Region of Peel
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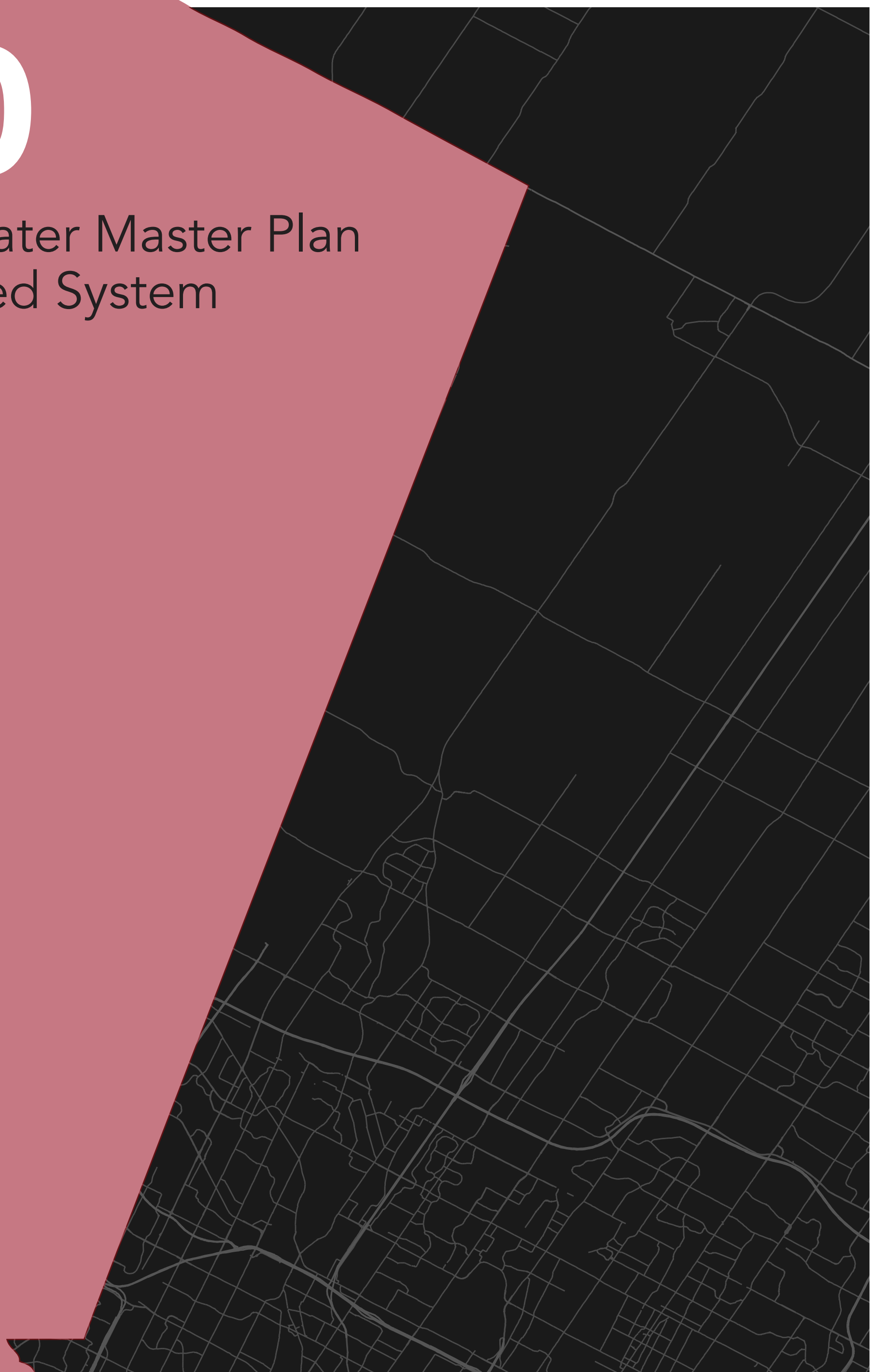
2020

Water & Wastewater Master Plan for the Lake-Based System



VOLUME 4

Wastewater Master Plan

Prepared by: GM BluePlan Engineering

2020 Water and Wastewater Master Plan for the Lake-Based Systems Class Environmental Assessment Study Report Outline

The report for the 2020 Water and Wastewater Master Plan for the Lake-based Systems ("2020 Master Plan") is a comprehensive document that describes the planning, evaluation, and decision-making process for developing the long-term water and wastewater strategies in the Region of Peel. The master plan documentation is compliant with the requirements of the *Environmental Assessment Act* and is being placed on public record for the prescribed review period.

The 2020 Master Plan Report is organized into five volumes:

Volume 1 – Executive Summary
Provides a brief overview of the 2020 Master Plan. It summarizes the information contained in Volumes 2, 3, 4 and 5, including problem statement, purpose of the study, planning, policy and technical considerations, and description of the preferred water and wastewater servicing strategies, including depiction of the projects and capital programs.

Volume 2 – Background and Planning Context
Details the master planning process including the Class EA process for Master Plans, related studies and background information, legislative and policy planning context, water and wastewater servicing principles and policies, population and employment growth forecasts, existing environmental and servicing conditions and future considerations.

Volume 3 – Water Master Plan
Provides the comprehensive documentation for the water system and details the study objectives, approach, methodologies, technical analyses, evaluation and selection of the preferred water servicing strategy. This volume contains baseline water system data and performance information. This volume documents the water servicing strategy development, with detailed information on the projects and capital program associated with the preferred water servicing strategy.

Volume 4 – Wastewater Master Plan
Provides the comprehensive documentation for the wastewater system and details the study objectives, approach, methodologies, technical analyses, evaluation and selection of the preferred wastewater servicing strategy. This volume contains baseline wastewater system data and performance information. This volume documents the wastewater servicing strategy development, with detailed information on the projects and capital program associated with the preferred wastewater servicing strategy.

Volume 5 – Public and Agency Consultation
Contains all relevant documentation of the public consultation process including notices, comments and responses, and distribution information. Presentation material from all public information centres (PICs) held during the process is included. Additional presentation materials and discussion information from workshops held with relevant agencies, approval bodies and other stakeholders are also included.

The following sections present Volume 4 which is one of five volumes that make up the complete 2020 Water and Wastewater Master Plan Report and should be read in conjunction with the other volumes.

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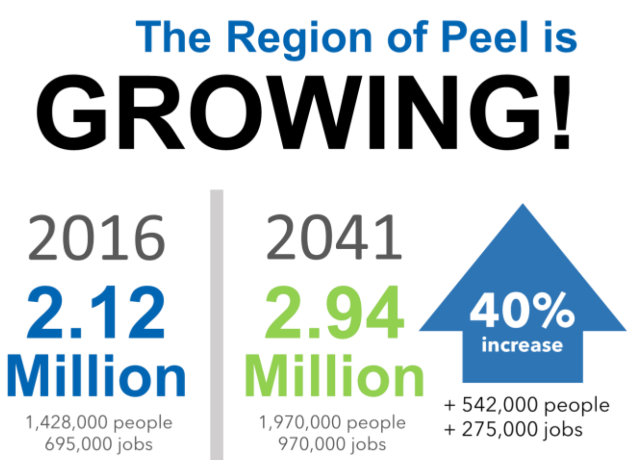
1.0 Introduction

1.0 Introduction

1.1 Background

The Region of Peel is made up of three local municipalities: the City of Mississauga, the City of Brampton, and the Town of Caledon. Located in southern Ontario, the Region of Peel is part of the Greater Golden Horseshoe area, one of the most dynamic and fast-growing regions in Canada and North America.

The Region of Peel is responsible for water treatment, transmission and distribution mains, storage facilities and pumping stations, as well as wastewater treatment, sanitary sewers, force mains and sewage pumping stations. The Region builds and maintains infrastructure to treat, deliver and move water and wastewater across the Region.



As one of the fastest growing municipalities in Ontario, the Region of Peel and its Public Works department recognizes that readily available and accessible public water and wastewater infrastructure is essential to the viability of existing and growing communities across the Region. The *Places to Grow Act* and supporting documentation has identified the 2041 residential and employment projection for the Region of Peel. The Region of Peel's population is expected to grow to almost 2 million people by 2041[1]. This means that by 2041, the Region needs to accommodate water and wastewater servicing for over 542,000 new residents and 275,000 additional jobs.

To balance the needs of growth with the protection and preservation of natural, environmental and heritage resources, the Region of Peel initiated an update of its water and wastewater master plan.

The 2020 Water and Wastewater Master Plan for the Lake-Based Systems ("2020 Master Plan") is a study intended to address the increasing demands on the Region's water and wastewater infrastructure. The study provides a review, evaluation, and development of water and wastewater servicing strategies for all servicing needs within the lake-based systems in the cities of Mississauga and Brampton and parts of the Town of Caledon. The 2020 Master Plan does not examine the groundwater-based systems or communal wastewater systems in Caledon as they are addressed separately by the Region.

The 2020 Master Plan builds on previous work undertaken as part of the 1999 Master Plan, the 2002 Master Plan Addendum, the 2007 Master Plan, and the 2013 Master Plan. The master plan is a critical component of the Region's growth management strategy and will provide the framework and vision for the water and wastewater servicing needs for the lake-based service areas of the Region to 2041 and beyond. In addition, the 2020 Master Plan serves as the basis for short-term and long-term infrastructure programming and capital budgeting. The 2020 Master Plan is the foundation for the water and wastewater program as part of the Region of Peel's Development Charges (DC) Background Study and By-law update.

1.2 Water and Wastewater Master Plan Objectives

The 2020 Master Plan comprehensively documents the development, evaluation and selection of the preferred water and wastewater servicing strategies to meet the servicing needs of existing and future development to 2041.

The key objectives of the 2020 Water and Wastewater Master Plan are as follows:

- Identify a preferred lake-based water and wastewater servicing strategy to support existing servicing needs and projected growth.
- Coordinate with the Regional Official Plan Amendment (ROPA), which guides provincially mandated growth within the Region to 2041.
- Emphasis on intensification impacts, consideration of post-2041 growth and alignment with the Regional Strategic Plan.
- Provide the need, timing and cost of servicing and infrastructure.
- Follow the Municipal Class Environmental Assessment process for master plans.

The 2020 Master Plan study incorporates the latest planning information, modelling tools, historical flow and demand data, and servicing studies to complete a full review and update of the servicing strategies. The study also reviews the Region's capital plan to meet the current servicing agreements with York Region and the City of Toronto.

This study follows Approach 1 of the Class Environmental Assessment (EA) process for master plans. The approach involves preparing a master plan document at the conclusion of Phase 1 and 2 of the Class EA process. This approach allows for Schedule A, A+ identified in the master plan to move forward to implementation and become the basis for future investigations for specific Schedule B and C projects.

1.3 Problem Opportunity Statement

The problem or opportunity statement defines the principal starting point in the undertaking of the Class EA study and assists in defining the scope of the project. The problem or opportunity statement for the 2020 Master Plan for the Lake-Based Systems is defined as follows:

The Region of Peel has completed several updates to the water and wastewater master plan, completing the most recent update in 2013.

With an updated planning horizon to 2041, the Master Plan needs to be updated to determine how the Region's water and wastewater infrastructure will support growth in a sustainable and financially responsible manner.

The Master Plan will develop a long-term servicing strategy and capital forecast to ensure level of service for existing residents and businesses, to support future growth in the community through 2041, and to consider potential impacts post-2041.

1.4 Study Area

The Region of Peel is situated in the west-central inner ring of the Greater Golden Horseshoe area. The Region is bounded to the north by Dufferin County and Simcoe County, to the south by Lake Ontario, to the east by the City of Toronto and York Region, and to the west by Halton Region and Wellington County.

The Region of Peel is made up of three local municipalities: the City of Mississauga; the City of Brampton; and the Town of Caledon, as shown in **Figure 1.** The Region includes a diverse mix of urban, suburban, rural, agricultural and natural landscapes including the Oak Ridges Moraine, the Niagara Escarpment and the Greenbelt.

The Region of Peel covers an area of 1,247 square kilometres with a population of approximately 1.4 million people as listed in the 2016 census. The study area covers the existing and future lake-based water and wastewater systems. The groundwater-based systems and communal wastewater system in Caledon are not included in the scope of this study.

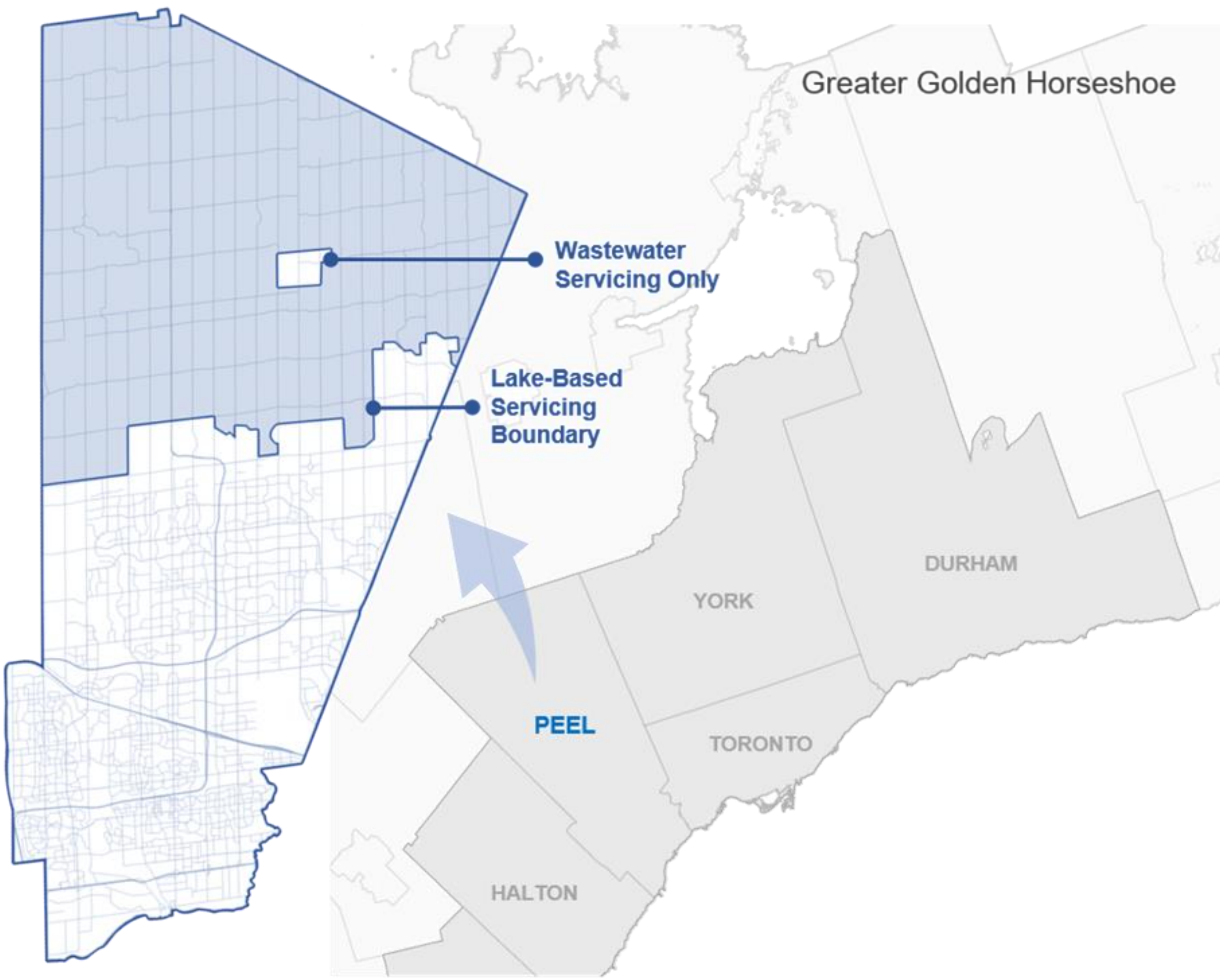


Figure 1 – Study area for the 2020 Water and Wastewater Master Plan.

2.0 Wastewater System Policy and Criteria

2.1 Wastewater Servicing Principles and Policies

2.2 Design Criteria – Flow Projections

2.3 Design Criteria – System Assessment

2.4 Cost Estimation Framework

2.0 Wastewater System Policy and Criteria

Wastewater policies, design criteria, and level of service requirements were updated as part of the 2020 Master Plan to provide guidelines and direction to the master planning process, in addition to ensuring that wastewater flows are adequately representative to support the decision making for sizing and timing of future infrastructure.

2.1 Wastewater Servicing Principles and Policies

A principles and policies paper was developed during the 2007 Master Plan and further updated during the 2013 Master Plan. Through the 2020 Master Plan, principles and policies were reviewed and updated to guide the development of wastewater servicing strategies.

In general, the Region's goal is to build and maintain efficient, reliable, sustainable, and well-managed wastewater systems that provide high level of service to the public. In order to capture these goals, the servicing principles and policies have been structured as follows:

General Water and Wastewater Policies

Outlines policies and guiding principles that impact both water and wastewater servicing.

- G.01: Municipal Servicing
- G.02: Environmental Protection
- G.03: Planning Horizon
- G.04: Reserve Capacity
- G.05: System Reliability and Security
- G.06: Location of Municipal Services and Facilities
- G.07: Climate Change
- G.08: Energy Efficiency
- G.09: Integrated Infrastructure Program
- G.10: Level of Service
- G.11: Inter-Regional Collaboration
- G.12: Sustainability
- G.13: Source Water Protection
- G.14: Term of Council Priorities

Wastewater Policies

Outlines policies and guiding principles that impact wastewater servicing only, including:

- WW.01: Health and Safety
- WW.02: Receiving Water Bodies
- WW.03: Wastewater Treatment and Collection Requirements
- WW.04: Wastewater Flow Projections
- WW.05: Separated Wastewater and Stormwater Systems
- WW.06: Wastewater Collection and Pumping Systems
- WW.07: Wet Weather Flow Criteria

For the complete list of servicing principles and policies, please refer to **Volume 2 – Appendix 2A**

2.2 Design Criteria – Flow Projections

The guiding principle for the design criteria is to ensure that flow projections are accurately predicted with an appropriate level of safety and risk management. This principle ensures that infrastructure has capacity to meet servicing requirements and that the timing of key infrastructure does not compromise operation of the facilities or impede approved and planned growth.

The development of design criteria is an element that has been reviewed during each master plan update and, as a result, has evolved over the years. As such, an analysis of wastewater design criteria was completed by the Region to ensure that the projected wastewater flows are accurate and reflect new trends to support decision making for the sizing and timing of future infrastructure. The Region produced a Design Criteria Memo which is included in **Appendix 4A**. The evolution of the wastewater design criteria is also presented in **Figure 2**. The following is a summary of the findings and recommendations:

- Treatment plant flow trends in the Region showed an average daily flow at the two wastewater treatment plants (WWTP)of approximately 287 L/person or employee/day over the last 10 years. An increasing flow trend and an element of inflow and infiltration in the average flows to the plant support adding a 10 percent safety factor that equates to **315 L/person or employee/day** for wastewater treatment plant flow projections. The criteria include base levels of inflow and infiltration and is meant to capture the average daily flow to the plants.
- Dry weather wastewater flow generation trends in the Region of Peel support the reduction of the average day wastewater design criteria from 302.8 to **285 L/person or employee/day** within the collection system. This represents a reduction of 5.9 per cent.
- As part of the Growth Management Initiative, discussions with the development industry led to the decision of discretizing a single design criterion into separate residential and non-residential components based on serviced population.
- The residential average day wastewater flow for collection system calculations will be **290 L/person/day**, while employment will be **270 L/employee/day.**
- Peak dry weather flow will continue to be calculated using the Harmon formula.
- There is evidence to support the increase of the extraneous flow allowance of 0.20 L/s/ha. The inflow and infiltration allowance will be **0.26 L/s/ha.**

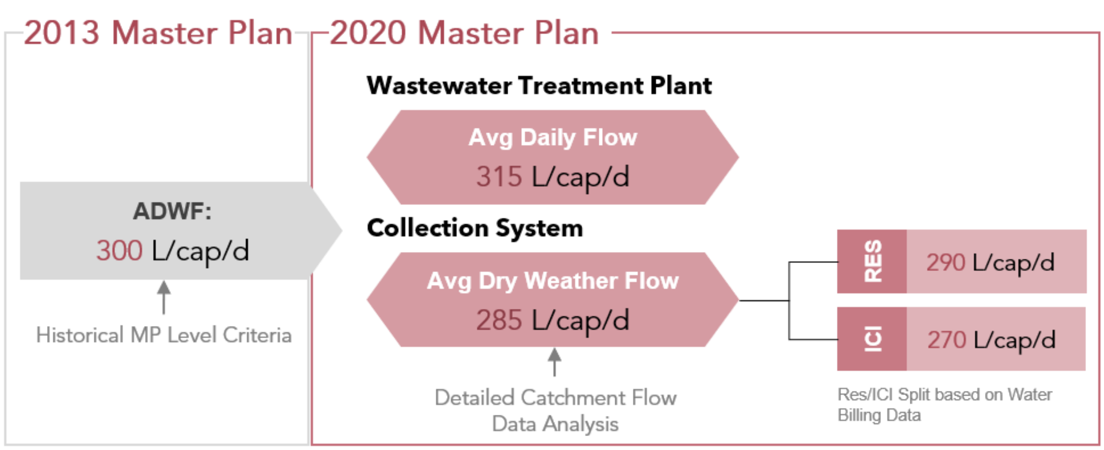


Figure 2 – Wastewater design criteria evolution.

Table 1 and **Table 2** provide a summary of the recommended wastewater design criteria for treatment plant and collection system components. The design criteria were used to identify wastewater infrastructure requirements for the 2020 Master Plan.

Table 1 – Wastewater design criteria for treatment plants.

Type of Development	Average Daily Flow
Residential	315 L/person/day
Employment	315 L/employee/day

Table 2 – Wastewater design criteria for collection system components.

Type of Development	Average Dry Weather Flow	Peaking Factor	Infiltration
Residential	290 L/person/day	Harmon (min 2, max 4)	0.26 L/s/ha
Employment	270 L/employee/day	Harmon (min 2, max 4)	0.26 L/s/ha

2.2.1 Wastewater Treatment - Hydraulic Flow Projections

Wastewater hydraulic flow projections are required in order to establish the capital infrastructure needs to service existing users and future growth. Consistent with previous Master Plans, the Region's wastewater hydraulic flow projections are calculated based on a "Starting Point" methodology. This methodology uses historical measured (actual) wastewater flows as a basis to calculate a representative *Starting Point* that will become the baseline for projecting future wastewater flows and assessing the hydraulic or liquid capacity of the treatment plants.

2.2.1.1 Starting Point Methodology

The starting point was calculated based on a 5-year rolling average as follows:

1. Compile data for the wastewater flows from each wastewater treatment facility for the past five years.
2. Subtract York Region and City of Toronto wastewater flows where applicable.
3. Calculate equivalent per capita flow rate for every year by dividing that year's average flows by the year's total residential serviced population.
4. Calculate the average of the equivalent per capita flow rate for the past five years (5-year rolling average).
5. Calculate the year's Starting Point by multiplying the year's serviced population by the 5-year rolling average and add back York and Toronto wastewater flows.

The calculation of the 2019 Hydraulic Starting Point is summarized as follows:

2019 Starting Point = (2019 Serviced Population x Equivalent per capita rate 5-year Rolling Average) + York + Toronto

2.2.1.2 Future Flow Projections

The approach to determine future wastewater flow projections continues to be based on establishing annual starting point and projecting growth flows from that point forward. Future growth average flows throughout the system at any given point are determined by multiplying the residential and employment growth forecasts by the design criteria presented in **Table 1**.

The future total flows are then determined by adding the future growth flow to the starting point (calculated using the 5-year rolling average methodology) and adding the York and Toronto flows based on the Inter-Regional Wastewater Servicing Agreement. The calculation of future wastewater flows can be summarized as follows:

2041 Flows = 2019 Starting Point + (2041 Growth x Design Criteria) + York + Toronto

Figure 3 and **Figure 4** present graphical representation of the starting point and future flow projections for the Region of Peel lake-based wastewater system. More detailed information about future wastewater flow projections are presented in **Section 4.3.1**.

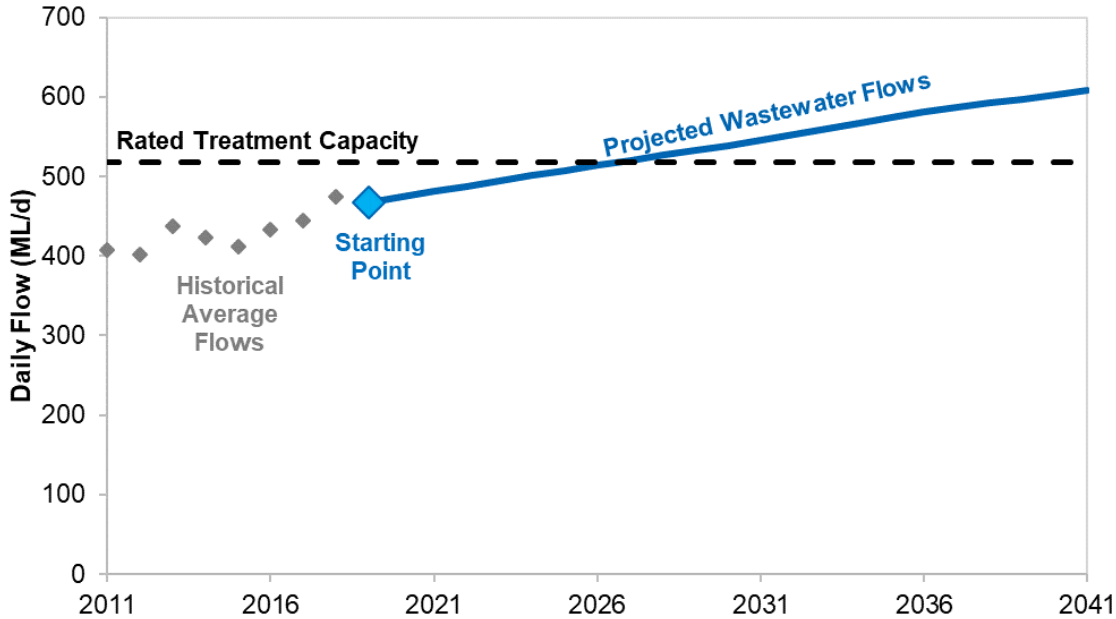


Figure 3 – G.E. Booth WWTP hydraulic starting point and future flow projections.

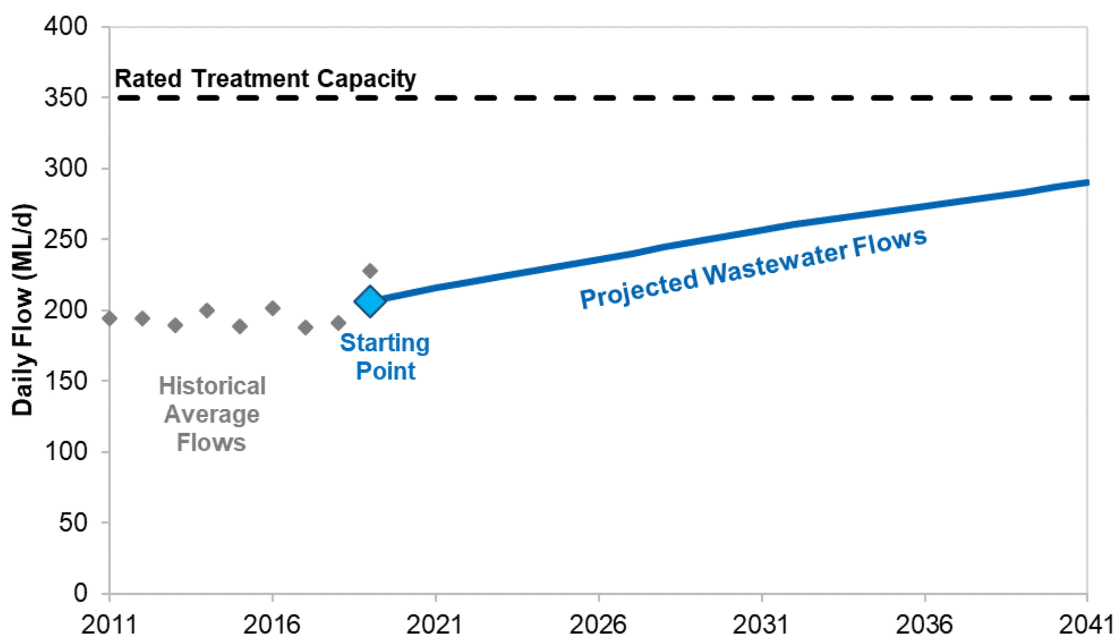


Figure 4 – Clarkson WWTP hydraulic starting point and future flow projections.

2.2.2 Wastewater Treatment - Loadings Projections

Wastewater organic loading projections were developed as part of the enhancements to the 2020 Master Plan and the development of servicing strategies.

Historically, master plan level WWTP projections have been focused on the Environmental Compliance Approval (ECA) rated hydraulic capacity. Through this Master Plan, additional review of the treatment plant processes and the limiting treatment process capacities were undertaken from both a hydraulics and organics loadings perspective. This provides the Region with an additional level of detail for identifying potential future capacity constraints at the plants. It is important to review both the hydraulic and organic loading capacity constraints at the plants in order to accurately plan for plant upgrades/expansions as well as future flow diversions between plant catchment areas.

2.2.2.1 Historical Loadings and Starting Point

For organic loadings projections and analysis within the Master Plan, Biochemical Oxygen Demand (BOD) was used. This parameter provides a direct link between liquids and biosolids capacity and overall, is a reasonable proxy to measure impacts to both Peel WWTPs.

Five years (2015-2019) of measured historical BOD loadings along with associated average concentrations for each WWTP were collected. As noted previously, a rolling average for the plant hydraulic projections is used. This is generally to account for more variable rainfall/wet weather conditions, whereas, it was assumed that year-over-year loadings won't fluctuate as dramatically and will steadily increase over time. As such, the starting point for loading projections was assumed to be equivalent to the measured 2019 loadings, as opposed to calculating the rolling average method.

