
115	0	6	338	542	9	17	912
116	0	13	40	34	65	131	283
117	6	52	147	5	0	0	210
118	0	1	9	64	28	59	161
119	0	4	24	226	93	189	536
120	0	4	148	66	48	96	362
121	0	5	81	14	90	178	368
122	0	0	196	59	28	58	341
123	0	0	151	1,211	26	51	1,439
124	0	0	106	995	0	0	1,101
125	0	0	104	2	0	0	106
126	3	117	669	132	12	24	957
127	0	4	494	114	21	43	676
128	0	21	250	26	1	2	300
129	0	0	341	3	11	22	377
130	0	42	946	26	3	5	1,022
131	0	4	306	0	0	0	310
132	0	7	424	11	3	6	451
133	0	15	349	250	32	64	710
134	0	116	368	17	19	38	558
135	0	5	86	825	29	58	1,003
136	0	31	442	164	128	250	1,015
137	0	0	0	0	0	0	0
138	0	11	323	22	9	18	383
139	4	20	831	306	21	44	1,226
140	0	4	25	81	17	36	163
141	0	18	377	94	29	58	576
142	0	8	29	14	26	53	130
143	0	2	39	25	11	19	96
144	0	0	152	36	80	162	430
145	0	8	174	395	18	35	630
146	0	5	0	5	2	4	16
147	0	33	352	707	47	94	1,233
148	0	7	255	23	1	2	288
149	0	34	476	33	119	238	900
150	0	52	678	334	345	695	2,104
151	0	58	1,787	340	5	11	2,201
152	0	55	22	10	36	70	193
153	0	8	0	98	36	71	213
154	0	0	11	111	53	103	278
155	0	85	161	318	87	169	820
201	0	0	38	255	221	442	956
202	0	0	95	160	236	474	965
203	0	0	64	80	79	158	381
204	0	0	0	0	83	166	249
205	0	0	1,354	101	153	304	1,912
206	0	0	56	155	252	505	968
207	0	0	50	81	87	175	393
208	0	306	200	73	0	0	579
209	0	771	506	187	0	1	1,465
210	0	1,560	1,029	383	0	1	2,973
211	0	302	183	62	0	1	548
212	0	1,102	573	162	0	0	1,837
213	0	0	317	399	267	535	1,518
214	0	56	119	501	211	424	1,311
215	0	1,360	708	197	0	0	2,265
216	0	6	211	83	205	411	916
Total	**45**	**25,017**	**56,882**	**31,597**	**9,789**	**19,629**	**142,959**

2061 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
87	0	4	0	25	9	20	58
88	0	6	6	0	7	14	33
89	0	13	790	915	0	0	1,718
90	0	334	581	539	10	19	1,483
91	0	25	190	179	93	184	671
92	0	3	85	158	51	102	399
93	0	8	6	0	64	130	208
94	0	0	7	59	53	107	226
95	0	4	34	12	62	124	236
96	0	4	12	1	26	51	94
97	0	64	1,070	117	13	25	1,289
98	0	0	107	50	25	52	234
99	0	0	16	70	28	59	173
100	0	129	4,023	466	27	52	4,697
101	0	0	1	0	47	91	139
102	0	6	8	103	59	119	295
103	0	1	6	2	28	57	94
104	1	25	9	62	122	245	464
105	0	67	1,158	183	30	62	1,500
106	0	2	41	187	84	164	478
107	0	10	89	137	45	90	371
108	0	14	19	51	95	190	369
109	0	4	112	64	130	262	572
110	0	0	6	94	21	42	163
111	0	0	33	5	52	102	192
112	0	0	0	0	0	0	0
113	0	6	11	1	38	72	128
114	0	12	1,953	295	37	74	2,371
115	0	6	344	550	9	17	926
116	0	13	40	34	66	132	285
117	6	53	150	5	0	0	214
118	0	1	9	65	31	63	169
119	0	4	24	229	93	191	541
120	0	4	155	68	50	97	374
121	0	5	83	16	95	189	388
122	0	0	205	65	28	58	356
123	0	0	159	1,275	27	53	1,514
124	0	0	106	995	0	0	1,101
125	0	0	110	2	0	0	112
126	3	117	709	138	12	24	1,003
127	0	4	521	120	21	43	709
128	0	21	265	27	1	2	316
129	0	0	359	3	11	22	395
130	0	42	1,003	27	3	5	1,080
131	0	4	325	0	0	0	329
132	0	7	450	11	3	6	477
133	0	15	367	263	32	65	742
134	0	116	388	18	19	38	579
135	0	5	89	866	29	58	1,047
136	0	31	451	173	126	252	1,033
137	0	0	0	0	0	0	0
138	0	11	342	24	9	19	405
139	4	20	881	325	22	45	1,297
140	0	4	26	84	18	37	169
141	0	18	377	99	31	60	585
142	0	8	29	14	29	58	138
143	0	2	40	25	11	20	98
144	0	0	152	38	82	168	440
145	0	8	184	415	18	35	660
146	0	5	0	5	2	4	16
147	0	33	361	717	47	94	1,252
148	0	7	261	23	1	2	294
149	0	34	518	37	135	273	997
150	0	52	700	342	357	709	2,160
151	0	58	1,893	357	5	11	2,324
152	0	56	22	10	36	70	194
153	0	8	0	99	36	73	216
154	0	0	11	113	53	105	282
155	0	86	164	321	87	172	830
201	0	0	39	258	221	444	962
202	0	0	96	162	237	475	970
203	0	0	65	81	79	159	384
204	0	0	0	0	83	166	249
205	0	0	1,374	102	152	304	1,932
206	0	0	57	157	253	507	974
207	0	0	51	82	87	175	395
208	0	310	203	74	0	0	587
209	0	783	513	189	0	1	1,486
210	0	1,583	1,044	389	0	1	3,017
211	0	306	186	63	0	1	556
212	0	1,119	581	164	0	0	1,864
213	0	0	322	405	269	536	1,532
214	0	57	121	508	212	424	1,322
215	0	1,381	718	199	0	0	2,298
216	0	6	214	84	205	413	922
Total	**45**	**25,359**	**58,573**	**32,382**	**10,032**	**20,116**	**146,507**

2066 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
1	0	16	119	126	131	262	654
2	0	1,050	834	437	24	47	2,392
3	0	793	721	106	37	75	1,732
4	0	964	880	163	0	0	2,007
5	0	439	2,466	294	0	0	3,199
6	0	1,944	998	111	0	0	3,053
7	0	1,473	623	116	0	0	2,212
8	0	17	59	297	133	269	775
9	0	0	0	0	105	213	318
10	0	43	72	191	190	383	879
11	0	17	3	0	31	62	113
12	0	22	1,138	193	455	917	2,725
13	0	10	52	127	206	418	813
14	0	4	679	101	71	141	996
15	0	5	3	6	28	55	97
16	0	48	141	78	50	99	416
17	0	405	516	427	0	0	1,348
18	3	1,309	592	93	0	0	1,997
19	0	64	1,047	310	0	0	1,421
20	0	272	694	73	0	0	1,039
21	0	312	3,194	147	0	0	3,653
22	0	783	571	123	51	102	1,630
23	0	40	312	112	230	464	1,158
24	0	6	5	348	63	128	550
25	0	6	30	118	128	257	539
26	0	3	7	0	42	85	137
27	0	19	159	49	178	365	770
28	0	431	735	112	103	203	1,584
29	0	4	1,243	47	22	43	1,359
30	0	278	165	48	0	0	491
31	0	0	306	19	7	14	346
32	0	122	144	234	32	64	596
33	0	725	315	21	1	3	1,065
34	0	0	2	0	19	39	60
35	0	951	625	102	0	0	1,678
36	0	3	20	125	68	134	350
37	0	13	57	15	142	280	507
38	0	7	500	101	137	274	1,019
39	0	1	74	21	88	173	357
40	0	11	75	0	93	189	368
41	0	5	134	32	89	180	440
42	0	42	68	83	31	64	288
43	0	7	17	1	52	103	180
44	0	2	231	33	32	66	364
45	0	0	299	51	1	2	353
46	0	135	615	74	101	206	1,131
47	0	12	367	126	115	230	850
48	0	6	134	81	93	186	500
49	0	10	211	69	87	175	552
50	0	7	78	300	46	93	524
51	0	34	464	151	106	213	968
52	0	7	8	0	14	26	55
54	0	0	965	59	87	171	1,282
55	0	927	264	718	17	35	1,961
56	0	24	111	134	236	472	977
57	0	5	0	248	105	208	566
58	0	114	30	2	61	125	332
59	3	736	1,042	113	52	104	2,050
60	0	711	386	35	0	1	1,133
61	0	55	702	88	0	0	845
62	0	0	192	11	41	83	327
63	0	1,139	653	21	4	9	1,826
64	0	4	263	59	34	68	428
65	0	191	284	309	85	169	1,038
66	25	1,185	889	153	43	86	2,381
67	0	15	47	96	199	399	756
68	0	0	0	53	0	0	53
69	0	99	36	209	185	379	908
70	0	228	1,280	355	40	82	1,985
71	0	15	4	45	63	130	257
72	0	12	163	5	40	79	299
73	0	4	5	0	16	32	57
74	0	6	79	118	40	79	322
75	0	21	20	11	49	98	199
76	0	22	76	28	71	143	340
77	0	0	19	87	65	129	300
78	0	0	54	4,284	0	0	4,338
79	0	0	25	4,300	0	0	4,325
80	0	11	21	214	64	129	439
81	0	6	406	249	81	158	900
82	0	4	17	8	39	77	145
83	0	0	36	7	10	17	70
84	0	0	40	18	36	71	165
85	0	26	12	0	66	132	236
86	0	0	89	4	35	70	198

2071 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
1	0	16	120	128	135	272	671
2	0	1,061	846	441	26	52	2,426
3	0	800	730	107	38	77	1,752
4	0	974	894	164	0	0	2,032
5	0	443	2,518	298	0	0	3,259
6	0	1,965	1,016	111	0	0	3,092
7	0	1,487	631	117	0	0	2,235
8	0	17	60	300	133	270	780
9	0	0	0	0	106	215	321
10	0	43	73	192	192	384	884
11	0	17	3	0	31	63	114
12	0	22	1,155	195	462	927	2,761
13	0	10	53	128	213	426	830
14	0	4	694	106	74	149	1,027
15	0	5	3	6	28	56	98
16	0	48	144	79	50	101	422
17	0	410	524	431	0	0	1,365
18	3	1,324	600	93	0	0	2,020
19	0	65	1,061	313	0	0	1,439
20	0	275	703	74	0	0	1,052
21	0	315	3,236	149	0	0	3,700
22	0	792	582	124	51	102	1,651
23	0	40	326	114	235	469	1,184
24	0	6	5	352	65	129	557
25	0	6	31	119	129	263	548
26	0	3	7	0	43	86	139
27	0	19	160	50	183	373	785
28	0	436	735	114	105	208	1,598
29	0	4	1,327	52	24	49	1,456
30	0	281	166	48	0	0	495
31	0	0	309	21	8	16	354
32	0	123	147	236	32	64	602
33	0	733	321	21	1	3	1,079
34	0	0	2	0	20	40	62
35	0	960	635	103	0	0	1,698
36	0	3	20	126	68	137	354
37	0	13	58	15	143	283	512
38	0	7	500	107	147	296	1,057
39	0	1	74	22	91	183	371
40	0	11	76	0	95	193	375
41	0	5	134	32	92	188	451
42	0	42	69	84	32	64	291
43	0	7	17	1	53	105	183
44	0	2	236	33	33	66	370
45	0	0	306	52	1	2	361
46	0	136	620	80	110	219	1,165
47	0	12	371	138	119	236	876
48	0	6	134	83	94	190	507
49	0	10	225	71	88	180	574
50	0	7	80	306	47	94	534
51	0	34	480	164	109	220	1,007
52	0	7	8	0	14	26	55
54	0	0	970	59	87	173	1,289
55	0	937	268	725	20	39	1,989
56	0	24	112	135	238	476	985
57	0	5	0	251	105	210	571
58	0	115	30	2	71	143	361
59	3	744	1,056	113	56	111	2,083
60	0	719	395	37	0	1	1,152
61	0	56	725	97	0	0	878
62	0	0	196	11	41	83	331
63	0	1,152	666	21	4	9	1,852
64	0	4	272	62	34	68	440
65	0	193	290	318	85	172	1,058
66	25	1,199	906	161	49	98	2,438
67	0	15	47	97	203	408	770
68	0	0	0	54	0	0	54
69	0	100	36	211	190	384	921
70	0	230	1,352	363	42	87	2,074
71	0	15	4	45	64	132	260
72	0	12	166	5	40	79	302
73	0	4	5	0	16	32	57
74	0	6	81	119	40	80	326
75	0	21	20	11	50	100	202
76	0	22	77	28	72	145	344
77	0	0	19	88	66	131	304
78	0	0	55	4,351	0	0	4,406
79	0	0	25	4,368	0	0	4,393
80	0	11	21	217	64	132	445
81	0	6	434	254	84	164	942
82	0	4	17	8	39	77	145
83	0	0	36	7	10	17	70
84	0	0	41	19	36	72	168
85	0	26	12	0	69	139	246
86	0	0	89	4	37	72	202

2066 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
87	0	4	0	25	9	21	59
88	0	6	6	0	7	14	33
89	0	13	797	926	0	0	1,736
90	0	338	594	546	10	19	1,507
91	0	25	193	181	98	196	693
92	0	3	87	159	52	103	404
93	0	8	6	0	65	132	211
94	0	0	7	60	54	108	229
95	0	4	35	12	63	126	240
96	0	4	12	1	26	53	96
97	0	65	1,107	130	15	29	1,346
98	0	0	107	51	26	53	237
99	0	0	16	71	28	59	174
100	0	130	4,157	520	27	52	4,886
101	0	0	1	0	47	92	140
102	0	6	8	104	59	123	300
103	0	1	6	2	28	59	96
104	1	25	9	63	126	248	472
105	0	67	1,196	198	30	62	1,553
106	0	2	41	189	85	166	483
107	0	10	91	139	45	92	377
108	0	14	19	52	97	196	378
109	0	4	114	65	131	266	580
110	0	0	6	95	21	42	164
111	0	0	33	5	51	104	193
112	0	0	0	0	0	0	0
113	0	6	11	1	38	75	131
114	0	12	2,075	316	40	81	2,524
115	0	6	350	558	9	17	940
116	0	13	40	34	67	135	289
117	6	54	153	5	0	0	218
118	0	1	9	66	34	68	178
119	0	4	24	232	95	193	548
120	0	4	161	70	50	98	383
121	0	5	85	18	99	199	406
122	0	0	214	70	29	60	373
123	0	0	166	1,334	27	54	1,581
124	0	0	106	995	0	0	1,101
125	0	0	116	2	0	0	118
126	3	117	746	144	12	24	1,046
127	0	4	546	125	21	43	739
128	0	21	279	28	1	2	331
129	0	0	376	3	11	22	412
130	0	42	1,058	28	3	5	1,136
131	0	4	343	0	0	0	347
132	0	7	474	11	3	6	501
133	0	15	384	274	33	65	771
134	0	116	407	19	19	38	599
135	0	5	92	903	29	59	1,088
136	0	31	460	181	126	251	1,049
137	0	0	0	0	0	0	0
138	0	11	359	26	9	19	424
139	4	20	929	342	23	46	1,364
140	0	4	27	86	20	39	176
141	0	18	377	104	31	62	592
142	0	8	29	14	30	63	144
143	0	2	41	25	11	20	99
144	0	0	152	40	86	171	449
145	0	8	193	433	18	35	687
146	0	5	0	5	2	4	16
147	0	33	370	726	47	94	1,270
148	0	7	267	23	1	2	300
149	0	34	558	41	155	305	1,093
150	0	52	722	350	362	725	2,211
151	0	58	1,995	372	6	11	2,442
152	0	57	22	10	37	70	196
153	0	8	0	100	36	73	217
154	0	0	11	115	56	107	289
155	0	87	167	324	90	175	843
201	0	0	40	261	222	445	968
202	0	0	97	164	237	476	974
203	0	0	66	82	79	159	386
204	0	0	0	0	83	167	250
205	0	0	1,394	103	152	304	1,953
206	0	0	58	159	254	509	980
207	0	0	52	83	88	175	398
208	0	314	206	75	0	0	595
209	0	793	520	191	0	1	1,505
210	0	1,604	1,059	395	0	1	3,059
211	0	310	189	64	0	1	564
212	0	1,134	589	166	0	0	1,889
213	0	0	327	410	269	539	1,545
214	0	58	123	515	213	426	1,335
215	0	1,399	728	201	0	0	2,328
216	0	6	217	85	206	412	926
Total	**45**	**25,663**	**60,219**	**33,134**	**10,265**	**20,583**	**149,909**