2.2.2.2 Growth Loadings Projections

Similar to the hydraulic flow projections, the BOD loadings projections follow an approach based on establishing a yearly starting point and projecting growth loadings from that point forward. Future BOD loadings throughout the system are determined by multiplying residential population and employment forecasts by design criteria developed through discussions with subject matter experts in the industry and at the Region:

- General population criteria of **75 grams per person per day** was applied to residential growth increase between the existing 2019 starting point to 2041.
- General employment criteria of **37.5 grams per employee per day** was applied to employment growth increase between the existing 2019 starting point to 2041.

In addition, the Region has high strength users that contribute significant BOD to the wastewater system. There is potential that these high users could increase loadings and/or that new employment could develop that contribute high strength wastewater to the system. To account for the potential growth in both the number of high strength users as well as increase in loadings from existing high strength users, the loadings projections have assumed an overall high strength user BOD annual increase of 500 kg/d.

The design criteria for loading projections is summarized as follows:

Table 3 – Wastewater design criteria for loading projections.

Type of Development	BOD Loading
Residential	75 g/person/day
Employment	37.5 g/employee/day
High User Annual Increase	500 kg/d

2.2.2.3 High Strength Users and Geographical Distribution

High strength users were identified and are required to pay a surcharge payment to compensate the Region for additional costs of operation, repair, replacement or maintenance of the wastewater system associated with their high strength sewage discharge. The following summarizes the number of high strength users identified within each of the natural catchment areas of the WWTP for 2018:

- G.E. Booth WWTP Catchment = 119 high strength users which account for 35 per cent of the total loadings to the plant
- Clarkson WWTP Catchment = 16 high strength users which account for 4 per cent of the total loadings to the plant

The G.E. Booth WWTP receives significantly higher BOD loadings and concentration than the Clarkson WWTP due to the higher distribution of high strength users in the G.E. Booth WWTP catchment area.

The distribution of the high strength users in the catchment areas of the G.E. Booth WWTP and the Clarkson WWTP is shown in **Figure 5** and in higher resolution in **Appendix 4H**.

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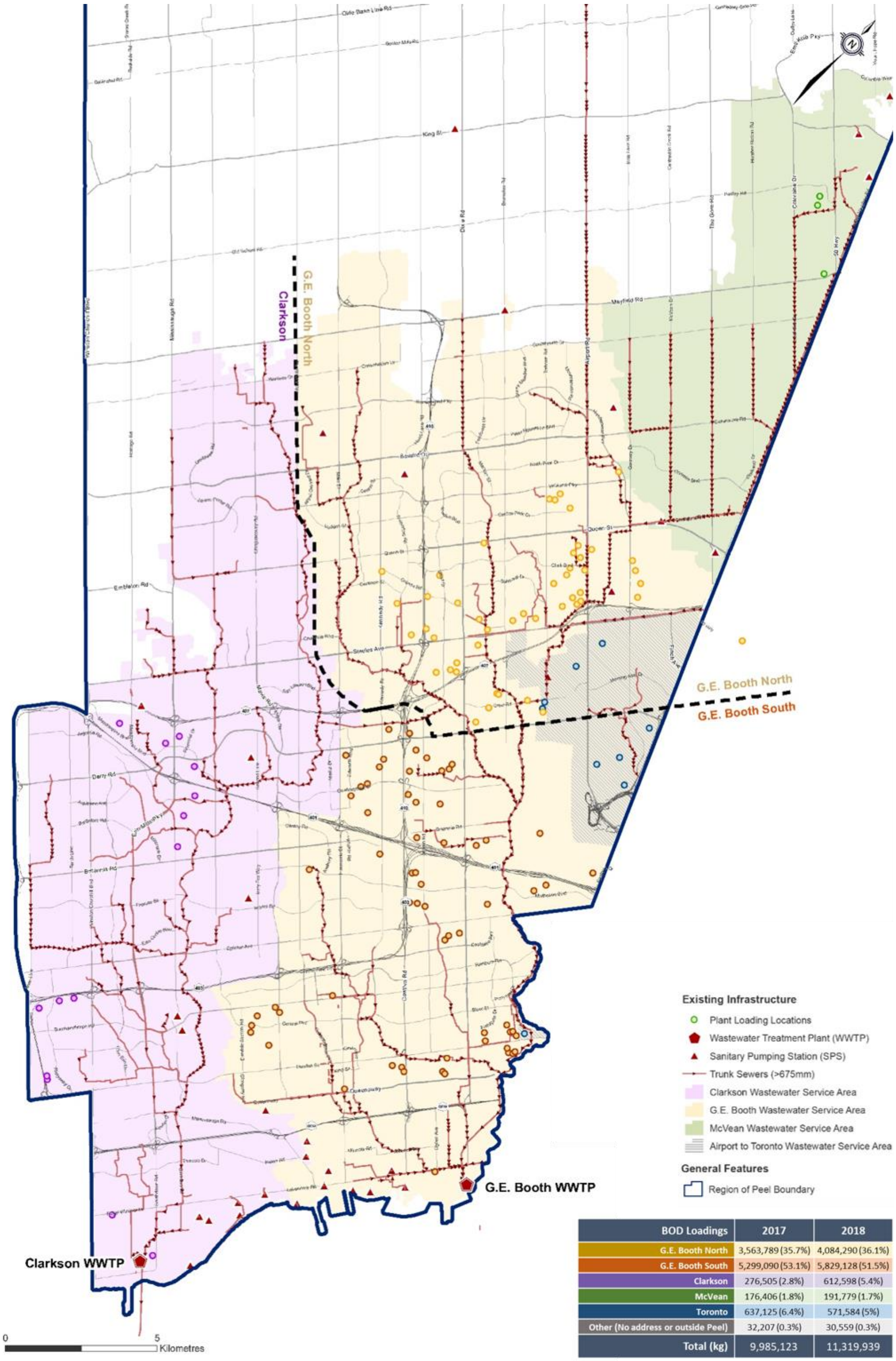


BOD Loadings	2017	2018
G.E. Booth North	3,563,789 (35.7%)	4,084,290 (36.1%)
G.E. Booth South	5,299,090 (53.1%)	5,829,128 (51.5%)
Clarkson	276,505 (2.8%)	612,598 (5.4%)
McVean	176,406 (1.8%)	191,779 (1.7%)
Toronto	637,125 (6.4%)	571,584 (5%)
Other (No address or outside Peel)	32,207 (0.3%)	30,559 (0.3%)
Total (kg)	9,985,123	11,319,939

Note: High resolution image is available in Appendix 4H.

Figure 5 - High strength users distribution.

Based on the population and employment forecast to 2041, the design criteria for loading projections, and the high strength users distribution, the loading projections for each WWTP natural catchment area are shown in **Figure 6** and **Figure 7**.

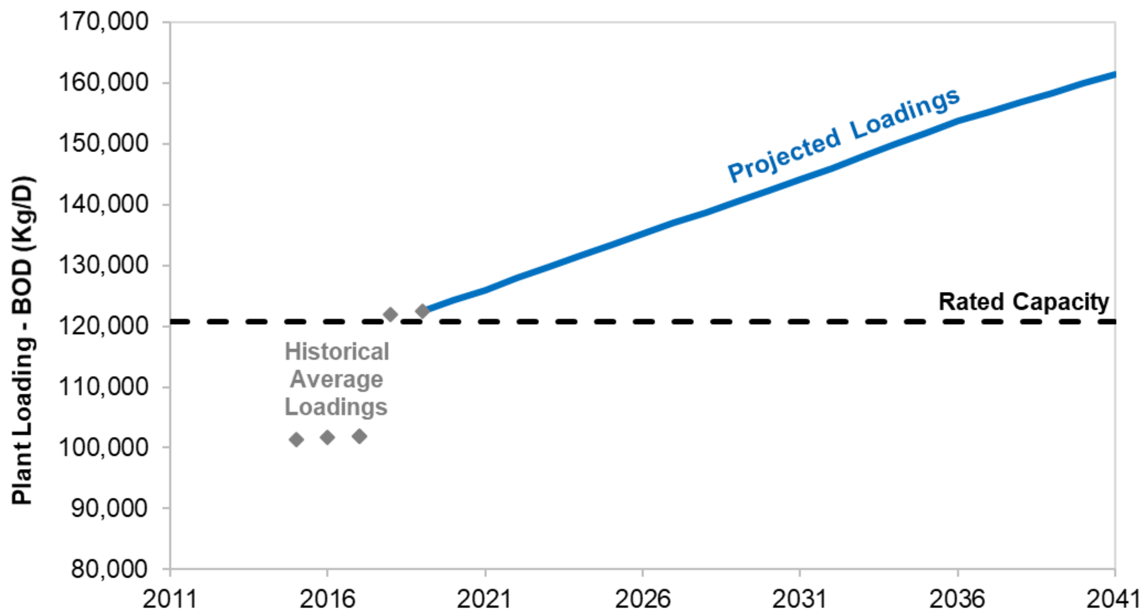


Figure 6 - **G.E. Booth WWTP BOD loadings starting point and growth projections.**

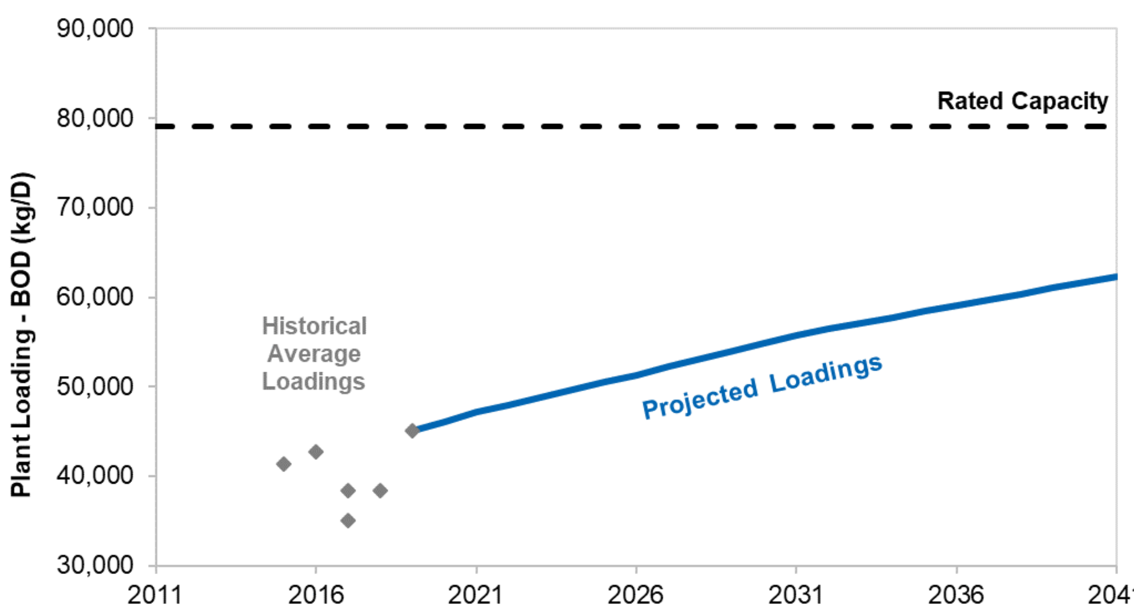


Figure 7 – **Clarkson WWTP BOD loadings starting point and growth projections.**

2.3 Design Criteria – System Assessment

2.3.1 Wastewater Treatment Plants

Wastewater collection systems are designed and rated to deliver peak wastewater flow to the treatment facilities, however the treatment plants are rated for average day flows. The following criteria were used to develop wastewater treatment plant expansion strategies:

- The rated capacity of a wastewater treatment plant is defined as the average daily flow that the facility is approved to treat.
- When 90 per cent of the plant rated capacity is projected to be reached, an expansion to the treatment plant is required.
- Biological treatment processes at the plant should be designed to meet effluent quality requirements over a range of flows including peak flows.
- If an expansion is recommended, further analysis should be conducted to confirm actual timing of the plant expansion project. The age and condition of the plant should be considered, as well as operating conditions, equipment performance and emergency conditions.

Figure 8 – Clarkson Wastewater Treatment Plant.

2.3.2 Sewage Pumping Stations

Sewage pumping stations (SPS) are rated on their firm capacity, which is defined as the total installed capacity of the pumping station with the largest pump out of service. Sewage pumping stations are sized based on wastewater flows and service level as follows:

- Firm pumping capacity to meet peak wet weather flows for its respective catchment area.
- When peak wet weather flows reach the firm capacity of a pumping station, an expansion of the pumping station capacity is required.

2.3.3 Sanitary Trunk Sewers

Sanitary trunk sewers are designed based on wastewater flows and service level including:

- Design of gravity sewers is based on maintaining a minimum cleansing velocity (0.75 metres per second[2]) in the pipe through a combination of diameter and slope.
- Capacity requirements for sanitary sewers are based on peak wet weather flows, which comprises peak dry weather flow plus a representative level of extraneous flow (inflow and infiltration).

The Region of Peel's all-pipe hydraulic model was utilized to assess the wastewater network and to further refine sanitary trunk sewer capacities. Several scenarios (dry weather, 5-year and 25-year AES storm, 5-year and 25-year SCS Type II storm) were evaluated to confirm sanitary sewer requirements.

Although the focus of the master plan is on the sanitary trunk system, service impacts to the local collection system were also considered.

2.3.4 Service Levels

Design storm and capacity triggers used for analysis in the 2020 Master Plan are summarized in **Table 4**.

In general, a sanitary sewer is triggered for a potential capacity upgrade or flagged for further analysis when the model results show:

- Surcharging (flow depth (d) / Diameter (D) - d/D ≥ 0.85) under a 5-year storm; or
- If the maximum water level is within 1.8 metres of ground level under a 25-year storm

The design storms and capacity update triggers, as well as their application to the Region of Peel's wastewater system can be summarized as follows:

Table 4 – Design storms and capacity update triggers.

Diameter	Design Storm	Capacity Upgrade Trigger
> 600-mm	5-year AES 12 hr 30%	d/D ≥ 0.85
	25-year AES 12 hr 30%*	Water depth ≤ 1.8 m below ground
≤ 600-mm	5-year SCS Type II	d/D ≥ 0.85
	25-year SCS Type II*	Water depth ≤ 1.8 m below ground

**Model results for 25-year storms alone will not be the only basis for upgrade trigger.*

2.4 Cost Estimation Framework

The cost estimation framework for capital projects at a master planning level are typically based on an overall unit cost approach. In this approach, project costs are generated from unit rates with added contingency and other additional costs.

2.4.1 Unit Rates

The unit cost rates used for this master plan are represented in 2020 dollars and, in general, take into consideration costs of labour and availability of materials in Southern Ontario. The development of these rates was informed by multiple master planning studies and have undergone peer reviews in order to further refine and ensure overall accuracy of the cost estimates. They were also compared to costs of recent capital projects completed within the Region of Peel and the GTA. A summary of the unit costs is provided in **Appendix 4B**.

2.4.2 Final Project Cost

A capital cost is provided for all projects proposed as part of this Master Plan. For most wastewater system projects, a base construction cost was obtained using either a unit rate construction cost or unique project analysis. The base construction cost considers several factors specific to each project such as:

- Construction methodology
- Depth of the pipe
- Creek crossings
- Railway and highway crossings
- Utility crossings
- Tunneling requirements
- Location of construction (rural, urban, suburban).

Design, administration, contingency, and non-recoverable HST costs were added to arrive at a final project cost estimate. Detailed costing sheets were developed to support the financial evaluation for each capital project. The final project costs are provided in the Capital Program, **Section 6.2**.

More detailed information about the cost estimation framework is provided in **Appendix 4B**.

2.4.3 Operation and Maintenance

Operation and maintenance (O&M) costs were considered qualitatively at every stage of the evaluation process. For example, where one strategy requires more pumping stations relative to other strategies, that strategy will score less favourably under the financial impact category due to higher O&M costs inherent with the new facilities.

In addition, the capital program provides a list and timing of new assets that the Region will have to operate and maintain; therefore, it is the starting point for the planning of O&M costs and resource allocation for new wastewater infrastructure.

3.0 Existing Wastewater Collection System

3.1 Existing Infrastructure

3.2 Hydraulic Wastewater Model

3.0 Existing Wastewater Collection System

3.1 Existing Infrastructure

The lake-based wastewater system services the City of Mississauga, the City of Brampton and parts of the Town of Caledon. The system consists of two wastewater treatment plants, 31 sewage pumping stations and three main trunk sewer systems (McVean, east, and west). These systems convey flows through a network of pumping stations, force mains, trunk and local gravity sewers, to the treatment plants for final treatment and discharge to Lake Ontario.

The McVean trunk system connects to the east trunk system via the McVean Sewage Pumping Station that discharges flow to the East Brampton sanitary trunk sewer. The east and west trunk sewer systems service areas are approximately divided by the watershed boundary between the Etobicoke Creek and the Credit River. The two systems are connected via the west-to-east sanitary trunk sewer, which can be used to divert some flows from the west trunk system to the east trunk system at Highway 407.

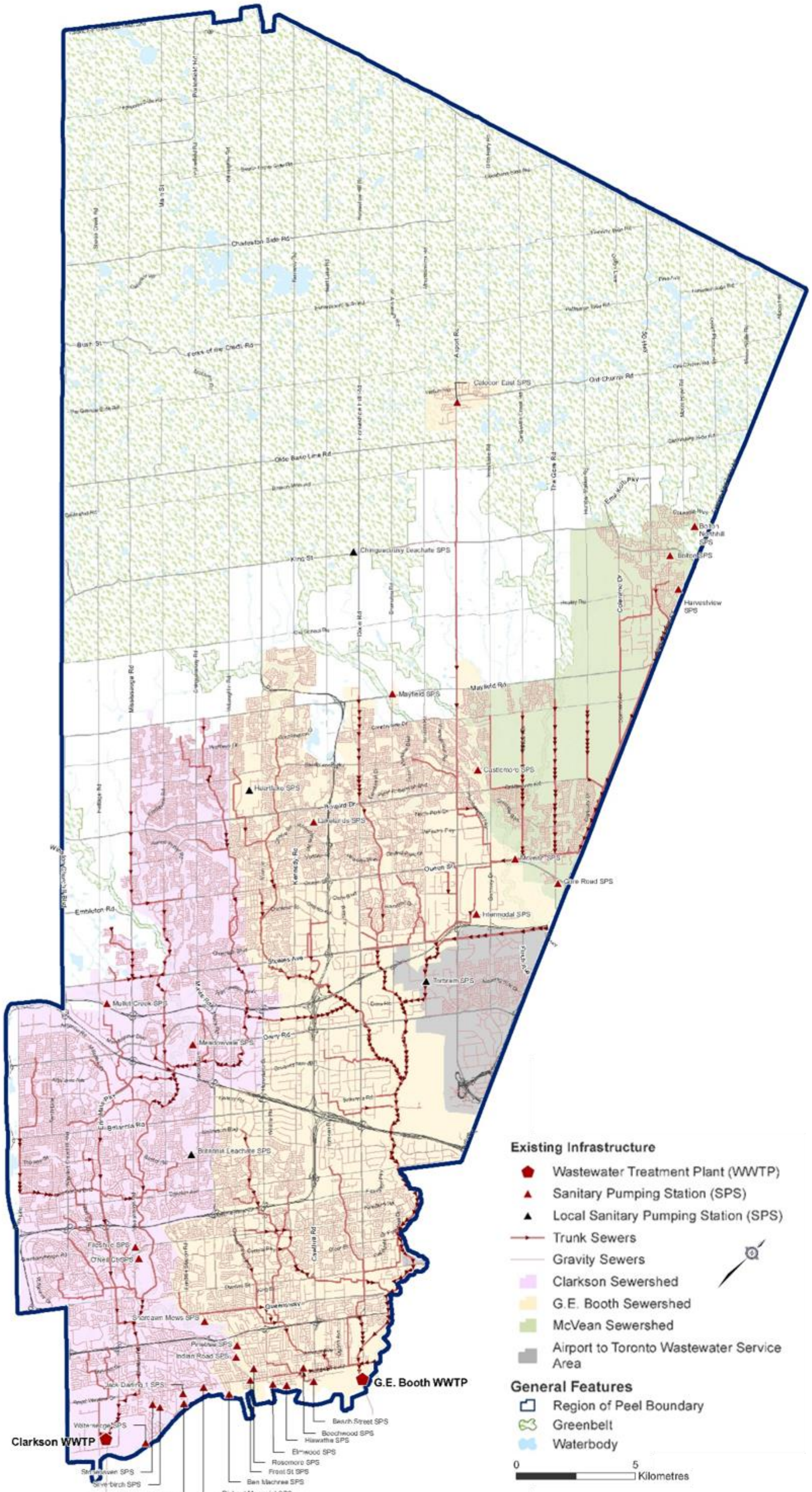
Both trunk systems provide direct conveyance for the local wastewater collection system which consists of the sewers extending up to the sanitary service lines for each user.

Table 5 and **Figures 9, 10, 11, and 12** provide an overview of the Region of Peel existing lake-based wastewater trunk system. Additional information about the lake-based wastewater trunk system is provided in **Section 3.1.2**. Schematic representation of the wastewater trunk system can be found in **Appendix 4C**.

Table 5 – Existing lake-based wastewater trunk system.

West Trunk System	East Trunk System	McVean Trunk System
Clarkson Industrial (W18.0) Steeles West (W10.0) Credit Valley (W09.0) Meadowvale (W08.0) Erin Mills North (W07.0) Sawmill Creek (W06.0) Orr Road (W04.0) Fletchers Creek (W03.0) Upper West (East Leg) (W02.0) Lower West (East Leg) (W01.1)	Lakefront (E20.0) Erindale (E19.0) Queensway West (E18.0) Confederation (E17.0) Upper Cooksville Creek (E16.0) Lower Cooksville Creek (E15.0) Little Etobicoke Creek (E14.0) Lakeshore East (E13.0) Spring Creek (E08.0) Etobicoke Creek (B) (E07.B) Etobicoke Creek (A) (E07.A) CPR (E06.0) Airport (E03.0) East Brampton (E02B.0) East Brampton (E02A.0) East (B) (E01B.0) East (A) (E01A.0)	Albion Vaughan (M06.0) Coleraine (A) (M05A.0) Clarkway (M04.0) The Gore Road (M03.0) McVean (M02.0) Brampton-Bolton (B) (M01B.0) Brampton-Bolton (A) (M01A.0)

W - West, E - East, M - McVean



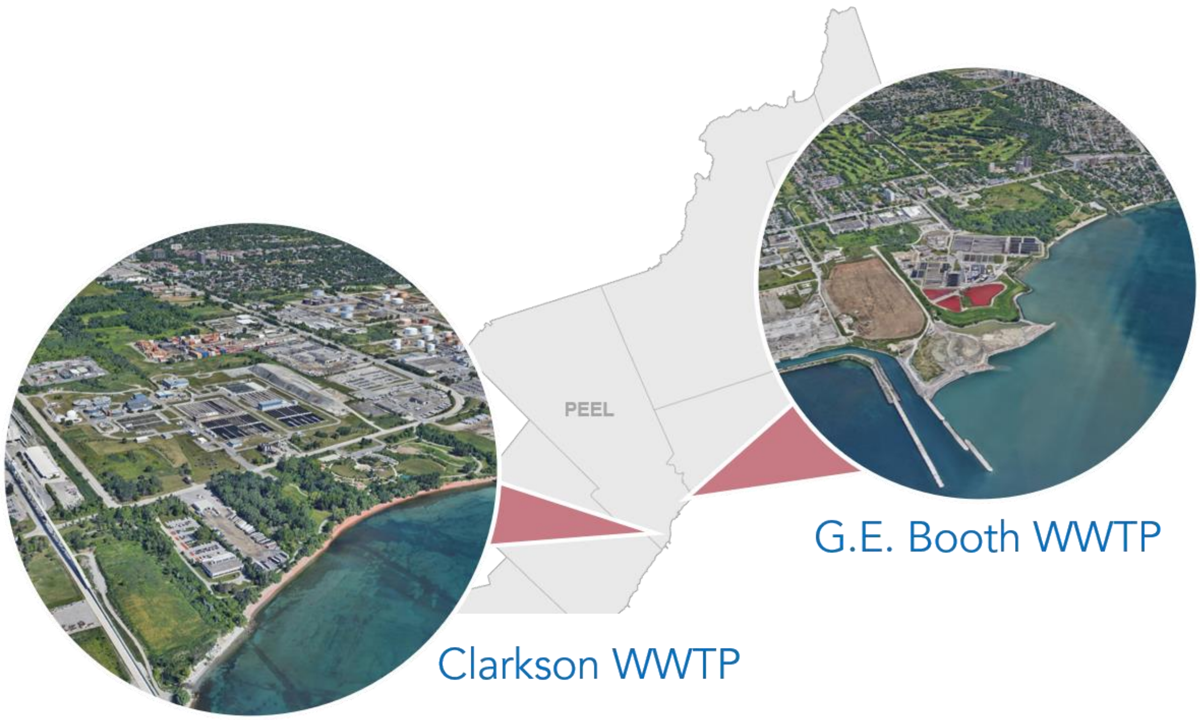
Note: High resolution image is available in Appendix 4H.

Figure 9 – Existing Region of Peel lake-based wastewater system.

3.1.1 Wastewater Treatment Plants

Wastewater treatment systems in Ontario are governed by the Ministry of Environment, Conservation and Parks (MECP) and are also subject to federal legislation. The purpose of a wastewater treatment system is to remove solids and nutrients to minimize impact of the effluent on the receiving waterbody.

The Region of Peel owns two large wastewater treatment plants (WWTP): the G.E. Booth WWTP and the Clarkson WWTP. The plants are located on the shores of Lake Ontario and are operated by the Ontario Clean Water Agency (OCWA) on behalf of the Region. These facilities provide treatment for wastewater coming from the City of Brampton, City of Mississauga and urban parts of the Town of Caledon.



The Environmental Compliance Approval (ECA) issued under the *Environmental Protection Act* is a facility-specific document through which the Ministry sets the discharge quality limits for that facility based on the sensitivity of the receiving waters. The Region ensures that the final effluent produced, and activities associated with wastewater treatment comply with the ECA and related legislation.

The Region also prepares an annual report that addresses the operation and overall performance of the wastewater system, which can be found on the Region's website:
https://www.peelregion.ca/pw/water/sewage-trtmt/

Image: G.E. Booth Wastewater Treatment Plant

3.1.1.1 G.E. Booth Wastewater Treatment Plant

The G.E. Booth WWTP is located in the southeast corner of the City of Mississauga south of Lakeshore Road East, between Dixie Road and Cawthra Road and east of the site of the proposed Inspiration Lakeview development. The site has an area of approximately 36 hectares (90 acres).

The G.E. Booth WWTP is a conventional activated sludge facility with a current rated average daily flow capacity of 518 million litres per day (ML/d), as per the latest ECA. All flow to the plant is conveyed by gravity with trunk sewers converging at an inlet chamber system then flowing through three conduits into the headworks facility and subsequent conventional treatment processes. The plant is diverted into three separate secondary treatment plants known as Plants 1, 2 and 3.

The facility includes two blower buildings, phosphorus removal and disinfection processes and one solids handling facility where all sludge from the G.E. Booth WWTP and cake from the Clarkson WWTP are processed through four fluidized bed incinerators. The residual ash slurry from the incineration system is transferred to on-site settling lagoons and the supernatant returns via pumps to the Plant 3 primary inlet channel. The ash accumulated in the lagoons is then dredged to an ash pond and stored on-site.

The final effluent from the G.E. Booth WWTP is discharged to Lake Ontario through a 3.65-metre diameter and 1,400-metre long outfall. This outfall structure ensures the final effluent is retained for long enough to be thoroughly disinfected and that it is discharged to the lake over a large area. This ensures that a high standard of treated wastewater quality is attained to protect Lake Ontario which is the primary source of drinking water for the Region and many neighbouring municipalities.

Image: Clarkson Wastewater Treatment Plant

3.1.1.2 Clarkson Wastewater Treatment Plant

The Clarkson WWTP is located in southwest Mississauga, south of Lakeshore Road between Southdown Road and Winston Churchill Boulevard. The site has an area of approximately 32 hectares (79 acres).

The Clarkson WWTP is a conventional activated sludge system with a current rated average daily flow capacity of 350 ML/d, as per the latest ECA, provided by two separate primary and secondary process trains designated as Plant 1 and Plant 2. The major liquid treatment processes include screening and grit removal, primary treatment, secondary treatment, phosphorus removal, effluent disinfection and de-chlorination. The plant currently practices chemically enhanced primary treatment using ferrous chloride to precipitate phosphorus and improve primary treatment performance. The final treated effluent is discharged to Lake Ontario through a 3-metre diameter tunnel that extends 2,200 metres out into Lake Ontario.

The solids handling processes at the Clarkson WWTP include waste activated sludge (WAS) thickening, anaerobic digestion, and dewatering. Raw sludge from the primary clarifiers and thickened WAS are blended and directed to anaerobic digesters for digestion. The digested sludge is dewatered and trucked to the G.E. Booth WWTP for incineration. The biogas produced at the digesters is directed to a 1.4 megawatt cogeneration facility (combined heat and power engine). The electricity generated at this facility is used within the treatment plant distribution system, and heat is used for digester process heating.

3.1.2 Sanitary Trunk Sewers

The Region Peel lake-based wastewater collection system is divided into three main trunk systems: west, east and McVean trunk systems. Naming convention and labelling of the trunk sewers has been developed over time by the Region. This section describes the main trunk sewers; additional detail can be found in **Appendix 4C**.

3.1.2.1 West Trunk System

The west trunk system is shown in **Figure 10**, with main branches described below:

W18.0: Clarkson Industrial

The Clarkson industrial trunk sewer is a 675-mm to 825-mm sewer that services southwest Mississauga by conveying flows to the Clarkson WWTP.