2071 Employment							
Traffic Zone	Primary	Industrial	Commercial	Institutional	Work at Home	No Fixed Place of Work	Total
87	0	4	0	25	10	21	60
88	0	6	6	0	7	14	33
89	0	13	804	937	0	0	1,754
90	0	341	607	553	10	19	1,530
91	0	25	196	183	103	203	710
92	0	3	89	160	52	106	410
93	0	8	6	0	68	134	216
94	0	0	7	61	55	110	233
95	0	4	36	12	64	128	244
96	0	4	12	1	27	53	97
97	0	66	1,143	143	16	33	1,401
98	0	0	107	52	26	53	238
99	0	0	16	72	28	60	176
100	0	131	4,291	575	27	53	5,077
101	0	0	1	0	48	93	142
102	0	6	8	105	60	124	303
103	0	1	6	2	28	60	97
104	1	25	9	64	127	254	480
105	0	67	1,234	213	30	62	1,606
106	0	2	41	191	86	166	486
107	0	10	93	141	47	93	384
108	0	14	19	53	100	199	385
109	0	4	116	66	133	271	590
110	0	0	6	96	22	43	167
111	0	0	33	5	52	108	198
112	0	0	0	0	0	0	0
113	0	6	11	1	39	76	133
114	0	12	2,190	337	43	87	2,669
115	0	6	356	565	9	18	954
116	0	13	40	34	68	138	293
117	6	55	156	5	0	0	222
118	0	1	9	67	36	72	185
119	0	4	24	235	97	195	555
120	0	4	166	72	50	99	391
121	0	5	85	20	104	205	419
122	0	0	221	74	29	60	384
123	0	0	172	1,377	28	54	1,631
124	0	0	106	995	0	0	1,101
125	0	0	120	2	0	0	122
126	3	117	774	149	12	24	1,079
127	0	4	564	129	21	43	761
128	0	21	290	29	1	2	343
129	0	0	389	3	11	22	425
130	0	42	1,099	29	3	5	1,178
131	0	4	356	0	0	0	360
132	0	7	492	11	3	6	519
133	0	15	396	283	33	67	794
134	0	116	421	20	19	38	614
135	0	5	95	932	30	59	1,121
136	0	31	467	187	127	254	1,066
137	0	0	0	0	0	0	0
138	0	11	372	28	9	19	439
139	4	20	964	355	23	49	1,415
140	0	4	28	88	20	40	180
141	0	18	377	109	32	66	602
142	0	8	29	14	34	68	153
143	0	2	42	25	11	20	100
144	0	0	152	42	88	176	458
145	0	8	199	447	18	35	707
146	0	5	0	5	2	4	16
147	0	33	379	734	47	95	1,288
148	0	7	273	23	1	2	306
149	0	34	594	45	169	334	1,176
150	0	52	743	358	367	736	2,256
151	0	58	2,071	384	6	11	2,530
152	0	57	22	10	37	70	196
153	0	8	0	101	36	74	219
154	0	0	11	117	56	108	292
155	0	88	170	327	90	177	852
201	0	0	41	264	224	447	976
202	0	0	98	166	238	478	980
203	0	0	67	83	80	160	390
204	0	0	0	0	83	167	250
205	0	0	1,414	104	152	304	1,974
206	0	0	59	161	255	511	986
207	0	0	53	84	88	175	400
208	0	317	209	76	0	0	602
209	0	802	527	193	0	1	1,523
210	0	1,622	1,074	400	0	1	3,097
211	0	313	192	65	0	1	571
212	0	1,147	597	168	0	0	1,912
213	0	0	332	415	268	539	1,554
214	0	59	125	521	213	427	1,345
215	0	1,415	738	203	0	0	2,356
216	0	6	220	86	206	413	931
Total	**45**	**25,923**	**61,705**	**33,808**	**10,474**	**21,002**	**152,957**

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
ACAT41000	3.911	0.9	0.1	243.2	37.8
ACAT41100	3.188	0.7	0.1	198.5	30.9
ACAT42000	3.261	2.1	0.3	198.6	84.1
ACAT42010	4.065	3.7	0.5	338.1	143.2
ACAT42020	2.810	2.5	0.3	230.1	97.4
ACAT42030	5.263	4.7	0.6	437.0	185.1
ACAT42040	4.487	4.0	0.5	372.9	157.9
ACAT42050	5.975	2.0	0.2	335.7	47.9
ACAT42100	5.382	1.8	0.2	298.8	39.8
ACAT42110	2.966	1.0	0.1	168.1	25.3
ACAT42120	2.555	0.8	0.1	141.9	18.9
ACAT42130	1.773	0.6	0.1	98.5	13.1
ACAT42140	3.372	1.1	0.1	187.2	24.9
ACAT42150	2.194	0.7	0.1	121.1	16.1
ACAT42160	4.376	0.8	0.1	140.0	18.6
ACAT42200	6.844	0.7	0.1	125.1	16.7
ACAT42210	4.439	1.4	0.1	246.4	32.8
ACAT42220	4.534	0.9	0.1	152.6	20.3
ACAT42300	1.166	0.3	0.0	72.6	11.3
ACAT42310	1.098	0.2	0.0	68.3	10.6
ACAT42320	2.605	0.4	0.0	97.6	15.2
ACAT42400	0.982	0.2	0.0	61.2	9.5
ACAT42410	0.880	0.2	0.0	54.7	8.5
ACAT42420	2.215	0.5	0.1	131.0	20.4
ACAT42500	4.715	0.6	0.1	172.1	26.8
ACAT42510	4.577	0.3	0.0	74.8	11.6
ACAT42520	5.030	1.1	0.1	312.5	48.6
ACAT42530	6.026	0.6	0.1	169.8	26.4
ACAT42600	4.074	0.3	0.0	85.9	13.4
ACAT42610	15.132	0.6	0.1	178.5	27.8
ACAT42620	4.935	1.1	0.1	306.7	47.7
ACAT42630	4.898	0.9	0.1	253.2	39.4
ACAT43000	5.892	5.3	0.7	490.0	207.5
ACAT43010	4.337	1.2	0.1	167.8	33.7
ACAT43020	2.136	0.7	0.1	118.6	15.8
ACAT43030	2.674	2.0	0.3	190.0	76.2
ACAT43040	3.434	1.2	0.1	194.3	28.9
ACAT43050	3.446	1.1	0.1	191.4	25.5
ACAT43060	2.997	1.0	0.1	166.3	22.1
ACAT43100	2.643	0.9	0.1	146.8	19.6
ACAT43110	3.094	1.0	0.1	171.8	22.9
ACAT43120	3.315	1.1	0.1	184.2	24.5
ACAT43130	3.302	1.1	0.1	183.3	24.4
ACAT43140	2.807	0.9	0.1	155.9	20.8
ACAT43150	5.637	1.8	0.2	313.0	41.7
ACAT43200	3.795	1.2	0.1	210.8	28.1
ACAT43210	4.825	0.6	0.1	99.4	13.2
ACAT43220	4.127	0.7	0.1	112.9	15.0
ACAT43230	3.368	0.3	0.0	50.3	6.7
ACAT43240	1.981	0.6	0.1	110.1	14.7
ACAT43300	3.925	1.3	0.1	218.1	29.0
ACAT43310	1.574	0.5	0.0	87.4	11.6
ACAT43320	4.582	1.5	0.1	253.8	33.8
ACAT43330	3.424	1.1	0.1	190.2	25.3
ACAT43340	2.590	0.8	0.1	143.5	19.1

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
ACAT43400	3.215	1.1	0.1	178.6	23.8
ACAT43410	1.896	0.6	0.1	105.3	14.0
ACAT43420	1.923	0.6	0.1	106.8	14.2
ACAT43430	3.262	1.1	0.1	181.3	24.1
ACAT43440	2.867	0.9	0.1	159.3	21.2
ACAT43500	2.303	0.8	0.1	128.0	17.0
ACAT43510	2.728	0.5	0.0	87.1	11.6
ACAT43520	3.252	1.1	0.1	180.5	24.0
ACAT43530	3.921	1.3	0.1	217.9	29.0
ACAT43540	5.529	0.2	0.0	42.2	5.6
ACAT44000	3.103	0.7	0.1	67.3	28.5
ACAT44010	4.718	4.2	0.5	392.4	166.2
ACAT44020	4.392	2.7	0.3	250.6	106.1
ACAT44030	3.451	3.1	0.4	287.0	121.5
ACAT44040	2.565	2.3	0.3	213.3	90.4
ACAT44050	2.128	1.9	0.2	177.0	74.9
ACAT44060	1.630	1.5	0.2	135.5	57.4
ACAT44100	3.191	2.9	0.4	265.0	112.0
ACAT44110	3.310	1.1	0.1	183.9	24.5
ACAT44120	2.785	2.5	0.3	231.6	98.1
ACAT44130	2.911	0.3	0.0	54.8	7.3
ACAT44200	1.200	0.4	0.0	66.6	8.9
ACAT44210	0.353	0.1	0.0	19.6	2.6
ACAT45100	0.464	0.1	0.0	22.4	3.3
ACAT45101	2.878	0.5	0.1	93.2	13.3
ACAT45102	1.095	0.1	0.0	19.9	2.8
ACAT45103	4.317	1.0	0.1	163.4	23.1
ACAT45104	6.436	1.0	0.1	156.7	22.1
ACAT45105	2.326	0.8	0.1	126.9	17.9
ACAT45106	1.822	0.5	0.0	83.2	11.8
ACAT45107	6.416	0.7	0.1	116.8	16.5
ACAT45108	23.789	4.8	0.4	251.0	41.7
ACAT45109	13.002	10.7	1.0	560.6	93.1
ACAT45110	32.839	11.7	1.1	613.2	101.8
ACAT45111	17.819	4.4	0.4	682.4	96.4
ACAT45120	8.636	0.5	0.1	178.4	26.6
ACAT45121	13.396	1.6	0.2	518.6	77.4
ACAT45122	22.634	0.7	0.1	223.9	33.4
ACAT45123	2.228	0.2	0.0	69.8	10.4
ACAT45124	17.831	2.1	0.2	686.3	102.4
ACAT45130	0.230	0.0	0.0	10.8	1.6
ACAT45131	0.966	0.1	0.0	46.8	7.0
ACAT45132	1.843	0.3	0.0	89.2	13.3
ACAT45133	4.014	0.6	0.1	194.2	29.0
ACAT45134	4.387	0.6	0.1	212.3	31.7
ACAT45135	1.969	0.3	0.0	95.2	14.2
ACAT45136	5.282	0.8	0.1	255.6	38.1
ACAT45137	6.533	1.0	0.1	316.0	47.2
ACAT45140	6.219	1.0	0.1	209.2	30.3
ACAT45200	1.363	0.2	0.0	66.6	9.9
ACAT45201	7.817	1.1	0.1	376.7	56.2
ACAT45202	2.503	0.4	0.0	120.2	17.9
ACAT45203	5.345	1.4	0.1	221.0	31.2
ACAT45204	2.929	0.8	0.1	152.8	22.0
ACAT45205	2.602	0.9	0.1	142.2	20.1

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
ACAT45206	1.072	0.4	0.0	58.6	8.3
ACAT45207	1.238	0.4	0.0	67.7	9.6
ACAT45208	3.412	1.2	0.1	186.5	26.4
ACAT45210	2.933	1.0	0.1	160.4	22.7
ACAT45211	3.459	1.2	0.1	188.3	26.6
ACAT45212	2.836	1.0	0.1	154.8	21.9
ACAT45213	1.311	0.2	0.0	29.1	4.1
ACAT45220	5.138	1.8	0.2	93.6	15.5
ACAT45221	3.471	2.3	0.2	120.6	20.0
ACAT45222	10.353	6.8	0.6	357.7	59.4
ACAT45223	20.384	0.8	0.1	40.0	6.6
ACAT45224	14.385	2.3	0.2	122.6	20.4
ACAT45230	2.905	1.7	0.2	87.4	14.5
ACAT45231	2.373	0.2	0.0	38.7	5.5
ACAT45240	5.822	1.6	0.1	250.5	35.4
ACAT45241	2.936	0.7	0.1	113.2	16.0
ACAT45242	4.734	1.3	0.1	199.2	28.1
ACAT45250	4.098	0.9	0.1	143.2	20.2
ACAT45251	3.280	0.5	0.0	73.6	10.4
ACAT45252	1.966	0.7	0.1	107.4	15.2
ACAT45253	2.131	0.6	0.1	88.7	12.5
ACAT45254	3.767	1.1	0.1	164.3	23.2
ACAT45255	7.768	2.0	0.2	304.5	43.0
ACAT45256	2.269	0.5	0.1	84.1	11.9
ACAT45257	1.972	0.1	0.0	13.1	1.9
ACAT45258	2.815	1.0	0.1	153.8	21.7
ACAT45260	1.480	0.5	0.0	80.7	11.4
ACAT45261	1.183	0.4	0.0	64.7	9.1
ACAT45262	1.235	0.4	0.0	67.5	9.5
ACAT45263	9.228	2.4	0.2	370.8	52.4
ACAT45270	6.042	1.8	0.2	280.0	39.6
ACAT45271	8.897	2.4	0.2	376.8	53.2
ACAT45272	1.228	0.4	0.0	67.1	9.5
ACAT45273	1.211	0.4	0.0	66.2	9.3
ACAT45274	2.067	0.7	0.1	112.9	16.0
ACAT45275	6.778	2.0	0.2	310.3	43.8
ACAT45276	3.730	1.2	0.1	192.2	27.2
ACAT45277	4.654	0.8	0.1	125.1	17.7
ACAT45280	6.864	0.0	0.0	318.9	33.3
ACAT45281	1.178	0.0	0.0	100.3	10.5
ACAT45282	5.672	0.0	0.0	172.8	18.0
ACAT45283	14.516	0.0	0.0	386.5	40.3
ACAT45284	1.196	0.0	0.0	102.0	10.6
ACAT45285	6.763	0.0	0.0	391.9	40.9
ACAT45286	2.249	0.0	0.0	108.6	11.3
ACAT45287	7.155	0.0	0.0	205.4	21.4
ACAT45288	2.096	0.1	0.0	178.8	22.0
ACAT45289	2.155	0.0	0.0	183.5	19.1
ACAT45290	4.734	0.0	0.0	219.0	22.9
ACAT45291	1.104	0.0	0.0	7.0	1.0
ACAT45292	1.143	0.0	0.0	0.0	0.0
ACAT46000	2.790	0.4	0.0	135.0	20.1
ACAT47000	0.844	0.1	0.0	40.8	6.1
ACAT47100	6.663	1.0	0.1	322.3	48.1
ACAT47200	4.186	1.0	0.1	163.0	24.4

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
ACAT48000	3.199	0.5	0.0	154.0	23.0
ACAT48010	2.471	0.4	0.0	119.3	17.8
ACAT48020	2.686	0.4	0.0	130.0	19.4
ACAT48100	1.058	0.2	0.0	51.2	7.6
ACAT48110	4.285	0.6	0.1	207.1	30.9
ACAT48120	3.973	0.4	0.0	65.3	9.8
ACAT48200	2.992	0.4	0.0	132.3	19.8
ACAT48300	2.522	0.4	0.0	122.0	18.2
ACAT49000	4.519	0.7	0.1	218.6	32.6
ACAT49010	2.894	0.4	0.0	140.0	20.9
ACAT49020	2.764	0.4	0.0	133.6	19.9
ACAT49030	3.134	0.5	0.1	151.6	22.6
ACAT49100	4.283	0.6	0.1	207.0	30.9
ACAT49200	3.335	0.4	0.0	122.4	18.3
ACAT51100	16.874	2.3	0.6	305.4	46.9
ACAT51101	16.023	0.0	0.0	0.0	0.0
ACAT51102	3.982	1.6	0.4	213.2	32.8
ACAT51103	9.175	1.5	0.5	204.3	31.6
ACAT51104	1.177	0.5	0.1	65.5	10.1
ACAT51105	4.539	1.6	0.4	215.7	33.2
ACAT51110	1.719	0.7	0.2	94.5	14.5
ACAT51111	5.109	0.9	0.2	120.8	18.6
ACAT51112	1.159	0.5	0.1	61.8	9.5
ACAT51113	1.965	0.8	0.2	109.3	16.8
ACAT51114	2.494	0.6	0.2	75.9	11.7
ACAT51120	2.725	0.8	0.2	109.8	16.9
ACAT51121	2.413	0.9	0.2	118.7	18.3
ACAT51130	2.625	1.1	0.3	145.7	22.4
ACAT51131	2.766	1.1	0.3	148.1	22.8
ACAT51132	2.443	1.0	0.3	135.7	20.9
ACAT51133	1.445	0.6	0.2	80.2	12.3
ACAT51140	2.648	1.1	0.3	147.7	22.7
ACAT51141	2.820	0.9	0.2	113.1	17.4
ACAT51150	1.629	0.5	0.1	65.2	10.0
ACAT51151	5.417	1.3	0.3	167.8	25.8
ACAT51152	2.085	0.3	0.1	36.0	5.5
ACAT51160	1.724	0.1	0.0	8.5	1.3
ACAT51200	3.512	0.8	0.2	89.6	13.8
ACAT51210	5.446	1.8	0.5	242.0	37.2
ACAT51220	2.180	1.0	0.3	121.6	18.7
ACAT51230	1.776	0.7	0.2	99.1	15.2
ACAT51240	1.578	0.9	0.2	88.0	13.5
ACAT52000	9.787	0.6	1.2	122.0	25.8
ACAT52010	4.052	0.5	0.6	81.5	16.0
ACAT52020	4.496	0.0	0.0	0.0	115.5
ACAT52030	4.806	0.0	0.0	0.0	51.8
ACAT52040	6.451	0.0	0.0	0.0	27.3
ACAT52050	3.274	0.2	0.0	24.3	3.7
ACAT52060	10.126	1.8	0.5	236.4	36.3
ACAT52070	12.555	2.1	0.6	280.3	43.1
ACAT52080	8.191	2.0	0.6	270.0	41.5
ACAT53000	6.089	0.0	0.0	0.0	76.0
ACAT53010	5.045	0.0	0.0	0.0	137.3
ACAT53020	7.008	0.0	0.0	0.0	134.0
ACAT53030	6.635	0.0	0.0	0.0	180.7