W10.0: Steeles West

The Steeles west trunk sewer is a 600-mm to 825-mm sewer along Steeles Avenue West beginning between Heritage Road and Mississauga Road and converging into the Credit Valley trunk at Creditview Road.

W09.0: Credit Valley

The Credit Valley trunk sewer is a 675-mm to 1500-mm sewer servicing the southern Alloa areas flowing south along Mississauga Road and Creditview Road to a convergence with the Steeles West trunk. The trunk sewer continues southeast past Steeles Avenue West to a final convergence into the Upper West (East Leg) trunk sewer just north of Highway 401.

W08.0: Meadowvale

The Meadowvale trunk sewer is a 675-mm to 1350-mm sewer north of Britannia Road West near the intersection at Winston Churchill Boulevard to service the Meadowvale west area, converging with the upper west (east leg trunk) east of the Canadian Pacific Railway.

W07.0: Erin Mills North

The Erin Mills north trunk sewer is a 600-mm to 1050-mm sewer north of Britannia Road West and east of Hwy 407 to service the Meadowvale West and Erin Mills north areas, flowing southeast and turning parallel to Eglinton Avenue West to converge with the upper west (east leg) trunk sewer near the intersection of the Canadian Pacific Railway and Eglinton Avenue West.

W06.0: Sawmill Creek

The Sawmill Creek trunk sewer is a 600-mm to 1200-mm sewer beginning west of Erin Mills Parkway at Queen Elizabeth Way (Hwy 403) servicing the Sheridan and Erin Mills areas. The Trunk extends south past Dundas Street West east of Erin Mills Parkway where it passes several convergences including the O'Neill Court Sewage Pumping Station and ending at the upper west (east leg) trunk sewer.

W04.0: Orr Road

The Orr Road trunk sewer is a 1350-mm sewer from near the Orr Road and Clarkson Road South intersection where flows from the Watersedge Sewage Pumping station converge with the trunk as it extends west along Orr Road to another convergence at the lower west (east leg) trunk sewer.

W03.0: Fletchers Creek

The Fletchers Creek trunk sewer is a 675-mm to 1350-mm sewer servicing the Alloa/Mayfield West area at Mayfield Road, extending south east along the eastern boundary of the west trunk system and eventually converging with the Meadowvale Sewage Pumping Station, followed by the upper west (east leg) trunk.

W02.0: Upper West (East Leg)

The upper west (east leg) trunk sewer is a 1200-mm to 2250-mm sewer north of Hwy 401 and east of Creditview Road beginning at a convergence with both Fletchers Creek and Credit Valley trunk sewers, flowing south to receive flows from Meadowvale, Erin Mills North and Sawmill Creek trunk sewers before converging into the lower west (east leg) trunk.

W01.0: Lower West (East Leg)

The lower west (east leg) trunk sewer is a 2400-mm to 3000-mm sewer beginning at a convergence from the upper west (east leg) trunk sewer along Clarkson Road North and flowing southwest towards Southdown Road where it reaches another convergence with the Orr Road trunk sewer ultimately conveying flows to the Clarkson WWTP.

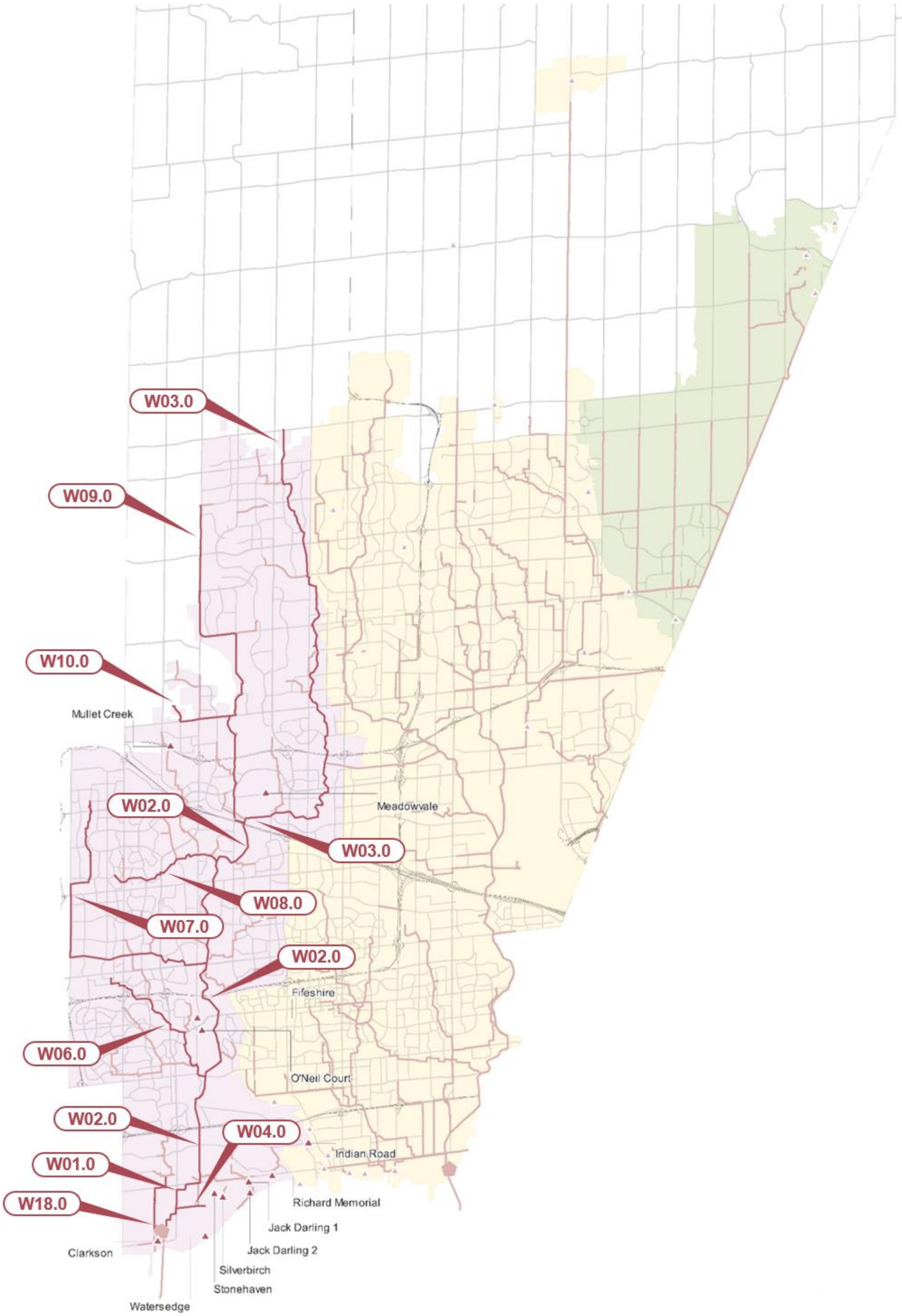


Figure 10 – West trunk system.

3.1.2.2 East Trunk System

The East trunk system is shown in **Figure 11** and described below:

E20.0: Lakefront

The lakefront trunk sewer is a 675-mm to 900-mm sewer conveying flows from various sewage pumping stations on the lakefront (Front Street SPS, Elmwood SPS, etc.) to the Beechwood Sewage Pumping Station.

E19.0: Erindale

The Erindale trunk sewer is a 600-mm to 1050-mm sewer along The Queensway West towards Hurontario Street servicing the Erindale area. This trunk diverts some flows to the Queensway west trunk sewer before converging into the Confederation trunk sewer.

E18.0: Queensway West

The Queensway west trunk sewer is a 1350-mm sewer beginning with diverted flows from the Erindale trunk. This trunk receives some flows from the Confederation trunk sewer along the Queensway West at Hurontario Street before ultimately converging into the Lower Cooksville Creek trunk sewer.

E17.0: Confederation

The Confederation trunk Sewer is a 600-mm to 1050-mm sewer beginning near the McLaughlin Road and Burnhamthorpe Road East intersection to service the Central Mississauga area, extending southeast where some flows diverge into the Queensway West trunk sewer before converging into the Lower Cooksville Creek trunk sewer.

E16.0: Upper Cooksville Creek

The Upper Cooksville Creek trunk sewer is a 600-mm to 825-mm sewer beginning north of Eglington Avenue East between McLaughlin Road and Hurontario Street. This trunk extends southeast past Hurontario Street and converges with the Lower Cooksville Creek trunk sewer at Burnhamthorpe Road East.

E15.0: Lower Cooksville Creek

This Lower Cooksville Creek trunk sewer is a 675-mm to 1500-mm sewer beginning south of Burnhamthorpe Road East, extending south to diverge some flows to the CPR trunk sewer. The sewer continues south east past the Queensway East where it converges with both the Queensway West and Erindale trunk sewers and ends at a convergence near the Lakeshore Road West and Cawthra Road intersection with the Lakeshore East trunk sewer.

E14.0: Little Etobicoke Creek

The Little Etobicoke Creek trunk sewer is a 600-mm to 1050-mm sewer extending southeast from north of Eglington Avenue East between Dixie Rd and Highway 403, taking some additional flows at the Dixie Road and Dundas Street East intersection from the CPR trunk sewer, and ultimately converging into the Lakeshore East trunk sewer before entering the G.E. Booth WWTP.

E13.0: Lakeshore East

The Lakeshore East trunk sewer is a 1650-mm sewer originating at a convergence with the Lower Cooksville Creek trunk, flowing east along Lakeshore to a convergence with the Little Etobicoke Creek trunk sewer before reaching G.E. Booth WWTP.

E08.0: Spring Creek

The Spring Creek trunk sewer is a 600-mm to 1200-mm sewer beginning near the Dixie Road and Mayfield Road intersection to service the Mayfield area. Trunk extends southeast past Highway 407 to converge with the East Brampton (A) and (B) twinned trunks.

E07.B: Etobicoke Creek (B)

The Etobicoke Creek trunk sewer is a 900-mm to 1350-mm sewer beginning south of the Brampton City Centre near Hurontario Street at a convergence with the Etobicoke Creek (A) trunk sewer. The twinned trunks continue to extend southeast passing through several crossover junctions until converging into the east trunks south of Derry Road East.

E07.A: Etobicoke Creek (A)

The Etobicoke Creek trunk sewer is a 675-mm to 1500-mm sewer that conveys flows from Conservation Drive between Hurontario Street and Kennedy Road southeast where it converges and twins with the Etobicoke Creek (B) trunk sewer. As the twinned trunks continue to extend southeast, there are several crossover junctions until they converge with the east trunks south of Derry Road East.

E06.0: CPR

The CPR trunk is a 900-mm to 1200-mm sewer beginning at a flow divergence from the Lower Cooksville Creek trunk sewer, southeast of the Burnhamthorpe Road East and Hurontario Street intersection to service the Mississauga Valley area. The sewer extends east along Dundas Street East, diverting some flows to the Little Etobicoke Creek trunk and ultimately converging with the east (A) trunk sewer.

E03.0: Airport

The Airport trunk sewer is a 600-mm to 1350-mm sewer extending south along Airport Road with a convergence of flows from the Airport Road Sewage Pumping Station and the Chinguacousy Landfill, as well as from other sewage pumping stations further south. The trunk passes Goreway Drive north of Queen Street East where it converges with the East Brampton twinned trunk sewers.

E02B.0: East Brampton (B)

The East Brampton (B) trunk sewer is 1200-mm to 1800-mm sewer originating at McVean Sewage Pumping Station extending south past the 407 with a crossover junction picking up flows from twinned trunk near Airport Road at Highway 407. The trunk sewer continues south to a convergence with the Spring Creek trunk and ends near the Derry Road West and Bramalea Road intersection at a convergence with the east (A) and (B) twinned trunks.

E02A.0: East Brampton (A)

The East Brampton (A) trunk sewer is 1200-mm to 1800-mm sewer originating at McVean Sewage Pumping Station extending south past Intermodal Sewage Pumping Station and past Highway 407 with a crossover junction picking up flows from twinned trunk near Airport Road at Highway 407. The sewer continues south to a convergence with the Spring Creek trunk. The twinned trunk ends near the Derry Road West and Bramalea Road intersection at a convergence with the east (A) and (B) twinned trunks.

E01B.0: East (B)

The east (B) trunk sewer is a 1650-mm to 1950-mm twinned trunk sewer beginning at the convergence of the Etobicoke Creek twinned trunk sewers and the East Brampton twinned trunk sewers south of Derry Road East and east of Dixie Road. The twinned trunks extend southeast, passing through several areas of crossover junctions between east trunk (A) and (B) and an inter-regional junction where flows are diverted from Toronto near Eglinton Avenue East.

E01A.0: East (A)

The east (A) trunk sewer is a 1650-mm to 2400-mm twinned trunk sewer beginning at the convergence of the Etobicoke Creek twinned trunk sewers and the East Brampton twinned trunk sewers south of Derry Road East and east of Dixie Road. The twinned trunks extend southeast, passing through several areas of crossover junctions between east trunk (A) and (B) and an inter-regional junction where flows are diverted from Toronto near Eglinton Avenue East. After extending past Dundas Street East, the east (A) trunk sewer continues south and converges with the CPR trunk sewer ultimately reaching the G.E. Booth WWTP.

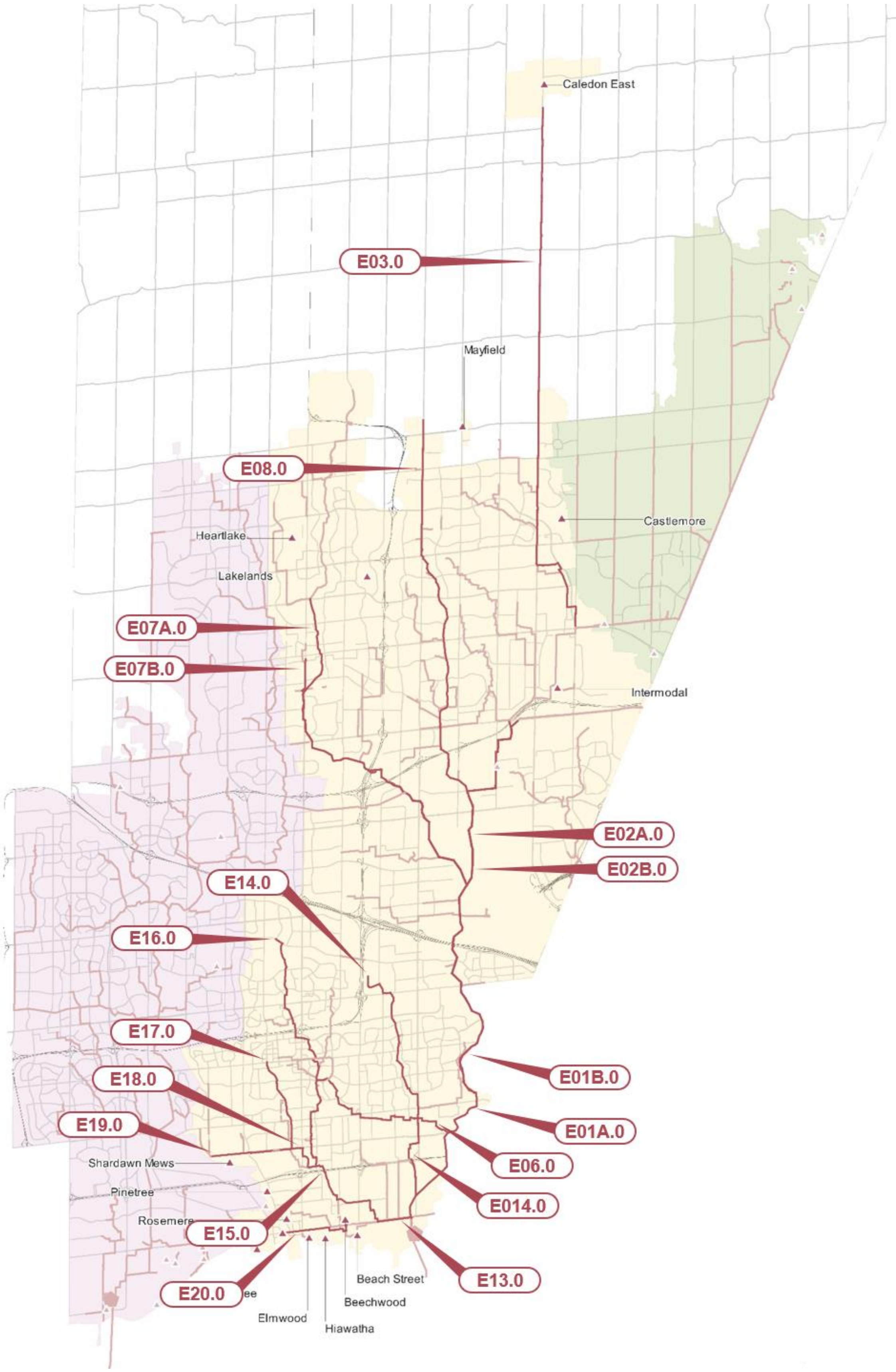


Figure 11 – East trunk system.

3.1.2.3 McVean Trunk System

The McVean trunk system is shown in **Figure 12** and described below:

M06.0: Albion Vaughan

The Albion Vaughan trunk sewer is a 900-mm to 975-mm sewer along Albion Vaughan Townline (Hwy 50) to service the Bolton area, converging into the twinned Brampton-Bolton trunk sewers.

M05A.0: Coleraine (A)

The Coleraine trunk sewer is a 750-mm sewer along Coleraine Drive servicing the southern Bolton area, converging into the twinned Brampton-Bolton trunk sewers at Albion Vaughan Townline (Hwy 50).

M04.0: Clarkway

The Clarkway trunk sewer is a 750-mm to 900-mm sewer along Clarkway Drive from Countryside Drive, passing through Castlemore Road and extending east to converge with the twinned Brampton-Bolton trunk sewers along Albion-Vaughan Townline (Hwy 50) south of Castlemore Road

M03.0: The Gore Road

The Gore Road trunk sewer is a 750-mm to 1200-mm sewer along The Gore Road converging into the twinned Brampton-Bolton Sewers along Ebenezer Road.

M02.0: McVean

The McVean trunk sewer is a 675-mm to 1200-mm sewer extending from Countryside Drive along McVean Drive, converging into the Brampton-Bolton Twinned trunk sewers along Ebenezer Road.

M01B.0: Brampton-Bolton (B)

The Brampton-Bolton (B) trunk sewer is a 750-mm twinned trunk beginning at major convergence from the Coleraine and Albion-Vaughan trunk sewers. Twinned trunk sewer converges with other major trunks, Clarkway, Gore Road and McVean, along Albion-Vaughan Townline (Hwy 50) and Ebenezer Road before reaching McVean Sewage Pumping Station.

M01A.0: Brampton-Bolton (A)

The Brampton-Bolton (A) trunk sewer is a 1200-mm twinned trunk beginning at major convergence from the Coleraine and Albion-Vaughan trunk sewers. the twinned trunk sewer converges with other major trunks, Clarkway, Gore Road and McVean, along Albion-Vaughan Townline (Hwy 50) and Ebenezer Road before reaching the McVean Sewage Pumping Station.

The west, east and McVean trunk systems form the Region of Peel lake-based wastewater collection system. A schematic diagram representing the lake-based wastewater collection system in more detail can be found in **Appendix 4C**.

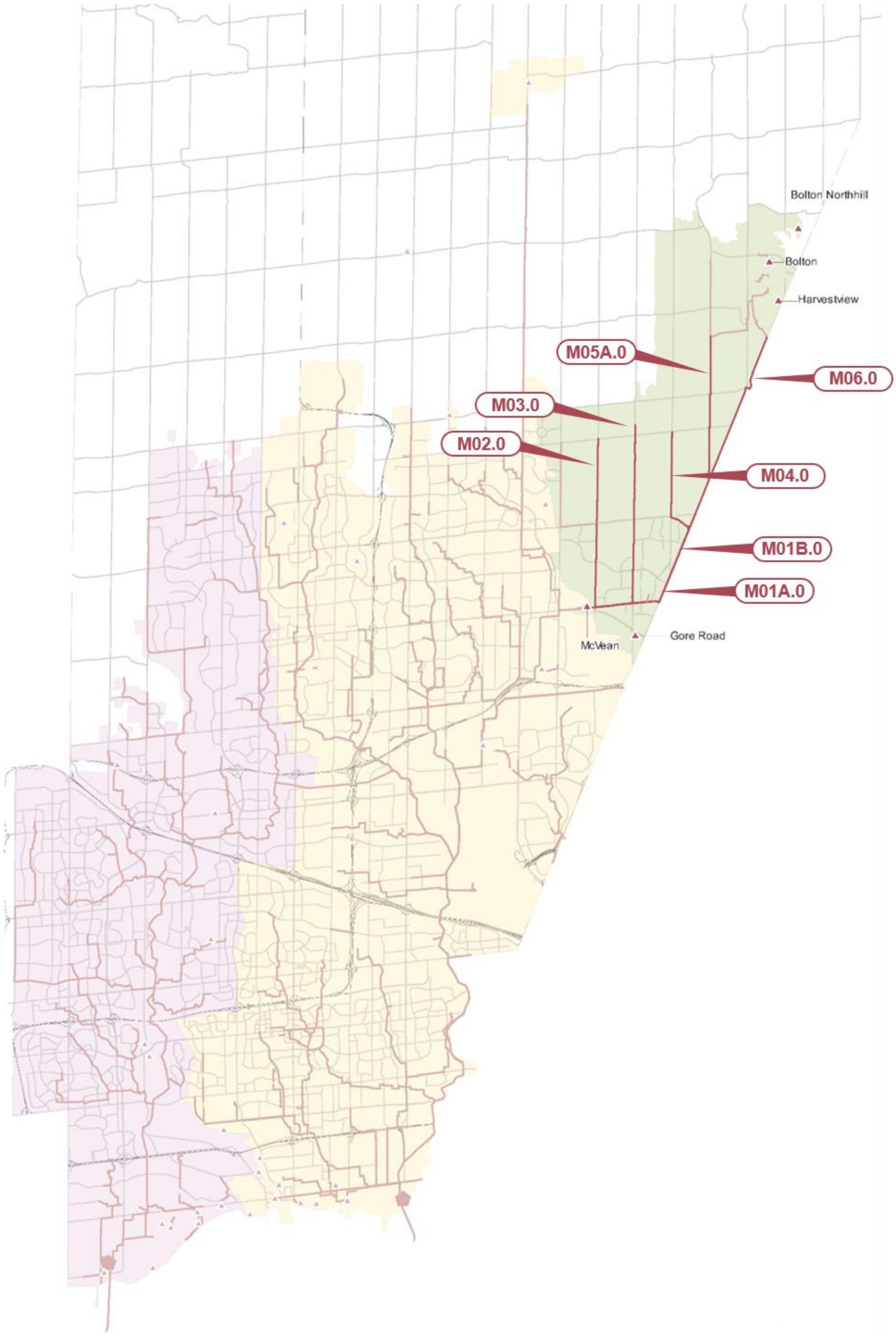


Figure 12 – McVean trunk system.

3.1.2.4 Sewage Pumping Stations

Table 6 lists the existing sewage pumping stations in the Region of Peel lake-based wastewater system.

Table 6 – Lake-based sewage pumping stations.

	Sewage Pumping Station	Municipality	Trunk/ Local	Number of Pumps	Firm Capacity (L/s)
West System	Clarkson	Mississauga	Local	2	38
	Fifeshire	Mississauga	Local	2	27.5
	Indian Road	Mississauga	Local	2	72.5
	Jack Darling 1	Mississauga	Trunk	4	800
	Jack Darling 2	Mississauga	Trunk	3	107
	Meadowvale	Mississauga	Local	2	11
	Mullet Creek	Mississauga	Local	4	232
	O'Neil Court	Mississauga	Local	2	1.5
	Richard's Memorial	Mississauga	Trunk	3	195
	Silverbirch Trail	Mississauga	Local	2	48
	Stonehaven Drive	Mississauga	Local	2	6
	Watersedge	Mississauga	Local	2	14
East System	Beach Street	Mississauga	Trunk	3	756
	Beechwood	Mississauga	Trunk	4	1,500
	Ben Machree	Mississauga	Local	2	30
	Caledon East	Caledon	Local	3	101
	Castlemore	Brampton	Local	2	20
	Elmwood Avenue	Mississauga	Local	3	195
	Front Street	Mississauga	Local	4	276
	Hiawatha Parkway	Mississauga	Local	2	16.5
	Intermodal Drive	Brampton	Local	2	160
	Lakelands	Brampton	Local	3	64
	Mayfield	Caledon	Local	2	16
	Pinetree Crescent	Mississauga	Local	2	7
	Rosemere Road	Mississauga	Local	2	25
	Shardawn Mews	Mississauga	Local	2	3
McVean System	Bolton	Caledon	Trunk	3	380
	Bolton North Hill	Caledon	Local	2	22.5
	Gore Road	Brampton	Local	3	81
	Harvestview	Caledon	Local	2	7
	McVean Drive	Brampton	Trunk	3	1,400

3.2 Hydraulic Wastewater Model

The Region of Peel maintains an all-pipe wastewater model using InfoWorks ICM by Innovyze. The model includes all sanitary mains including trunk and local sewers, as well as all wastewater facilities. The model was initially calibrated in 2014, utilizing 2013 flow survey and rainfall data. Since the most recent calibration, the model has had a full Geographic Information System (GIS) update in 2016 and other key infrastructure projects have been added on an ongoing basis from the best available data including design and as-built drawings, GIS, and reports.

The all-pipe wastewater model was used to perform analyses on the sanitary system for the purpose of the 2020 Master Plan, which focuses mainly on the trunk system defined as sanitary sewers with a diameter of 675-mm or larger. However, the local collection system impacts were also considered for the development of the servicing strategies. The following summarizes the model analysis activities:

- The model was used to provide additional baseline understanding of system performance under dry weather and wet weather conditions.
- Additional flows due to growth were added to the baseline model to represent predicted system performance in future years to 2041 and beyond.
- Projected flows from York Region and Toronto were identified for the purposes of master planning and the impact of these flows on the proposed projects were analyzed.
- Alternative strategies and potential projects were represented in the model to analyze the effect on system performance, and to confirm the appropriate sizing for projects in the capital program.

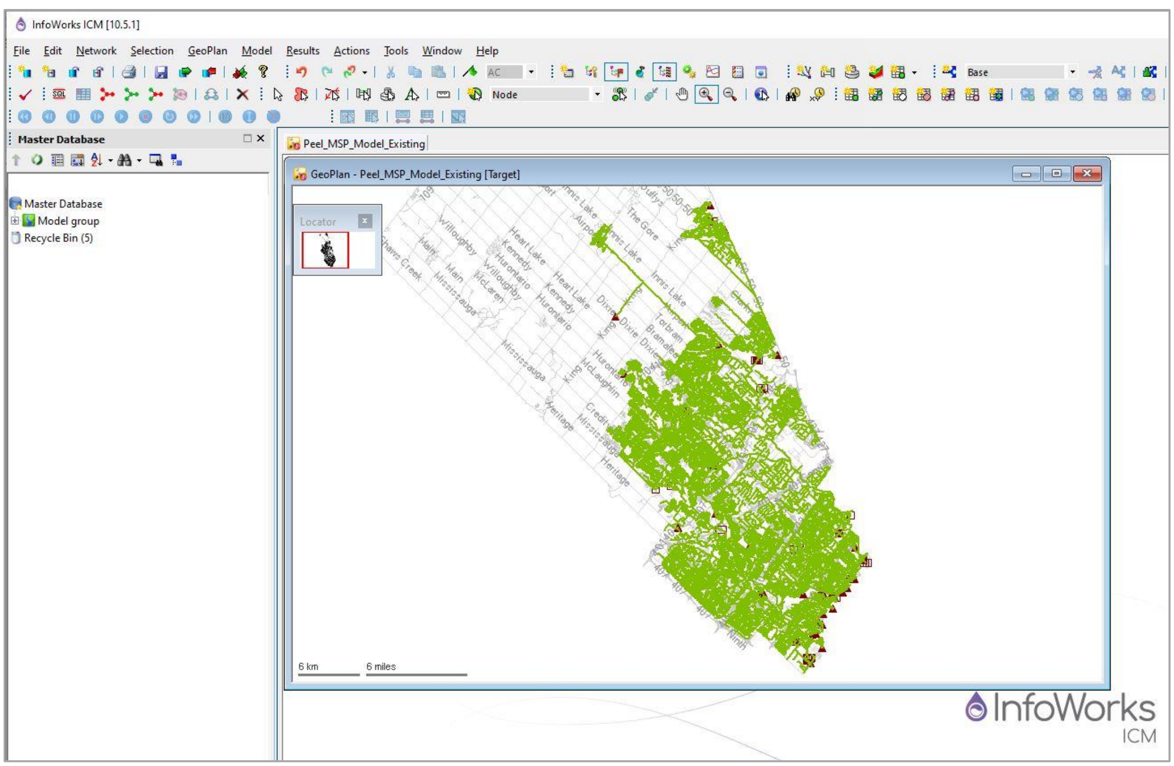


Figure 13 – **All-pipe hydraulic wastewater model.**

4.0 Assessment of Future Wastewater Infrastructure

4.0 Assessment of Future Wastewater Infrastructure

A critical initial step in the master planning process is the assessment of existing infrastructure to establish the wastewater system baseline conditions. These baseline conditions became the basis of the future recommendations of the master plan; therefore, it was important to ensure that they were determined through a comprehensive detailed analysis of the system. Once the existing system conditions were established, the potential impacts of the future growth flows on the wastewater system were analyzed to develop and recommend future servicing strategies.

The following sections describe current opportunities and constraints in the existing wastewater system and assess the capacity deficiencies within the 2041 planning horizon with some post-period considerations.

4.1 Opportunities and Constraints

Existing wastewater opportunities and constraints were identified through discussions with Regional staff as well as a baseline review and preliminary hydraulic analyses. The following opportunities and constraints were identified:

4.1.1 Growth

- Requirement to extend servicing to new growth areas in West Bolton and north of Mayfield Road.
- Significant growth continues to be anticipated in Bolton, northeast Brampton and northwest Brampton areas.
- Downtown Brampton and Uptown Brampton are anticipated to be the City's focus for future redevelopment and intensification.
- The Hurontario Corridor and Mississauga City Centre continue to be targeted for high-density intensification.
- Growth continues to be projected in the Mayfield West development area including new growth areas north of the Etobicoke Creek.
- Specific development areas identified due to their growth potential include: Inspiration Lakeview, Port Credit Mobility Hub, Dundas Connects, Uptown Mississauga (Hurontario and Eglinton), Bovaird and Creditview, Clarkson GO, Reimagining the Mall (Central Erin Mills, Meadowvale, Rathburn-Applewood, Sheridan and South Common Community Nodes)

Additionally, the following considerations for post-period growth were also identified:

- Opportunity to upsize strategic infrastructure to account for potential post-period growth.
- If the GTA West Transportation Corridor proceeds, the Region expects increased growth and intensification to occur along the corridor area.

4.1.2 Wastewater Treatment Plants

- The G.E. Booth WWTP property currently has limited site capacity for future expansion, however there is opportunity to reconfigure certain processes to free up space within the site and enable capacity expansion.
- The G.E. Booth WWTP outfall is currently approaching the end of its estimated service life.
- Clarkson WWTP currently has capacity to service existing flows. The plant property has capacity for future expansion if required.
- The G.E. Booth WWTP experiences high peak flows during wet weather conditions that result in capacity issues within the facility. In addition, recent changes to treatment standards have resulted in limitations in certain treatment processes.
- Several factors have changed that impact the capacity of unit processes at the WWTP including:
  - MECP Design Guidelines were updated in 2008 providing more stringent unit process loading criteria for primary and secondary clarifiers.
  - The plant has seen higher peak flows in recent years.
  - Over time, per capita water usage has declined resulting in potential for increased raw wastewater concentrations.
- Organic loadings in raw wastewater at the WWTPs are expected to increase in proportion with increased population and employment.
- Opportunity to balance hydraulic flows, organic loadings and capacity requirements at the treatment plants will be provided by implementing the East-to-West diversion sanitary trunk sewer. Diversion of flows between the trunk systems can provide flexibility in planning for upgrade of the wastewater treatment facilities and sanitary trunk sewers.

4.1.3 Sanitary Trunk Sewers and Collection System

- Recently constructed west trunk sewer provides substantial conveyance capacity in the Clarkson WWTP catchment area.
- Implementation of inflow and infiltration mitigation measures could help minimize risk and free up capacity in the wastewater system.
- The East-to-West diversion sewer is currently in the detailed design phase. Once constructed, the strategy to transfer flow between the east and west trunk systems can provide additional operational flexibility and capacity optimization within the trunk systems and at the WWTPs
- Opportunity to implement real time controls and additional flow diversion measures to balance flows and optimize capacity within the system.
- Potential capacity constraints identified within sections of the existing Fletcher's Creek and Etobicoke Creek sewers.
- Significant growth planned within the Mississauga City Centre (MCC), Uptown Mississauga (Hurontario and Eglinton) and along the Hurontario LRT Corridor, resulting in potential capacity constraints in the Cooksville and CPR trunk sewers
- Wastewater storage could be considered to mitigate high peak flows during wet weather conditions.

4.1.4 Sewage Pumping Stations

- Significant growth in west Bolton will require conveyance upgrades/extension and may impact capacity needs at the McVean Sewage Pumping Station. Overall servicing strategy for northeast Brampton and Bolton will be required.
- Potential to decommission existing sewage pumping stations throughout the Region as new gravity trunk sewers are constructed including, but not limited to, Front Street, Indian Road, Harvestview and Ben Machree sewage pumping stations.

These opportunities and constraints were used as a starting point to define the potential servicing strategies, which are discussed in **Section 5**.

4.2 Wastewater Flow Requirements

Wastewater flow requirements were developed for the system to identify existing and potential future system deficiencies. Based on the planning projections, average daily flow projections for the Region's lake-based wastewater system, including York flows, are summarized below:

Table 7 – Forecasts of average daily wastewater flows for the lake-based system (ML/d).

Service Area	2019*	2021	2026	2031	2036	2041
East Trunk System	395	408	437	463	499	526
York Region (Agreement)	43	44	49	53	53	53
City of Toronto (Agreement)	29	29	29	29	29	29
East Trunk Sub-Total	467	481	514	545	581	608
West Trunk System	206	216	236	257	273	290
West Trunk Sub-Total	206	216	236	257	273	290
TOTAL	**673**	**697**	**750**	**802**	**854**	**898**

2019 Starting Point based on 5-year rolling average as defined in **Section 2.2.1.1.*

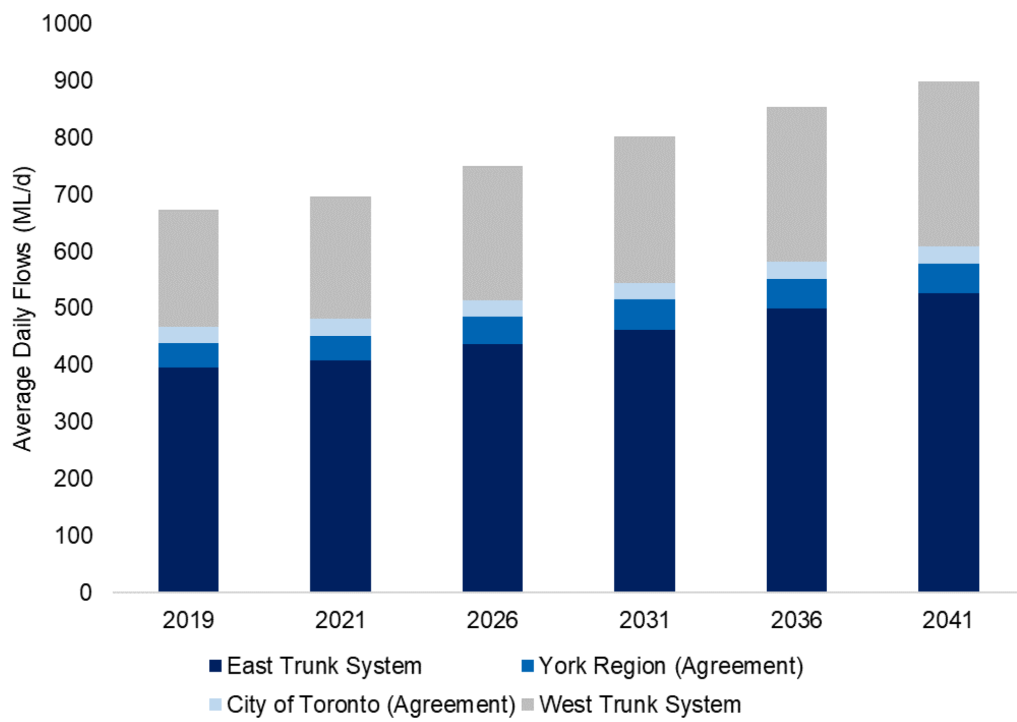


Figure 14 – Forecasts of average daily wastewater flows for the lake-based system (ML/d).

Table 7 and **Figure** 14 do not include any transfers between the East and West Trunk Systems.

4.3 Assessment of Wastewater Infrastructure

The assessment of the lake-based wastewater infrastructure was completed based on the Region's planning estimates and design criteria as described in previous sections. The results of the assessment are summarized in the following sections.

4.3.1 Wastewater Treatment Plants

The wastewater treatment plants' capacity to accommodate growth have been assessed on both a hydraulic and loading capacity basis. The following sections outline the results of the assessments.

4.3.1.1 Hydraulic Capacity Assessment

The assessment of the wastewater treatment plants' hydraulic capacity indicated that the existing treatment capacity at G.E. Booth WWTP would not be sufficient to meet projected growth within the 2041 planning horizon, while there is surplus capacity at Clarkson WWTP. **Table 8**,

Figure 15 and **Figure 16** summarize the projected flows for each wastewater treatment plant based on their existing service area and results of the treatment capacity assessment. The table and figures below do not include any transfers between the east and west trunk systems.

Table 8 – **Wastewater treatment plant hydraulic capacity assessment summary.**

Treatment Capacity Assessment	2019	2021	2026	2031	2036	2041
G.E. Booth WWTP						
Current Plant Rated Capacity (ML/d)	518	518	518	518	518	518
90% Plant Rated Capacity (ML/d)	466	466	466	466	466	466
Forecasted Demand (ML/d)	467	481	514	545	581	608
Capacity Surplus(+) / Deficit (-) (ML/d) *	**-1**	**-15**	**-48**	**-79**	**-115**	**-142**
Clarkson WWTP						
Current Plant Rated Capacity (ML/d)	350	350	350	350	350	350
90% Plant Rated Capacity (ML/d)	315	315	315	315	315	315
Forecasted Demand (ML/d)	206	216	236	257	273	290
Capacity Surplus(+) / Deficit (-) (ML/d) *	**+109**	**+99**	**+79**	**+58**	**+42**	**+25**

**Based on 90 percent of rated treatment capacity.*

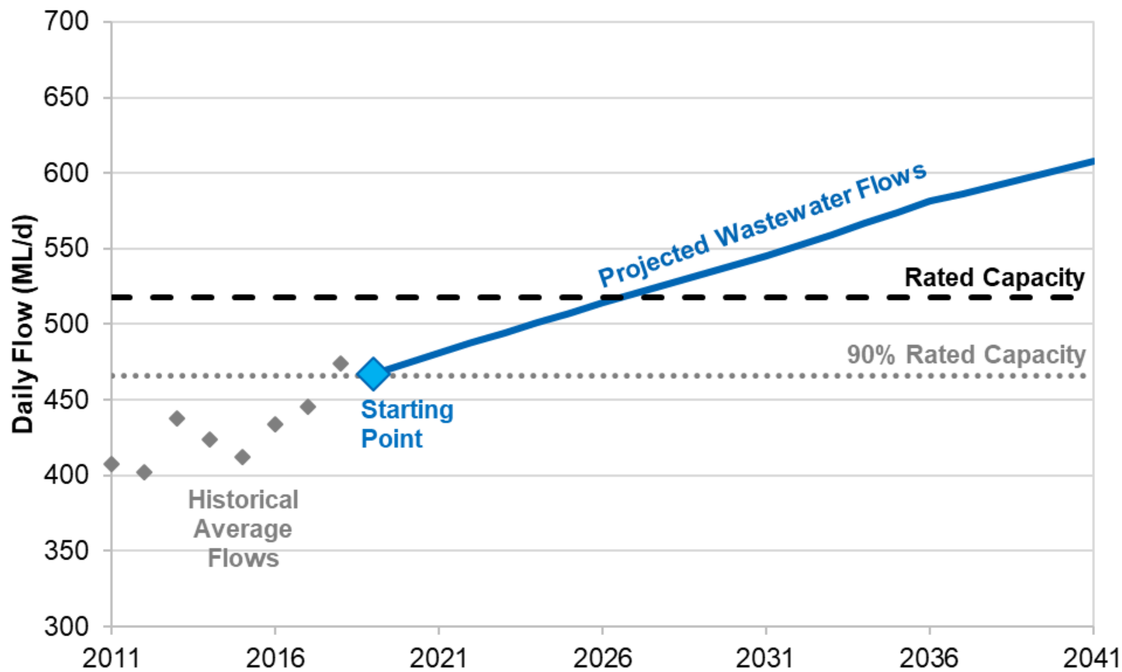


Figure 15 – Projected wastewater flows at G.E. Booth WWTP.

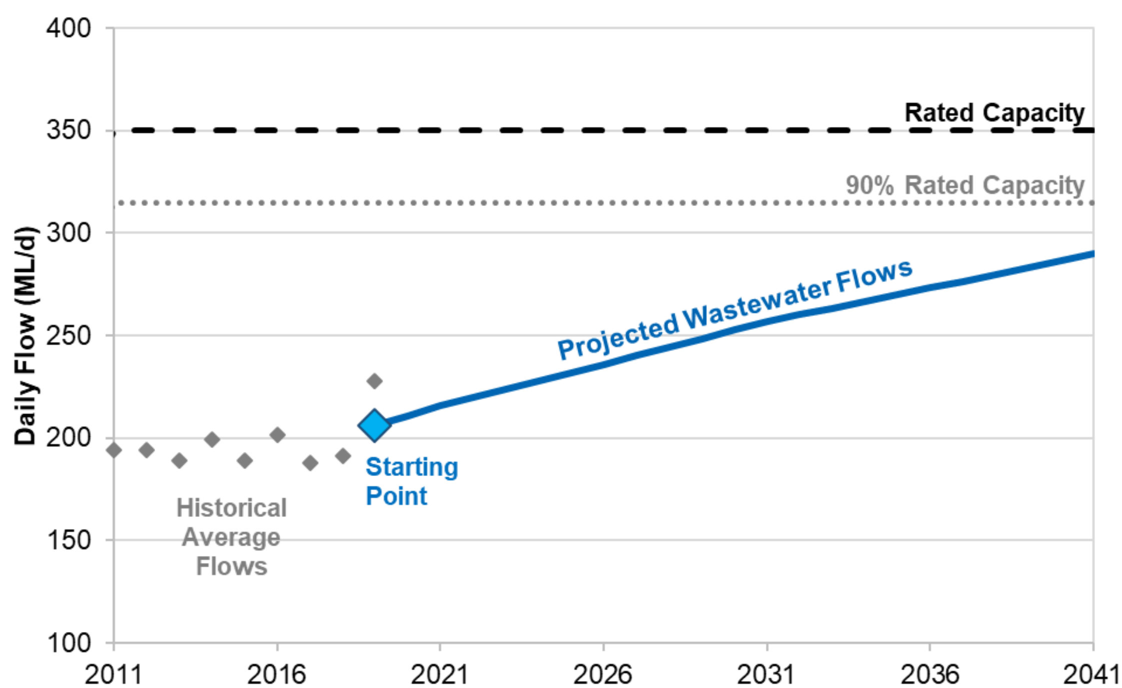


Figure 16 – Projected wastewater flows at Clarkson WWTP.

For more detailed information regarding the wastewater treatment plant capacity assessment, please refer to **Appendix 4D**.

4.3.1.2 Loadings Capacity Assessment

The Region of Peel WWTPs were designed based on the MECP (previously MOE) Design Guidelines, flows and loadings at the time of design. Since the latest expansions at the plants were completed, there have been a number of changes influencing the design and treatment capacity, including but not limited to:

- Higher and more frequent peak wet weather flows
- Higher raw wastewater concentrations
- MECP Design Guidelines (design basis to be used for determining unit process capacity)

Recent changes to these parameters have effectively reduced the governing capacity for some unit processes to operate below the rated capacity of the plant. The impacts of the flow, loading and MECP Design Guideline changes on the capacity of the unit process at the WWTP can be summarized as follows:

- Primary and secondary clarifiers - capacity reduced due to higher peak flows and the change in MECP Guidelines for loading rates.
- Outfall - capacity reduced due to higher peak flows and lower more stringent discharge limits set by the ECA.

The assessment of the wastewater treatment plants' loadings capacity indicated that the existing treatment capacity at the G.E. Booth WWTP would not be sufficient to meet projected growth within the planning horizon, while there is surplus capacity at the Clarkson WWTP. **Table 9, Figure 17** and **Figure 18** summarize the projected loadings for each WWTP based on their service area and results of the treatment capacity assessment. The tables and figures below do not include any transfers between the East and West trunk systems.

Table 9 – Wastewater treatment plant loading capacity assessment summary.

Treatment Capacity Assessment	2019	2021	2026	2031	2036	2041
G.E. Booth WWTP						
Current Plant Rated Capacity (Kg/d)	120,694	120,694	120,694	120,694	120,694	120,694
90% Plant Rated Capacity (Kg/d)	108,625	108,625	108,625	108,625	108,625	108,625
Existing Governing Capacity (Kg/d) **	96,695	96,695	96,695	96,695	96,695	96,695
Forecasted Demand (Kg/d)	122,430	126,013	135,207	144,042	153,765	161,501
Capacity Surplus(+) / Deficit (-) (Kg/d) *	**-25,735**	**-29,318**	**-38,512**	**-47,347**	**-57,070**	**-64,806**
Clarkson WWTP						
Current Plant Rated Capacity (Kg/d)	79,100	79,100	79,100	79,100	79,100	79,100
90% Plant Rated Capacity (Kg/d)	71,190	71,190	71,190	71,190	71,190	71,190
Existing Governing Capacity (Kg/d) ***	58,790	58,790	58,790	58,790	58,790	58,790
Forecasted Demand (Kg/d)	45,124	47,118	51,310	55,752	59,053	62,329
Capacity Surplus(+) / Deficit (-) (Kg/d) *	**13,666**	**11,672**	**7,480**	**3,038**	**-263**	**-3,539**

**Based on existing governing capacity.*
***Existing governing capacity based on Secondary Clarifiers at G.E. Booth WWTP.*
****Existing governing capacity based on Anaerobic Digestion at Clarkson WWTP.*

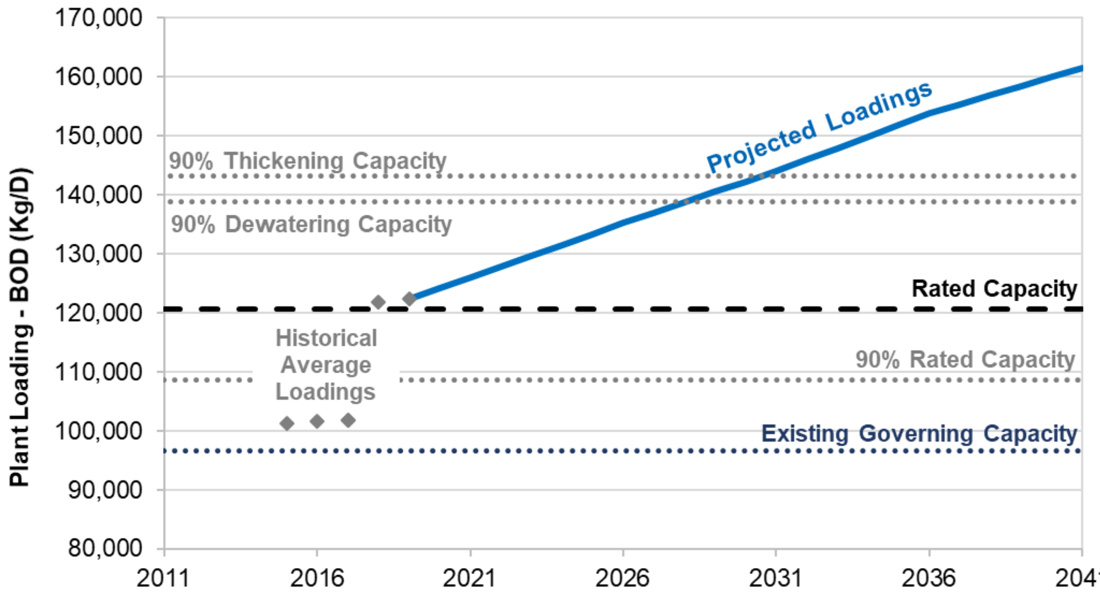


Figure 17 – Projected loadings at the G.E. Booth WWTP.

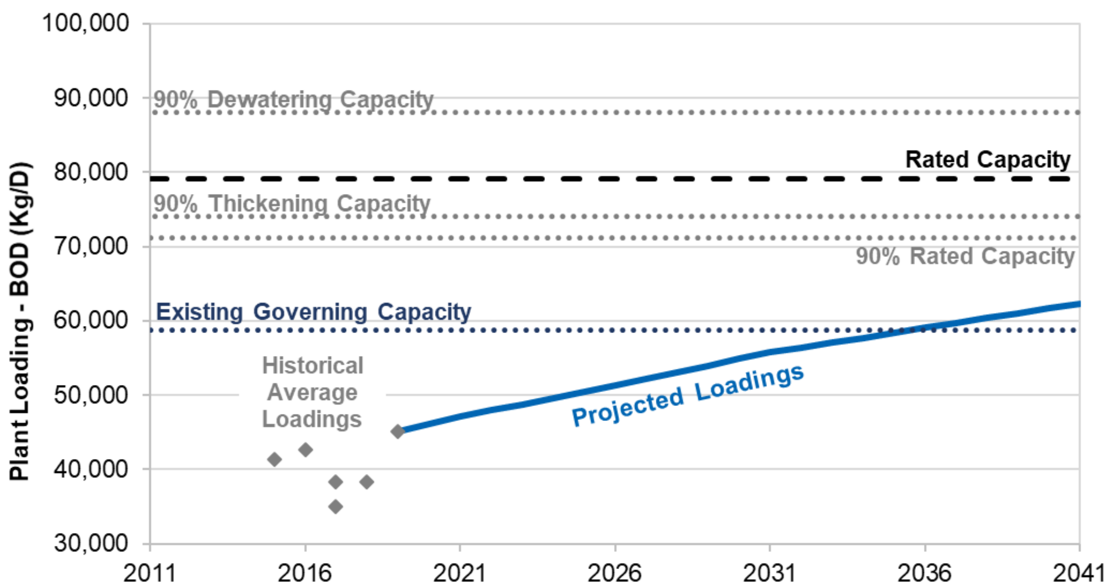


Figure 18 – Projected loadings at the Clarkson WWTP.

For more detailed information about the wastewater treatment plants capacity assessment, please refer to **Appendix 4D**.

4.3.2 Sewage Pumping Stations

Assessment of pumping capacity is based on the ability to provide the firm capacity to meet the required peak wet weather flows in the catchment area. This assessment required review of the potential growth area within sewage pumping station catchments as well as hydraulic analysis undertaken with the Region's all-pipe wastewater hydraulic model. Based on the analysis and other supporting studies, the following pumping station upgrades and servicing strategies were identified:

Elmwood Sewage Pumping Station

The Elmwood SPS infrastructure is facing condition, maintenance and performance issues, and will face further issues with projected future growth. The station requires additional capacity to service growth and is currently undergoing a separate Class EA study. The Elmwood SPS Class EA is being completed in parallel with the Class EA for Hiawatha SPS.

McVean Sewage Pumping Station

Peak flows at this station are projected to exceed the firm capacity before 2026. The station requires an additional 700 L/s of pumping capacity and force main upgrades to service future development in northeast Brampton and southeast Caledon.

Front Street Sewage Pumping Station

Equipment at the Front Street SPS is reaching end-of-life and needs to be replaced. A Class EA was recently completed that proposed decommissioning the existing Front Street SPS and constructing a new gravity sewer along Lakeshore Road to direct flows to the Richard's Memorial SPS[3].

Richard's Memorial Sewage Pumping Station

The Richard's Memorial SPS will require reconstruction with an expanded capacity to service growth in the Port Credit area. A Class EA was recently completed that proposed a new pumping station to be located within the Richard's Memorial Park, west of the existing pumping station with expanded capacity to take new flows from a proposed new gravity sewer on Lakeshore Road[3].

Two new sewage pumping stations and force mains are proposed in order to service growth areas in the Inspiration Lakeview development and in Mayfield West Phase 3.

4.3.3 Sanitary Trunk Sewers

The InfoWorks ICM all-pipe hydraulic model was used to evaluate the wastewater system's conveyance capacity. The assessments of sanitary trunk sewers capacity involve the following considerations:

- Location of growth
- Existing wastewater network
- Overall conveyance strategy
- System redundancy and flexibility
- Ability to provide wastewater service beyond planning horizon

Based on the assessment, the following sanitary trunk sewer upgrades and/or servicing strategies were identified:

Etobicoke Creek Trunk Sewers

The existing Etobicoke Creek twin trunk sewers, from Kennedy Road to south of Highway 407 in the City of Brampton, are experiencing capacity and condition constraints that will be exacerbated by the projected growth in the catchment area. The twin trunk sewers require addressing overall capacity and operational needs, existing condition, location and performance issues and is currently undergoing a separate Schedule C Class EA.

Fletcher's Creek Trunk Sewer

A section of the existing Fletcher's Creek trunk sewer between Queen Street and Steeles Avenue to the does not have sufficient capacity to convey the projected future flows in the catchment area. A twin trunk sewer will be required to resolve future capacity issues.

Lower West Sanitary Trunk Sewer

The lower west sanitary trunk sewer shows potential capacity constraints to convey future growth and wet weather flows to the Clarkson WWTP. A twin trunk sewer will be required from Lakeshore Road West to the Clarkson WWTP to service future development in the Region of Peel to 2041.

Upper West Sanitary Trunk Sewer

The Upper West sanitary trunk sewer shows existing and future capacity constraints in the general area bounded by Argentia Road to the north and Dundas Street to the south. These issues will be resolved by the commissioning of the new west trunk sewer along Erin Mills Parkway.

Sewer details and locations are depicted schematically in **Appendix 4C**.

New sanitary trunk sewers were recommended to extend servicing to future greenfield growth areas and to accommodate intensification growth in various locations within Peel. New trunk sewers were also recommended to relieve future constraints within existing trunk sewers and also to support various strategies such as: east to west flow diversion, interconnection between trunk sewers and decommissioning of existing SPSs.

5.0 Wastewater Servicing Strategy

5.0 Wastewater Servicing Strategy

The identification and evaluation of servicing options is a fundamental component of the master planning process. The servicing strategies development process allows for a comprehensive review of various servicing solutions and is completed through a transparent process to fully demonstrate decision-making and to provide defensible recommended strategies.

Consistent with previous water and wastewater master plans, east and west drainage areas were considered in isolation with the list of opportunities, issues, and constraints in mind, both within the larger Regional context and at the local service level. The 2020 Master Plan revisited concepts and strategies outlined in the previous master plans from a new perspective to take into consideration key changes that are critical for the Region's infrastructure plan moving forward. The purpose of this process was to validate current water and wastewater servicing strategies, and to ensure that all options are considered while highlighting why the preferred servicing solutions were chosen.

Key changes since the previous master plan include:

- Planning projections to the new 2041 planning horizon.
- Expansion of the future lake-based servicing boundary to areas north of Mayfield Road and west Bolton.
- Changes to master plan evaluation criteria, including the addition of the Innovation/Adaption criteria.
- Increased focus on climate change consideration in the Region's decision-making and planning processes.

The wastewater servicing strategy development process is described in the following sections.

5.1 Objectives

The Region intends for the 2020 Master Plan to meet the Approach 1 requirements under the Municipal Engineers Association (MEA) Class EA process. Under Approach 1, a master plan report is prepared at the conclusion of Phases 1 and 2 of the Class EA process. This approach allows for all Schedule A and A+ projects identified in the master plan to move forward to implementation. Any Schedule B and C projects identified will require supporting information and decision-making to proceed onto separate studies and continue through Phases 3 and 4 of the Class EA process.

The proposed strategy development approach described herein has been designed to ensure a logical and transparent process that documents the evaluation and decision-making that will ultimately develop a capital program that is defensible. Sustainability principles were also considered in the development of the 2020 Master Plan and were integrated within the strategy development, such as:

1. Making best use of existing infrastructure.
2. Minimizing the cost of new infrastructure.
3. Considering operation and maintenance costs to ensure financial sustainability.
4. Ensuring the long-term reliability and security of the water and wastewater systems.
5. Increasing system resiliency to climate change.
6. Avoiding disruptions to natural and cultural heritage resources.
7. Minimizing environmental crossings and other disruptions to the environment.
8. Planning for future infrastructure within the existing road right-of-way, where possible.
9. Avoiding/reducing production of greenhouse gas (GHG) emissions.
10. Preventing impact to areas that could represent a significant drinking water threat.

5.2 Evaluation Process and Criteria

Opportunities and constraints for the wastewater system were identified at the outset of the study and were used as a starting point for identifying conceptual servicing options. The evaluation process progresses from high-level concepts to more detailed servicing strategies and, where applicable, to further evaluation of specific servicing solutions in certain focus areas. The progression from high-level to more detailed servicing strategies allows for a more efficient process as it screens out non-feasible and unfavourable servicing concepts before they are carried forward for detailed evaluation.

Servicing concepts, strategies and specific servicing solutions are subject to evaluation of six major areas of impact: technical, environmental, financial, legal/jurisdictional, socio/cultural, and innovation/adaptation. The evaluation criteria and their associated impacts are described in **Table 10**.

Table 10 – Master Plan evaluation criteria.

Criteria	Description
Technical Impact	– Describes any overall technical advantage/disadvantage to an option related to capacity requirements and level of service – Describes difficulty and feasibility of construction (construction in limited areas, crossings, protection of utilities, trees or structures) – Assesses whether existing infrastructure upgrades are required – Describes risk considerations of conveying peak flows under wet weather flow conditions and operational flexibility of diverting flows throughout system – Describes the ability for phasing: o Staged growth and maximizing the use of existing or planned infrastructure and service areas o Incremental extensions of infrastructure as growth progresses o Describes potential opportunities/constraints to servicing post-2041 and intensification – Describes potential opportunity to decommission existing pumping stations and allow for gravity solutions – Describes the technical consideration required for construction and maintenance: o Highlights need for deep pipe construction, creek/highway/railway crossings, alignments along road rights-of-way and/or easements, and potential challenges during construction and future maintenance activities, where applicable o Where applicable, comments on construction of projects that can be coordinated with road improvements or construction of other projects o Assesses proximity and/or conflicts with existing infrastructure o Considers ability to maintain existing services during construction/implementation – Describes ability to provide and maintain desired level of service under climate change conditions
Environmental Impact	– Describes the potential impacts of the option on the natural environment – Proximity to existing natural features and designations including but not limited to the Greenbelt, Niagara Escarpment, ESAs, ANSIs, conservation authority regulation limits, vegetation, woodlands, wildlife, aquatic resources and fisheries and nearby agricultural lands – Highlights requirements for major environmental crossings, deep sewers, development through environmental designated areas, and requirements for mitigative action – Describes potential impact on groundwater quantity and quality – Consider resiliency and adaptation to climate change

Criteria	Description
Financial Impact	– Outlines when use of existing infrastructure is maximized – Considers construction costs for new infrastructure and for upgrades to existing system – Describes the capital cost relative to other options – Highlights major projects that differ from other options that significantly contribute to the capital costs – Describes large up-front costs required for phasing of growth and implementation of capital projects over time – Comments on long-term energy costs and operation and maintenance costs and requirements – Assesses long-term financial sustainability – Describes opportunities for integration with state of good repair projects
Legal / Jurisdictional Impact	– Notes any land requirement issues and agency concerns that may arise related to project alignments, land acquisition, planning permits, crossings, etc. – Notes if coordination, approvals and land acquisition will be required – Potential to maximize worker safety and operability
Socio / Cultural Impact	– Describes the potential impacts to local businesses and residents, archaeological/heritage resources, and visual aesthetics – Describes any potential noise, odour, dust, vibrations, traffic disruptions to residents and businesses during construction and operation – Consider potential community resistance to servicing alternatives
Innovation / Adaptation	– Considers ability to apply innovation and new technologies – Highlights use of data for evidence based decision-making process – Outlines opportunities for operational flexibility to adapt to climate change – Describes ability to maximize energy efficiency, incorporate water conservation, and other sustainability and environmental practices – Considers performance of system under power outage conditions and opportunities for renewable energy production and use – Comments on avoiding energy-intensive infrastructure

5.3 Servicing Strategy Development

Within a Master Plan for such a large, mature municipality such as Peel, with well-established trunk infrastructure networks it can be beneficial to develop several separate focused strategies with clearly defined constraints and goals, in addition to a broad system wide servicing strategy.