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
ACAT53040	6.747	0.0	0.0	0.0	183.2
ACAT53050	6.414	0.0	0.0	0.0	174.7
ACAT53060	9.103	0.0	0.0	0.0	247.8
ACAT54100	9.580	0.0	0.0	0.0	260.9
ACAT54110	10.844	0.0	0.0	0.0	93.0
ACAT54120	13.176	0.0	0.0	0.0	131.8
ACAT54130	8.492	0.0	0.0	0.0	187.2
ACAT54140	8.463	0.0	0.0	0.0	134.6
ACAT54150	9.874	4.3	0.4	4.3	183.8
ACAT54200	44.821	7.7	1.9	7.7	332.5
ACAT54300	23.086	0.0	0.8	0.0	208.4
ACAT54310	13.217	0.0	0.0	0.0	150.7
ACAT54320	0.618	0.0	0.0	0.0	9.2
ACAT54330	3.155	0.0	0.0	0.0	41.5
ACAT54340	2.569	0.0	0.0	0.0	31.1
ACAT55100	1.843	0.7	0.2	95.4	14.7
ACAT55101	2.408	1.0	0.3	134.3	20.6
ACAT55102	2.730	1.1	0.3	152.3	23.4
ACAT55110	8.378	3.3	0.9	432.2	66.4
ACAT55111	18.905	1.1	2.4	237.3	50.3
ACAT55112	9.291	3.7	1.0	497.9	76.5
ACAT55113	5.347	2.2	0.6	298.3	45.8
ACAT55114	6.097	1.3	2.6	263.4	55.8
ACAT55120	0.480	0.2	0.1	26.7	4.1
ACAT55121	14.653	2.8	5.9	589.3	124.8
ACAT55122	5.145	0.9	1.9	192.7	40.8
ACAT55130	7.933	0.9	1.9	192.8	40.8
ACAT55131	13.918	1.8	3.8	378.8	80.2
ACAT55132	30.435	1.0	2.0	198.0	41.9
ACAT55140	4.341	0.2	0.1	232.8	45.5
ACAT55141	7.861	0.1	0.0	199.6	38.8
ACAT55142	5.138	0.2	0.0	280.6	54.6
ACAT55150	2.874	0.4	0.8	86.5	18.3
ACAT55151	1.530	0.0	0.0	67.0	13.0
ACAT55152	5.571	0.5	0.9	159.4	32.6
ACAT55153	9.151	0.7	1.0	445.4	88.3
ACAT55154	6.066	0.2	0.0	265.6	51.7
ACAT55160	8.546	0.3	0.0	444.9	86.6
ACAT55161	1.798	0.1	0.0	98.2	19.1
ACAT55162	4.002	0.1	0.0	180.8	35.2
ACAT55163	2.377	0.0	0.0	30.9	6.0
ACAT55170	1.469	0.0	0.0	17.5	3.4
ACAT55171	2.941	0.1	0.0	160.6	31.2
ACAT55172	4.967	0.1	0.0	201.2	39.1
ACAT55180	4.446	0.0	0.0	44.6	8.7
ACAT55181	5.962	0.1	0.0	209.8	40.8
ACAT55182	3.278	0.1	0.0	153.4	29.8
ACAT55200	3.305	0.1	0.0	126.3	24.6
ACAT55201	2.791	0.1	0.0	117.5	22.9
ACAT55202	6.632	0.1	0.0	201.7	39.2
ACAT55203	40.029	3.2	6.6	662.4	140.3
ACAT55204	24.979	1.7	3.4	343.8	72.8
ACAT55210	4.094	0.1	0.0	84.8	16.5
ACAT55211	4.953	0.2	0.0	270.4	52.6
ACAT55212	3.661	0.1	0.0	199.9	38.9

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
ACAT55213	5.805	0.1	0.0	194.7	37.9
ACAT55220	2.655	0.1	0.0	92.9	18.1
ACAT55221	4.442	0.1	0.0	146.2	28.5
ACAT55222	3.775	0.1	0.0	205.7	40.0
ACAT55223	5.665	0.2	0.0	271.7	52.9
ACAT55230	3.716	0.1	0.0	202.8	39.5
ACAT55231	5.799	0.2	0.0	278.7	54.2
ACAT55232	5.989	0.3	0.6	57.0	12.1
ACAT55233	4.088	0.1	0.0	170.5	33.2
ACAT55234	3.695	0.1	0.0	201.7	39.2
ACAT55235	6.634	1.4	2.9	286.6	60.7
ACAT55236	5.084	1.1	2.2	219.6	46.5
ACAT55240	3.752	0.1	0.0	121.8	23.7
ACAT55241	1.002	0.0	0.0	46.7	9.1
ACAT55242	1.172	0.0	0.0	64.0	12.5
ACAT55243	2.211	0.1	0.0	120.7	23.5
ACAT55250	6.124	0.1	0.0	204.9	39.9
ACAT55251	5.557	0.2	0.0	303.4	59.0
ACAT55252	8.211	0.3	0.0	448.0	87.2
ACAT55253	12.699	0.2	0.0	249.7	48.6
ACAT55254	4.707	0.2	0.0	257.0	50.0
ACAT55260	24.462	1.3	2.7	274.8	58.2
ACAT55261	18.403	0.7	1.4	140.9	29.8
ACAT55262	10.075	1.1	2.3	230.4	48.8
ACAT55263	17.921	1.2	2.5	253.1	53.6
ACAT55264	10.406	1.0	2.1	205.9	43.6
ACAT55270	8.254	1.5	3.2	317.0	67.1
ACAT55271	7.841	1.4	2.8	281.9	59.7
ACAT55272	36.114	0.6	0.0	0.6	332.2
ACAT55273	4.853	1.0	2.1	209.7	44.4
ACAT55280	17.013	0.8	0.0	0.8	467.2
ACAT55281	18.597	0.9	0.0	0.9	510.1
ACAT55282	17.908	0.7	0.0	0.7	422.5
ACAT55300	10.128	0.4	0.0	0.4	89.5
ACAT55301	7.934	0.7	0.1	0.7	152.3
ACAT55310	2.673	0.2	0.0	0.2	39.9
ACAT55311	7.827	0.6	0.1	0.6	140.8
ACAT55312	7.909	0.7	0.1	0.7	173.5
ACAT55313	4.623	0.5	0.0	0.5	118.1
ACAT55314	4.221	0.5	0.0	0.5	107.8
ACAT55320	3.249	0.4	0.0	0.4	82.9
ACAT55321	8.264	0.8	0.1	0.8	190.9
ACAT55322	6.268	0.7	0.1	0.7	158.0
ACAT55330	6.272	0.5	0.0	0.5	117.7
ACAT55331	0.924	0.1	0.0	0.1	23.6
ACAT55332	3.396	0.2	0.0	0.2	47.4
ACAT55333	5.451	0.5	0.0	0.5	117.7
ACAT55334	3.473	0.3	0.0	0.3	72.3
ACAT55335	7.785	0.5	0.0	0.5	127.9
ACAT55340	4.217	0.4	0.0	0.4	97.3
ACAT55341	5.436	0.5	0.0	0.5	110.2
ACAT55342	1.312	0.1	0.0	0.1	21.0
ACAT55343	3.291	0.3	0.0	0.3	40.4
ACAT55350	6.330	0.4	0.0	0.4	64.1
ACAT55351	9.678	0.1	0.0	0.1	16.1

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
ACAT55352	6.044	0.4	0.0	0.4	66.8
ACAT55353	4.030	0.4	0.0	0.4	55.5
ACAT55354	3.415	0.3	0.0	0.3	47.2
ACAT55360	8.324	0.5	0.1	0.5	72.6
ACAT55361	9.904	0.9	0.1	0.9	117.9
ACAT55362	0.430	0.0	0.0	0.0	5.3
ACAT55363	10.401	0.7	0.1	0.7	96.1
ACAT55364	4.792	0.2	0.0	0.2	20.8
ACAT55365	9.239	0.6	0.1	0.6	81.7
ACAT55366	14.161	1.0	0.1	1.0	135.7
ACAT55370	6.279	0.6	0.0	0.6	138.2
ACAT55371	3.841	0.4	0.0	0.4	87.3
ACAT55372	4.067	0.4	0.0	0.4	85.1
ACAT55373	4.133	0.3	0.0	0.3	69.5
ACAT55374	7.117	0.5	0.0	0.5	125.8
ACAT55375	3.487	0.4	0.0	0.4	88.9
ACAT55376	51.306	0.2	0.0	0.2	42.1
ACAT55377	3.722	0.4	0.0	0.4	94.9
ACAT55378	2.072	0.2	0.0	0.2	37.1
ACAT55380	3.409	0.2	0.0	0.2	30.9
ACAT55381	3.130	0.3	0.0	0.3	40.4
ACAT55382	9.777	0.7	0.1	0.7	95.5
ACAT55383	4.222	0.4	0.0	0.4	51.9
ACAT55384	8.077	0.6	0.1	0.6	86.0
ACAT55385	6.330	0.1	0.0	0.1	11.0
ACAT55386	8.588	0.7	0.1	0.7	94.0
ACAT55387	7.948	0.3	0.0	0.3	39.7
ACAT55388	2.454	0.2	0.0	0.2	24.4
ACAT55390	2.845	0.2	0.0	0.2	34.4
ACAT55391	6.653	0.6	0.1	0.6	76.3
ACAT55392	4.402	0.2	0.0	0.2	28.4
ACAT55393	5.301	0.0	0.0	0.0	54.5
ACAT55394	6.630	0.0	0.0	0.0	51.4
ICAT1000	4.383	122.7	17.3	126.1	17.9
ICAT1010	2.729	126.0	17.5	129.6	18.3
ICAT1020	2.293	98.5	13.2	101.5	14.1
ICAT1030	1.667	71.7	9.8	73.8	10.3
ICAT1040	34.360	1339.8	188.6	1376.7	195.2
ICAT1060	21.033	815.4	107.4	841.0	116.5
ICAT1070	17.352	654.4	96.2	670.8	100.6
ICAT1080	15.707	0.1	0.0	0.1	0.0
ICAT1090	14.515	14.7	2.4	15.2	2.6
ICAT1100	126.967	51.2	36.2	67.5	57.2
ICAT1110	4.028	127.2	15.0	174.4	23.6
ICAT1120	5.537	195.4	23.1	267.9	36.2
ICAT1130	9.277	402.8	67.1	417.0	71.0
ICAT1140	3.967	103.9	44.0	109.2	50.5
ICAT1150	52.475	2186.0	364.3	2263.1	385.1
ICAT1160	2.910	29.3	57.1	33.4	68.3
ICAT1170	4.781	46.8	91.3	53.4	109.1
ICAT1180	2.154	86.6	14.4	89.6	15.3
ICAT1190	12.495	499.8	83.3	517.4	88.1
ICAT2000	1.919	30.8	4.6	31.5	4.8
ICAT2010	4.680	143.1	23.4	146.6	24.4
ICAT2020	39.586	1197.2	180.7	1225.1	187.4

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
ICAT2030	1.428	33.6	5.1	34.4	5.3
ICAT2040	8.984	229.4	34.6	234.8	35.9
ICAT2050	5.740	228.5	36.6	234.1	38.2
ICAT2060	19.996	821.0	130.4	845.1	136.6
ICAT2070	9.470	386.7	64.1	405.0	68.2
ICAT2080	4.648	97.5	13.9	136.3	18.0
ICAT2090	2.020	52.2	8.4	58.7	9.3
ICAT2100	7.010	299.5	49.9	310.0	52.8
ICAT2110	3.387	109.0	18.2	112.8	19.2
ICAT2120	1.795	71.3	11.9	73.8	12.6
ICAT2130	6.199	113.3	16.2	158.3	20.9
ICAT2200	7.791	255.3	80.1	266.6	90.3
ICAT2210	11.911	92.8	180.8	105.9	216.2
ICAT3000	2.399	42.7	13.5	57.5	17.8
ICAT3010	9.303	211.2	25.0	289.5	39.2
ICAT3020	18.823	207.7	404.8	237.1	484.1
ICAT3030	6.093	58.8	114.5	67.1	136.9
ICAT3040	16.923	2.9	92.2	133.9	295.7
ICAT3050	0.550	6.0	11.7	6.8	13.9
ICAT3060	13.040	2.3	85.2	55.0	173.7
ICAT3070	32.237	7.0	700.6	7.0	832.6
ICAT3080	15.528	53.1	344.8	60.8	427.6
ICAT3090	11.449	72.6	141.6	82.9	169.4
ICAT4000	2.905	0.3	118.1	7.2	138.3
ICAT4010	1.479	0.2	61.1	3.7	71.5
ICAT4020	8.885	0.9	309.6	18.8	362.3
ICAT4030	4.613	0.4	155.5	9.4	182.0
ICAT4040	3.486	0.0	0.1	0.0	0.1
ICAT4050	22.486	19.5	746.8	50.5	861.2
ICAT4060	3.607	7.3	87.1	7.4	96.7
ICAT4100	7.623	15.2	182.4	15.5	202.6
ICAT4110	5.048	9.6	115.1	9.8	127.9
ICAT4120	14.775	40.6	325.8	41.6	361.7
ICAT4200	3.428	6.9	83.0	7.0	92.2
ICAT4210	8.608	13.0	213.5	16.7	240.7
ICAT4220	1.117	2.0	24.1	2.0	26.8
ICAT4230	8.148	52.4	177.8	93.7	204.6
ICAT4240	1.738	3.6	42.7	3.6	47.4
ICAT4300	8.805	99.6	132.3	476.7	219.7
ICAT4310	8.883	201.1	146.8	408.4	199.1
ICAT4320	1.919	64.0	39.0	130.4	54.8
ICAT5000	11.702	413.3	48.9	566.5	76.5
ICAT5005	9.025	222.2	26.3	304.6	41.2
ICAT5010	0.961	22.7	2.7	31.2	4.2
ICAT5020	1.727	58.2	6.9	79.8	10.8
ICAT5030	3.123	99.6	11.8	136.5	18.4
ICAT5040	19.646	599.3	70.8	821.5	111.0
ICAT5050	10.443	80.2	9.5	110.0	14.9
ICAT5060	2.851	92.0	10.9	126.2	17.1
ICAT5070	8.153	271.2	32.1	371.8	50.2
ICAT5080	10.662	350.7	41.5	480.7	65.0
ICAT5090	1.485	53.9	6.4	73.8	10.0
ICAT5100	10.687	371.5	43.9	509.2	68.8
ICAT5110	1.952	56.1	6.6	76.9	10.4
ICAT5120	3.303	100.6	11.9	137.8	18.6

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
ICAT5200	4.510	76.1	12.3	109.0	24.8
ICAT5210	5.284	90.1	22.5	140.3	54.7
ICAT5220	15.206	159.9	71.4	293.5	198.5
ICAT5230	18.480	2.3	75.0	108.9	240.4
ICAT5240	78.920	0.6	142.9	103.4	205.5
ICAT6000	1.152	24.3	3.8	32.5	4.9
ICAT6010	5.192	125.0	19.5	165.0	24.5
ICAT6020	21.422	227.0	35.4	299.7	44.5
ICAT6030	99.071	18.4	2.9	24.2	3.7
ICAT6040	11.315	415.9	64.9	549.1	81.5
ICAT6050	14.266	405.1	63.2	534.8	79.4
ICAT6100	57.303	166.4	31.6	426.3	79.8
ICAT6110	74.000	1137.2	177.7	1500.3	223.1
ICAT6120	6.450	136.6	21.1	179.2	26.5
ICAT6130	8.376	150.5	28.6	385.4	72.2
ICAT6140	15.179	108.6	20.6	278.2	52.1
ICAT6200	35.181	115.9	22.0	296.9	55.6
ICAT6210	7.039	116.2	22.1	297.7	55.7
ICAT6220	6.736	69.7	13.2	178.5	33.4
ICAT6230	5.111	98.5	18.7	252.3	47.2
ICAT6300	42.120	1118.2	124.6	1143.2	130.6
ICAT6310	6.141	74.1	14.1	189.7	35.5
ICAT6320	9.093	73.0	13.9	186.6	34.9
ICAT6400	3.915	94.2	13.5	120.5	17.7
ICAT6410	5.852	177.1	25.3	225.0	32.9
ICAT6420	11.782	374.5	53.6	476.0	69.5
ICAT6500	56.869	670.3	103.1	1048.1	169.1
ICAT7000	95.270	1323.3	236.6	1575.7	287.7
ICAT7010	1.634	39.9	6.2	47.9	7.4
ICAT7020	1.483	64.7	10.1	77.6	12.0
ICAT7100	1.810	56.1	8.7	67.3	10.4
ICAT7110	3.978	159.6	24.8	191.4	29.7
ICAT7120	3.214	107.6	15.4	136.7	20.0
ICAT7130	12.998	359.0	53.1	446.2	66.7
ICAT7140	6.969	177.0	25.3	224.9	32.8
ICAT7200	3.789	125.9	18.0	160.1	23.4
ICAT7210	8.333	141.1	20.2	179.3	26.2
ICAT7220	5.521	122.3	17.5	155.5	22.7
ICAT7230	1.651	53.3	7.6	67.7	9.9
ICAT7240	2.605	83.3	11.9	105.9	15.5
ICAT7250	4.076	117.4	16.8	149.3	21.8
ICAT7260	5.935	211.6	30.3	268.9	39.3
ICAT7300	11.524	377.7	58.8	452.9	70.4
ICAT7310	6.438	231.4	33.1	294.1	42.9
ICAT7320	66.516	2204.3	331.3	2710.2	410.0
ICAT7330	120.808	798.2	1679.7	1252.1	2076.8
ICAT7340	7.767	247.4	35.9	314.4	46.4
ICAT7400	5.007	103.5	81.5	131.6	90.5
ICAT7410	14.355	0.0	425.1	0.0	454.7
ICAT7420	27.574	811.2	116.1	1030.9	150.5
ICAT7430	7.093	0.0	179.6	0.1	192.1
ICAT7440	6.230	1.3	80.5	1.3	91.5
ICAT8000	4.813	0.5	15.3	22.2	49.1
ICAT8010	15.871	1.0	32.6	47.3	104.5
ICAT8020	14.314	0.0	1.2	1.7	3.8

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
ICAT8030	24.151	4.3	137.7	200.0	441.8
ICAT8040	2.551	0.4	13.4	19.5	43.1
ICAT8100	12.622	2.1	66.6	96.7	213.5
ICAT8110	5.090	0.6	19.1	27.8	61.3
ICAT8120	7.714	2.3	134.0	2.3	152.5
ICAT8130	7.395	2.3	136.5	2.3	155.4
ICAT8140	7.805	1.4	80.6	1.4	91.7
ICAT8200	44.086	666.6	439.1	2534.3	1449.4
ICAT8205	6.152	121.4	49.1	396.2	147.6
ICAT8210	30.372	457.4	112.1	1135.9	351.6
ICAT8215	54.325	1354.6	398.1	1516.0	469.7
ICAT8220	6.574	172.3	77.9	317.6	113.2
ICAT8230	2.754	48.8	28.4	259.0	72.2
ICAT8240	17.245	472.8	201.5	790.2	281.5
ICAT8250	6.502	137.8	76.3	371.5	130.0
ICAT9000	4.337	81.9	294.3	285.4	518.8
ICAT9010	32.238	341.7	790.2	789.3	1048.9
ICAT9020	0.968	61.3	16.6	238.2	62.1
ICAT9030	0.482	29.3	7.9	113.7	29.6
ICAT9040	1.707	114.0	30.9	442.9	115.4
ICAT9050	0.574	30.5	12.3	118.5	35.6
ICAT9100	1.469	96.7	54.2	377.1	131.1
ICAT9110	1.761	97.8	54.9	381.6	132.6
ICAT9120	8.397	145.4	88.6	296.4	124.6
ICAT9130	3.539	82.2	48.2	187.8	73.0
ICAT9140	1.613	41.1	18.8	183.1	53.9
ICAT9150	0.889	9.5	3.1	49.2	11.9
ICAT9160	7.419	111.1	35.9	574.5	139.0
ICAT9999	0.570	8.7	2.8	45.2	10.9
NCAT10000	46.859	1661.2	231.7	1718.1	245.7
NCAT10100	18.808	740.9	82.6	774.9	87.6
NCAT10200	24.225	876.0	98.0	916.1	103.9
NCAT10300	11.378	200.9	54.7	206.2	57.6
NCAT10400	6.608	154.2	42.0	158.3	44.3
NCAT10500	9.160	300.5	77.6	307.6	81.7
NCAT10600	52.110	162.2	764.5	163.0	1137.2
NCAT10700	42.597	209.0	28.0	806.0	178.0
NCAT11000	20.704	8.6	2631.3	9.0	3800.1
NCAT11100	19.347	598.9	251.6	626.8	288.4
NCAT11200	12.231	441.8	145.7	462.4	155.1
NCAT11300	35.086	450.3	1441.9	471.3	2047.1
NCAT11400	14.126	581.0	161.2	602.3	170.4
NCAT11500	20.446	736.0	123.5	815.9	158.7
NCAT11600	25.787	1117.0	180.8	1240.9	235.4
NCAT11700	4.841	113.3	18.2	115.7	18.7
NCAT11800	32.479	1231.7	196.2	1256.6	202.0
NCAT11900	6.634	199.0	28.8	204.4	30.1
NCAT12000	19.823	8.3	754.2	57.8	1034.2
NCAT12100	38.711	4.2	2753.4	723.6	3696.1
NCAT12200	8.426	359.0	62.1	359.6	65.0
NCAT12300	23.985	1061.8	150.9	1094.6	158.3
NCAT12400	33.429	1331.4	334.5	1391.2	387.8
NCAT12500	34.075	1404.7	187.3	1463.3	196.8
NCAT12600	25.194	963.8	128.3	1004.2	134.8
NCAT12700	20.298	672.2	183.0	689.8	192.9

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
NCAT12800	30.046	939.7	463.9	981.1	511.4
NCAT12900	45.099	1471.5	628.3	1540.6	692.0
NCAT13000	29.384	0.0	1346.0	0.0	1965.8
NCAT13100	14.422	443.8	182.6	555.9	219.3
NCAT13200	26.720	882.4	188.1	897.0	198.8
NCAT13300	22.846	596.8	130.8	606.7	138.7
NCAT13400	9.149	266.1	91.7	311.7	106.9
NCAT13500	14.719	483.6	202.5	614.6	243.4
NCAT13600	11.518	351.9	108.3	358.5	111.0
NCAT13700	10.912	298.4	89.0	307.7	92.4
NCAT14000	13.893	0.0	347.7	0.0	522.8
NCAT14100	39.011	405.7	1356.2	405.1	1407.2
NCAT14200	31.331	446.1	246.8	464.9	290.6
NCAT14300	18.975	563.5	174.0	574.0	178.4
NCAT14400	11.144	320.4	94.2	327.3	97.0
NCAT14500	87.333	2655.4	532.0	2750.0	576.8
NCAT14600	51.072	1744.9	412.6	1904.6	465.3
NCAT14700	28.117	624.4	756.7	3094.5	1371.9
NCAT15000	14.091	523.7	76.2	537.7	79.5
NCAT15100	21.849	884.8	234.4	935.9	244.0
NCAT15200	26.950	855.6	189.2	874.3	198.0
NCAT15300	95.389	2560.3	492.2	2655.3	523.9
NCAT15400	30.226	576.4	103.7	596.3	106.8
NCAT15500	6.307	132.8	24.1	137.5	24.8
NCAT15600	15.925	182.6	44.3	186.1	45.1
NCAT15700	18.638	468.6	82.4	482.2	85.6
NCAT15800	19.951	612.4	94.6	633.2	100.2
NCAT16000	2.218	36.6	4.6	37.6	4.9
NCAT16050	33.106	1301.6	170.9	1342.6	185.7
NCAT16100	1.613	73.3	8.5	75.0	8.7
NCAT16150	9.028	362.0	62.3	370.3	64.8
NCAT16200	7.912	345.0	46.7	353.4	48.6
NCAT16250	6.211	263.2	34.0	269.5	35.2
NCAT16300	7.171	259.4	72.2	265.3	75.9
NCAT16350	5.440	211.2	55.5	215.7	58.5
NCAT16400	24.038	923.6	157.7	948.5	168.0
NCAT16450	39.377	1872.4	260.5	1900.7	278.2
NCAT16460	21.185	561.9	96.7	710.1	226.1
NCAT16500	10.614	457.7	89.5	464.8	95.4
NCAT16550	41.548	1616.5	338.0	1650.5	355.3
NCAT16600	30.563	1076.7	383.0	1185.1	453.1
NCAT16650	9.576	0.1	0.0	0.1	0.0
NCAT16700	19.953	763.1	586.7	1008.0	749.8
NCAT16800	27.566	484.4	793.4	867.9	1028.9
NCAT16850	21.340	212.9	758.8	555.1	993.9
NCAT17000	102.125	1414.8	409.1	1719.0	458.4
NCAT17100	10.536	196.2	172.4	210.9	189.9
NCAT17200	34.326	683.0	564.3	870.9	642.3
NCAT17300	34.947	933.5	607.3	1115.9	711.5
NCAT17310	3.855	24.8	380.1	96.7	648.7
NCAT17320	5.068	74.9	26.2	100.1	35.9
NCAT17330	2.676	46.8	49.9	114.4	99.5
NCAT17400	9.053	171.9	277.0	590.2	594.7
NCAT17500	8.725	341.2	429.3	1470.5	980.0
NCAT17600	9.574	255.8	191.2	419.8	224.3

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
NCAT17700	12.000	295.2	289.5	384.1	430.6
NCAT17800	11.218	422.0	613.8	1022.0	1123.7
NCAT17900	1.624	188.7	144.7	253.3	215.9
NCAT18000	37.162	1151.9	238.6	1676.1	430.5
NCAT18100	4.241	83.0	818.0	229.4	1496.6
NCAT18200	8.041	203.0	688.8	794.2	1216.1
NCAT18300	2.176	48.3	393.9	184.7	643.7
NCAT18400	29.085	776.1	153.1	1501.7	293.2
NCAT18500	8.920	403.7	390.0	969.3	1033.1
NCAT18600	2.917	196.6	455.8	474.0	762.1
NCAT18700	2.357	65.3	46.1	206.0	100.7
NCAT18800	2.135	12.3	65.9	15.7	103.2
NCAT18900	1.938	14.0	76.7	18.0	120.2
NCAT18950	1.874	26.0	85.9	199.2	186.5
NCAT19000	0.888	73.4	72.1	138.5	121.8
NCAT19100	1.745	13.2	10.1	17.8	15.1
NCAT19200	1.310	0.0	0.0	0.0	0.0
NCAT19300	1.975	53.9	14.6	209.5	54.6
NCAT19400	4.377	237.0	64.2	920.6	239.9
NCAT19999	10.210	6.9	2.8	26.7	8.1
SCAT30000	3.527	72.5	14.7	85.7	18.1
SCAT30010	15.601	501.2	101.3	592.9	124.8
SCAT30020	9.833	387.5	78.4	458.2	96.6
SCAT30030	6.090	142.6	28.9	168.6	35.5
SCAT30040	9.354	455.4	68.2	517.8	88.5
SCAT30050	3.476	196.3	27.5	221.6	36.2
SCAT30060	0.931	41.0	5.7	46.3	7.6
SCAT30070	6.466	174.2	24.4	196.6	32.1
SCAT30080	10.545	533.3	74.7	602.1	98.3
SCAT30100	50.970	2496.1	359.1	2818.8	467.9
SCAT30110	4.390	163.5	27.3	177.1	31.9
SCAT30120	3.550	128.8	21.2	140.0	25.0
SCAT30130	3.034	128.8	20.0	142.0	24.5
SCAT30140	1.128	25.0	4.7	26.2	5.1
SCAT30150	4.446	130.8	24.7	136.9	26.6
SCAT30160	15.151	0.3	0.0	0.3	0.1
SCAT30170	12.187	431.4	81.6	451.3	87.9
SCAT30200	24.227	464.2	136.0	491.0	243.4
SCAT30210	3.857	124.7	23.6	130.5	25.4
SCAT30220	2.020	65.2	12.3	68.3	13.3
SCAT30230	4.148	140.5	26.6	147.0	28.6
SCAT30240	9.564	325.1	61.5	340.1	66.2
SCAT30300	0.931	20.5	3.9	21.5	4.2
SCAT30310	0.471	13.2	2.5	13.8	2.7
SCAT30320	2.144	0.0	0.0	0.0	0.0
SCAT30330	0.490	16.4	3.1	17.2	3.4
SCAT30340	3.341	119.1	22.5	124.6	24.3
SCAT30350	1.370	51.3	9.7	53.7	10.5
SCAT30360	2.526	85.3	16.1	89.5	17.4
SCAT30370	1.025	3.7	0.7	3.9	0.8
SCAT30400	75.948	2828.2	623.4	3029.1	716.4
SCAT30410	2.237	96.9	27.9	99.0	30.2
SCAT30420	1.767	55.8	10.5	58.4	11.4
SCAT30430	6.804	229.9	43.5	240.5	46.8
SCAT30440	0.501	18.2	3.4	19.1	3.7

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
SCAT30500	2.491	0.2	17.7	0.2	43.3
SCAT30510	2.629	0.3	19.6	0.3	47.9
SCAT30520	5.951	0.7	50.2	0.7	122.6
SCAT30530	14.552	1.8	139.2	1.8	339.0
SCAT30540	10.312	1.2	89.3	1.2	218.4
SCAT30550	3.926	0.5	27.9	1.6	74.4
SCAT30600	49.660	3.4	1090.5	3.4	1485.6
SCAT30610	8.662	0.0	296.7	0.0	307.0
SCAT30620	29.017	1.0	899.6	1.0	1039.8
SCAT30630	7.972	0.0	299.4	0.0	309.8
SCAT30640	6.848	0.0	265.3	0.0	274.5
SCAT30700	36.100	0.0	695.3	0.0	901.1
SCAT30710	3.781	0.0	80.0	0.0	103.7
SCAT30720	5.493	0.0	114.6	0.0	148.5
SCAT30730	32.155	0.3	573.3	0.3	764.8
SCAT30740	9.570	0.0	19.5	0.0	25.2
SCAT30800	39.846	1.9	526.8	1.9	802.4
SCAT30805	14.404	1.1	122.4	1.1	229.5
SCAT30810	10.613	119.1	41.4	123.3	75.5
SCAT30815	57.838	4.3	561.8	4.3	998.4
SCAT30820	27.506	5.6	173.3	5.8	324.9
SCAT30825	23.805	100.1	11.6	103.7	19.9
SCAT30830	15.236	0.5	76.0	0.5	181.4
SCAT30835	24.347	19.7	56.0	20.4	190.2
SCAT30840	17.854	0.0	123.8	0.0	405.5
SCAT30845	9.330	0.0	43.1	0.0	149.0
SCAT30850	13.472	8.2	17.1	8.5	56.5
SCAT31000	6.461	227.7	44.9	260.8	78.2
SCAT31010	5.850	0.0	41.7	58.0	112.6
SCAT31020	50.356	9.5	368.6	49.6	1134.2
SCAT31030	10.589	0.0	80.6	112.9	217.2
SCAT31040	17.000	41.8	135.3	231.0	355.7
SCAT31050	4.951	0.3	33.5	31.2	95.0
SCAT31060	32.327	0.0	253.5	360.0	681.7
SCAT31070	30.388	5.4	210.9	28.4	649.0
SCAT31080	6.792	1.0	37.5	5.0	115.4
SCAT31100	21.837	256.1	269.0	341.5	423.1
SCAT31110	6.884	0.7	52.7	0.7	129.0
SCAT31120	12.756	167.7	177.6	171.6	270.4
SCAT31130	13.261	0.0	403.3	0.0	555.3
SCAT31140	51.840	398.4	1020.5	407.8	1741.2
SCAT31150	16.180	0.0	144.9	0.0	187.7
SCAT31160	7.322	0.0	140.8	0.0	182.4
SCAT31200	11.065	0.5	74.1	0.5	143.8
SCAT31210	42.619	1.6	429.5	1.6	989.2
SCAT31220	10.582	0.1	95.1	0.1	135.1
SCAT31230	13.454	0.0	92.1	0.0	126.4
SCAT31300	13.254	0.0	170.3	0.0	233.7
SCAT31310	38.813	0.7	422.0	0.7	635.5
SCAT31320	8.107	0.0	79.5	0.0	109.1
SCAT32000	3.982	0.1	0.0	0.1	0.0
SCAT32010	2.089	39.5	8.0	46.7	9.8
SCAT32020	3.742	165.6	33.5	195.7	41.3
SCAT32030	5.337	203.4	41.2	240.5	50.7
SCAT32040	2.536	89.3	18.1	105.6	22.3

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
SCAT32050	8.131	320.7	64.7	379.0	79.7
SCAT32060	3.099	109.2	22.1	129.1	27.2
SCAT32100	1.740	64.2	13.0	75.9	16.0
SCAT32110	6.801	266.8	54.0	315.5	66.5
SCAT32120	9.336	391.1	79.2	462.4	97.5
SCAT32130	7.816	298.7	60.8	353.7	75.4
SCAT32140	9.524	312.0	63.2	368.9	77.8
SCAT32150	4.219	141.6	32.7	173.2	46.3
SCAT32160	3.301	99.2	24.7	120.7	34.6
SCAT32200	27.892	863.6	201.8	1014.3	250.2
SCAT32210	1.541	24.0	20.0	24.6	25.6
SCAT32220	12.932	191.7	167.5	196.2	219.3
SCAT32230	11.888	176.8	147.2	181.0	188.3
SCAT32240	13.974	88.3	305.6	90.3	537.8
SCAT32250	23.617	0.0	577.3	0.0	1103.5
SCAT32300	55.523	1703.9	344.8	2014.5	424.6
SCAT32310	5.132	200.5	40.6	237.1	50.0
SCAT32320	16.085	547.3	111.6	685.5	160.2
SCAT32330	14.571	0.0	12.3	586.0	362.7
SCAT32340	11.957	0.0	10.2	486.3	301.0
SCAT32350	13.605	53.8	159.4	242.0	384.7
SCAT32400	27.427	0.0	17.6	836.1	517.7
SCAT32420	10.482	8.4	192.3	8.9	226.7
SCAT33000	40.158	1.5	327.7	1.5	750.6
SCAT33010	19.599	4.4	213.4	4.6	323.9
SCAT33020	13.210	0.0	139.4	0.0	216.1
SCAT33030	13.975	0.4	155.7	0.4	241.5
SCAT33040	14.671	0.0	162.1	0.0	222.5
SCAT33100	9.216	0.0	105.6	0.0	147.3
SCAT33110	3.705	118.2	45.9	119.2	53.2
SCAT33120	5.157	128.2	68.5	129.2	83.4
SCAT33200	5.297	209.9	62.3	211.6	65.1
SCAT33210	12.424	29.4	8.2	30.0	8.9
SCAT33220	3.615	137.7	28.7	146.6	36.9
SCAT33230	24.047	893.0	202.4	1162.8	248.5
SCAT33240	7.046	259.0	32.6	290.0	59.0
SCAT33300	3.494	127.0	15.8	141.7	28.8
SCAT33310	1.911	70.4	8.8	78.5	16.0
SCAT33320	2.931	100.6	12.5	112.3	22.9
SCAT33330	3.541	100.5	12.5	112.2	22.8
SCAT33340	8.695	317.7	39.6	354.6	72.2
SCAT33400	8.494	89.0	44.6	156.9	70.1
SCAT33410	3.384	16.6	17.3	44.8	26.5
SCAT33420	12.541	133.8	103.4	346.5	161.3
SCAT33430	1.440	11.4	11.9	30.7	18.2
SCAT33500	8.037	11.2	80.8	11.3	124.1
SCAT33510	1.750	33.5	17.1	33.7	23.0
SCAT33520	42.275	23.2	334.8	23.4	597.9
SCAT33530	65.877	44.7	362.6	45.5	640.0
SCAT33540	2.206	55.4	8.3	60.9	13.3
SCAT33550	2.346	65.1	8.1	72.6	14.8
SCAT33560	3.078	126.0	15.7	140.7	28.6
SCAT33600	25.166	697.6	101.6	792.4	119.5
SCAT33610	4.699	50.8	52.2	135.3	79.7
SCAT33620	3.598	38.9	40.5	104.7	61.9