The Peel Wastewater Strategies consisted of the following:

- **System Wide Servicing Concepts** – address future treatment capacity constraints (hydraulic and loading), and flow flexibility within the trunk systems
- **Focus Areas Servicing Solutions** – several separate stand-alone strategies to address area-specific sewer and/or pumping capacity constraints

5.3.1 System Wide Servicing Concepts

A list of servicing concepts to address the future treatment and servicing capacity constraints was considered at a high level, weighing the advantages and disadvantages of each concept. The initial, strategic concepts were evaluated simplistically, with advantages and disadvantages listed. Based on the evaluation, concepts were either screened out or carried forward in combination for further evaluation. The concepts evaluated are listed as follows and the description and detailed evaluation of these concepts can be found in **Appendix 4E**.

Table 11 – Wastewater system wide servicing concepts.

Concept	Carried Forward / Screened Out
Do nothing	Screened Out ✘
Limit growth	Screened Out ✘
Satellite treatment	Screened Out ✘
New treatment plant (Discharging to watercourse or Lake Ontario)	Screened Out ✘
Build off Planned Infrastructure (Expand existing WWTP and diversion of flows)	Carried Forward ✓
Inflow and Infiltration Reduction	Carried Forward ✓
Combined Storage / Conveyance	Screened Out ✘

5.3.2 System Wide Servicing Strategies Evaluation

Combinations of the concepts carried forward formed various strategies that are generally considered system-wide solutions. The descriptions of the strategies are relatively detailed and thus offer greater scope for more detailed evaluation. At this stage, each strategy is subjected to evaluation against the master plan evaluation criteria. Evaluation of the system-wide servicing strategies is presented in **Appendix 4E**.

Three system-wide wastewater servicing strategies were developed and evaluated with this process. The system wide servicing strategies are described as follows:

Strategy 1 – Build off planned infrastructure and maximize the east system and the G.E. Booth WWTP

- Build off planned 2031 infrastructure by expanding conveyance to support development of north growth areas in Brampton and Caledon.
- No diversion of flows from east to west. WWTPs treat flows from their natural catchments only
- Multiple staged expansions of G.E. Booth WWTP within period.
- No expansion of the Clarkson WWTP.
- East trunk system conveyance capacity increase for growth flows.
- Inflow and infiltration reduction.

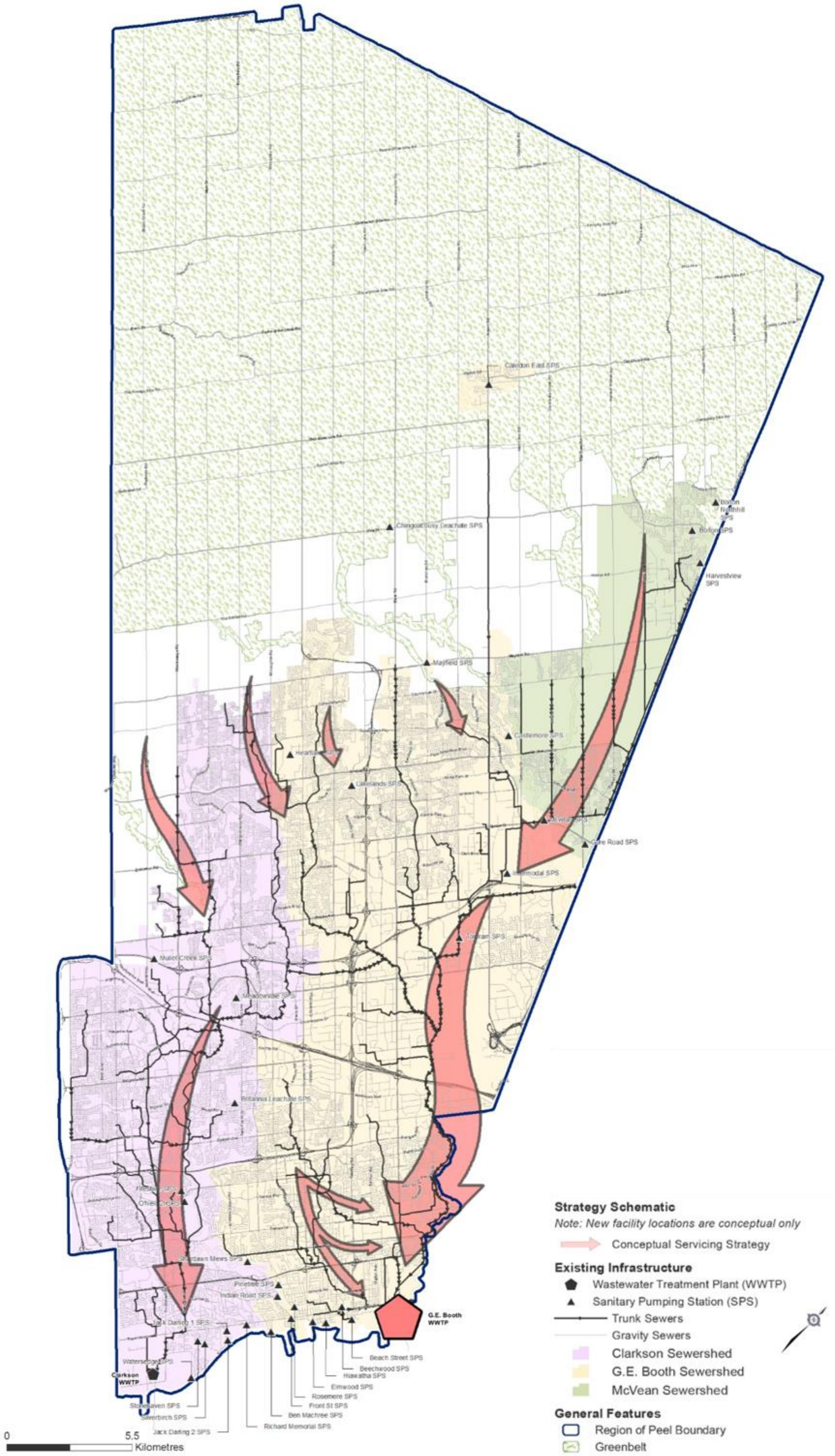
Strategy 2 – Build off planned infrastructure and maximize the west system and the Clarkson WWTP

- Build off planned 2031 infrastructure by expanding conveyance to support development of north growth areas in Brampton and Caledon.
- Diversion of flow from east system to west system
- Multiple staged expansions of the Clarkson WWTP within period.
- No expansion of the G.E. Booth WWTP.
- Inflow and infiltration reduction.

Strategy 3 – Build off planned infrastructure and balance flows between the east and west systems

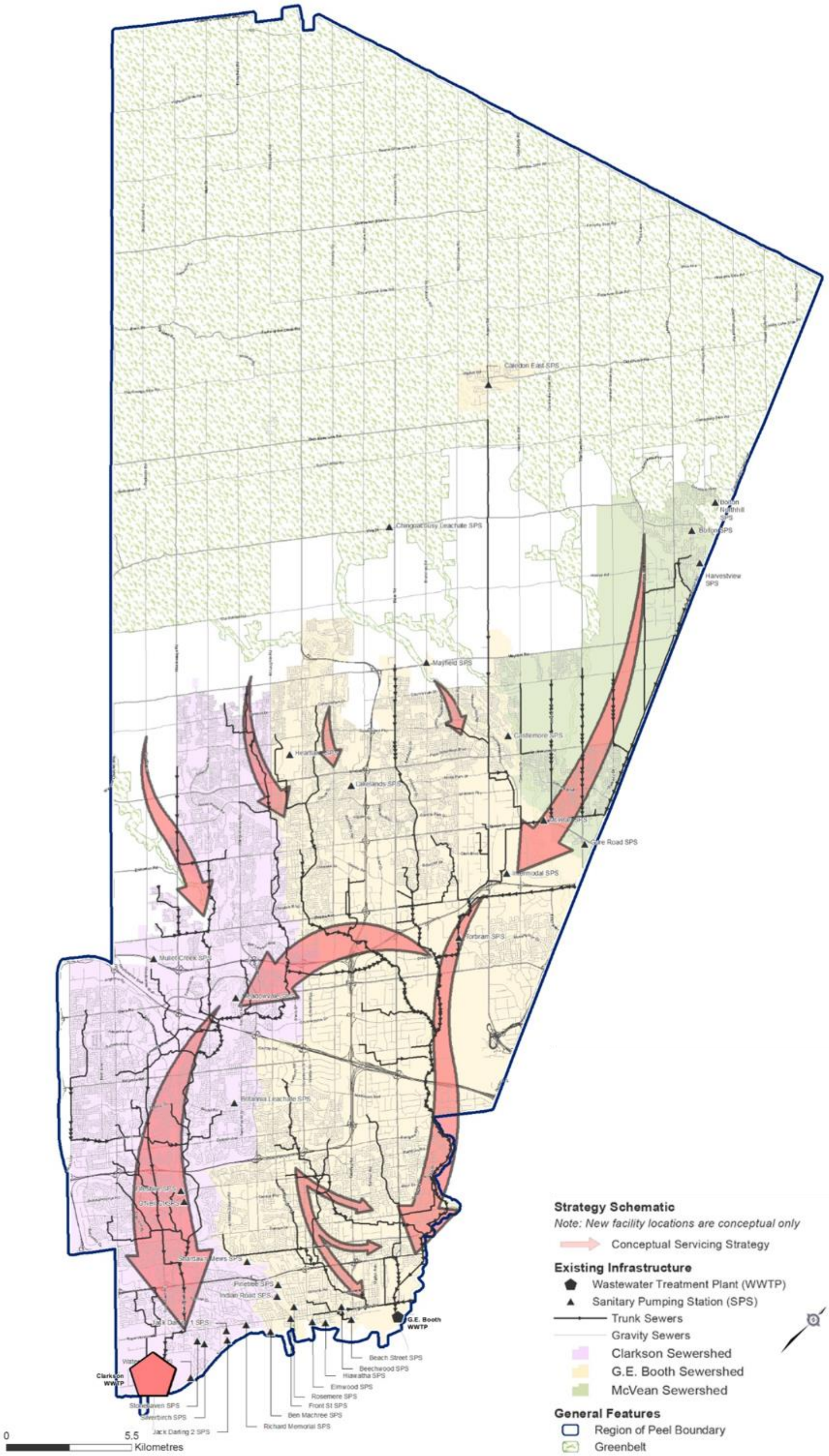
- Build off planned 2031 infrastructure by expanding conveyance to support development of north growth areas in Brampton and Caledon.
- Diversion of flow from east system to west system
- Expansion of the Clarkson WWTP and the G.E. Booth WWTP within period.
- Inflow and infiltration reduction.

The results of the strategy evaluation show that Strategy 1 and 2 were screened out and Strategy 3 was carried forward; further details are outlined in **Appendix 4E**.



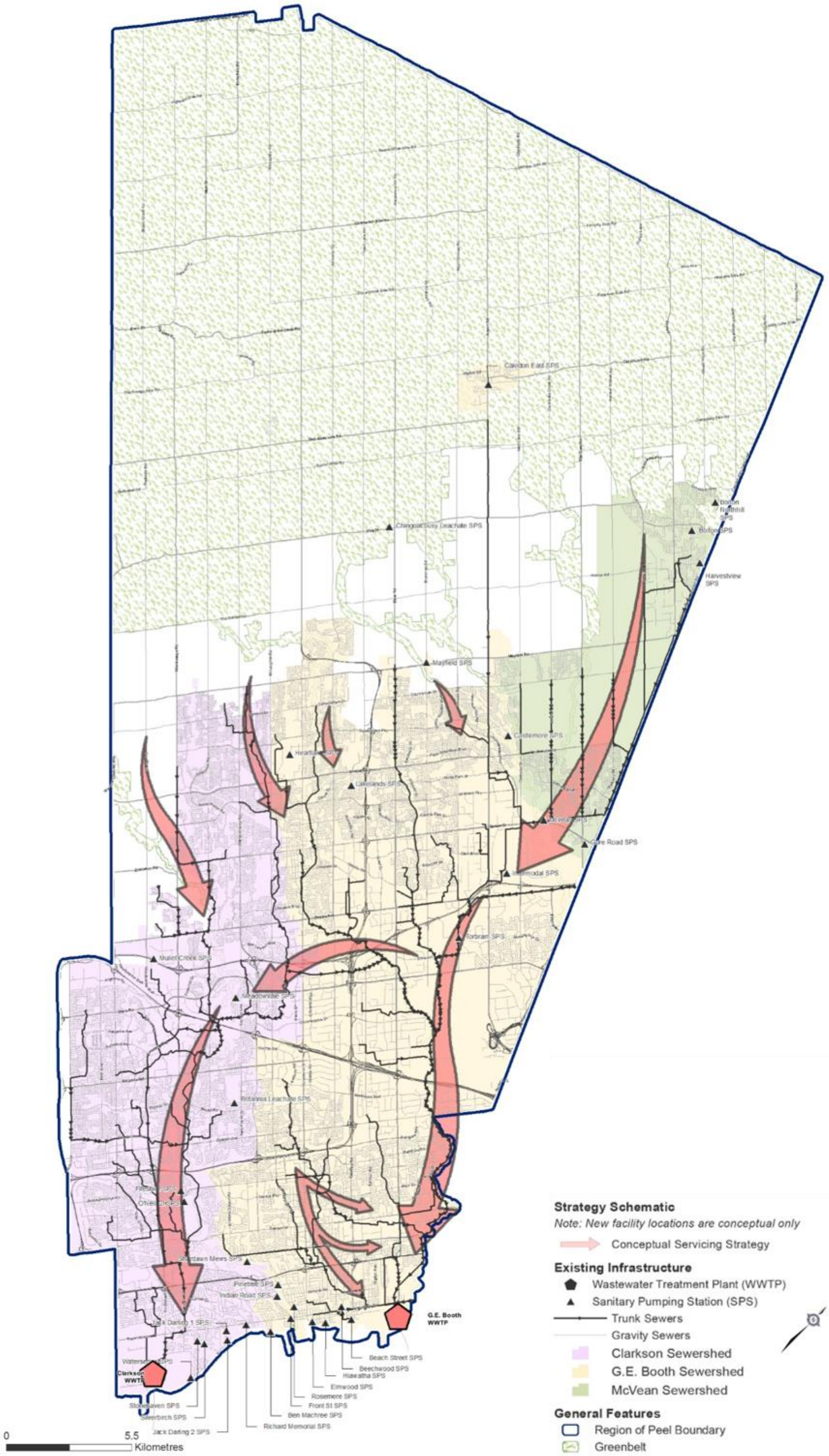
Note: High resolution image is available in Appendix 4H.

Figure 19 – System wide servicing strategy 1 - build off planned infrastructure and maximize the east system and G.E. Booth WWTP.



Note: High resolution image is available in Appendix 4H.

Figure 20 – System wide servicing strategy 2 - build off planned infrastructure and maximize the west system and Clarkson WWTP.



Note: High resolution image is available in Appendix 4H.

Figure 21 – System wide servicing strategy 3 - build off planned infrastructure and balance flows between the east and west systems.

5.3.3 Focus Areas Servicing Solutions

The lake-based wastewater system is a complex system with multiple components. In addition to the System Wide Servicing Strategy outlined above, the 2020 Master Plan outlines servicing solutions in focus areas where key components of the system are reviewed, and the optimal servicing solutions are identified and presented. Collectively, the System Wide and Focus Area Servicing Solutions combine to form the overall wastewater servicing strategy for the Region of Peel. The following sections summarize key aspects of the wastewater servicing solutions for key areas in the lake-based system. All alignments identified along new roads are preliminary based on the projected growth estimates in accordance with Scenario 16 (Council endorsed). These alignments will be further refined during design and implementation and are subject to change. Additional information is provided in **Appendix 4E**.

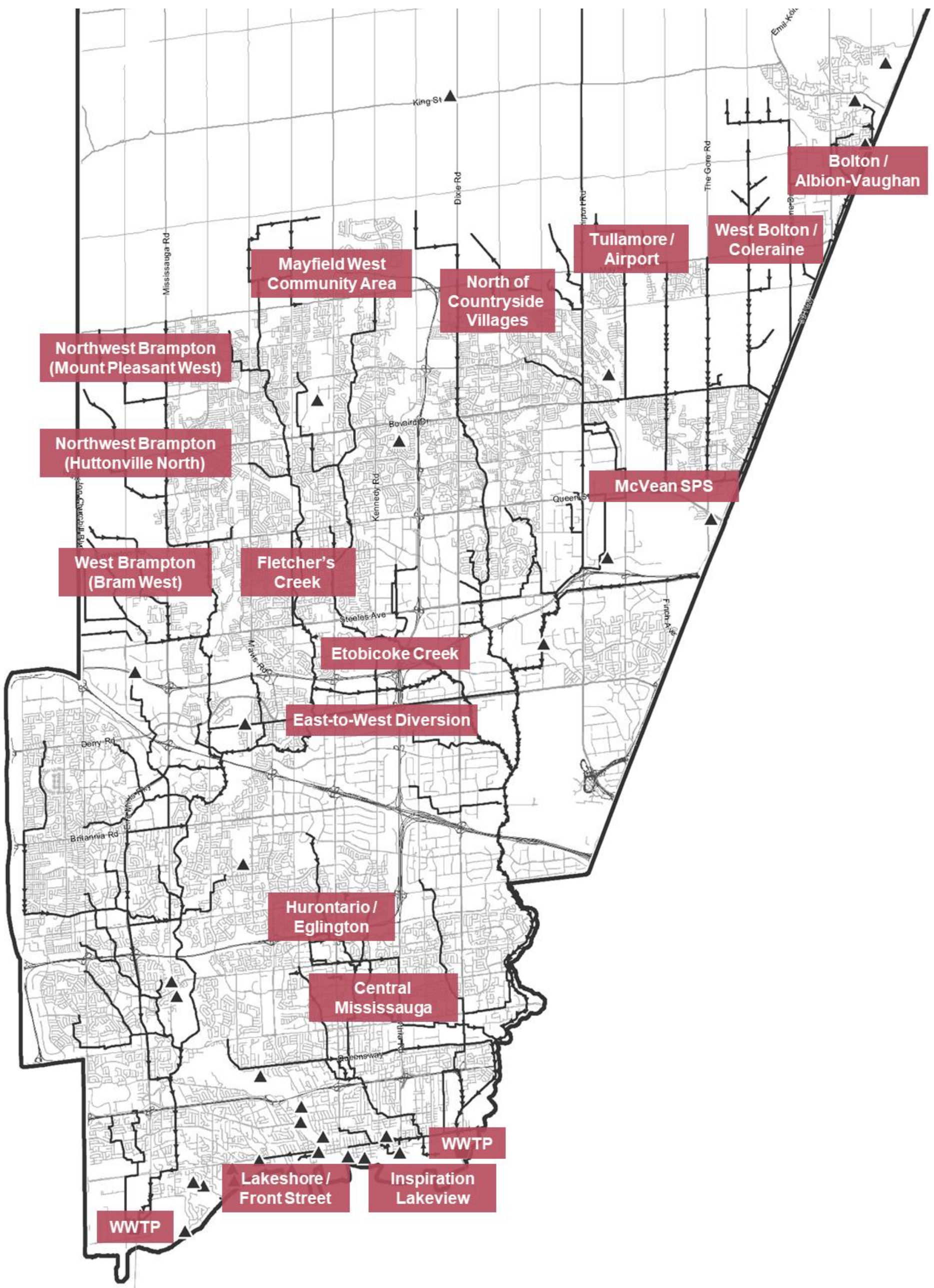


Figure 22 – Wastewater focus area servicing solutions overview map.

5.3.3.1 Wastewater Treatment and East to West Diversion

The Region of Peel wastewater treatment plants are anticipated to require capacity upgrades to meet the projected wastewater flows for the Region to 2041. The servicing solutions based on the system-wide servicing strategy to balance flows between east and west systems includes the implementation of the East-to-West Diversion trunk sewer as well as various treatment plant upgrades outlined as follows:

East-to-West Diversion Trunk Sewer

Construction of a new 2400-mm sanitary trunk sewer on Derry Road from the East sanitary trunk sewer at Spring Creek to the Upper West sanitary trunk sewer (West Leg) at Highway 401 and Creditview Road.

The following treatment plant upgrades are incorporated in the servicing strategy:

G.E. Booth WWTP – New Plant 1

Major capital improvements at the treatment plant, including demolition (Existing Plant 1) works, new inlet conduit, new odour control facility, new primary clarifiers and a new by-pass conduit to replace the existing Plant 1 and to support future expansion of the facility.

G.E. Booth WWTP – Capacity Restoration

Recovery of 40 ML/d of liquid treatment capacity to restore the G.E. Booth WWTP capacity to 518 ML/d. Further details on the capacity restoration are provided in **Appendix 4G**.

G.E. Booth WWTP – Various Improvements

Several improvements at the G.E. Booth WWTP have been identified, including:

- Replacement of three existing blowers at Plant 2 with six multi-stage high-efficiency blowers.
- Modification of existing cake silos and pumping system to allow the exportation of cake offsite.
- Implementation of the recommendations of the odour study with the anticipation of additional odour control necessary as redevelopment occurs in the vicinity of the treatment facility.

G.E. Booth WWTP Expansion

Expansion of the G.E. Booth WWTP will include the following components:

- Expansion of liquid treatment capacity from 518 ML/d to 600 ML/d.
- Construction of additional biosolids capacity with the installation of two additional incinerators.
- Construction of a new outfall to accommodate the full site capacity.

Clarkson WWTP Expansion

Expansion of the Clarkson WWTP liquid treatment capacity from 350 ML/d to 500 ML/d.

Clarkson WWTP – Biosolids Expansion

Expansion of the biosolids process at the Clarkson WWTP with the addition of three digesters.

Clarkson WWTP and G.E. Booth WWTP - Standby Power Expansion

Installation of outdoor modular systems with external houses for switchgear systems. Clarkson includes aerial conversion for the remaining power system to buried duct and switchgear modules.

More information about proposed WWTP upgrades is provided in **Appendix 4G**.

5.3.3.2 Bolton SPS / Albion-Vaughan Road Trunk Sewer

Growth is projected within the Bolton Sewage Pumping Station catchment area. In addition, significant growth is planned in west Bolton, within the existing Coleraine gravity catchment. As part of the East Bolton Wastewater Servicing Strategy, a new trunk sewer along Albion-Vaughan Road was constructed from Mayfield Road to Royalton Drive. Current flows from the Bolton sewage pumping station are directed to the Coleraine Drive sewer and the Albion-Vaughan Road trunk sewer. The servicing strategy is to divert more sanitary flow to the Albion-Vaughan trunk sewer. As such, the recommended solutions for this area mainly consist of new Bolton SPS force main pumping flows to the east and continued extension of the Albion-Vaughan sanitary trunk sewer.

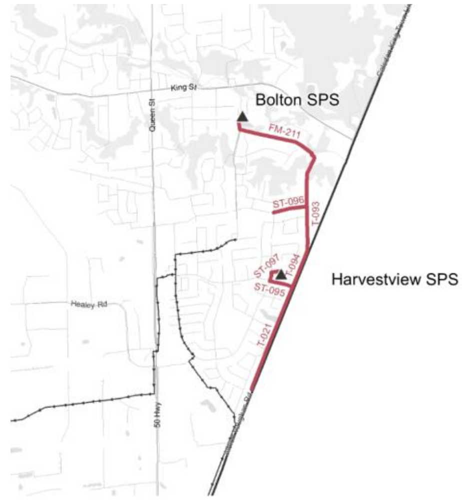


Figure 23 – Bolton SPS / Albion-Vaughan Road trunk sewer.

Key issues in this area include:

- Potential capacity constraints at the Coleraine Drive sewer to service growth to 2041.
- Spare capacity at Albion-Vaughan trunk sewer

Key projects required to achieve the proposed solutions include:

Albion-Vaughan Road Sanitary Trunk Sewer

Extension of the sanitary trunk sewer on Albion-Vaughan Road from the existing trunk sewer at Royalton Drive to Nunnville Road and on Nunnville Road from Albion-Vaughan Road to the end of Nunnville Road to direct flows away from the Coleraine Drive sewer and free up capacity for future growth in West Bolton.

Bolton Sewage Pumping Station Force Main Twinning

Construction of a new force main from the Bolton SPS to the Albion-Vaughan Road sanitary trunk sewer to direct flows away from the Coleraine Drive sewer and free up capacity for future growth in west Bolton.

Decommissioning of the Harvestview Sewage Pumping Station

Decommission the Harvestview SPS and direct flows to the Albion-Vaughan Road trunk sewer.

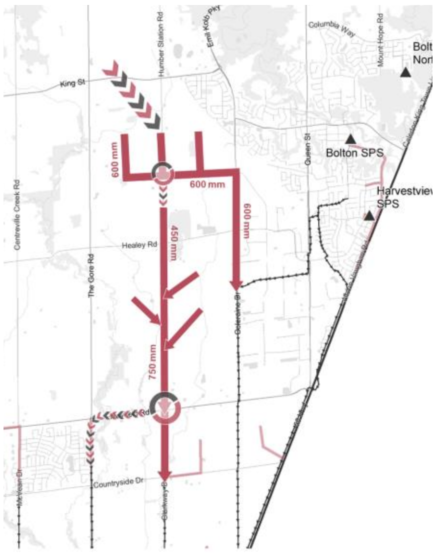
Growth-Related Sanitary Sewers in Bolton

Construction of several growth-related sanitary sewers to service future development in Bolton, support the decommissioning of the Harvestview SPS, and divert a small catchment area (from Glenwood Crescent to Riverwood Terrace) to the extension of Albion-Vaughan Road trunk sewer at Nunnville Road.

5.3.3.3 West Bolton / Coleraine Drive

Significant growth to 2041 is projected in west Bolton, west of Coleraine Drive and North of Mayfield Road. The servicing solutions for this area consist of extending servicing into the new growth areas and directing flows to existing sewers on Coleraine Drive and Clarkway Drive. As part of the 2020 Master Plan the following options for extending servicing were considered and further investigated:

Option 1: Current Strategy
Flow Split between Coleraine Drive Sewer and New Humber Station Road Sewer



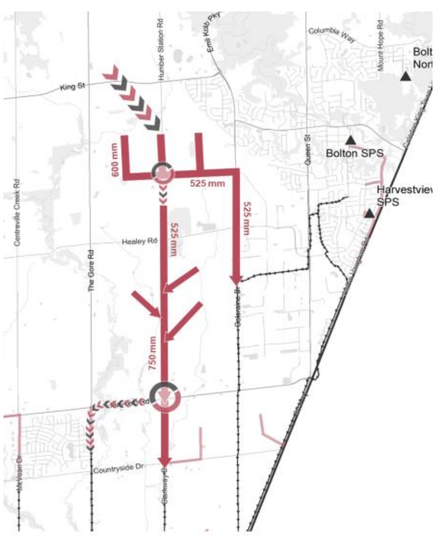
Carried Forward ✓

- Coleraine Drive twin sewer (larger size)
- Humber Station sewer (smaller size)

Key Considerations:

- Maximizes capacity of the existing Coleraine Drive sewer.
- Facilitates phasing of northern area connecting to the existing sewer on Coleraine Drive.
- Larger size and longer length required than Option 2 for twinning sewer on Coleraine Drive.
- Trunk sewer extension along The Gore Road will be required post-2041.
- Potential for future splits for diversion of post-period flows from Coleraine Drive to Humber Station Road and from Humber Station Road to the Gore Road.

Option 2: Modified Current Strategy – Reduced flow to Coleraine Drive Sewer
Flow Split between Coleraine Drive Sewer and New Humber Station Road Sewer



Screened Out ✘

- Coleraine Drive twin sewer (smaller size)
- Humber Station sewer (larger size)

Key Considerations:

- Does not maximize capacity of the existing Coleraine Drive sewer.
- More buildout flows to future Humber Station Road sewer and less to Coleraine Drive sewer.
- Facilitates phasing of northern area connecting to the existing sewer on Coleraine Drive.
- Smaller size and shorter length required than Option 1 for twinning sewer on Coleraine Drive.
- Trunk sewer extension along The Gore Road will be required post-2041.
- Potential for future splits for diversion of post-period flows from Coleraine Drive to Humber Station Road and from Humber Station Road to the Gore Road.