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
SCAT33630	15.564	346.5	92.0	409.8	115.2
SCAT33640	4.536	58.8	180.3	139.2	208.6
SCAT34000	3.389	82.3	14.1	371.8	75.2
SCAT34005	2.286	38.6	7.4	248.4	51.7
SCAT34010	2.084	88.3	11.7	91.3	12.5
SCAT34020	2.719	139.3	18.5	144.0	19.8
SCAT34030	5.757	245.1	32.6	253.3	34.8
SCAT34040	4.671	220.6	29.3	228.0	31.3
SCAT34100	1.309	47.5	6.3	49.1	6.7
SCAT34110	1.128	52.5	7.0	54.3	7.4
SCAT34120	2.329	91.8	12.2	94.9	13.0
SCAT34200	2.574	102.3	13.6	105.7	14.5
SCAT34210	2.644	110.4	14.7	114.1	15.7
SCAT34220	11.219	523.6	69.5	541.3	74.3
SCAT34230	4.559	212.3	28.2	219.5	30.1
SCAT34300	19.054	729.0	84.2	755.4	144.8
SCAT34310	15.709	17.2	1.9	17.8	3.7
SCAT34320	7.112	285.2	31.8	295.1	62.0
SCAT34330	11.813	445.8	49.6	461.3	96.9
SCAT34340	6.879	157.1	17.5	162.5	34.1
SCAT34350	4.275	187.0	24.8	193.3	26.5
SCAT34360	3.574	151.2	20.1	156.3	21.4
SCAT34400	10.704	203.1	39.1	1306.6	271.8
SCAT34405	8.762	196.1	37.7	1261.4	262.4
SCAT34410	16.621	372.2	71.6	2394.8	498.2
SCAT34415	2.753	50.9	9.8	327.7	68.2
SCAT34420	11.668	166.9	32.1	1073.6	223.3
SCAT34430	7.863	141.7	27.3	911.3	189.6
SCAT34440	9.881	204.4	36.4	1049.7	214.8
SCAT34450	3.263	158.6	21.1	163.9	22.5
SCAT34460	2.593	128.9	17.1	133.3	18.3
SCAT34470	6.739	325.8	43.3	336.8	46.2
SCAT34500	11.157	300.5	44.4	715.6	132.3
SCAT34510	3.879	218.0	29.0	225.4	30.9
SCAT34520	1.098	50.3	6.7	52.0	7.1
SCAT34530	8.757	404.9	53.8	418.6	57.4
SCAT34540	2.853	134.0	17.8	138.5	19.0
SCAT34600	3.308	81.1	10.8	83.8	11.5
SCAT34610	1.625	0.0	0.0	0.0	0.0
SCAT34620	27.604	1072.7	233.2	1330.4	357.8
SCAT34630	2.104	0.0	0.0	0.0	0.0
SCAT34640	52.687	1588.5	366.8	1633.3	434.9
SCAT34650	50.838	245.7	125.4	254.0	351.8
SCAT34660	4.901	0.0	0.0	0.0	0.0
SCAT34700	16.598	335.7	64.6	2159.4	449.2
SCAT34710	18.814	204.7	173.5	572.1	361.3
SCAT34720	10.484	175.3	100.2	312.5	171.5
SCAT34730	8.055	148.9	79.7	286.4	150.2
SCAT34740	6.865	199.4	27.0	277.7	38.4
SCAT34750	1.787	9.3	4.1	12.2	5.6
SCAT34800	5.287	76.2	33.5	99.8	46.2
SCAT34810	24.466	917.8	147.3	1570.8	245.7
SCAT34820	4.046	48.5	17.8	78.6	26.1
SCAT34830	22.557	470.3	207.1	615.8	285.0
SCAT34840	23.455	407.1	179.2	533.1	246.7

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
SCAT34850	1.938	25.5	11.2	33.4	15.5
SCAT34860	3.084	10.8	4.1	16.9	6.0
SCAT34870	94.616	3198.4	405.7	3428.3	437.7
SCAT35000	0.597	29.2	3.8	29.6	5.9
SCAT35010	2.089	96.1	12.5	97.5	19.4
SCAT35020	2.465	128.2	16.6	130.2	25.8
SCAT35030	3.884	177.9	23.1	180.6	35.9
SCAT35040	3.224	151.9	19.7	154.2	30.6
SCAT35050	12.433	627.7	81.4	636.9	126.5
SCAT35100	11.682	478.7	62.0	485.9	96.5
SCAT35110	3.435	167.3	21.7	169.7	33.7
SCAT35120	10.758	131.7	17.1	133.9	26.5
SCAT35130	7.786	363.7	48.9	389.0	68.8
SCAT35200	1.985	87.7	12.1	97.3	15.8
SCAT35210	10.764	480.1	66.4	532.8	86.4
SCAT35220	7.635	319.1	44.1	354.1	57.4
SCAT35230	10.511	440.5	60.7	487.2	79.6
SCAT35240	12.091	552.6	76.4	613.3	99.4
SCAT35250	8.460	402.8	55.7	447.0	72.5
SCAT35300	8.326	0.1	0.0	281.4	29.5
SCAT35310	28.646	25.7	4.9	2183.2	246.0
SCAT35320	23.835	1034.3	134.1	1049.6	208.4
SCAT35330	9.280	380.2	49.4	386.9	76.4
SCAT35340	4.978	95.2	12.4	96.8	19.1
SCAT35350	2.012	27.6	3.8	30.6	5.0
SCAT35400	25.471	901.7	124.7	1000.7	162.2
SCAT35410	1.262	41.0	5.7	45.5	7.4
SCAT35420	2.357	31.1	4.3	34.1	5.7
SCAT35430	2.672	0.0	0.0	0.0	0.0
SCAT35440	6.063	304.1	42.0	337.4	54.7
SCAT35500	3.854	193.6	26.8	214.9	34.8
SCAT35510	54.370	793.8	105.7	1791.0	243.7
SCAT35520	22.540	28.0	3.6	30.3	4.0
SCAT35530	3.147	153.6	21.2	170.5	27.6
SCAT35540	11.147	463.9	64.1	514.9	83.5
SCAT35600	25.937	449.6	84.0	474.8	89.1
SCAT35610	9.595	271.7	50.8	287.0	53.9
SCAT35620	1.863	48.1	9.0	50.8	9.5
SCAT35630	11.034	247.2	46.2	261.0	49.0
SCAT35640	8.939	0.3	0.0	0.3	0.1
SCAT35650	2.187	38.4	7.2	40.5	7.6
SCAT35660	10.887	235.9	44.1	249.1	46.7
SCAT35670	24.206	32.4	6.0	34.2	6.3
SCAT35700	2.695	55.1	8.3	60.4	11.2
SCAT35705	2.593	52.5	7.9	57.4	10.6
SCAT35710	2.930	112.7	16.9	123.4	22.9
SCAT35720	6.037	179.8	27.0	196.9	36.5
SCAT35730	5.438	155.2	23.3	170.0	31.5
SCAT35740	3.437	97.5	14.7	106.8	19.8
SCAT35750	2.066	44.7	6.7	49.0	9.1
SCAT35800	22.199	333.0	41.8	414.7	51.4
SCAT35805	21.715	633.7	93.4	705.3	125.0
SCAT35810	8.930	159.0	23.0	179.6	30.5
SCAT35820	13.687	338.4	48.0	376.2	61.6
SCAT35830	5.307	111.1	14.0	129.5	16.2

Model Subcatchment Existing and Future Population Summary

Model Subcatchment ID	Area (ha)	2016 Residential Population	2016 Employment Population	2041 Residential Population	2041 Employment Population
SCAT36000	5.889	4.3	98.8	4.6	116.5
SCAT36010	14.358	6.9	204.1	7.3	269.4
SCAT36020	55.947	141.6	413.7	149.5	861.9
SCAT36030	9.422	230.5	146.2	243.3	159.8
SCAT36040	5.208	97.5	61.6	102.9	67.3
SCAT36100	2.944	103.7	18.2	113.5	22.2
SCAT36110	3.236	93.3	16.4	102.2	20.0
SCAT36120	5.959	176.3	30.8	194.1	38.0
SCAT36130	2.846	83.1	14.6	91.4	17.9
SCAT36140	1.935	43.5	8.0	45.9	9.1
SCAT36200	3.727	115.2	33.4	127.3	38.5
SCAT36210	53.503	1388.4	270.8	1624.6	340.4
SCAT36220	2.833	82.6	23.9	252.4	63.0
SCAT36230	27.372	735.4	225.8	2282.9	580.2
SCAT37000	30.791	764.8	149.6	1590.5	278.4
SCAT37010	16.085	90.7	11.4	110.1	13.7
SCAT37020	70.378	746.6	297.5	1189.9	419.7
SCAT37030	4.609	76.8	28.2	78.0	29.4
SCAT37040	5.669	105.7	38.8	107.5	40.5
SCAT37050	2.551	45.6	16.7	46.3	17.5
SCAT37100	1.401	14.2	64.7	14.4	65.9
SCAT37110	22.865	517.4	232.1	525.8	241.1
SCAT37120	1.154	14.7	55.1	14.9	56.1
SCAT37130	0.525	3.0	20.2	5.4	21.2
SCAT37140	8.423	35.5	34.6	96.9	53.9
SCAT37200	3.276	0.3	0.3	0.8	0.5
SCAT37220	8.438	74.7	30.7	314.0	82.7
SCAT37300	3.545	32.2	12.3	167.3	41.9
SCAT39999	2.322	0.0	0.0	0.0	0.0
WPCC	0.775	10.6	3.4	55.0	13.3
TOTALS	***9,792***	***145,849***	***73,773***	***252,971***	***128,999***

APPENDIX C

Growth and System Improvements Project Cost Estimates

City of Barrie
Wastewater Service

2014 Base

HST Included

Description	Comments/Notes	COB Notes	Total		2019	2020	2021	2022	2023	2024-2031	2032-2041	Post 2041	Growth %
Twin 1940m of 350mm diameter forcemain from Holly Pumping Station on Mapleview, (Project 21101-a)	Project is ongoing, not substancially complete, (Project 21101-a)	Required in 2021	$2,935,526	**tender price**									
Upgrade Holly Pumping Station to a rated capacity of 180 L/s	Project is ongoing, but not substancially completed (Project 21101-b)	Required in 2021	$6,639,000	**Cost provided**									
Construction of 1213m of 525mm on McKay Road (Project 21102a) (typical depth = 12m)	Required in 2021 (Project 21102)	Required in 2021	$3,410,506	Updated- assume all open cut, includes 1.76% for HST		682,101	2,728,405						100%
Construction of 1196m of 600mm on McKay (project 21102b) from Veterans east, typical depth=13m	Required in 2021 (Project 21102)	Required in 2021	$8,740,850	Updated - assume tunnel, includes 1.776% for HST		1,748,170	6,992,680						100%
Construction of 1852m of 600mm on McKay (Project 21102b2) from end of 21102b to Huronia Road, typical depth 7.5m	Required in 2021 (Project 21102)	Required in 2021	$13,535,163	Updated - assume tunnel, includes 1.76% for HST		2,707,033	10,828,130						100%
Construct 1425m of 750mm on Huronia Road (Project 21103), typical depth of 6m	Required in 2021 (Project 21103)	Required in 2021	$10,666,788	Updated -assume tunnel, includes 1.76% for HST		2,133,358	8,533,431						100%
Construct 640m of new 525mm on Huronia Road (Project 21401)	Required in 2021 (Project 21401)	Required in 2021	$4,915,741	Updated -assume tunnel, includes 1.76% for HST		983,148	3,932,593						100%
New West Annex PS, capacity 100 L/s (Project 21301)	2024-2031 (Project 21301)	Needed in Phase 2 Watersand Development - 2028 2031	$11,966,976	Updated from WSP and includes 60% global factor, and 1.76% for HST						11,966,976			100%
New twin forcemain from West Annex PS, 578m of 250mm forcemain (Project 21302) (PS to MH677)	2024-2031 (Project 21302)	This project is tied to the one above - will have same timing	$2,225,646	Updated - assume open cut, includes 1.76% for HST						2,225,646			100%
Mapleview Drive East Trunk Sewer - East Annex SPS Discharge to Hewitts Creek Trunk (Project 22102) 1530m-of 525mm diameter sanitary sewer, typical depth 5.5m (MH201 to SAH09099)	Required in 2021 (Project 22102)		$3,118,527	Updated - assume open cut, includes 1.76% for HST			623,705	2,494,821					100%
Extension to existing Hewitts Creek Trunk Sewer Project,1050m-525mm diameter sanitary sewer , Project 22101, (MH68-SAH09099), Tyipcal depth=9m	Required in 2021 (Project 22101)		$2,586,790	Updated - assume open cut, includes 1.76% for HST			517,358	2,069,432					100%
Extension to existing Hewitts Creek Trunk Sewer, 575m - 450 mm, typical depth 5m, project 22301 (MH63 to MH68)	Required in 2021 (Project 22301)		$904,596	Updated - assume open cut, includes 1.76% for HST			180,919	723,676					100%
New East Annex Pumping Station, Project 22302	Required in 2026-2031 (Project 22302)	Required in 2031	$11,966,976	Updated from WSP, includes 1.76% for HST						11,966,976			100%
New Twin Forcemain from East Annex PS, 730m of 250mm fm, Project 22303	Required in 2026-2031 (Project 22303)	Required in 2031 - will be needed with the project 22302 above	$2,810,937	Updated, includes 1.76% for HST						2,810,937			100%
Expand capacity at West Annex PS, Project 21402	Post 2031 (Project 21402)	Post 2031 - will be needed with the project 22302 above	$350,136	Updated as per WSP, includes 1.76% for HST							350,136		100%
Expand capacity at East Annex PS, Project 21401	Post 2031 (Project 21401)	Post 2031 - will be needed with the project 22302 above	$350,136	Updated as per WSP, includes 1.76% for HST							350,136		100%
Decommisioning of PS#4 and construction of 750m of 300mm diameter sanitary sewer on Lockhart (SAP26003 to SAP08001), typical depth =5m	Post 2031 (Project 213401)	Post 2031	$929,578	Updated, includes 1.76% for HST									
Construction of 552m of 450mm diameter sanitary on McKay Road from West Annex PS forcemain discharge to Project 21102. Typical depth 6.5m (677 to 702)	2024-2031 (Project 21303)	Project is tied to West Annex PS and Forcemain projects	$958,848	Updated, includes 1.76% for HST									
Former Barrie Projects:													
Flow Monitoring Program for I/I investigation, Project WC2019-01	Growth related (Project WC2019-01)	Required in 2021	$10,000,000	Updated allowance of $500000/yr over 20 years, includes HST		500,000	500,000	500,000	500,000	3,500,000	4,500,000		43%
Tiffin Street sanitary sewer, sewer replacement to meet City's level of service requirements with future growth, replace 114m of existing 450mm with new 600mm, typical depth =6.5m	Growth related (Project WC2019-02)	Post 2031	$196,262	Updated, includes 1.76% for HST							196,262		43%
Stunden Lane sanitary sewer, Sewer replacement to meet City's level of service requirements with future growth, replace 281m of existing 375 with new 525mmm, typical depth=9.5m	Growth related (Project WC2019-03)	Post 2031	$708,573	Updated, includes 1.76% for HST							708,573		43%
Lakeshore South Trunk Sewer, sewer twin to meet City's level of service requirements with future growth, twin 3175m of existing 900mm with new 1050mm, typical depth=10.5m	Growth related (Project WC2019-04)	Post 2031	$24,619,306	Updated based on tunnel cost, includes 1.76% for HST							24,619,306		43%
Easement south of Tiffin sanitary sewer, sewer replacement to meet City's level of service requirements with future growth, replace 707m of existing 600mm with new 750mm, typical depth=5.5m	Growth related (Project WC2019-05)	Post 2031	$1,454,714	Updated, includes 1.76% for HST							1,454,714		43%
Mapleview Drive West, Veterans to Hwy, sewer replacement to meet City's level of service requirements with future growth, replace 2259m of existing 525mm and 600mm with new 675mm, typical depth=7.5m	Growth related (Project WC2019-06)	Post 2031	$4,786,015	Updated, includes 1.76% for HST							4,786,015		43%
Brock Street sanitary sewer, sewer replacement to meet City's level of service requirements for future growth, replace 1609m of existing 750mm with new 900mm, typical depth=5m	Growth related (Project WC2019-07)	Post 2031	$3,756,008	Updated, includes 1.76% for HST							3,756,008		43%
Brock Street sanitary sewer, sewer replacement to meet City's level of service requirements for future growth, replace 119m of existing 825mm with new 900mm, typipcal depth=6m	Growth related (Project WC2019-07)	Post 2031	$296,560	Updated, includes 1.76% for HST							296,560		43%
Kierland Road sanitary sewer, sewer replacement to meet City's level of service requirements for future growth, replace 446m of existing 525mm with new 600mm, typical depth=5.5m	Growth related (Project WC2019-08)	Post 2031	$671,244	Updated, includes 1.76% for HST							671,244		43%
Patterson Road sanitary sewer, sewer replacement to meet City's level of service requirements for future growth, replace 10m of existing 250mm with new 300mm, typical depth=4m	Growth related (Project WC2019-09)	Post 2031	$15,376	Updated, includes 1.76% for HST							15,376		43%
Tiffin Street Sanitary Sewer, sewer replacement to meet City's level of service under existing conditions, replace 1352m of existing 600mm with new 900mm, typical depth=7.5m	Growth related(Project WC2019-10)	Required in 2021** - Former Barrie projects	$3,717,399	Updated, includes 1.76% for HST		3,717,399							43%
Tiffin Street sanitary sewer, sewer replacement to meet City's level of service under existing conditions and support future growth, replace 240m of 750mm with new 900mm, typical depth=7m	Growth related (Project WC2019-11)	Required in 2021** - Former Barrie projects	$639,378	Updated, includes 1.76% for HST		639,378							43%
Sanitary sewer downstream of Minets Point PS, (on White Oaks Dirve and easement from White Oaks Drive to Lakeshore) sewer replacement to meet City's level of service requirements under existing conditions and support future growth, replace 220m of existing	Growth related (Project WC2019-12)	Required in 2021** - Former Barrie projects	$324,614	Updated, includes 1.76% for HST		324,614							43%
Mapleview Drive sanitary sewer east of Holly PS, sewer replacement to meet City's level of service requirements under existing conditions and support future growth, replace 28m of existing 450mm with new 525mm, typical depth=4m	Growth related (Project WC2019-13)	Required in 2021** - Former Barrie projects	$52,313	Updated, includes 1.76% for HST		52,313							43%
Monitoring and assessment of Penetanguishene Sideroad sanitary sewer, downstream of PS1, to confirm need for sewer replacement to meet City's level of service requirements and support future growth	Growth related (Project WC2019-18)	Required in 2021** - Former Barrie projects	$100,000	Updated, includes 1.76% for HST		100,000							43%