Option 3: Flow to Humber Station Road Trunk Sewer

Screened Out ✘

- No Coleraine Drive twin sewer
- Humber Station sewer (larger size)
- The Gore Road sewer

Key Considerations:

- Does not maximize capacity of the existing Coleraine Drive sewer.
- All buildout flows to Humber Station Road trunk sewer. Flow split with The Gore Road sewer will be required.
- Eliminates the need for twinning the existing Coleraine Drive sewer.
- Limits phasing of growth. The Humber Station Road trunk sewer will be required to be in place to service the growth areas north of Healey Road.
- Brings part of sewer along The Gore Road in period.
- Requires Humber Station Road trunk sewer to be upsized for post-2041.

More details on the evaluation of these three options can be found in **Appendix 4E**.

Key projects required to achieve the preferred Option 1 solution include:

Humber Station Road Sanitary Trunk Sewer

Construction of a new 450-mm to 750-mm sanitary trunk sewer on Humber Station Road from Mayfield Road to north of Healey Road to service future development in west Bolton.

Coleraine Drive Sanitary Sewer Twin

Construction of new 600-mm sanitary sewer on Coleraine Drive from Manchester Court to McEwan Drive to service future development in west Bolton.

Various Sanitary Sewers

Construction of new sanitary sewers along future roads to service future development in west Bolton between Mayfield Road and south of King Street and connecting to future sewers on Coleraine Drive and Humber Station Road.

5.3.3.4 McVean Sewage Pumping Station

The previous master plan identified the need for pumping capacity upgrades and a new force main to the McVean SPS. With the introduction of the 2041 planning horizon, significant growth is projected within the McVean SPS catchment area, potentially exceeding the current and planned pumping station capacity. In addition, further growth projections post-2041 require additional pumping capacity at this station, which would potentially trigger the construction of a major upgrade or a twin pumping station.

Key issues in this area include:

- Significant growth in the existing McVean catchment area to 2041.
- Potential requirement for pumping station expansion beyond existing site limits.
- Lifecycle cost of additional pumping.
- Long-term growth beyond the station's planned capacity to 2041.

As part of the 2020 Master Plan the following servicing solutions options were considered and further investigated:

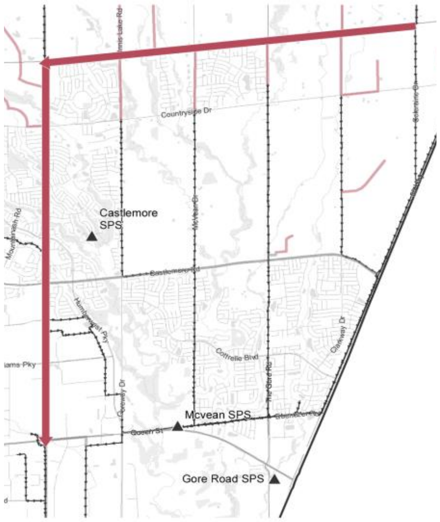
Option 1: New sewage pumping station, additional force mains and overflow storage

Screened Out ✘

Key Considerations:

- Requires a new sewage pumping station (ultimate capacity of approximately 2,500 L/s to service to 2041 and post 2041 buildout), two additional forcemains and an overflow storage basin (2hr storage – 35,000 m^3).
- New SPS requires expansion beyond the existing site limits.
- Potential for disruptions contained within site of new SPS.
- Does not avoid potential need for capacity upgrades of trunk sewers upstream of the SPS.
- Does not provide operational flexibility to adapt to climate change impacts.
- Does not reduce greenhouse gas emissions and potential SPS overflows to the environment.
- Lower capital cost but higher operational and maintenance cost out of all options.

Option 2: Bypass McVean SPS with Gravity Sewer (Bypass catchment area north of Mayfield Road)



Screened Out ✘

Key Considerations:

- Provide opportunity for SPS de-rating and avoid new SPS beyond site limits.
- Provide opportunity for operational flexibility and security.
- Allow for gravity solution versus pumping flows.
- Provide for better adaption to climate change.
- Reduces greenhouse gas and potential SPS overflows to the environment.
- Potential for more disruptions during construction due to longer alignment.
- Higher capital cost than new SPS. However, operation and maintenance savings over the life of SPS may offset additional cost.
- Provide post-2041 conveyance capacity for growth north of Mayfield Road
- Higher cost than option 3.
- Innovative solution that defies the status quo.

Option 3: Bypass McVean SPS with Gravity Sewer (Bypass catchment area north of Castlemore Road)

Carried Forward ✓

Key Considerations:

- Provide opportunity for SPS de-rating and avoid new SPS beyond site limits.
- Provide opportunity for operational flexibility and security.
- Allow for gravity solution versus pumping flows.
- Provide for better adaption to climate change.
- Reduces greenhouse gas and potential SPS overflows to the environment.
- Potential for disruptions during construction.
- Higher capital cost than new SPS. However, operation and maintenance savings over the life of SPS will offset additional cost.
- Provide section of Airport Road sewer for post-2041 conveyance capacity for growth north of Mayfield Road
- Better support of phasing when compared to Option 2.
- Lower cost than option 2.
- Innovative solution that defies the status quo.

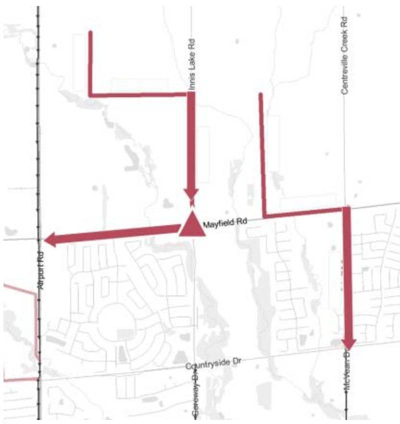
More details on the evaluation of these three options can be found in **Appendix 4E** and **Appendix 4F**.

Option 3 was selected as the preferred servicing option for the McVean catchment. This option includes a new diversion sanitary trunk sewer along Castlemore Road and Airport Road and will require the completion of a Schedule C Class EA prior to proceed with design and implementation. Through the EA process, other alignments and options will be evaluated with consideration to pipe size, material, construction methods and mitigation measures.

5.3.3.5 Tullamore / Airport Road

Growth is projected in the Tullamore and Airport Road area north of Mayfield Road between Airport Road and Centreville Creek Road. The servicing solutions for this area consist of extending servicing into the new growth areas and directing flows to existing sewers on McVean Drive and Goreway Drive. As part of the 2020 Master Plan the following options for extending servicing were considered and further investigated:

Option 1: New SPS and force main to Airport Road and new gravity sewer on McVean Drive



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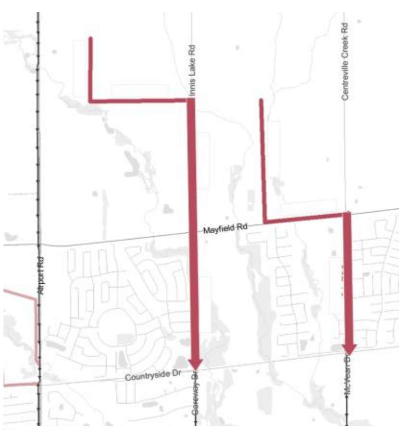
Key Considerations:

- New SPS on Innis Lake Road with provisions for expansion to service buildout growth.
- New force main on Mayfield Road from new SPS to Airport Road sewer (includes creek crossing).
- Diversion of flows from the McVean SPS catchment area.
- Extension of the McVean Drive sewer to Mayfield Road to service new growth area between Innis Lake Road and Centreville Creek Road.
- Does not maximize the capacity of existing sewers on Goreway Drive and McVean Drive and future Castlemore bypass sewer.

Option 2: New gravity sewers on Innis Lake Road / Goreway Drive and McVean Drive



Carried Forward ✓

Key Considerations:

- New gravity sewer on Innis Lake Road and Goreway Drive to service area East of Salt Creek.
- Extension of the McVean Drive sewer to Mayfield Road to service new growth area between Innis Lake Road and Centreville Creek Road,
- Future Castlemore bypass sewer will allow more flow south eliminating the need to send flows to Airport Road sewer.
- Allow for gravity solution versus pumping flows eliminating the need for a new SPS and force main on Mayfield Road.
- Maximizes capacity of existing sewers and future Castlemore Bypass.

More details on the evaluation of these two options can be found in **Appendix 4E**.

Key projects required to achieve the preferred Option 2 solution include:

McVean Drive Sewer

Construction of a new sanitary sewer on McVean Drive from Mayfield Road to Countryside Road.

Innis Lake Drive/Goreway Drive Sewer

Construction of a new sanitary sewer on Innis Lake Road and Goreway Drive from north of Mayfield Road to Countryside Drive.

5.3.3.6 North of Countryside Villages Area / North of Mayfield Road

Growth is projected in the north of Countryside Villages area, north of Mayfield Road between Dixie Road and Airport Road (e.g., Mayfield West Future Phase, Tullamore Industrial). The servicing solution for these areas consists of new sewer extensions, mainly along future roads and the decommissioning of the existing Mayfield sewage pumping station.

Key projects required to achieve the preferred servicing solution for this area include:

Mayfield West Phase 4 Sanitary Sewer

Construction of new sanitary sewer extension on a future street from Mayfield Road heading northwest crossing Bramalea Road to service future development in Mayfield West Phase 4.

Countryside Villages Sanitary Sewers

Construction of new gravity sewers within the development area to service future development in the Countryside Villages connecting to existing infrastructure on Bramalea Road, Torbram Road and Airport Road.

Mayfield Sewage Pumping Station Decommission

Decommissioning of the existing Mayfield SPS and conveying flows to a new gravity sewer that will service future development in Mayfield West Phase 4.

Figure 24 – Countryside Villages / North of Mayfield Road.

5.3.3.7 Mayfield West Community Areas

Growth is projected in the Mayfield West community area (north of Mayfield Road between Chinguacousy Road and Dixie Road). The servicing solution for this area is guided by the preliminary Mayfield West Phase 2 secondary plan functional servicing study and mainly consists of new gravity sewers along existing and future roads to connect to existing sewers south of Mayfield Road. In addition, a new sewage pumping station and force main is proposed to service lands north of the Etobicoke Creek and east of McLaughlin Road.

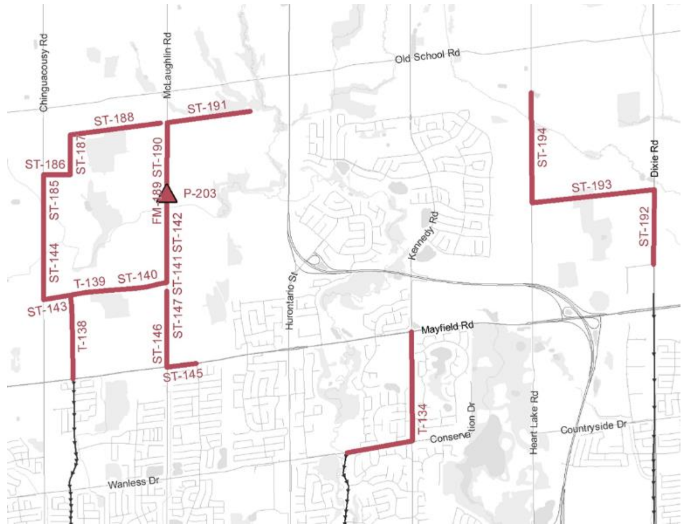


Figure 25 – Mayfield West.

Key issues in this area include:

- Distance to existing trunks sewers (e.g., Edenbrook Hill Drive, Van Kirk Drive and Dixie Road)
- Environmental features (Etobicoke Creek, Humber River Tributary)

Key projects required to achieve the proposed solutions include:

Kennedy Road North/Conservation Drive Sanitary Sewer

Construction of new sanitary sewer on Kennedy Road from Boreham Circle to Mayfield Road to service future development in Mayfield West Phase 1 that cannot be serviced by the existing 525-mm sanitary sewer on Inder Heights Drive.

Mayfield West Community Phase 2 Sanitary Sewers

Construction of new sanitary sewers on McLaughlin Road connecting to the existing sewer on Van Kirk Drive to service future development in Mayfield West Phase 2 around McLaughlin Road and Mayfield Road.

Construction of a new sanitary sewer network connecting to the existing sewer on Edenbrook Hill Drive to service future development in Mayfield West Phase 2 in lands south of the Etobicoke Creek between Chinguacousy Road and McLaughlin Road.

Mayfield West Community Phase 3 Sanitary Sewers and Sewage Pumping Station

Construction of new sanitary sewers, sewage pumping station and force main in the vicinity of McLaughlin Road and the Etobicoke Creek to service future development in Mayfield West Phase 3.

Construction of new sanitary sewers in the vicinity of Chinguacousy Road and Old School Road to service future development in Mayfield West Phase 3 in lands north of the Etobicoke Creek between Chinguacousy Road and McLaughlin Road.

Mayfield West (Future Phase) Sanitary Sewers

Construction of new sanitary sewers on various roads from Heart Lake Road to Dixie Road to service future development in a future phase of Mayfield West.

5.3.3.8 Northwest Brampton (Mount Pleasant West)

Growth is projected for the Mount Pleasant West area[4] bounded by Mayfield Road to the north, Mississauga Road to the east, Winston Churchill Boulevard to the west, and the CN Railway to the south. The servicing solution for this area mainly consists of new gravity sewers along existing and future roads to connect to existing trunk sewer on Mississauga Road.

Key issues in this area include:

- Distance to existing trunks sewer along Mississauga Road.
- Environmental features (Huttonville Creek and Credit River Tributary).
- Consideration for post-2041 growth north of Mayfield Road.

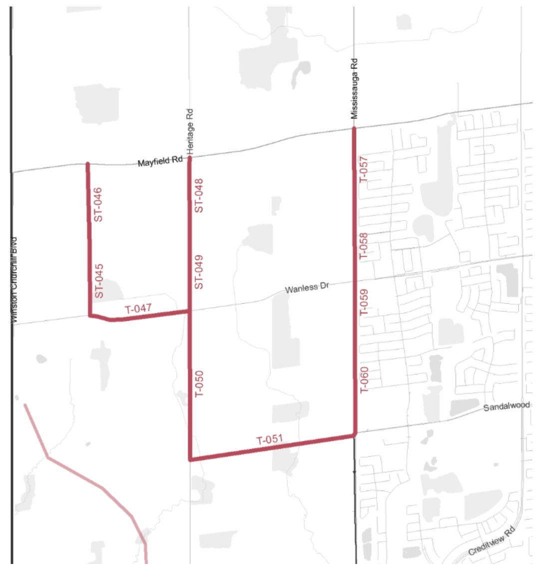


Figure 26 – Northwest Brampton (Mount Pleasant West).

Key projects required to achieve the proposed solutions include:

Credit Valley Sanitary Trunk Sewer

Construction of a new sanitary trunk sewer on Mississauga Road from Wanless Drive to Mayfield Road to service future development in the Mount Pleasant West Secondary Plan area and post-2041 growth in southwest Caledon.

Northwest Brampton Sanitary Trunk Sewer

Construction of a new sanitary trunk sewer on Heritage Road from the future Sandalwood Parkway extension at Mississauga Road to Wanless Drive to service future development in the Mount Pleasant West Secondary Plan area and southwest Caledon.

Mount Pleasant West Sanitary Sewers

Construction of a new sanitary sewer network connecting to the future Northwest Brampton sanitary trunk sewer to service future development in the Mount Pleasant West Secondary Plan area and southwest Caledon.

5.3.3.9 North-West Brampton (Huttonville North)

Growth is projected for the Huttonville North area[5] bounded by CN Railway to the North, Mississauga Road to the east, Winston Churchill Boulevard to the West, and the Credit River to the south. The servicing solution for this area is guided by the preliminary secondary plan road alignments and mainly consists of new gravity sewers along roads right of way and future roads to connect to existing trunk sewer on Mississauga Road.

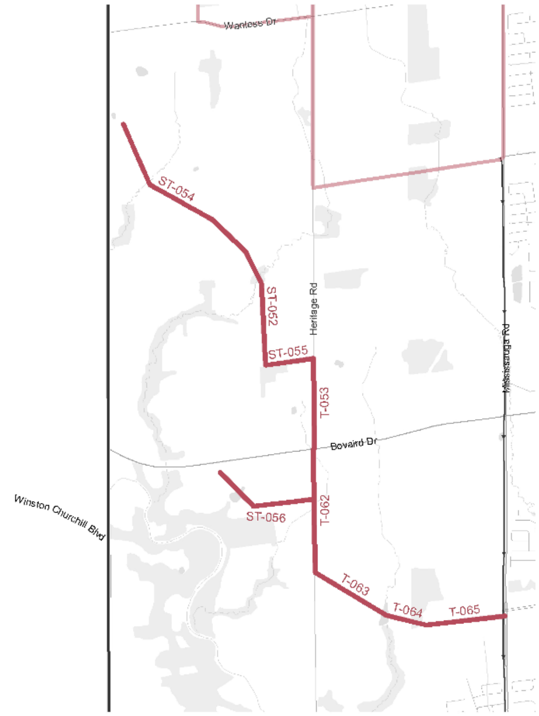


Figure 27 – Northwest Brampton (Huttonville North).

Key issues in this area include:

- Distance to existing trunks sewer along Mississauga Road.
- Environmental features (Credit River and tributaries).

Key projects required to achieve the proposed solutions include:

Heritage Heights Sanitary Trunk Sewer

Construction of a new sanitary trunk sewer on the future extension of Williams Parkway from Mississauga Road to Heritage Road north of Bovaird drive to service future development in the Huttonville North Secondary Plan area.

Huttonville North Sanitary Sewers

Construction of a new sanitary sewer network connecting to the future Heritage Heights sanitary trunk sewer to service future development in the Huttonville North Secondary Plan area.

5.3.3.10 West Brampton (Bram West)

Growth is projected for the Bram West area[6] bounded by the Credit River to the north, Mississauga Road to the east, Winston Churchill Boulevard to the west, and the Steeles Avenue to the south. The servicing solution for this area generally follows the preliminary secondary plan road alignments and mainly consists of new gravity sewers along roads right of way and future roads to connect to the existing Steeles West trunk sewer.

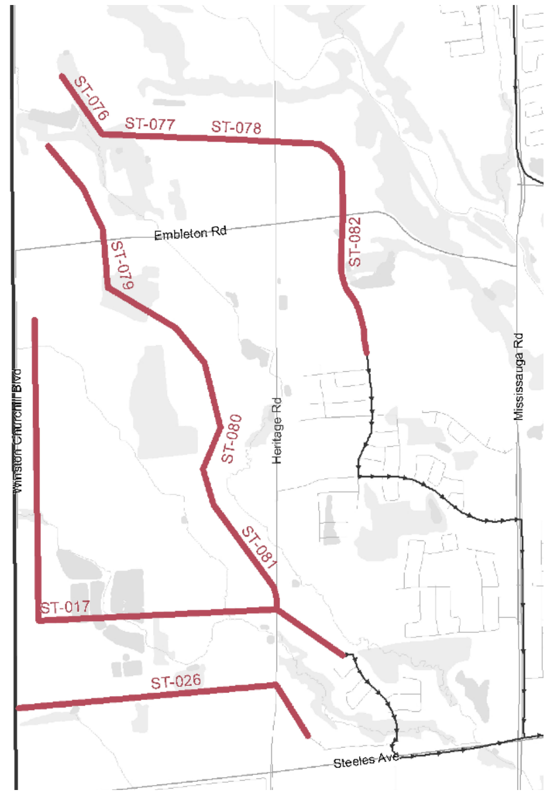


Figure 28 - West Brampton (Bram West).

Key issues in this area include:

- Distance to existing trunks sewer on Rivermont Road and Steeles Avenue West.
- Environmental features (Credit River and tributaries).

Key projects required to achieve the proposed solution include:

Bram West Sanitary Sewers

Construction of a new sanitary sewer network connecting to the existing Steeles West sanitary trunk sewer to service future development in the Bram West Secondary Plan area.

5.3.3.11 Fletcher’s Creek

Significant growth is projected in the catchment area of the Fletcher’s Creek trunk sewer including future and existing developments generally located bounded by McLaughlin Road to the east, Huttonville Creek to west, the CN Railway to the south, and Mayfield Road and Old School Road to the north.

Key issues in this area include:

- Capacity constraints within trunk sewer due to growth in northern catchment area.
- Environmental features (Fletcher's Creek).

As part of the 2020 Master Plan the following servicing solutions options were considered and further investigated:

Carried Forward ✓

Option 1: New twin sewer along McLaughlin Road from Queen Street West to Steels Avenue West

Key Considerations:

- New tunneled sewer along McLaughlin Road.
- Provides opportunity for potential interconnection with middle section of the existing Fletchers Creek twin on McLaughlin Road which can be used for phasing of the project.
- Requires crossings of Fletcher's Creek.
- Potential for future extension south to connect to the East-to-West Diversion.

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Option 2: New twin sewer along McMurchy Avenue from Queen Street West to Steeles Avenue West

Key Considerations:

- Provide opportunity for SPS de-rating and avoid new SPS beyond site limits.
- New tunneled sewer along McMurchy Avenue.
- Does not allow for potential interconnection with middle section of the existing Fletchers Creek twin on McLaughlin Road.
- Longer alignment than option 1.
- Does not require crossings of Fletcher's Creek.

More details on the evaluation of these two options can be found in **Appendix 4E**.

The proposed Fletcher’s Creek sanitary trunk sewer twinning will require the completion of a Schedule C Class EA prior to proceeding with design and implementation. Through the EA process, other alignments and options could be evaluated with consideration to pipe size, material, construction methods and mitigation measures.

5.3.3.12 Etobicoke Creek

The Etobicoke Creek Trunk Sewer (parallel to the creek between Kennedy Road and Tomken Road) is primarily comprised of twin 1050-mm and 1200-mm diameter pipes that cross Highway 410, the Old Brampton WWTP lands and Highway 407. The Etobicoke Creek trunk sewers service the areas adjacent to the Etobicoke Creek as well as areas parallel to Hurontario Street as far north as Mayfield West, north of Mayfield Road.

Significant growth is expected in the service area, including intensification in Downtown and Uptown Brampton, new growth in Mayfield West and potential growth beyond 2041 north of Old School Road.

Key issues in this area include:

- Existing and future capacity constraints.
- Existing condition and performance issues including hydraulic restrictions in the conveyance capacity downstream of the abandoned Old Brampton WWTP.
- Limited or challenging access to sections of the trunk sewer.
- Risk of maintaining the old flow control structures at the site of the abandoned plant.
- Exposure of the linear infrastructure due to erosion.

The servicing solutions for this area include twinning the Etobicoke Creek sewers along the existing alignment in the vicinity of the old Brampton WWTP, and a new gravity trunk sewer along Kennedy Road to connect to the proposed East-to-West Diversion trunk sewer on Derry Road. However, the servicing solutions for the area bounded by Steeles to the north, Kennedy Road to the west, Dixie Road to the east, and Derry Road to the south will be further developed and evaluated through a separate Class EA, which is underway. The Schedule C Class EA aims to identify, develop and implement a solution to address future capacity needs and existing sanitary sewer issues in the Etobicoke Creek sanitary trunk sewer from Kennedy Road to south of Highway 407 in the City of Brampton.

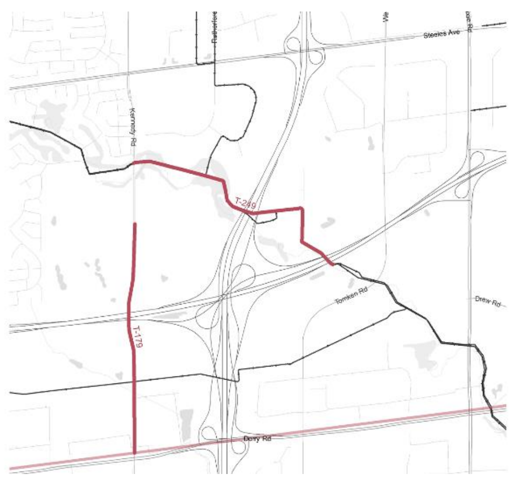

Figure 29 – Etobicoke Creek.

5.3.3.13 Central Mississauga

Central Mississauga is expected to experience significant growth over the next 20 years, specifically within core areas such as the Mississauga City Centre, Hurontario Corridor and the Dundas Corridor. It is expected that these areas will grow by over 40 per cent by 2041. The current wastewater infrastructure does not have available capacity to service this increased growth.

Key issues in this area include:

- Capacity constraints within the system to deal with the rise of increasingly intense wet weather events and to support future growth in the service area.
- Hydraulic restrictions along sections of the Cooksville Creek and Little Etobicoke Creek trunk sewers, and other limitations that challenge further upgrades to existing trunk sewers.
- Operational flexibility to divert flows for sewer rehabilitation, emergency operations and inspections.
- Future integration with real -time controls (RTC) for system operation and optimization.

The servicing solutions for this area include new sanitary sewers and sanitary trunk sewers along Centre View Drive, Duke of York Boulevard and Webb Drive, new sanitary trunk sewers along Cawthra Road, Burnhamthorpe Road and the Queensway, and several other growth-related sewer improvements.

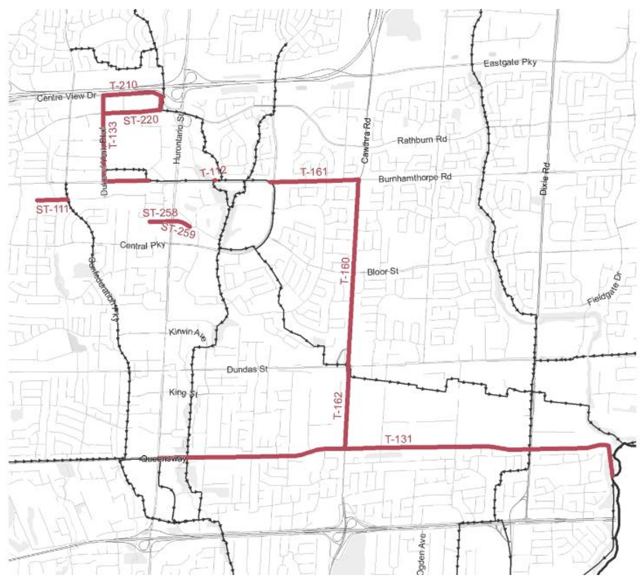

Figure 30 – Central Mississauga.

However, the servicing solutions for this area will be further developed and evaluated through a separate Class EA, which is underway. The Schedule C Class EA aims to address the Central Mississauga capacity constraints by developing an integrated wastewater strategy for the Central Mississauga system to achieve operational flexibility, which will enable more capacity for growth and potential for wet weather flow management.

5.3.3.14 Hurontario / Eglinton

Growth is projected within the planning horizon around the intersection of Hurontario Street and Eglinton Avenue. In addition, current development applications in this area indicate that there is potential for higher growth than the 2041 projections.

Key issues in this area include:

- Current development applications in the area with high growth projections.
- Additional growth is projected to occur upstream of the Hurontario/Eglinton area within the Britannia Farm site, which could have an impact on the Upper Cooksville Creek sanitary trunk sewer.

The servicing solutions for this area include:

- New gravity sewers from the existing sanitary sewer on Eglinton Avenue East to the proposed developments within the Hurontario/Eglinton area.
- Maximize use of the capacity within existing infrastructure, where possible monitor flows as development occurs in the area.

Ongoing review and monitoring of development applications, proposed flow and sewer capacity in the area will be required. The Region will also coordinate with other planned infrastructure work in the area such as the Hurontario Light Rail Transit (LRT).

Figure 31 – Hurontario / Eglinton.

5.3.3.15 Lakeshore / Front Street

Growth is projected along Lakeshore Road in Mississauga including intensification and new growth in development areas such as the Port Credit West Village.

Key issues in this area include:

- Requirement for Front Street SPS equipment replacement.
- Requirement for Richard's Memorial SPS reconstruction with an expanded capacity to service growth in the Port Credit area.
- Balance of wastewater flows between the G.E. Booth and the Clarkson WWTPs.

A Schedule B Class EA for the Front Street Pumping Station Wastewater Diversion was recently completed[3]. The current servicing solutions proposed for this area include:

- Decommissioning of the existing Front Street SPS and Ben Machree SPS
- Construction of a new gravity trunk sewer along Lakeshore Road to direct flows to the Richard's Memorial SPS.
- New pumping station to be located within the Richard's Memorial Park, west of the existing pumping station with expanded capacity to take new flows from the proposed new gravity trunk sewer on Lakeshore Road.

Although the completed EA selected a preliminary preferred strategy (shown below and included in the Master Plan), further analysis is to be completed to investigate potential extension of the gravity sewer to the east and west along Lakeshore Rd and decommissioning of additional sewage pumping stations.

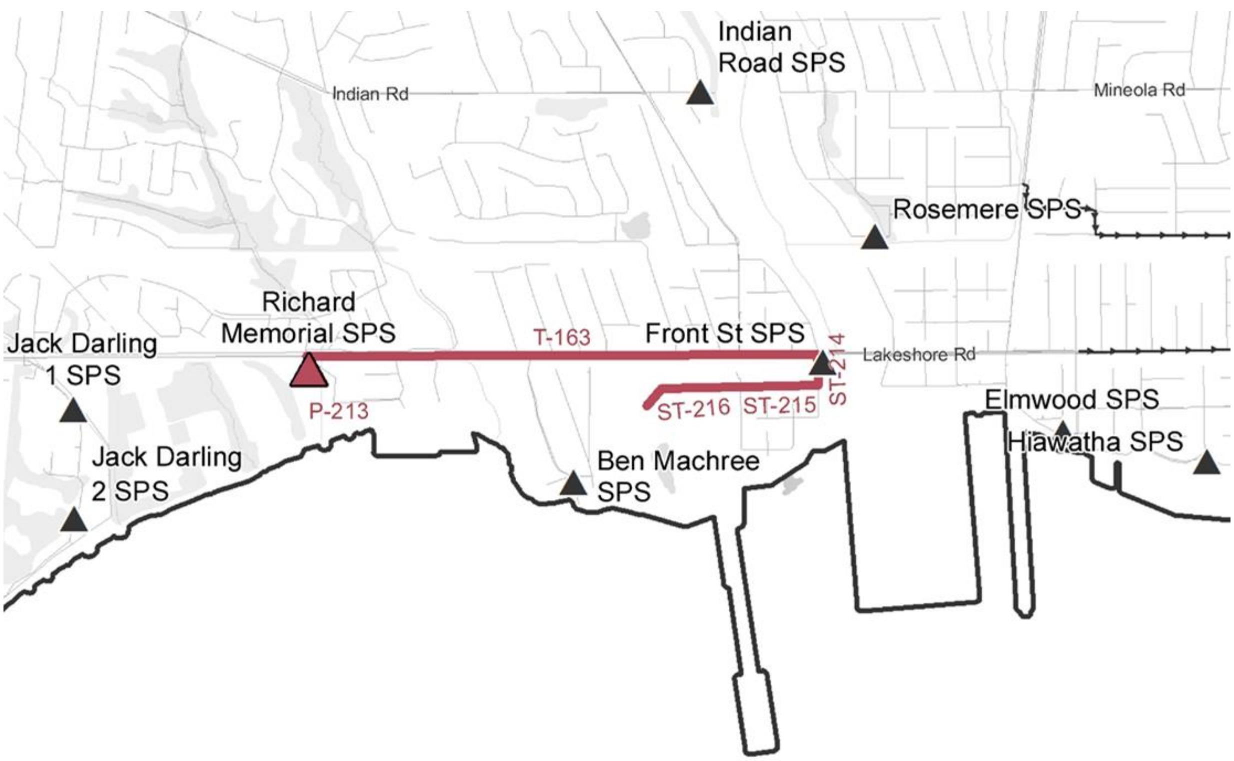

Figure 32 – Lakeshore / Front Street.

5.3.3.16 Inspiration Lakeview

Significant growth is projected in the development area known as Inspiration Lakeview. The site, formerly owned by Ontario Power Generation (OPG), is located in south-east Mississauga on Lake Ontario, approximately 3.8 kilometres east of Port Credit, near the western limits of the City of Toronto. The existing site grading does not allow for servicing of the entire area by gravity to existing sewers along Lakeshore Road East and Rangeview Road. Some of the flows generated on-site will require pumping to Lakeshore Road East.

Key issues in this area include:

- Flows generated within the southern portion of the site will require to be directed to a new local sewage pumping station.

The servicing strategy proposed for this area was based on the Lakeview Village Development Master Plan, and includes:

- Construction of new network of local gravity sewers.
- Construction of new on-site local sewage pumping station and forcemain discharging to Lakeshore Road East sanitary trunk sewer.

Figure 33 – Inspiration Lakeview.

5.3.4 Inter-Regional Agreements

5.3.4.1 York Region Wastewater Servicing

York Region average day flows sent to Peel are defined in the York-Peel Servicing Agreement. The agreement provides York Region with 53 ML/d of wastewater treatment capacity in Peel Region to 2031 and beyond. The wastewater average day flows as per the York-Peel Servicing Agreement are shown in **Figure 34**.

Wastewater flows from York Region are pumped from the Humber sewage pumping station in York Region and enter the Region of Peel via twin 900-mm force mains at Highway 427 and Steeles Avenue East. The force mains discharge to the gravity network at Steeles Avenue East, just west of Airport Road, which ultimately convey flows to the G.E. Booth WWTP for treatment before final discharge to Lake Ontario.

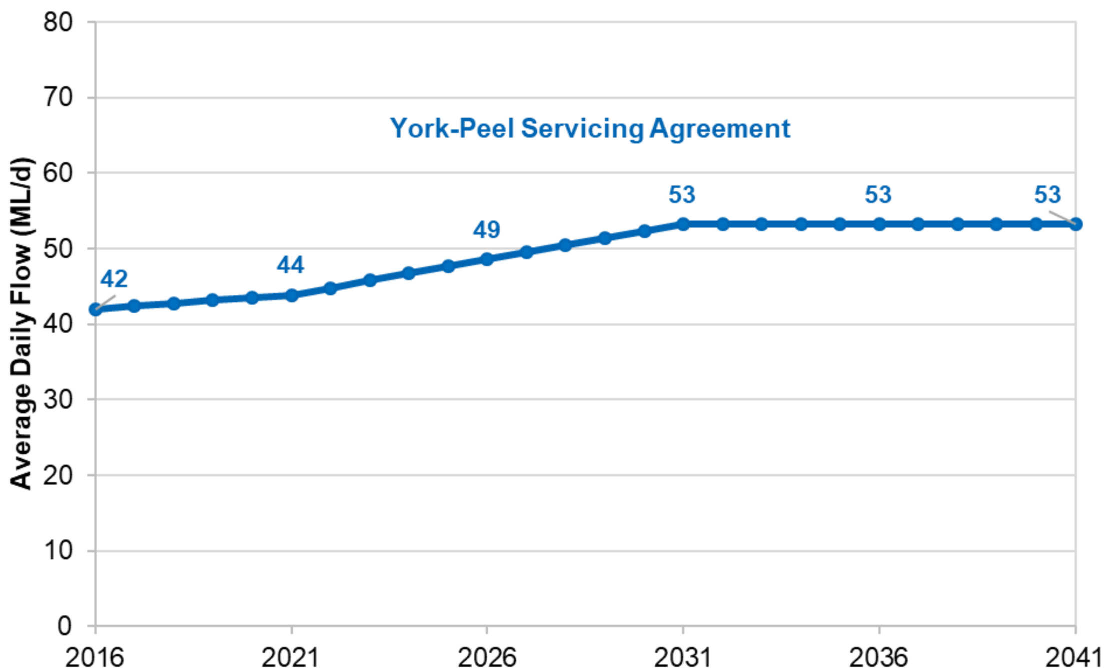

Figure 34 – Average day flows as per the York-Peel servicing agreement.

Committed wastewater treatment capacity of an average day wastewater flow of 53 ML/d to 2041 is factored into the development of the Peel wastewater servicing strategy for the lake-based system. Some of the components of the wastewater servicing strategy impacted by the York flows include the G.E. Booth WWTP upgrades.

5.3.4.2 Peel-Toronto Servicing Agreement

The Peel-Toronto Wastewater Servicing Agreement allows for the provision of treatment services to parts of the City of Toronto's and the Region of Peel's respective sanitary sewer sheds that would otherwise require significant additional infrastructure to intercept and convey sewage flows back to each municipalities' respective wastewater treatment plants. The agreement effectively eliminates the need for both municipalities to construct and maintain additional pumping stations and force mains.

The agreement states that there are several locations where sewage flows cross the municipal boundary between Peel and Toronto, as listed in **Table 12**.

Table 12 – Locations of sewage flows between the Peel and Toronto Inter-Regional Servicing.

Direction of Flow	Interconnection Point	Receiving System	Receiving Facility
Toronto to Peel	Rakely Court and Eglinton Avenue East	Peel East Sanitary Trunk Sewer	G.E. Booth WWTP
Toronto to Peel	41st Street and Lakeshore Road East	Peel East Sanitary Trunk Sewer	G.E. Booth WWTP
Peel to Toronto	Disco Road and Highway 427	Toronto	Humber Bay WWTP
Peel to Toronto	Dundas St. East to Dundas St. W Transition on the East side of Etobicoke Creek	Toronto	Humber Bay WWTP

The agreement states that each municipality will receive the flow from the other at the designated interconnection points and treat it at the designated treatment facility. It also specifies a rate per cubic metre to be charged on a net flow basis. The three locations identified in Table 7 are equipped with flow monitors for the purposes of quantifying the wastewater flows that are being conveyed from each municipality to the other. Recent analysis of historic flows shows that flows from Toronto to Peel exceed the flows from Peel to Toronto, meaning that there is a net flow from Toronto to the Region of Peel.

Wastewater flows from the City of Toronto are factored into the development of the Peel wastewater servicing strategy for the lake-based system. Some of the components of the wastewater servicing strategy impacted by the Toronto flows include G.E. Booth WWTP upgrades and expansion.

6.0 Preferred Wastewater Servicing Strategy

6.1 Preferred Servicing Strategy

6.2 Capital Program for the Preferred Wastewater Servicing Strategy

6.0 Preferred Wastewater Servicing Strategy

This section summarizes the preferred Wastewater Servicing Strategy for the Region of Peel to service growth to 2041.

6.1 Preferred Servicing Strategy

The Preferred Wastewater Servicing Strategy is a combination of system-wide recommendations, area-specific servicing solutions, plus wastewater system and facility recommendations collectively addressing the wastewater needs of the Region of Peel out to year 2041.

The preferred water servicing strategy is outlined in Figure 35 and was developed to ensure that:

- Extension of the existing lake-based wastewater system is aligned with existing Regional and Local planning policies
- Use of the existing wastewater system and facilities is maximized and used as the backbone for new infrastructure to meet the planned 2041 needs.
- Strategic oversizing of infrastructure, where justified, is planned to support growth beyond 2041.
- The Master Plan recommendations were developed by, and provided feedback to, the Region's Growth Management Strategy through an integrated process.

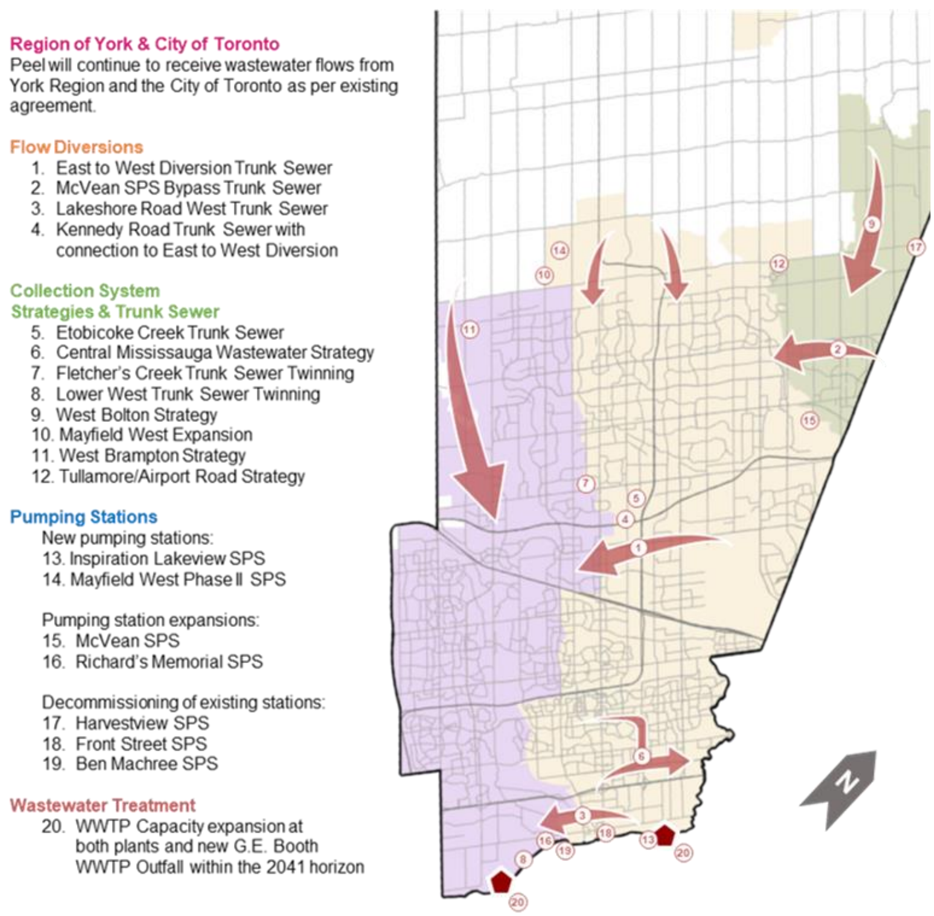

Figure 35 – Preferred wastewater servicing strategy for the lake-based system.

6.2 Capital Program for the Preferred Wastewater Servicing Strategy

As described in previous sections, the preferred Wastewater Servicing Strategy has been developed to support servicing needs of the existing and future growth areas within the Region of Peel lake-based system to 2041. The capital costs for each project within the preferred servicing strategy were estimated according to the costing methodology described in **Section 2.4**. These projects are listed according to their project type (“ST” Sub-Trunk, “T” Trunk, “SPS” Sewage Pumping Station, “FM” Force Main, “I/I” Inflow and Infiltration, “OC” Odour Control, “TR” Wastewater Treatment Plant) and project number in the capital program map and table.

The capital program table contains project descriptions, project type, location, dimensions, proposed timing, and estimated total project cost. The capital program table also outlines the Class EA requirement for each project including those that have been completed.

The wastewater capital program will serve as a foundation for the Region of Peel Capital Budget. The wastewater capital program is a comprehensive list of projects complete with description, costs and timing. This program is not only a list of capital investment, it also represents new infrastructure that will require future operation and maintenance costs. Capital costs in combination with the ongoing operation and maintenance costs represent the lifecycle costs for the Region infrastructure.

The capital program table for the preferred Wastewater Servicing Strategy is shown in **Table 13.** The capital program table for the preferred Wastewater Servicing Strategy is shown in **Figure 36**. The wastewater capital program map presents the general location and extents of the projects that form the preferred servicing strategy.

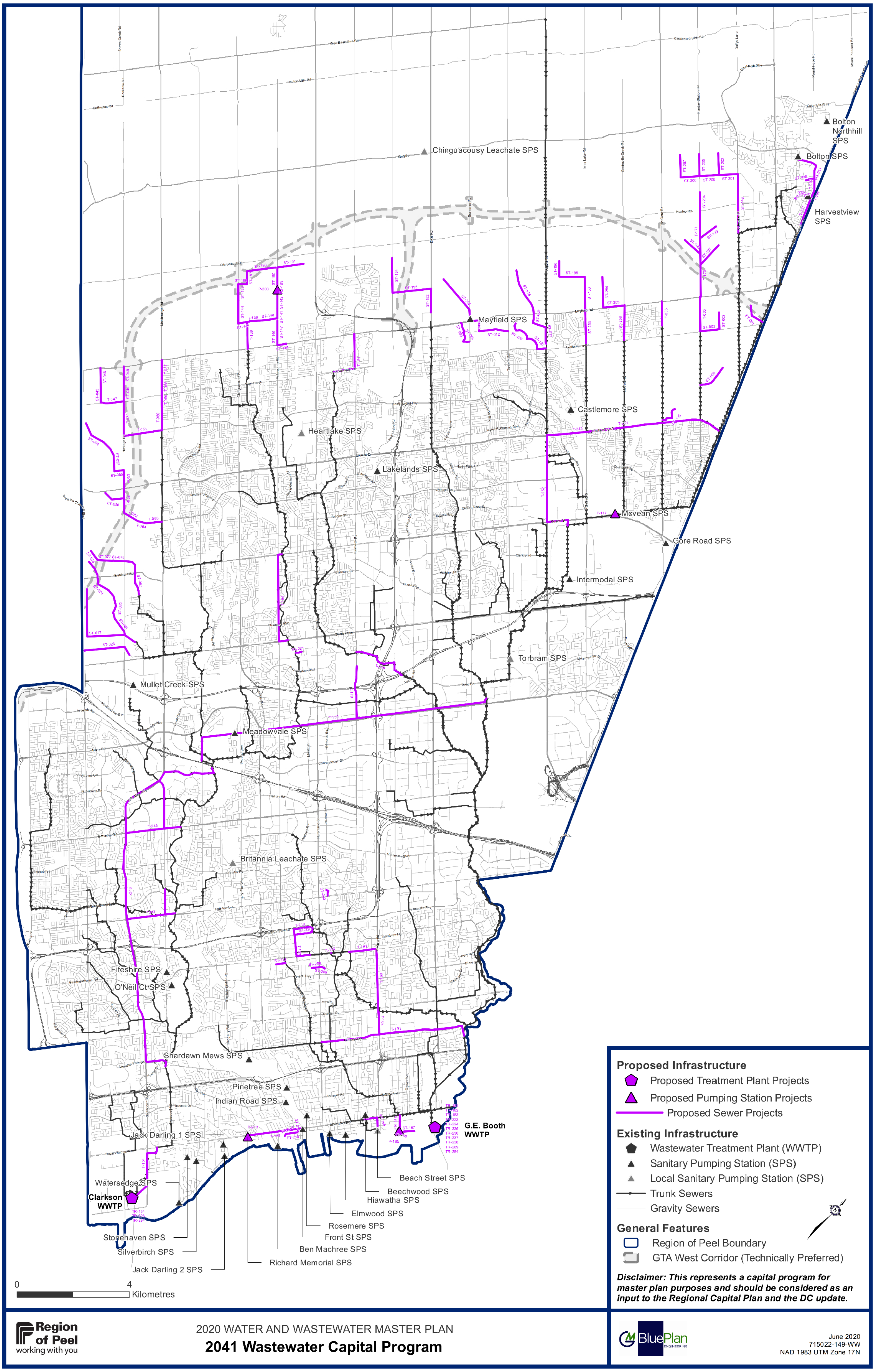

Figure 36 – Preferred wastewater servicing strategy capital program for the lake-based system.

Table 13 – **Capital program table for the preferred wastewater servicing strategy.**

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
WW-ST-001	375-mm Sanitary Sewer - Future Street (Highway 427 Industrial)	Construction of a 375-mm sanitary sewer on a future street north of Countryside Drive from Highway 50 to approximately 810 metres north-westerly.	2026	Caledon	Schedule A+	ST	375 mm	810	$ 3,072,000
WW-ST-002	375-mm Sanitary Sewer - Future Street (Highway 427 Industrial)	Construction of a 375-mm sanitary sewer on a future street west of Coleraine Drive from Countryside Drive to approximately 600 metres northerly.	2028	Brampton	Schedule A+	ST	375 mm	600	$ 576,000
WW-ST-003	525-mm Sanitary Sewer - Countryside Drive	Construction of a 525-mm sanitary sewer on Countryside Drive from Clarkway Drive to approximately 690 metres easterly.	2027	Brampton	Schedule A+	ST	525 mm	690	$ 3,747,000
WW-T-005	750-mm Sanitary Sewer - Clarkway Drive	Construction of a 750-mm sanitary sewer on Clarkway Drive from Countryside Drive to Mayfield Road.	2036	Brampton	Schedule A+	ST	750 mm	1230	$ 9,015,000
WW-ST-006	375-mm Sanitary Sewer - Future Street (Highway 427 Industrial)	Construction of a 375-mm sanitary sewer on a future street north of Castlemore Road from Clarkway Drive to approximately 1060 metres north-easterly.	2023	Brampton	Schedule A+	ST	375 mm	1060	$ 4,020,500
WW-ST-009	600-mm Sanitary Sewer - Future Street (Countryside Villages)	Construction of a 600-mm sanitary sewer on a future street west of Airport Road from Mayfield Road to approximately 760 metres southerly.	2024	Brampton	Schedule A+	ST	600 mm	760	$ 3,383,900
WW-ST-011	600-mm Sanitary Sewer - Future Street (Countryside Villages)	Construction of a 600-mm sanitary sewer on a future street from Airport Road to approximately 1070 metres north-westerly, north of Countryside Drive.	2023	Brampton	Schedule A+	ST	600 mm	1070	$ 4,764,300
WW-ST-012	525-mm Sanitary Sewer - Future Inspire Boulevard (Countryside Villages)	Construction of a 525-mm sanitary sewer on the future Inspire Boulevard from Torbram Road to approximately 1050 metres westerly.	2022	Brampton	Schedule A+	ST	525 mm	1050	$ 4,271,500
WW-ST-013	375-mm Sanitary Sewer - Easement (Clarkson)	Construction of a 375-mm sanitary sewer in an easement north of Lakeshore Road and east of Winston Churchill Boulevard.	2026	Mississauga	Schedule A+	ST	375 mm	630	$ 915,100
WW-ST-017	375-mm Sanitary Sewer - Future Street (Bram West)	Construction of a 375-mm sanitary sewer on a future street from Heritage Road to approximately 2740 metres north-westerly, north of Steeles Avenue West.	2023	Brampton	Schedule A+	ST	375 mm	2740	$ 3,085,000
WW-ST-018	525-mm Sanitary Sewer - Future Street (Countryside Villages)	Construction of a 525-mm sanitary sewer on a future street east of Bramalea Road from Mayfield Road to approximately 400 metres southerly.	2023	Brampton	Schedule A+	ST	525 mm	400	$ 1,627,200
WW-T-021	Albion-Vaughan Road Sanitary Trunk Sewer (Phase 2)	Construction of a 900-mm sanitary trunk sewer on Albion Vaughan Road and Nunneville Road from Royalton Drive to the end of Nunneville Road. (Section 1 of 3)	2022	Caledon	Schedule A+	T	900 mm	990	$ 17,897,728
WW-FM-030	McVean Force Main Twinning	Construction of a 900-mm force main on Queen Street East from the McVean Sewage Pumping Station to Goreway Drive.	2022	Brampton	Schedule B Completed	FM	900 mm	1060	$ 4,978,000
WW-ST-045	600-mm Sanitary Sewer - Future Street (Mount Pleasant West)	Construction of a 600-mm sanitary sewer on a future street east of Winston Churchill Boulevard from Wanless Drive to 560 metres northerly.	2036	Brampton	Schedule A+	ST	600 mm	560	$ 2,494,300
WW-ST-046	600-mm Sanitary Sewer - Future Street (Mount Pleasant West)	Construction of a 600-mm sanitary sewer on a future street east of Winston Churchill Boulevard from Mayfield Road to 680 metres southerly.	2036	Brampton	Schedule A+	ST	600 mm	680	$ 3,027,900
WW-T-047	Northwest Brampton Sanitary Trunk Sewer (Phase 3)	Construction of a 675-mm sanitary trunk sewer on Wanless Drive from Heritage Road to 820 metres westerly.	2035	Brampton	Schedule A+	T	675 mm	820	$ 5,903,000

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
WW-ST-048	600-mm Sanitary Sewer - Heritage Road (Mount Pleasant West)	Construction of a 600-mm sanitary sewer on Heritage Road from Mayfield Road to 620 metres southerly.	2035	Brampton	Schedule A+	ST	600 mm	620	$ 3,685,700
WW-ST-049	600-mm Sanitary Sewer - Heritage Road (Mount Pleasant West)	Construction of a 600-mm sanitary sewer on Heritage Road from Wanless Drive to 620 metres northerly.	2035	Brampton	Schedule A+	ST	600 mm	620	$ 3,685,700
WW-T-050	Northwest Brampton Sanitary Trunk Sewer (Phase 2)	Construction of a 750-mm sanitary trunk sewer on Heritage Road from the future Sandalwood Parkway extension to Wanless Drive.	2034	Brampton	Schedule B Completed	T	750 mm	1200	$ 8,807,500
WW-T-051	Northwest Brampton Sanitary Trunk Sewer (Phase 1)	Construction of a 825-mm sanitary trunk sewer on the future extension of Sandalwood Parkway from Heritage Road to Mississauga Road.	2032	Brampton	Schedule B Completed	T	825 mm	1350	$ 13,898,900
WW-ST-052	525-mm Sanitary Sewer - Future Street (Huttonville North)	Construction of a 525-mm sanitary sewer on a future street north of Bovaird Drive, west of Heritage Road, from a future street to 830 metres northerly.	2031	Brampton	Schedule A+	ST	525 mm	830	$ 3,651,200
WW-T-053	Heritage Heights Sanitary Trunk Sewer (Phase 2)	Construction of a 675-mm sanitary trunk sewer on Heritage Road from Bovaird Drive to 630 metres northerly.	2028	Brampton	Schedule A+	T	675 mm	630	$ 4,541,600
WW-ST-054	450-mm Sanitary Sewer - Future Street (Huttonville North)	Construction of a 450-mm sanitary sewer on a future street south of Wanless Drive from Winston Churchill Boulevard to 1310 metres south-easterly.	2031	Brampton	Schedule A+	ST	450 mm	1310	$ 5,429,400
WW-ST-055	600-mm Sanitary Sewer - Future Street (Huttonville North)	Construction of a 600-mm sanitary sewer on a future street north of Bovaird Drive from Heritage Road to 340 metres westerly.	2029	Brampton	Schedule A+	ST	600 mm	340	$ 1,831,200
WW-ST-056	375-mm Sanitary Sewer - Future Street (Huttonville North)	Construction of a 375-mm sanitary sewer on a future street south of Bovaird Drive from Heritage Road to 770 metres westerly.	2028	Brampton	Schedule A+	ST	375 mm	770	$ 2,920,800
WW-T-057	Credit Valley Sanitary Trunk Sewer (Phase 4)	Construction of a 900-mm sanitary trunk sewer on Mississauga Road from Mayfield Road to 680 metres southerly.	2034	Brampton	Schedule A+	T	900 mm	680	$ 5,354,600
WW-T-058	Credit Valley Sanitary Trunk Sewer (Phase 4)	Construction of a 900-mm sanitary trunk sewer on Mississauga Road from Wanless Drive to 570 metres northerly.	2034	Brampton	Schedule A+	T	900 mm	570	$ 4,488,000
WW-T-059	Credit Valley Sanitary Trunk Sewer (Phase 3)	Construction of a 900-mm sanitary trunk sewer on Mississauga Road from Wanless Drive to Sandalwood Parkway.	2032	Brampton	Schedule A+	T	900 mm	360	$ 2,834,100
WW-T-060	Credit Valley Sanitary Trunk Sewer (Phase 3)	Construction of a 900-mm sanitary trunk sewer on Mississauga Road from Wanless Drive to Sandalwood Parkway.	2030	Brampton	Schedule A+	T	900 mm	920	$ 7,245,000
WW-T-062	Heritage Heights Sanitary Trunk Sewer (Phase 2)	Construction of a 675-mm sanitary trunk sewer on Heritage Road from Bovaird Drive to 880 metres southerly.	2028	Brampton	Schedule A+	T	675 mm	880	$ 6,912,400
WW-T-063	Heritage Heights Sanitary Trunk Sewer (Phase 1)	Construction of a 750-mm sanitary trunk sewer on the future extension of Williams Parkway from Mississauga Road to Heritage Road.	2026	Brampton	Schedule A+	T	750 mm	580	$ 5,895,800
WW-T-064	Heritage Heights Sanitary Trunk Sewer (Phase 1)	Construction of a 750-mm sanitary trunk sewer on the future extension of Williams Parkway from Mississauga Road to Heritage Road.	2026	Brampton	Schedule A+	T	750 mm	300	$ 1,882,000

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
WW-T-065	Heritage Heights Sanitary Trunk Sewer (Phase 1)	Construction of a 750-mm sanitary trunk sewer on the future extension of Williams Parkway from Mississauga Road to Heritage Road.	2026	Brampton	Schedule A+	T	825 mm	560	$ 4,187,200
WW-ST-076	375-mm Sanitary Sewer - Future Street (Bram West)	Construction of a 375-mm sanitary sewer on a future street north of Embleton from east of Winston Churchill Boulevard Road to 440 metres west of Heritage Road.	2026	Brampton	Schedule A+	ST	375 mm	400	$ 2,092,400
WW-ST-077	450-mm Sanitary Sewer - Future Street (Bram West)	Construction of a 450-mm sanitary sewer on a future street north of Embleton from 440 metres west of Heritage Road to 540 metres west of Heritage Road.	2027	Brampton	Schedule A+	ST	450 mm	540	$ 2,126,100
WW-ST-078	450-mm Sanitary Sewer - Future Street (Bram West)	Construction of a 450-mm sanitary sewer on a future street north of Embleton from Heritage Road to 440 metres westerly.	2026	Brampton	Schedule A+	ST	450 mm	440	$ 1,732,300
WW-ST-079	375-mm Sanitary Sewer - Future Street (Bram West)	Construction of a 375-mm sanitary sewer on a future street east of Winston Churchill Boulevard from north of Embleton Road to 1580 metres south-easterly.	2024	Brampton	Schedule A+	ST	375 mm	1580	$ 6,569,000
WW-ST-080	450-mm Sanitary Sewer - Future Street (Bram West)	Construction of a 450-mm sanitary sewer on a future street south of Embleton Road from approximately 1000 metres southeast of Winston Churchill Boulevard to approximately 840 metres south-easterly.	2023	Brampton	Schedule A+	ST	450 mm	840	$ 3,306,400
WW-ST-081	450-mm Sanitary Sewer - Future Street (Bram West)	Construction of a 450-mm sanitary sewer on a future street south of Embleton Road from Heritage Road to 700 metres westerly.	2023	Brampton	Schedule A+	ST	450 mm	700	$ 2,755,500
WW-ST-082	525-mm Sanitary Sewer - Future Street (Bram West)	Construction of a 525-mm sanitary sewer on a future street from Embleton Road north-westerly to Heritage Road.	2022	Brampton	Schedule A+	ST	525 mm	720	$ 2,928,900
WW-T-085	750-mm Sanitary Sewer - The Gore Road	Construction of a 750-mm sanitary sewer on The Gore Road from Mayfield Road to approximately 860 metres southerly.	2035	Brampton	Schedule A+	T	750 mm	860	$ 5,398,000
WW-ST-088	375-mm Sanitary Sewer - Future Street (Countryside Villages)	Construction of a 375-mm sanitary sewer on a future street from Bramalea Road northwesterly to Mayfield Road, north of Countryside Drive. (Section 1 of 2)	2019	Brampton	Schedule A+	ST	375 mm	610	$ 1,016,000
WW-ST-089	375-mm Sanitary Sewer - Future Street (Countryside Villages)	Construction of a 375-mm sanitary sewer on a future street from Bramalea Road north-westerly to Mayfield Road, north of Countryside Drive. (Section 2 of 2)	2019	Brampton	Schedule A+	ST	375 mm	380	$ 1,243,125
WW-T-093	Albion-Vaughan Road Sanitary Trunk Sewer (Phase 2)	Construction of a 900-mm sanitary trunk sewer on Albion Vaughan Road and Nunneville Road from Royalton Drive to the end of Nunneville Road. (Section 2 of 3)	2020	Caledon	Schedule A+	T	900 mm	650	$ 2,334,491
WW-T-094	Albion-Vaughan Road Sanitary Trunk Sewer (Phase 2)	Construction of a 900-mm sanitary trunk sewer on Albion Vaughan Road and Nunneville Road from Royalton Drive to the end of Nunneville Road. (Section 3 of 3)	2020	Caledon	Schedule A+	T	900 mm	360	$ 3,328,559
WW-ST-095	Growth-Related Sanitary Sewers in Bolton	Construction of several growth-related sanitary sewers in Bolton.	2020	Caledon	Schedule A+	ST	450 mm	210	$ 499,236
WW-ST-096	Growth-Related Sanitary Sewers in Bolton	Construction of several growth-related sanitary sewers in Bolton.	2021	Caledon	Schedule A+	ST	375 mm	300	$ 1,663,637
WW-ST-097	Growth-Related Sanitary Sewers in Bolton	Construction of several growth-related sanitary sewers in Bolton.	2020	Caledon	Schedule A+	ST	375 mm	200	$ 373,744