Penvil Trail sanitary sewer, sewer replacement to meet City's level of service requirements under existing conditions and support future growth, replace 737m of existing 250mm with new 375mm, typical depth=3.5m, replace 212m of existing 375mm with new 450mm (typical depth of 7,5m), replace 64m of existing 250mm with new 300mm (typical depth of 3.5m)	Growth related (Project WC2019-14)	Required in 2021** - Former Barrie projects	$904,465	Updated, includes 1.76% for HST		1,364,250							43%
Bear Eco sanitary sewer, sewer replacement to meet City's level of service requirements under existing conditions and support future growth, replace 840m of existing 250mm sanitary sewer with new 375mm, typical depth=5.5m	Growth related (Project WC2019-15)	Required in 2021** - Former Barrie projects	$1,197,552	Updated, includes 1.76% for HST		1,197,552							43%
Monitoring and assessment of Lougheed Road sanitary sewer (375mm) to confirm need for sewer replacement to meet City's level of service requirements and support future growth	Growth related (Project WC2019-19)	Required in 2021** - Former Barrie projects	$100,000	Updated, includes 1.76% for HST		100,000							43%
Monitoring and assessment of Montserrand Street sanitary sewer (300mm) to confirm need for sewer replacement to meet City's level of service requirements and support future growth	Growth related (Project WC2019-20)	Required in 2021** - Former Barrie projects	$100,000	Updated, includes 1.76% for HST		100,000							43%
Ardagh Street sanitary sewer, Essa to Morrow, sewer replacement to meet City's level of service requirements under existing conditions and support future growth, replace 220m of existing 250mm diameter sanitary sewer with new 300mm diameter (typical depth of 3.5m)	Growth related (Project WC2019-16)	Required in 2021** - Former Barrie projects	$249,393	Updated, includes 1.76% for HST		249,393							43%
Morrow Road sanitary sewer, Ardagh to 2017 construction limits to meet City's level of service requirements under existing conditions and support future growth, replace 595m of existing 250mm diameter sanitary sewer with new 375mm diameter (typical depth of 3.5m)	Growth related (Project WC2019-17)	Required in 2021** - Former Barrie projects	$730,199	Updated, includes 1.76% for HST		730,199							43%
Monitoring and assessment of Duckworth Street sanitary sewer (375mm) to confirm need for sewer replacement to meet City's level of service requirements for existing conditions and support future growth	Growth related (Project WC2019-21)	Required in 2021** - Former Barrie projects	$100,000	Updated, includes 1.76% for HST		100,000							43%
Pumping Station 1 Improvements, increase storage by 95m^3 to meet the City's level of service requriements for existing conditions and support future growth	Growth related (Project WC2019-22)	Post 2031	$628,368	Unit Cost as per WSP, includes 1.76% for HST							628,368		43%
PS 1 Improvements - Twin 253m of 400mm diameter forcemain to meet the City's level of service requirements for existing conditions and support future growth	Growth related (Project WC2019-23)	Required in 2021** - Former Barrie projects	$713,144	Updated, includes 1.76% for HST		713,144							43%
PS2 Improvements - Twin 343m - 250mm diameter forcemain to meet the City's level of service requirements for existing conditions and support future growth	Growth related (Project WC2019-24)	Required in 2021** - Former Barrie projects	$487,101	Ujpdated, includes 1.76% for HST		487,101							43%
PS 12 Improvements Capacity Increase at Tynedale PS (PS12), to firm capacity of 15 L/s to meet the City's level of service requirements for existing conditions and support future growth	Growth related (Project WC2019-25)	Post 2031	$254,400	WSP, includes 1.76% for HST							254,400		43%
PS 12 Improvements -Twin 375m-100mm diameter forcemain to meet the City's level of service requirements for existing conditions and support future growth	Growth related (Project WC2019-26)	Required in 2021** - Former Barrie projects	$482,724	Updated, includes 1.76% for HST		482,724							43%
Total Capital Expenditures		-	**$136,723,302**		-	**19,111,877**	**34,837,221**	**5,787,930**	**500,000**	**32,470,535**	**42,587,098**	-	

Existing Sewer Upgrade Requirements - 2041

Pipe ID	Upstream ID	Downstream ID	Diam	Length	Depth (m)	Slope (%)	Existing Full Flow Capacity (L/s)	2041 Peak Flow	Estimated d/D	Required Diameter (mm)	Upgraded Full Flow Capacity (L/s)	Upgraded d/D	Unit Cost	Cost
298	SAI14004	SAI14003	0.75	118.22	6.8	0.058	268.3	209.93	0.73	0.9	436.19	0.60	$2,324	$274,743
299	SAI14003	SAI14002	0.75	102.01	6.6	0.067	288.3	210.8	0.72	0.9	468.82	0.60	$2,324	$237,071
300	SAI14002	SAI14001	0.75	126.53	6.5	0.051	251.6	211.64	0.69	0.9	409.03	0.60	$2,324	$294,056
305	SAI16006	SAI16005	0.6	125.03	6.8	0.058	148.0	208.67	1.00	0.9	436.19	0.61	$2,454	$306,824
308	SAI16005	SAI16004	0.6	101.27	7.0	0.088	182.3	208.18	1.00	0.9	537.29	0.61	$2,590	$262,289
309	SAI16004	SAI16003	0.6	126.53	7.2	0.069	161.4	207.93	1.00	0.9	475.76	0.61	$2,755	$348,590
310	SAI16003	SAI16002	0.6	120.24	7.3	0.072	164.9	207.68	1.00	0.9	485.99	0.60	$2,807	$337,514
311	SAI16002	SAI16001	0.6	120.24	7.5	0.072	164.9	207.89	1.00	0.9	485.99	0.58	$2,960	$355,910
312	SAI16001	SAI14004	0.6	114.62	6.9	0.079	172.7	209.41	1.00	0.9	509.07	0.56	$2,521	$288,957
313	SAI16010	SAI16009	0.6	105.98	6.6	0.076	169.4	170.45	1.00	0.9	499.31	0.56	$2,324	$246,298
314	SAI16009	SAI16008	0.6	110.71	6.6	0.099	193.3	170.10	1.00	0.9	569.88	0.62	$2,324	$257,290
315	SAI16008	SAI16007	0.6	105.98	6.6	0.047	133.2	207.20	1.00	0.9	392.66	0.63	$2,324	$246,298
316	SAI16007	SAI16006	0.6	101.27	6.6	0.049	136.0	207.04	1.00	0.9	400.92	0.62	$2,324	$235,351
317	SAI17054	SAI17053	0.6	69.66	5.5	0.1	194.3	100.27	1.00	0.75	352.26	0.50	$1,975	$137,579
318	SAI17053	SAI16013	0.6	57.02	5.5	0.123	215.5	100.26	1.00	0.75	390.68	0.53	$1,975	$112,615
319	SAI16013	SAI16012	0.6	91.95	5.5	0.044	128.9	100.21	1.00	0.75	233.67	0.54	$1,975	$181,601
320	SAI16012	SAI16011	0.6	99.65	5.6	0.09	184.3	100.18	1.00	0.75	334.19	0.56	$1,975	$196,809
322	SAI17057	SAI17056	0.6	99.65	5.6	0.06	150.5	113.22	1.00	0.75	272.86	0.50	$1,975	$196,809
323	SAI17056	SAI17055	0.6	79.08	5.6	0.089	183.3	109.5	1.00	0.75	332.32	0.50	$1,975	$156,183
324	SAI17055	SAI17054	0.6	110.71	5.6	0.072	164.9	104.9	1.00	0.75	298.91	0.50	$1,975	$218,652
1126	SAI16037	SAI16010	0.45	113.99	6.3	0.12	98.9	51.33	1.00	0.6	212.86	0.60	$1,706	$194,467
8815	SAP09072	SAP09073	0.375	50.6	4.5	0.42	113.7	119.70	1.00	0.45	184.95	0.65	$1,597	$80,808
8816	SAP09071	SAP09072	0.375	104	3.2	1.2	192.3	119.70	1.00	0.45	312.61	0.50	$1,597	$166,088
8817	SAP09072	SAP09073	0.375	113.1	4.5	0.28	92.9	119.70	1.00	0.45	151.01	0.69	$1,597	$180,621
8818	SAP09069	SAP09070	0.375	119.4	4.0	0.28	92.9	119.70	1.00	0.525	227.76	0.61	$1,597	$190,682
8819	SAP09068	SAP09069	0.375	111.7	4.2	0.28	92.9	119.70	1.00	0.525	227.76	0.55	$1,597	$178,385
8820	SAP09067	SAP09068	0.375	103	5.1	0.3	96.1	119.7	1.00	0.525	235.75	0.56	$1,597	$164,491
8821	SAP09064	SAP09067	0.3	37.07	6.1	0.459	65.6	13.00	1.00	0.375	118.91	0.47	$1,107	$41,036
8863	SAP09020	SAP09022	0.525	112.92	8.9	0.505	305.9	223.40	0.74	0.6	436.67	0.58	$1,479	$167,009
8864	SAP09018	SAP09020	0.375	83.1	5.9	0.36	105.3	119.70	1.00	0.45	171.23	0.64	$1,597	$132,711
18977	SAP09073	SAP09018	0.375	16	4.4	0.44	116.4	119.70	1.00	0.525	285.51	0.59	$1,597	$25,552
C1	SAB01004	SAB01003	1.35	130.47	6.7	0.11	1,770.6	1856.50	1.00	1.65	3023.17	0.64	$4,920	$641,912
C19	SAB01002	SAB01001orJ4	1.5	89.35	6.6	0.142	2,664.1	1857.00	0.71	1.65	3434.87	0.64	$4,920	$439,602
L098	SAL08059	SAL08058	0.525	80.52	4.5	0.46	295.9	284.34	0.82	0.6	416.76	0.65	$1,033	$83,177
S10	SAF01006	SAF01005	1.2	145.4	12.2	0.15	1,510.4	1698.00	1.00	1.5	2738.16	0.65	$5,014	$729,036
S1027	SAB06003	SAB06021	0.375	48.1	6.6	0.397	110.6	20.1	0.84	0.45	179.81	0.76	$1,920	$92,352
S11	SAF01007	SAF01006	1.2	150.9	12.5	0.15	1,510.4	1698.00	1.00	1.5	2738.16	0.64	$5,014	$756,613
S113	SAP27001	SAF01008	1.05	134.6	12.6	0.21	1,251.9	1817.00	1.00	1.35	2446.44	0.63	$5,075	$683,095
S12	SAF01008	SAF01007	1.2	106.9	12.9	0.15	1,510.4	1699.00	1.00	1.5	2738.16	0.65	$5,135	$548,932
S162	SAP14058	SAP14015	1.05	101.63	6.6	0.187	1,181.3	799.80	0.75	1.2	1686.45	0.60	$5,135	$521,870
S172	SAP24004	SAP24003	1.05	145.27	6.2	0.2	1,221.7	791.60	0.72	1.2	1744.08	0.65	$2,892	$420,121
S173	SAP24003	SAP24002	1.05	74.45	7.5	0.134	1,000.0	792.00	0.74	1.2	1427.59	0.59	$3,122	$232,433

Existing Sewer Upgrade Requirements - 2041

Pipe ID	Upstream ID	Downstream ID	Diam	Length	Depth (m)	Slope (%)	Existing Full Flow Capacity (L/s)	2041 Peak Flow	Estimated d/D	Required Diameter (mm)	Upgraded Full Flow Capacity (L/s)	Upgraded d/D	Unit Cost	Cost
S174	SAP24002	SAP24001	1.05	118.05	7.8	0.152	1,065.0	791.80	0.74	1.2	1520.45	0.60	$3,175	$374,809
S175	SAP14006	SAP14005	1.05	81.61	7.1	0.184	1,171.8	806.8	0.76	1.2	1672.86	0.60	$3,051	$248,992
S177	SAP14015	SAP14014	1.05	68.89	6.5	0.174	1,139.5	799.9	0.81	1.2	1626.77	0.63	$2,945	$202,881
S179	SAP14013	SAP14012	1.05	70.36	7.7	0.171	1,129.6	800.20	0.82	1.2	1612.69	0.60	$3,051	$214,668
S180	SAP14012	SAP14011	1.05	66.29	9.6	0.175	1,142.8	801.03	0.76	1.2	1631.44	0.60	$3,493	$231,551
S182	SAP14010	SAP14009	1.05	111.19	7.7	0.207	1,242.9	800.98	0.74	1.2	1774.34	0.58	$3,157	$351,027
S183	SAP14009	SAP14008	1.05	106.7	4.8	0.169	1,123.0	806.03	0.83	1.2	1603.23	0.59	$2,645	$282,222
S185	SAP14007	SAP14006	1.05	74.99	4.4	0.173	1,136.2	806.49	0.82	1.2	1622.09	0.70	$2,474	$185,525
S188	SAP14005	SAP14004	1.05	85.53	9.5	0.152	1,065.0	806.8	0.74	1.2	1520.45	0.60	$3,475	$297,217
S189	SAP14004	SAP14003	1.05	97.7	8.8	0.164	1,106.3	810	0.73	1.2	1579.33	0.62	$3,352	$327,490
S194	SAP13002	SAP13003	0.9	76.05	8.0	0.276	951.5	825.50	0.91	1.2	2048.83	0.63	$3,352	$254,920
S195	SAP13003	SAP19034	0.9	96.5	8.0	0.21	830.0	1028.10	1.00	1.2	1787.15	0.61	$2,178	$210,177
S197	SAP19033	SAP19032	0.9	108.1	12.3	0.28	958.4	1656.00	1.00	1.35	2824.90	0.60	$5,014	$542,013
S198	SAP19032	SAP19031	0.9	68.9	11.5	0.26	923.5	1657.00	1.00	1.35	2722.14	0.64	$4,851	$334,234
S199	SAP19031	SAP19030	0.9	126.6	11.2	0.16	724.5	1656.00	1.00	1.35	2135.42	0.61	$4,790	$606,414
S2	SAB01003	SAB01002	1.35	146.53	6.5	0.12	1,849.3	1605.00	0.86	1.5	2449.09	0.66	$3,834	$561,796
S200	SAP19030	SAP19029	0.9	86.4	11.0	0.28	958.4	1653.00	1.00	1.35	2824.90	0.56	$4,749	$410,314
S201	SAP19029	SAP19028	0.9	74.2	10.9	0.32	1,024.6	1649.00	1.00	1.35	3019.95	0.54	$4,729	$350,892
S202	SAP19028	SAP27001	0.9	118.6	11.7	0.23	868.6	1639.00	1.00	1.35	2560.28	0.54	$4,892	$580,191
S232	SAP21037	SAP21036	1.05	64.79	9.1	0.123	958.1	722.60	0.73	1.2	1367.74	0.62	$3,405	$220,610
S250	SAP24063	SAP24062	1.05	89.31	7.6	0.258	1,387.6	735.40	0.71	1.2	1980.89	0.56	$3,405	$304,101
S251	SAP24062	SAP24061	1.05	60.48	7.6	0.182	1,165.4	735.40	0.78	1.2	1663.75	0.62	$3,122	$188,819
S252	SAP24061	SAP24007	1.05	176.56	7.9	0.108	897.8	735.80	0.78	1.2	1281.63	0.65	$3,193	$563,756
S276	SAP19054	SAP19055	0.25	115.76	3.9	0.993	59.3	65.97	1.00	0.375	174.90	0.62	$986	$114,139
S277	SAP19055	SAF01015	0.25	83.77	4.1	1.003	59.6	59.38	1.00	0.375	175.78	0.53	$994	$83,267
S278	SAF01015	SAF01008	0.25	21.03	8.0	0.951	58.1	58.01	1.00	0.375	171.16	0.56	$1,158	$24,353
S4	SAB01005	SAB01004	1.35	106.8	6.7	0.17	2,201.1	1856.70	1.00	1.65	3758.30	0.63	$4,920	$525,456
S5	SAF01001	SAB01005	1.2	189.5	8.5	0.15	1,510.4	1696.00	1.00	1.5	2738.16	0.66	$4,241	$803,670
S6	SAF01002	SAF01001	1.2	124.6	9.9	0.17	1,608.0	1696.00	1.00	1.5	2915.00	0.64	$4,526	$563,940
S7	SAF01003	SAF01002	1.2	143.7	10.9	0.15	1,510.4	1696.00	1.00	1.5	2738.16	0.63	$4,526	$650,386
S72	SAP12027	SAP12026	0.6	125.91	6.6	0.286	328.6	304.2	0.93	0.675	449.84	0.60	$1,514	$190,628
S73	SAP12028	SAP12027	0.6	106.31	7.3	0.32	347.6	304.2	0.88	0.675	475.83	0.64	$1,599	$169,990
S78	SAP32006	SAP32005	0.6	106.93	9.8	0.299	336.0	286.7	0.75	0.675	459.95	0.65	$1,902	$203,381
S79	SAP32007	SAP32006	0.6	103.76	10.6	0.299	336.0	285.7	0.76	0.675	459.95	0.62	$1,999	$207,416
S8	SAF01004	SAF01003	1.2	155.9	12.2	0.14	1,459.2	1697.00	1.00	1.5	2645.32	0.64	$5,014	$781,683
S80	SAP32008	SAP32007	0.6	107.55	10.7	0.298	335.4	286.5	0.76	0.675	459.18	0.62	$1,999	$214,992
S81	SAP32009	SAP32008	0.6	101.87	11.0	0.304	338.8	287.4	0.76	0.675	463.78	0.62	$2,048	$208,630
S82	SAP32010	SAP32009	0.6	109.45	10.6	0.292	332.0	288.4	0.76	0.675	454.54	0.62	$1,999	$218,791
S83	SAP32011	SAP32010	0.6	102.52	9.1	0.312	343.2	288.9	0.76	0.675	469.85	0.62	$1,905	$195,301
S883	SAP33022	SAP33021	0.45	27.52	3.0	0.945	277.4	237.2	0.86	0.6	597.34	0.59	$881	$24,245
S884	SAP33021	SAP33020	0.525	64.21	3.8	0.156	170.0	236.4	1.00	0.675	332.23	0.61	$1,174	$75,383
S885	SAP33020	SAP33019	0.525	96.79	4.9	0.238	210.0	232.2	1.00	0.675	410.36	0.56	$1,307	$126,505
S886	SAP33019	SAP33018	0.525	99.36	5.3	0.211	197.7	230.7	1.00	0.675	386.38	0.59	$1,353	$134,434

Existing Sewer Upgrade Requirements - 2041

Pipe ID	Upstream ID	Downstream ID	Diam	Length	Depth (m)	Slope (%)	Existing Full Flow Capacity (L/s)	2041 Peak Flow	Estimated d/D	Required Diameter (mm)	Upgraded Full Flow Capacity (L/s)	Upgraded d/D	Unit Cost	Cost
S887	SAP33018	SAP33017	0.525	98.4	5.3	0.163	173.8	231.5	1.00	0.675	339.60	0.58	$1,353	$133,135
S888	SAP33017	SAP33016	0.525	96.79	5.3	0.207	195.8	230.7	1.00	0.675	382.70	0.59	$1,353	$130,957
S889	SAP33016	SAP33015	0.525	100.91	5.3	0.188	186.6	233.9	1.00	0.675	364.72	0.59	$1,353	$136,531
S890	SAP33015	SAP33014	0.525	98.06	5.2	0.194	189.6	234.8	1.00	0.675	370.49	0.65	$1,353	$132,675
S891	SAP33014	SAP33013	0.525	97.44	5.2	0.195	190.1	234.93	0.84	0.6	271.35	0.69	$1,104	$107,574
S897	SAP33008	Plug001	0.6	74.97	7.9	0.403	390.1	234.6	0.76	0.675	533.99	0.63	$1,672	$125,350
S898	Plug001	SAP32011	0.6	39.57	8.1	0.04	122.9	233.5	0.82	0.675	168.23	0.67	$1,696	$67,111
S9	SAF01005	SAF01004	1.2	153.5	12.3	0.14	1,459.2	1698.00	1.00	1.5	2645.32	0.65	$5,014	$769,649
S929	SAP09022	SAP09023	0.525	47.14	9.6	0.509	307.1	223.40	0.76	0.6	438.39	0.63	$1,550	$73,067

Sanitary Sewer Replacements (Existing sanitary sewers where d/D>0.5, for diameters up to and including 375mm)

Sewer ID	Street	Inlet Node	Outlet Node	Length (m)	Diameter (mm)	Mannings n	Slope (m/m)	Q Mannings (l/s)	2041 Peak Flow (l/s)	2041 d/D	Proposed Diameter (mm)	Q Mannings (proposed) (l/s)	Replacement d/D	Unit Cost	Estimated Cost
38	Perry Street	SAC02010	SAC02009	82.8	200	0.013	0.0006	8.05	11.20	0.63	250	14.59	0.45	$1,215	100,602
40	Perry Street	sac02009	sac02009b	72	200	0.013	0.00889	30.97	12.53	0.41	250	56.15	0.32	$1,215	87,480
5489	Penvil Trail	SAI17209	SAI17202	64.74	250	0.013	0.00572	45.04	27.12	0.6	300	73.22	0.45	$1,511	97,822
6683	Summerset Drive	SAI17064	SAI17063	35.17	250	0.013	0.00483	41.38	23.13	0.56	300	67.29	0.43	$1,511	53,142
6682	Summerset Drive	SAI17063	SAI17062	76.37	250	0.013	0.00498	42.02	23.13	0.56	300	68.32	0.42	$1,511	115,395
6681	Summerset Drive	SAI17062	sai017059	89.02	250	0.013	0.00652	48.08	23.12	0.52	300	78.18	0.40	$1,511	134,509
6680	Summerset Drive	SAI17059	SAI17058	83.76	250	0.013	0.0043	39.05	23.12	0.58	300	63.49	0.44	$1,511	126,561
6679	Summerset Drive	SAI17058	SAI17057	82.44	250	0.013	0.01345	69.06	23.12	0.44	300	112.28	0.33	$1,511	124,567
8095	Yonge Street	SAP25139	SAP25140	117.63	250	0.013	0.004	37.66	19.78	0.56	300	61.23	0.42	$1,511	177,739
8094	Yonge Street	SAP25140	SAP25141	120.26	250	0.013	0.00407	37.99	19.77	0.53	300	61.77	0.40	$1,511	181,713
1171	Ferndale	SAI13131	SAI13095	29.16	250	0.013	0.00309	33.10	16.10	0.56	300	53.82	0.43	$1,511	44,061
118	Patterson	SAI13174	SAI13173	95.29	250	0.013	0.00493	41.81	15.24	0.54	300	67.98	0.54	$1,511	143,983
117	Patterson	SAI13173	SAI13172	99.6	250	0.013	0.00452	40.03	15.23	0.54	300	65.09	0.54	$1,511	150,496
107	Patterson	SAI13172	SAI13171	42.2	250	0.013	0.00545	43.96	15.23	0.5	300	71.48	0.49	$1,511	63,764
C122	Hammer Street	SAC09048	SAC09047	49.51	250	0.013	0.00465	40.61	25.62	0.51	300	66.02	0.39	$1,511	74,810
C121	Hammer Street	SAC09047	SAC09045	55.06	250	0.013	0.00291	32.12	22.78	0.53	300	52.23	0.41	$1,511	83,196
C120	Hammer Street	SAC09045	SAC09046	58.1	250	0.013	0.00431	39.09	19.00	0.42	300	63.56	0.36	$1,511	87,789
C119	Hammer Street	SAC09046	SAC09026	10.8	250	0.013	0.00648	47.93	18.60	0.44	300	77.94	0.34	$1,511	16,319
C118	Hammer Street	SAC09026	SAC09025	35.9	250	0.013	0.00529	43.31	21.10	0.41	300	70.42	0.34	$1,511	54,245
C117	Hammer Street	SAC09025	SAC09024	68.8	250	0.013	0.0048	41.26	20.40	0.43	300	67.08	0.34	$1,511	103,957
C116	Hammer Street	SAC09024	SAC09023	63	250	0.013	0.00461	40.43	19.50	0.43	300	65.74	0.33	$1,511	95,193
C115	Hammer Street	SAC09023	SAC09022	49.4	250	0.013	0.00547	44.04	19.20	0.41	300	71.61	0.32	$1,511	74,643
C114	Hammer Street	SAC09022	SAC09021	45.2	250	0.013	0.00509	42.48	19.00	0.42	300	69.07	0.32	$1,511	68,297
C113	Hammer Street	SAC09021	SAC09002	71.4	250	0.013	0.00546	44.00	18.60	0.4	300	71.54	0.31	$1,511	107,885
S511	Kingsridge	SAH03039	SAH03049	20.62	250	0.013	0.0063	47.26	22.87	0.51	300	76.85	0.39	$1,511	31,157
6659	Harvie	SAB05079	SAB05080	67.13	300	0.013	0.00445	64.59	43.78	0.67	375	117.09	0.46	$1,353	90,827
6660	Harvie	SAB05080	SAB05081	65.01	300	0.013	0.00665	78.95	43.77	0.58	375	143.13	0.41	$1,353	87,959
19	Harvie	SAB05081	SAB05082	115	300	0.013	0.00969	95.31	43.77	0.52	375	172.78	0.37	$1,353	155,595
6031	Harvie	SAB05082	SAB05083	103.9	300	0.013	0.03521	181.67	43.77	0.36	375	329.35	0.27	$1,353	140,577
6032	Harvie	SAB05083	SAB05084	99.51	300	0.013	0.01025	98.02	43.77	0.51	375	177.70	0.36	$1,353	134,637
6662	Harvie	SAB05084	SAB05085	62.5	300	0.013	0.01328	111.57	43.77	0.48	375	202.27	0.35	$1,353	84,563
7409	Harvie	SAB05085	SAB05086	115.8	300	0.013	0.02074	139.43	50.41	0.48	375	252.77	0.33	$1,353	156,677
7307	Harvie	SAB05086	SAB05087	121.35	300	0.013	0.02341	148.14	50.41	0.62	375	268.55	0.41	$1,353	164,187
7308	Harvie	SAB05087	SAB03002	113.48	300	0.013	0.00486	67.50	50.38	0.69	375	122.36	0.47	$1,353	153,538
S902	Ester	SAP25089	SAP25049	72.14	300	0.013	0.00568	72.97	22.54	0.59	375	132.28	0.41	$1,353	97,605
S903	Ester	SAP25049	SAP25051	59.5	300	0.013	0.00336	56.12	36.93	0.61	375	101.74	0.43	$1,353	80,504
S904	Ester	SAP25051	SAP25052	60.1	300	0.013	0.00433	63.71	36.93	0.57	375	115.50	0.41	$1,353	81,315
S905	Ester	SAP25052	SAP25053	119.9	300	0.013	0.01326	111.49	37.80	0.44	375	202.11	0.32	$1,353	162,225
S906	Ester	SAP25053	SAP25054	73.8	300	0.013	0.01149	103.78	38.50	0.46	375	188.14	0.34	$1,353	99,851
S907	Ester	SAP25054	SAP25055	74.2	300	0.013	0.01048	99.12	38.50	0.46	375	179.68	0.34	$1,353	100,393
S908	Ester	SAP25055	SAP24021	99.88	300	0.013	0.00432	63.64	40.58	0.63	375	115.36	0.43	$1,353	135,138
S909	Ester	SAP24021	SAP24020	52.05	300	0.013	0.00519	69.75	43.34	0.61	375	126.45	0.43	$1,353	70,424
S910	Ester	SAP24020	SAP24019	52.82	300	0.013	0.00549	71.74	43.34	0.6	375	130.05	0.43	$1,353	71,465
S911	Ester	SAP24019	SAP24018	65.21	300	0.013	0.00368	58.73	44.12	0.67	375	106.47	0.47	$1,353	88,229
S912	Ester	SAP24018	SAP24017	51.26	300	0.013	0.008	86.60	44.12	0.56	375	156.99	0.40	$1,353	69,355
S913	Ester	SAP24017	SAP24014	188.8	300	0.013	0.01194	105.79	44.12	0.49	375	191.79	0.36	$1,353	255,446
S914	Ester	SAP24014	SAP24013	22.6	300	0.013	0.03014	168.09	44.40	0.39	375	304.71	0.29	$1,353	30,578
S915	Ester	SAP24013	SAP24012	29	300	0.013	0.02034	138.08	44.40	0.44	375	250.32	0.32	$1,353	39,237
S916	Ester	SAP24012	SAP24011	43.7	300	0.013	0.01625	123.42	46.40	0.46	375	223.74	0.33	$1,353	59,126
S917	Ester	SAP24011	SAP24009	67.46	300	0.013	0.00815	87.41	46.64	0.57	375	158.45	0.41	$1,353	91,273
S918	Ester	SAP24009	SAP24008	29.55	300	0.013	0.01117	102.33	47.45	0.54	375	185.50	0.38	$1,353	39,981
S919	Ester	SAP24008	SAP24007	56.06	300	0.013	0.00678	79.72	47.44	0.61	375	144.52	0.43	$1,353	75,849
6037	Cumming	SAB05076	SAB05077	87.19	300	0.013	0.00286	51.78	20.40	0.52	375	93.87	0.37	$1,353	117,968
6323	Cumming	SAB05077	SAB05078	87.7	300	0.013	0.00344	56.79	26.40	0.5	375	102.94	0.36	$1,353	118,658
6030	Cumming	SAB05078	SAB05079	91.4	300	0.013	0.00394	60.77	26.40	0.49	375	110.17	0.35	$1,353	123,664
203	Sproule	SAI16017	SAI16018	87.04	300	0.013	0.00175	40.50	20.21	0.51	375	73.42	0.36	$1,353	117,765
202	Sproule	SAI16018	SAI16019	74.97	300	0.013	0.00227	46.13	23.61	0.51	375	83.62	0.37	$1,353	101,434
201	Sproule	SAI16019	SAI16028	46.94	300	0.013	0.00215	44.89	24.12	0.51	375	81.38	0.38	$1,353	63,510
200	Sproule	SAI16028	SAI16027	83.07	300	0.013	0.0022	45.41	24.13	0.55	375	82.33	0.41	$1,353	112,394
8527	Empire	SAH08079	SAH04062	20.92	300	0.013	0.00502	68.60	28.99	0.51	375	124.36	0.36	$1,353	28,305
8526	Empire	SAH04062	SAH04055	89.4	300	0.013	0.00401	61.31	28.99	0.47	375		0.26	$1,353	120,958
114	Patterson	SAI12024	SAI11024	17.03	350	0.013	0.01174	158.22	30.70	0.55	375	190.18	0.51	$1,353	23,042
N071	Duckworth	SAN08034	SAN08033	100	375	0.013	0.01	175.52	153.55	0.64	450	285.38	0.49	$1,546	154,600
N070	Duckworth	SAN08033	SAN08032	118.61	375	0.013	0.00497	123.74	129.67	0.71	450	201.19	0.54	$1,546	183,371
N069	Duckworth	SAN08032	SAN08031	120.8	375	0.013	0.02567	130.90	129.67	0.42	450		0.34	$1,546	186,757

Sanitary Sewer Replacements (Existing sanitary sewers where d/D>0.5, for diameters up to and including 375mm)

Sewer ID	Street	Inlet Node	Outlet Node	Length	Diameter	Mannings n	Slope (m/m)	Q Mannings	2041 Peak Flow	2041 d/D	Proposed	Q Mannings	Replacement	Unit Cost	Estimated Cost
N068	Duckworth	SAN08031	SAN08028	105.5	375	0.013	0.03092	130.90	129.20	0.4	450		0.32	$1,546	163,103
N067	Grove	SAN08028	SAN08027	43.38	375	0.013	0.00609	136.97	128.58	0.68	450	222.70	0.52	$1,546	67,065
N066	Grove	SAN08027	SAN08026	23.97	375	0.013	0.00668	143.45	128.55	0.68	450	233.24	,53	$1,546	37,058
N065	Grove	SAN08026	SAN08025	69.48	375	0.013	0.01036	178.65	127.34	0.56	450	290.47	0.44	$1,546	107,416
N064	Grove	SAN08025	SAN08024	73.3	375	0.013	0.04317	364.68	127.30	0.41	450	592.94	0.32	$1,546	113,322
N063	Grove	SAN08024	SAN08023	81	375	0.013	0.02048	251.18	124.50	0.44	450	408.40	0.35	$1,546	125,226
N062	Grove	SAN08023	SAN08005	47.7	375	0.013	0.02283	265.20	124.50	0.44	450	431.19	0.35	$1,546	73,744
N042	Grove	SAN08005	SAN08004	98.6	400	0.013	0.00821	188.89	156.40	0.61	450	258.58	0.51	$1,546	152,436
N041	Grove	SAN08004	SAN08003	85.8	400	0.013	0.00967	205.00	154.80	0.57	450	280.63	0.49	$1,546	132,647
N040	Grove	SAN08003	SAN08002	91.8	400	0.013	0.00893	197.00	156.80	0.58	450	269.68	0.49	$1,546	141,923
N039	Grove	SAN08002	SAN08001	83.2	400	0.013	0.00985	206.90	156.60	0.58	450	283.23	0.48	$1,546	128,627
N038	Grove	SAN08001	SAN05001	46.1	400	0.013	0.02084	300.95	151.21	0.46	450	411.97	0.39	$1,546	71,271
5493	Ardagh	SAI17228	SAI17347	106.71	375	0.013	0.00225	83.26	52.12	0.67	450	135.37	0.49	$1,546	164,974
872	Ardagh	SAI17347	SAI17133	106.13	375	0.013	0.00236	85.27	52.08	0.57	450	138.64	0.49	$1,546	
1129	Miller Drive	SAI16034	SAI16035	42.38	375	0.013	0.00562	131.58	38.40	0.61	450	213.94	0.45	$1,546	65,519
1128	Miller Drive	SAI16035	SAI16036	49.66	375	0.013	0.00181	74.67	63.76	0.67	450	121.41	0.52	$1,546	76,774
8820	Country Lane	SAP09067	SAP09068	103.02	375	0.013	0.00301	96.30	61.43	0.65	450	156.57	0.47	$1,546	159,269
8819	Country Lane	SAP09068	SAP09069	111.74	375	0.013	0.00286	93.87	61.42	0.65	450	152.62	0.47	$1,546	172,750
8818	Country Lane	SAP09069	SAP09070	119.36	375	0.013	0.00285	93.70	61.42	0.67	450	152.35	0.48	$1,546	184,531
8817	Country Lane	SAP09070	SAP09071	113.56	375	0.013	0.00282	93.21	61.41	0.61	450	151.55	0.46	$1,546	175,564
8816	Country Lane	SAP09071	SAO09072	103.98	375	0.013	0.01241	195.53	61.41	0.42	450	317.91	0.32	$1,546	160,753
8815	Country Lane	SAP09072	SAP09073	50.58	375	0.013	0.00415	113.07	61.41	0.57	450	183.84	0.42	$1,546	78,197
18977	Country Lane	SAP09073	SAP09018	15.69	375	0.013	0.00446	117.22	61.41	0.61	450	190.58	0.45	$1,546	24,257
8864	Country Lane	SAP09018	SAP09020	83.13	375	0.013	0.00361	105.46	61.40	0.57	450	171.46	0.43	$1,546	128,519
S1097	Byrne	SAP06008	SAP32022	70.23	375	0.013	0.00215	81.38	37.26	0.51	450	132.32	0.39	$1,546	108,576
S1096	Byrne	SAP32022	SAP32002	31.02	375	0.013	0.0029	94.52	38.00	0.66	450	153.68	0.54	$1,546	47,957
S784	Lougheed	SAP02020	SAP02019	109.52	375	0.013	0.00411	112.52	59.47	0.51	450	182.95	0.39	$1,546	169,318
S785	Lougheed	SAP02019	SAP02018	35.37	375	0.013	0.00339	102.19	59.56	0.54	450	166.16	0.41	$1,546	54,682
S786	Lougheed	SAP02018	SAP02017	60.43	375	0.013	0.00397	110.59	59.80	0.52	450	179.81	0.40	$1,546	93,425
S787	Lougheed	SAP02017	SAP02016	46.41	375	0.013	0.00366	106.18	59.88	0.53	450	172.65	0.41	$1,546	71,750
S788	Lougheed	SAP02016	SAP02015	109.14	375	0.013	0.00394	110.17	59.87	0.52	450	179.13	0.40	$1,546	168,730
S789	Lougheed	SAP02015	SAP02014	21.03	375	0.013	0.0038	108.20	59.87	0.53	450	175.92	0.41	$1,546	32,512
S790	Lougheed	SAP02014	SAP02010	74.02	375	0.013	0.00378	107.91	66.13	0.56	450	175.45	0.42	$1,546	114,435
S791	Lougheed	SAP02010	SAP02011	62.38	375	0.013	0.00753	152.31	66.13	0.51	450	247.64	0.39	$1,546	96,439
S792	Lougheed	SAP02011	SAP02012	29.62	375	0.013	0.00574	132.98	66.40	0.53	450	216.21	0.40	$1,546	45,793
S793	Lougheed	SAP02012	SAP02019	62.5	375	0.013	0.01471	212.88	66.50	0.39	450	346.12	0.30	$1,546	96,625
S794	Lougheed	SAP02019	SAP02013	32.5	375	0.013	0.02518	278.52	66.40	0.34	450	452.84	0.27	$1,546	50,245
S795	Lougheed	SAP02013	SAP02004	30.16	375	0.013	0.00332	101.13	66.94	0.58	450	164.43	0.44	$1,546	46,627
S796	Lougheed	SAP02004	SAP02003	28.08	375	0.013	0.00463	119.43	66.94	0.55	450	194.18	0.42	$1,546	43,412
S797	Lougheed	SAP02003	SAP02002	93.42	375	0.013	0.01028	177.96	93.60	0.59	450	289.34	0.47	$1,546	144,427
S996	Upstream of Trunk	SAH04123	SAH04121	25.81	375	0.013	0.00542	129.22	61.48	0.51	450	210.10	0.39	$1,546	39,902
S997	Upstream of Trunk	SAH04121	SAH04009	71.44	375	0.013	0.06495	447.31	61.50	0.25	450	727.29	0.2	$1,546	110,446
388	Ferndale	SAI06199	SAI06013	79.08	375	0.013	0.00329	100.67	57.09	0.54	450	163.69	0.50	$1,546	122,258

APPENDIX D

Capacity at Boundary Assessment

COLE

Memorandum

DATE:	June 21, 2019
TO:	Tom Reeve, Ralph Scheunemann, City of Barrie
FROM:	Christine Hill, COLE Engineering
CC:	Michelle Albert, WSP
OUR REF.#:	2017-0333
SUBJECT:	City of Barrie Wastewater Collection System – System Capacity at City Boundaries

As part of the City of Barrie Wastewater Collection System Master Plan Study, an analysis has been completed to assess what wastewater collection system capacity would be available to provide wastewater servicing to adjacent municipalities in the future. It is noted that this assessment did not consider available treatment capacity at the Barrie WwTF. This analysis was completed using the calibrated wastewater collection system model, developed as part of the City of Barrie Wastewater Collection System Master Plan.

In completing this assessment, a number of sanitary sewers which border the City's boundaries were identified and information developed for each location. Locations were selected if they were in close proximity to the City's boundary and located on a road allowance which extended into a neighbouring municipality. A screening level analysis was completed to identify potential locations. Table 1.1 presents the screening assessment.

Table 1.1 Screening Analysis Results

Location	Critical Downstream Capacity Issues	Results of Screening Assessment
Node 653 (County Road 27 and City's south boundary) – proposed 250mm	Flow from this node would be conveyed to the West Annex SPS and pumped to the McKay Road Trunk Sewer. Upgrade of West Annex SPS beyond planned capacity would be needed.	Not carried forward in detailed analysis.
Node 684 (Sewry Road and City's south boundary) – proposed 250mm	Flow from this node would be conveyed by gravity to McKay Road Trunk Sewer. Local sewer on Sewry has excess capacity.	Grouped with Nodes 728 and 757 due to proximity and common downstream sewer. Carried forward.

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Table 1.1 Screening Analysis Results

Location	Critical Downstream Capacity Issues	Results of Screening Assessment
Node 728 (Reid Drive north of City's south boundary) – proposed 250mm	Flow from this node would be conveyed by gravity to McKay Road Trunk Sewer. Located in close proximity to Node 684. Local sewer on Reid has excess capacity.	Grouped with Nodes 684 and 757 and carried forward.
Node 757 (Bowman Street at City's south boundary)- proposed 250mm	Flow from this node would be conveyed by gravity to McKay Road Trunk Sewer. Located in close proximity to Nodes 684 and 728. Local sewer on Bowman has excess capacity.	Grouped with Nodes 684 and 728 and carried forward.
Node 771 (Street east of Bowman Street at City's south boundary) – proposed 250mm	Flow from this node would be conveyed by gravity to McKay Road Trunk Sewer. The 250mm diameter section located immediately upstream of McKay Street will have a d/d that will be close to the City's design guidelines (d/D<0.5) in 2041.	Not carried forward.
Node 782 (Rawson Avenue at City's south boundary) – proposed 250mm	Flow from this node would be conveyed by gravity to McKay Road Trunk Sewer. The 250mm diameter section located immediately upstream of McKay Street will have a d/D that will be close to the City's design guidelines (d/D<0.5) in 2041	Not carried forward.
Node 789 (Huronia Road at City's south boundary) – proposed 525mm	Huronia Trunk Sewer discharges into Lovers Creek Trunk Sewer. No specific capacity issues identified.	Carried forward for detailed analysis.
Node 216 (Finsbury Street at City's south boundary) – proposed 250mm	Flows conveyed into upstream section of Lovers Creek Trunk Sewer. There are downstream upgrades required for existing conditions.	Not carried forward for analysis.
Node 114 (Yonge Street at City's south boundary) – proposed 300mm	Flows conveyed into upstream section of Lovers Creek Trunk Sewer. There are downstream upgrades required for existing conditions.	Not carried forward for analysis.
Node 57 (Kneeshawk Drive at City's south boundary) – proposed 250mm	Flows conveyed into upstream sections of Lakeshore Trunk Sewer. Located in close proximity to Node 63. No specific capacity issues identified.	Grouped with Node 63 and carried forward.

Table 1.1 Screening Analysis Results

Location	Critical Downstream Capacity Issues	Results of Screening Assessment
Node 63 (Prince William Way at City's south boundary) – proposed 450mm	Flows conveyed into upstream sections of Lakeshore Trunk Sewer. Located in close proximity to Node 57. No specific capacity issues identified.	Grouped with Node 57 and carried forward.
Node 104 (20 Sideroad and Lockhart Road) – proposed 250mm	Flows conveyed into East Annex SPS. Upgrade of East Annex SPS beyond planned capacity would be needed.	Not carried forward in detailed analysis.
Node 23 (Big Bay Point Road and 20 Sideroad) – proposed 250mm	Flows conveyed into East Annex SPS. Upgrade of East Annex SPS beyond planned capacity would be needed.	Not carried forward in detailed analysis.
Node SAH04030 (Prince William Way and Big Bay Point Road) – existing 450mm	Flows conveyed into upstream sections of Lakeshore Trunk Sewer. No specific capacity issues identified.	Carried forward for detailed analysis.
Node SAL08053 (Grove Street and Penetanguishene Sideroad) – existing 525mm	Flows conveyed by Lakeshore North Trunk Sewer. No specific capacity issues identified.	Carried forward for detailed analysis.
Node SAI16011 (Bayfield Road at City's north boundary) – existing 250mm	Flows conveyed by Lakeshore North Trunk Sewer. Local upgrades were identified in the downstream sewer.	Not carried forward.
Node SAC10007 (Ann Street at City's north boundary) – existing 250mm	Flows conveyed Lakeshore North Trunk Sewer. Local sewer immediately downstream of this node is at capacity under 2041 conditions.	Not carried forward.
Node SAC10048 (Sunnidale Road at City's north boundary – existing 250mm	Flows conveyed Lakeshore North Trunk Sewer. No specific capacity issues identified.	Carried forward for detailed analysis.
Node SAI06159 (Ferndale Drive north at City's north boundary) – existing 250mm	Flows conveyed Lakeshore North Trunk Sewer. An upgrade was identified under existing conditions in a downstream sewer and there are several shallow maintenance holes located downstream.	Not carried forward
Node SAI16035 (Tiffin Street at City's west boundary) – existing 450mm	Flows conveyed Tiffin Street sanitary sewer. Significant upgrades required in downstream sewer.	Not carried forward for detailed analysis.

Table 1.1 Screening Analysis Results

Location	Critical Downstream Capacity Issues	Results of Screening Assessment
Node SAN17345 (Ardagh Street at City's west boundary) – existing 250mm	Flows conveyed Tiffin Street sanitary sewer. Significant upgrades required in downstream sewer.	Not carried forward for detailed analysis.
Node SAP02083 (Mapleview Drive at City's west boundary) – existing 300mm	Flows conveyed to Holly Road SPS (SPS5). Upgrades would be required to SPS5, beyond current expansion.	Not carried forward in detailed analysis.
Node SAP02003 (Mabern Street at City's west boundary) – existing 525mm	Flows conveyed to Holly Road SPS (SPS5). Upgrades would be required to SPS5, beyond current expansion.	Not carried forward in detailed analysis.
Node 536 (Salem Road at City's west boundary) – proposed 300mm	Flows conveyed to Holly Road SPS (SPS5). Upgrades would be required to SPS5, beyond current expansion.	Not carried forward in detailed analysis.
Node 607 (County Road 27 and Essa Road)	Flows conveyed to West Annex SPS. Upgrade of West Annex SPS beyond planned capacity would be needed.	Not carried forward in detailed analysis.

Based on the above, the following locations were reviewed in detail and the following constraints and opportunities identified:

- Nodes 684/728 and 757 - These potential connection points are located upstream of the proposed McKay Road Trunk Sewer (Project 21101). The McKay Road Trunk Sewer will have excess capacity in 2041 and 2071. Local sewers on Sewry, Veterans Drive and Bowman are all 250mm in diameter and will have excess capacity under 2041 conditions. It is important to note that the City's design standards require that the d/D for sanitary sewers less than or equal to 375mm in diameter is a maximum of 0.5 at peak flow conditions.

- Node 789 - This potential connection point is the upstream maintenance hole planned for the Huronia Trunk Sewer (Project 21401). A 525mm sanitary sewer is planned at this location and will have excess capacity under 2041 and 2071 conditions.

- Node 57/63 – These potential connection points are located upstream of the Hewitts Creek extension (Project 22101). Both downstream sewers will have excess capacity in 2041 and 2071. It is noted that Node 57 is located on a 250mm diameter sanitary sewer while Node 63 is located on a 450mm diameter sanitary sewer.

- Node SAH04030 – This potential connection is the upstream maintenance hole for an existing 450mm diameter sanitary sewer on Prince William Way.

- Node SAL08053 - This potential connection is located on Penetanguishene Sideroad, downstream of an existing sanitary sewer identified as a capacity issue. The sewer downstream of this node is 525mm in diameter and does have excess capacity in 2041 and 2071.
- Node SAC10048 – This location is at Sunnidale Road. The downstream sanitary sewer is 250mm in diameter and does have excess capacity. It is noted that there are several shallow maintenance holes located downstream of this connection point.

To assess available capacity at each of the above locations, analysis of 2041 and 2071 conditions was completed. The analysis identified the maximum flow that could be contributed at each location and still achieve the City's design requirements for d/D (maximum of 0.5 for sanitary sewer with diameter of 375 and less and maximum of 0.7 for sanitary sewers greater than 375mm diameter). To assess the impact of the accepting flow at each potential connection point, model runs were completed for 2041 and 2071 conditions to assess system wide and downstream impacts. Based on these results, recommendations were made for each location. To assess the maximum additional flow that could be conveyed by from a neighbouring municipality, capacity limitations downstream of the potential connection point were identified. **Table 1.2** presents the maximum additional flow at each location and provides a summary of the 2041 and 2071 results. **Table 1.2** also identifies the limiting capacity downstream sewer identified through the analysis. For most of the potential connection points, the limiting capacity downstream sewers were found to be located close to the potential connection point.

Table 1.2 Potential Connection Points Assessment

Node ID	Maximum Additional Flow from Neighbouring Municipality (L/s)	Results of 2041 and 2071 Modelling Assessments
684/728/757	33.0	Planned sewers will have adequate capacity to allow a maximum flow of 33 L/s to be contributed at nodes 684 (12 L/s), 728 (6 L/s) and 757 (15 L/s) under 2041 and 2071 conditions. Limiting capacity downstream sewers are located on Sewry Road immediately downstream of the East Annex Pumping Station forcemain discharge (684), on Veterans Drive south of McKay Road (728), and on Bowman Street south of McKay Road (757).
789	45.0	Planned sewers will have adequate capacity to allow a maximum flow of 45 L/s to be contributed at boundary to node 789 under 2041 and 2071 conditions. The limiting capacity downstream sewer is located on Huronia Road immediately north of the City's southern boundary.
57/63	108.0	Existing and future sewers have adequate capacity for 2041 and 2071 conditions to allow a maximum flow of 100 L/s to be contributed at boundary to Node 63 and 8 L/s to be contributed at boundary at Node 57. Limiting capacity downstream sewers are located on Kneeshawk Road

Table 1.2 Potential Connection Points Assessment

Node ID	Maximum Additional Flow from Neighbouring Municipality (L/s)	Results of 2041 and 2071 Modelling Assessments
		immediately north of the City's southern boundary (57) and on Prince William Way immediately north of the City's southern boundary.
SAH04030	59.0	Existing and future sewers have adequate capacity for 2041 and 2071 conditions to allow a maximum flow of 59 L/s to be contributed at boundary at Node SAH04030. The limiting capacity downstream sewer is located on Prince William Way immediately south of Big Bay Point Road.
SAL08053	50.0	Existing sewers have adequate capacity for 2041 and 2071 conditions to allow a maximum flow of 50 L/s to be contributed at boundary. Maximum water level in a portion of the trunk sewer downstream will provide less than 1.8m of freeboard. However, no surcharge is predicted. The limiting capacity downstream sewer is located on Johnson Street at Blake Street.
SAC10048	10.0	Existing sewers have adequate capacity for 2041 and 2071 conditions to allow a maximum flow of 10 L/s to be contributed at boundary. The limiting capacity downstream sewer is located on Sunnidale Road west of Livingstone Road.

Summary and Recommendations

Based on the analysis of the planned wastewater system in 2041 and 2071, there will be excess capacity available in the system to convey additional flow from neighbouring municipalities. A screening level analysis and modelling analysis have been completed to identify the sewers at the City's boundaries that could accept additional flow. In total, an additional peak flow of 300 L/s could be accommodated within the system at a total of nine locations. It is noted that the modelling exercise has been completed using the calibrated wastewater collection system and that calibration data was available for a total of 15 locations. It is recommended that the City undertake flow data collection in any sewer being considered for accepting flows from a neighbouring municipality as well as confirmation modelling and/or analysis before proceeding.