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WW-T-104	Lower West Sanitary Trunk Sewer Twinning	Construction of a 2400-mm sanitary trunk sewer on Southdown Road and through easements from Lakeshore Road West to the Clarkson WWTP.	2033	Mississauga	Schedule B	T	2400 mm	2380	$ 82,768,100
WW-ST-111	375-mm Sanitary Sewer - Webb Drive (Mississauga City Centre)	Construction of a 375-mm sanitary sewer on Webb Drive from Confederation Parkway to Redmond Road.	2019	Mississauga	Schedule A+	ST	375 mm	340	$ 2,411,000
WW-T-112	Upper Cooksville Creek to Burnhamthorpe Road Sanitary Trunk Sewer Diversion	Diversion from the Upper Cooksville Creek Sanitary Trunk Sewer to the Burnhamthorpe Road Sanitary Trunk Sewer - Drop Shaft at Burnhamthorpe east of Arista	2017	Mississauga	Schedule B Completed	T	-	-	$ 4,960,000
WW-P-117	McVean Sewage Pumping Station Expansion	Expansion of the McVean Sewage Pumping Station from 1400 L/s to 2100 L/s.	2023	Brampton	Schedule A+	SPS	700 L/s	-	$ 19,500,000
WW-II-119	Inflow and Infiltration Remediation Program	Collection and analysis of data and development of solutions to reduce inflow and infiltration in the sanitary collection system.	n/a	Peel	-	I/I	-	-	$ 12,000,000
WW-II-120	Implementation of Inflow and Infiltration Remediation Measures	Funding for the implementation of remediation measures to reduce inflow and infiltration into the Region's lake-based sanitary sewer system.	n/a	Peel	-	I/I	-	-	$ 80,500,000
WW-T-130	East-to-West Diversion Sanitary Trunk Sewer	Construction of a 2400-mm sanitary trunk sewer on Derry Road from the East Trunk sewer at Spring Creek to West Trunk Sewer at Highway 401 and Creditview Road.	2025	Mississauga	Schedule C Completed	T	2400 mm	11550	$ 345,000,000
WW-T-131	Queensway East Sanitary Trunk Sewer	Construction of a 1800-mm sanitary trunk sewer on The Queensway from Hurontario Street to the East Sanitary Trunk Sewer.	2027	Mississauga	Schedule C	T	1800 mm	5300	$ 163,253,800
WW-T-133	Mississauga City Centre Sanitary Trunk Sewer	Construction of a 1200-mm sanitary trunk sewer on Duke of York Boulevard from Rathburn Road West to Burnhamthorpe Road West and on Burnhamthorpe Road West from Duke of York Boulevard to east of Kariya Gate.	2020	Mississauga	Schedule B Completed	T	1200 mm	1260	$ 27,391,000
WW-T-134	1200-mm Sanitary Sewer - Kennedy Road (Mayfield West Phase 1)	Construction of a 1200-mm sanitary sewer on Kennedy Road from Mayfield Road to Christie Drive.	2022	Brampton	Schedule A+	T	1200 mm	1970	$ 17,816,000
WW-ST-135	375-mm Sanitary Sewer - Future Street (Highway 427 Industrial)	Construction of a 375-mm sanitary sewer on a future street north of Castlemore Road from The Gore Road to approx. 750 metres northeasterly.	2023	Brampton	Schedule A+	ST	375 mm	750	$ 719,200
WW-ST-136	375-mm Sanitary Sewer - Future Street (Countryside Villages)	Construction of a 375-mm sanitary sewer on a future street north of Countryside Drive from approximately 900 metres northwest of Airport Road to approximately 920 metres north-westerly.	2023	Brampton	Schedule A+	ST	375 mm	920	$ 1,111,000
WW-ST-137	450-mm Sanitary Sewer - Future Street (Countryside Villages)	Construction of a 450-mm sanitary sewer on Countryside Drive from Airport Road to Mountainash Road and on Mountainash Road northerly.	2019	Brampton	Schedule A+	ST	450 mm	900	$ 1,279,651
WW-T-138	750-mm Sanitary Sewer - Future Street (Mayfield West Phase 2)	Construction of a 750-mm sanitary trunk sewer on a future street east of Chinguacousy Road from Mayfield Road to the future east-west spine road.	2019	Caledon	Schedule A+	T	750 mm	950	$ 6,677,781
WW-T-139	675-mm Sanitary Sewer - Future East West Spine Road (Mayfield West Phase 2)	Construction of a 675-mm sanitary sewer on the future east-west spine road from a future street east of Chinguacousy Road to approximately 630 metres west of McLaughlin Road.	2019	Caledon	Schedule A+	ST	675 mm	470	$ 2,697,000

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WW-ST-140	600-mm Sanitary Sewer - Future East West Spine Road (Mayfield West Phase 2)	Construction of a 600-mm sanitary sewer on the future east-west spine road from McLaughlin Road to approximately 630 metres westerly.	2019	Caledon	Schedule A+	ST	600 mm	630	$ 3,225,000
WW-ST-141	600-mm Sanitary Sewer - McLaughlin Road (Mayfield West Phase 2)	Construction of a 600-mm sanitary sewer on McLaughlin Road from the future east-west spine road to approximately 350 metres northerly.	2020	Caledon	Schedule A+	ST	600 mm	350	$ 2,052,000
WW-ST-142	525-mm Sanitary Sewer - McLaughlin Road (Mayfield West Phase 2)	Construction of a 525-mm sanitary sewer on McLaughlin Road from 350 metres north of the future east-west spine road to 420 metres northerly.	2025	Caledon	Schedule A+	ST	525 mm	420	$ 633,900
WW-ST-143	450-mm Sanitary Sewer - Future East West Spine Road (Mayfield West Phase 2)	Construction of a 450-mm sanitary sewer on the future east-west spine road from a future street east of Chinguacousy Road to Chinguacousy Road.	2019	Caledon	Schedule A+	ST	450 mm	310	$ 1,431,000
WW-ST-144	450-mm Sanitary Sewer - Chinguacousy Road (Mayfield West Phase 2)	Construction of a 450-mm sanitary sewer on Chinguacousy Road from the future east-west spine road to approximately 820 metres northerly.	2031	Caledon	Schedule A+	ST	450 mm	820	$ 4,247,800
WW-ST-145	450-mm Sanitary Sewer - Mayfield Road (Mayfield West Phase 2)	Construction of a 450-mm sanitary sewer on Mayfield Road from Van Kirk Drive to McLaughlin Road.	2019	Brampton	Schedule A+	ST	450 mm	330	$ 1,211,738
WW-ST-146	450-mm Sanitary Sewer - McLaughlin Road (Mayfield West Phase 2)	Construction of a 450-mm sanitary sewer on McLaughlin Road from Mayfield Road to approximately 510 metres northerly.	2020	Brampton	Schedule A+	ST	450 mm	510	$ 1,744,600
WW-ST-147	450-mm Sanitary Sewer - McLaughlin Road (Mayfield West Phase 2)	Construction of a 450-mm sanitary sewer on McLaughlin Road from approximately 510 metres north of Mayfield Road to approximately 440 metres northerly.	2020	Brampton	Schedule A+	ST	450 mm	440	$ 1,480,600
WW-ST-148	600-mm Sanitary Sewer - Coleraine Drive (Bolton West)	Construction of a 600-mm sanitary sewer on Coleraine Drive from Manchester Court to McEwan Drive.	2027	Caledon	Schedule A+	ST	600 mm	2080	$ 4,385,300
WW-ST-153	600-mm Sanitary Sewer - Innis Lake Road	Construction of a 600-mm sanitary sewer on Innis Lake Road from Mayfield Road to 1190 metres northerly.	2031	Caledon	Schedule A+	ST	600 mm	1190	$ 6,430,500
WW-T-160	Cawthra Road Sanitary Trunk Sewer (Phases 2 and 3)	Construction of a 1500-mm sanitary trunk sewer on Cawthra Road from Burnhamthorpe Road East to south of Dundas Street East to connect to the existing CPR Trunk.	2022	Mississauga	Schedule A+	T	1500 mm	2080	$ 51,675,000
WW-T-161	Cawthra Road Sanitary Trunk Sewer (Phase 4)	Construction of a 1500-mm sanitary trunk sewer on Burnhamthorpe Road East from Central Parkway East to Cawthra Road.	2026	Mississauga	Schedule C	T	1500 mm	990	$ 28,741,300
WW-T-162	Cawthra Road Sanitary Trunk Sewer (Phase 5)	Construction of a 1500-mm sanitary trunk sewer on Cawthra Road from the CPR to The Queensway.	2027	Mississauga	Schedule C	T	1500 mm	950	$ 27,579,000
WW-T-163	Lakeshore Road West Sanitary Trunk Sewer	Construction of a 1500-mm sanitary trunk sewer on Lakeshore Road West from Front Street to the Richard's Memorial Sewage Pumping Station.	2024	Mississauga	Schedule B Completed	T	1500 mm	2000	$ 67,500,000
WW-T-164	Fletcher's Creek Sanitary Trunk Sewer Twinning	Construction of a 1050-mm sanitary trunk sewer on McLaughlin Road from Queen Street West to Steeles Avenue West.	2031	Brampton	Schedule C	T	1050 mm	3540	$ 87,664,500
WW-P-165	Inspiration Lakeview Sewage Pump Station	Construction of a new sewage pumping station within the future Inspiration Lakeview development.	2031	Mississauga	Schedule B	SPS	96 L/s	-	$ 4,098,200

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WW-FM-166	Inspiration Lakeview Force Main	Construction of a 300-mm force main on Lakefront Promenade from the future Inspiration Lakeview Sewage Pumping Station to Lakeshore Road East.	2031	Mississauga	Schedule B	FM	300 mm	600	$ 873,300
WW-ST-167	450-mm Sanitary Sewer - Future Street (Inspiration Lakeview)	Construction of a 450-mm sanitary sewer on the future Street A from the future Street H to the future Street F.	2031	Mississauga	Schedule A+	ST	450 mm	380	$ 436,600
WW-ST-168	600-mm Sanitary Sewer - Future Street (Inspiration Lakeview)	Construction of a 600-mm sanitary sewer on the future Street A from the future Street F to the future Inspiration Lakeview Sewage Pumping Station.	2031	Mississauga	Schedule A+	ST	600 mm	200	$ 319,300
WW-T-170	Humber Station Road Sanitary Trunk Sewer (Phase 1)	Construction of a 750-mm sanitary trunk sewer on Humber Station Road from Mayfield Road to 1600 metres northerly.	2024	Caledon	Schedule A+	T	750 mm	1600	$ 4,756,800
WW-T-171	Humber Station Road Sanitary Trunk Sewer (Phase 2)	Construction of a 750-mm sanitary trunk sewer on Humber Station Road from Healey Road to 1500 metres southerly.	2026	Caledon	Schedule A+	T	750 mm	1500	$ 4,492,900
WW-ST-178	600-mm Sanitary Sewer - Future Street (Tullamore Industrial)	Construction of a 600-mm sanitary sewer on a future street west of Airport Road from Mayfield Road to approximate 1700 metres north-westerly.	2036	Brampton	Schedule A+	ST	600 mm	1700	$ 7,568,700
WW-T-179	Kennedy Road Sanitary Trunk Sewer	Construction of a 1500-mm sanitary trunk sewer on Kennedy Road from the Etobicoke Creek Sanitary Trunk Sewer to the future East-West Sanitary Trunk Sewer Diversion.	2026	Brampton	Schedule C	T	1500 mm	2350	$ 27,543,300
WW-TR-181	G.E. Booth WWTP - New Plant 1	Major capital improvement at the treatment facility including demolition works, new inlet conduit, new odour control facility, new primary clarifiers and a new by-pass conduit to replace Plant 1 and to support future expansion of the facility.	2024	Mississauga	Schedule C	TR	-	-	$ 175,000,000
WW-TR-182	G.E. Booth WWTP - Capacity Restoration	Recovery of 40 ML/d of liquid treatment capacity to restore the G.E. Booth WWTP capacity to 518 ML/d.	2027	Mississauga	Schedule C	TR	-	-	$ 83,000,000
WW-TR-183	G.E. Booth WWTP Expansion	Expansion of the G.E. Booth WWTP from 518 ML/d to 600 ML/d.	2038	Mississauga	Schedule C	TR	-	-	$ 487,000,000
WW-TR-184	Clarkson WWTP Expansion	Expansion of the Clarkson WWTP from 350 ML/d to 500 ML/d.	2027	Mississauga	Schedule C	TR	-	-	$ 278,600,000
WW-ST-185	450-mm Sanitary Sewer - Chinguacousy Road (Mayfield West Phase 3)	Construction of a 450-mm sanitary sewer on Chinguacousy Road from 820 metres north of the future east-west spine road to approximately 590 metres northerly.	2036	Caledon	Schedule A+	ST	450 mm	590	$ 2,716,400
WW-ST-186	375-mm Sanitary Sewer - Future Street (Mayfield West Phase 3)	Construction of a 375-mm sanitary sewer on a future street from Chinguacousy Road to 300 metres easterly, south of Old School Road.	2036	Caledon	Schedule A+	ST	375 mm	300	$ 287,700
WW-ST-187	375-mm Sanitary Sewer - Future Street (Mayfield West Phase 3)	Construction of a 375-mm sanitary sewer on a future street from a future street to 450 metres northerly, south of Old School Road.	2036	Caledon	Schedule A+	ST	375 mm	450	$ 431,500
WW-ST-188	375-mm Sanitary Sewer - Future Street (Mayfield West Phase 3)	Construction of a 375-mm sanitary sewer on a future street from a future street to 1000 metres easterly, south of Old School Road.	2036	Caledon	Schedule A+	ST	375 mm	1000	$ 959,000
WW-FM-189	McLaughlin Road Force Main	Construction of a 400-mm sewage force main on McLaughlin Road from the future McLaughlin Road Sewage Pumping Station to the south side of the Etobicoke Creek.	2036	Caledon	Schedule B	FM	400 mm	240	$ 747,900

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WW-ST-190	525-mm Sanitary Sewer - McLaughlin Road (Mayfield West Phase 3)	Construction of a 525-mm sanitary sewer on McLaughlin Road from the future McLaughlin Road Sewage Pumping Station to 800 metres northerly.	2027	Caledon	Schedule A+	ST	525 mm	800	$ 1,205,900
WW-ST-191	525-mm Sanitary Sewer - Future Street (Mayfield West Phase 3)	Construction of a 525-mm sanitary sewer on a future street from McLaughlin Road to 950 metres easterly.	2036	Caledon	Schedule A+	ST	525 mm	950	$ 1,072,200
WW-ST-192	525-mm Sanitary Sewer - Dixie Road (Mayfield West Phase 4)	Construction of a 525-mm sanitary sewer on Dixie Road from 500 metres north of Mayfield Road to 840 metres northerly.	2031	Caledon	Schedule A+	ST	525 mm	840	$ 1,265,300
WW-ST-193	525-mm Sanitary Sewer - Future Street (Mayfield West Phase 4)	Construction of a 525-mm sanitary sewer on a future street from Dixie Road to Heart Lake Road.	2031	Caledon	Schedule A+	ST	525 mm	1380	$ 3,298,300
WW-ST-194	450-mm Sanitary Sewer - Heart Lake Road (Mayfield West Phase 4)	Construction of a 450-mm sanitary sewer on Heart Lake Road from 1200 metres north of Mayfield Road to 1240 metres northerly.	2032	Caledon	Schedule A+	ST	450 mm	1240	$ 2,095,000
WW-ST-195	450-mm Sanitary Sewer - Future Street (Tullamore Industrial)	Construction of a 450-mm sanitary sewer on a future street from Innis Lake Road to 920 metres westerly, north of Mayfield Road.	2036	Caledon	Schedule A+	ST	450 mm	920	$ 962,000
WW-ST-196	450-mm Sanitary Sewer - Future Street (Tullamore Industrial)	Construction of a 450-mm sanitary sewer on a future street from a future street to 570 metres northerly, east of Airport Road and north of Mayfield Road.	2036	Caledon	Schedule A+	ST	450 mm	570	$ 596,800
WW-ST-197	450-mm Sanitary Sewer - Future Street (Bolton West)	Construction of a 450-mm sanitary sewer on a future street from Humber Station Road to 960 metres north-easterly.	2025	Caledon	Schedule A+	ST	450 mm	960	$ 1,003,900
WW-ST-198	450-mm Sanitary Sewer - Future Street (Bolton West)	Construction of a 450-mm sanitary sewer on a future street from Humber Station Road to 750 metres north-westerly.	2032	Caledon	Schedule A+	ST	450 mm	750	$ 1,057,900
WW-ST-199	450-mm Sanitary Sewer - Future Street (Bolton West)	Construction of a 450-mm sanitary sewer on a future street from Humber Station Road to 710 metres north-easterly, south of Healey Road.	2026	Caledon	Schedule A+	ST	450 mm	710	$ 742,700
WW-ST-200	600-mm Sanitary Sewer - Future Street (Bolton West)	Construction of a 600-mm sanitary sewer on a future street from Humber Station Road to 690 metres easterly, north of Healey Road.	2026	Caledon	Schedule A+	ST	600 mm	690	$ 998,800
WW-ST-201	600-mm Sanitary Sewer - Future Street (Bolton West)	Construction of a 600-mm sanitary sewer on a future street from Coleraine Drive to 680 metres westerly, north of Healey Road.	2026	Caledon	Schedule A+	ST	600 mm	680	$ 1,300,700
WW-ST-202	375-mm Sanitary Sewer - Future Street (Bolton West)	Construction of a 375-mm sanitary sewer on a future street from a future street east of Humber Station Road to 780 metres northerly.	2028	Caledon	Schedule A+	ST	375 mm	780	$ 747,800
WW-P-203	McLaughlin Road Sewage Pumping Station	Construction of a new sewage pumping station in the vicinity of McLaughlin Road and the Etobicoke Creek.	2036	Caledon	Schedule B	SPS	150 L/s	-	$ 6,403,500
WW-ST-204	450-mm Sanitary Sewer - Humber Station Road	Construction of a 400-mm sanitary sewer on Humber Station Road from Healey Road to 630 metres northerly.	2031	Caledon	Schedule A+	ST	450 mm	630	$ 880,200
WW-ST-205	600-mm Sanitary Sewer - Humber Station Road	Construction of a 600-mm sanitary sewer on Humber Station Road from 890 metres north of Healey Road to 790 metres northerly.	2028	Caledon	Schedule A+	ST	600 mm	790	$ 1,527,800
WW-ST-206	450-mm Sanitary Sewer - Future Street (Bolton West)	Construction of a 450-mm sanitary sewer on a future street from Humber Station Road to 670 metres westerly.	2036	Caledon	Schedule A+	ST	450 mm	670	$ 700,900

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
WW-ST-207	375-mm Sanitary Sewer - Future Street (Bolton West)	Construction of a 375-mm sanitary sewer on a future street from a future street 890 metres north of Healey Road to 800 metres northerly.	2036	Caledon	Schedule A+	ST	375 mm	800	$ 767,200
WW-ST-208	450-mm Sanitary Sewer - Future Street (Mayfield West Phase 4)	Construction of a 450-mm sanitary sewer on a future street from Mayfield Road to 2160 metres north-westerly, crossing Bramalea Road.	2031	Caledon	Schedule A+	ST	450 mm	2160	$ 2,885,100
WW-T-210	Centre View Sanitary Trunk Sewer	Construction of a 1200-mm sanitary trunk sewer on Centre View Drive from the proposed interceptor chamber to Duke of York Boulevard and on Duke of York Boulevard from Centre View Drive to Rathburn Road.	2024	Mississauga	Schedule A+	T	1200 mm	880	$ 22,566,500
WW-FM-211	Bolton Force Main Twinning	Construction of a 450-mm force main from Bolton Pumping Station to the Albion-Vaughan Road Sanitary Trunk Sewer.	2021	Caledon	Schedule A+	T	450 mm	1070	$ 2,078,700
WW-T-212	Etobicoke Creek Sanitary Trunk Sewer Diversion (Phase 2)	Construction of a 1500-mm sanitary trunk sewer on future easement from the Etobicoke Creek Sanitary Trunk Sewer to the proposed diversion on Kennedy Road.	2026	Brampton	Schedule C	T	1500 mm	590	$ 17,128,700
WW-P-213	Richard's Memorial Sewage Pumping Station Expansion	Reconstruction of the sewage pumping station with an expanded capacity to service growth in Port Credit.	2023	Mississauga	Schedule B Completed	SPS	405 L/s	-	$ 18,000,000
WW-ST-214	525-mm Sanitary Sewer - Front Street South (West Village)	Construction of a 525-mm sanitary sewer from Lakeshore Road West to Port Street.	2021	Mississauga	Schedule A+	ST	525 mm	120	$ 984,645
WW-ST-215	525-mm Sanitary Sewer - Port Street (West Village)	Construction of a 525-mm sanitary sewer from Front Street South to 310 metres westerly.	2021	Mississauga	Schedule A+	ST	525 mm	300	$ 457,078
WW-ST-216	375-mm/450-mm Sanitary Sewer - Future Street (West Village)	Construction of a 375-mm/450-mm sanitary sewer from the west end of Port Street to 385 metres westerly.	2021	Mississauga	Schedule A+	ST	450 mm	300	$ 439,204
WW-ST-220	450-mm Sanitary Sewer - Rathburn Road West	Construction of a 450-mm sanitary sewer on Rathburn Road West from Duke of York Boulevard to Station Gate Road.	2021	Mississauga	Schedule A+	ST	450 mm	85	$ 2,882,863
WW-ST-221	450-mm Sanitary Sewer - Easement at Herdmans Road (Steeles and Hurontario)	Construction of a 450-mm sanitary sewer from New London Court to the Fletcher's Creek Sanitary Trunk Sewer.	2021	Brampton	Schedule A+	ST	450 mm	285	$ 339,224
WW-TR-223	G.E. Booth WWTP Expansion - Incineration	Expansion of the G.E. Booth WWTP. Incinerator #1 & #2	2038	Mississauga	Schedule C	TR	-	-	$ 92,500,000
WW-TR-224	G.E. Booth WWTP Expansion - Incineration	Expansion of the G.E. Booth WWTP. Incinerator #1 & #2	2038	Mississauga	Schedule C	TR	-	-	$ 169,600,000
WW-TR-225	G.E. Booth WWTP Expansion - New Outfall	Construction of a new outfall at the G.E. Booth WWTP to accommodate the full site capacity.	2038	Peel	Schedule C	TR	-	-	$ 92,000,000
WW-TR-226	Clarkson WWTP - Biosolids Expansion	Expansion of the biosolids process at the Clarkson WWTP.	2023	Mississauga	Schedule C	TR	-	-	$ 30,000,000
WW-TR-236	G.E. Booth WWTP - Plant 2 Blower Replacement	Replacement of the existing three blowers at Plant 2 with six multi-stage high-efficiency blowers.	2027	Mississauga	-	TR	-	-	$ 21,000,000
WW-TR-237	G.E. Booth WWTP - Cake Exportation	Modification of the existing cake silos and pumping system to allow the exportation of cake offsite.	2022	Mississauga	-	TR	-	-	$ 7,500,000

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
WW-TR-238	G.E. Booth WWTP - Odour Control Improvements	Implementation of the recommendations of the odour study with the anticipation of additional odour control necessary as redevelopment occurs in the vicinity of the treatment facility.	2026	Mississauga	-	TR	-	0	$ 215,000,000
WW-T-243	McVean Diversion Sanitary Trunk Sewer - Class Environmental Assessment	Class Environmental Assessment to determine the preferred strategy to defer flows away from the McVean Sewage Pumping Station to service future development in northeast Brampton and southeast Caledon.	2024	Brampton	Schedule C	T	-	-	$ 1,500,000
WW-T-246	Britannia West Sanitary Trunk Sewer	Construction of a 1500-mm sanitary trunk sewer on Mississauga Road from Erin Mills Parkway to Britannia Road West and on Britannia Road West from the Credit River to Erin Mills Parkway.	2023	Mississauga	Schedule B	T	1500 mm	3700	$ 51,250,000
WW-T-247	Eglinton West Sanitary Trunk Sewer	Construction of a 1500-mm sanitary trunk sewer on Mississauga Road from the CPR to Eglinton Avenue West and on Eglinton Avenue West from the Credit River to Erin Mills Parkway.	2023	Mississauga	Schedule B	T	1500 mm	2600	$ 51,250,000
WW-T-248	West Sanitary Trunk Sewer Twinning	Installation of a structural liner for the entire length of the new West Sanitary Trunk Sewer.	2022	Mississauga	-	T	1500 mm	-	$ 40,000,000
WW-T-249	Etobicoke Creek Sanitary Trunk Sewer Twinning	Twinning of a 2150-metre section of sanitary trunk sewer in the vicinity of the Old Brampton WWTP (near Highway 407 and Highway 410).	2024	Brampton	Schedule C	T	1500 mm	2150	$ 58,215,000
WW-T-251	Castlemore Road Sanitary Trunk Sewer	Construction of a 1500-mm sanitary trunk sewer on Castlemore Road from Highway 50 to Airport Road.	2036	Brampton	Schedule C	T	1500 mm	6230	$ 139,105,800
WW-T-252	Upper East Sanitary Trunk Sewer (Phase 1)	Construction of a 2400-mm sanitary trunk sewer on Airport Road from Castlemore Road to Queen Street and on Queen Street from Airport Road to Sun Pac Boulevard.	2036	Brampton	Schedule C	T	2400 mm	4000	$ 107,921,400
WW-ST-253	600-mm Sanitary Sewer - Goreway Drive	Construction of a 600-mm sanitary sewer on Goreway Drive from Mayfield Road to Countryside Drive.	2031	Caledon	Schedule B	ST	600 mm	1230	$ 9,645,500
WW-ST-254	450-mm Sanitary Sewer - Future Street (Tullamore Industrial)	Construction of a 450-mm sanitary sewer on a future street east of Innis Lake Road from Mayfield Road to 1100 metres northerly.	2036	Caledon	Schedule A+	ST	450 mm	1100	$ 4,330,700
WW-ST-255	525-mm Sanitary Sewer - Mayfield Road	Construction of a 525-mm sanitary sewer on Mayfield Road from McVean Drive to a future street east of Innis Lake Road.	2031	Caledon	Schedule A+	ST	525 mm	750	$ 4,439,700
WW-ST-256	600-mm Sanitary Sewer - McVean Drive	Construction of a 600-mm sanitary sewer on McVean Drive from Mayfield Road to Countryside Drive.	2031	Caledon	Schedule A+	ST	600 mm	1250	$ 7,429,800
WW-ST-258	Growth-Related Sanitary Sewer in the Mississauga City Centre	Construction of several growth-related sanitary sewers in the Mississauga City Centre.	2024	Mississauga	Schedule A+	ST	375 mm	280	$ 896,829
WW-ST-259	Growth-Related Sanitary Sewer in the Mississauga City Centre	Construction of several growth-related sanitary sewers in the Mississauga City Centre.	2024	Mississauga	Schedule A+	ST	375 mm	290	$ 710,906
WW-ST-268	525-mm Sanitary Sewer - Aviation Road and Lakeshore Road East	Construction of a 525-mm sanitary sewer on Aviation Road and Lakeshore Road East for the Beach Street Sewage Pumping Station to the Beechwood Sewage Pumping Station.	2024	Mississauga	Schedule A+	ST	525 mm	940	$ 35,000,000
WW-TR-269	G.E. Booth Wastewater Treatment Plant - Ash Management Facility	Construction of a new ash management facility at the G.E. Booth Wastewater Treatment Plant.	2026	Mississauga	Schedule C	TR	-	0	$ 30,000,000

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
WW-OC-270	Collection System Odour and Corrosion Control Master Plan	Update of the Region's collection system odour and control Master Plan.	2022	Peel	-	OC	-	-	$ 750,000
WW-OC-272	Future Odour and Corrosion Control Facilities	Construction of new odour and corrosion control facilities at various locations in the Region of Peel.	2026	Mississauga	-	OC	-	-	$ 14,786,600
WW-ST-280	375-mm Sanitary Sewer - Future Thornwood Drive and Future Armdale Road	Construction of a 375-mm sanitary sewer on the future extension of Thornwood Drive and Armdale Road.	2020	Mississauga	Schedule A+	ST	375 mm	200	$ 230,600
WW-TR-284	Clarkson and G.E. Booth WWTP - Standby Power Expansion	Installation of outdoor modular systems with external ehouses for switchgear systems. Clarkson includes aerial conversion for the remaining power system to buried duct and switchgear modules.	2027	Mississauga	-	TR	-	-	$ 33,000,000
Total Program - 2041									**$3,646,767,039**

7.0 Implementation and Lifecycle

7.0 Implementation and Lifecycle

7.1 Capital Program Implementation

The 2020 Master Plan sets out to satisfy the Environmental Assessment (EA) Approach 1 requirements according to the Municipal Engineers Association (MEA) Class EA document. The preferred wastewater servicing strategy will support the servicing needs of the Region's lake-based system for future growth to 2041. This strategy will be implemented in accordance with each project's Class EA schedule.

The Class EA requirements for each project have been identified in the capital program. Schedule A and A+ projects may move forward to design and construction, with A+ projects requiring public notification prior to implementation. The 2020 Master Plan was prepared at a broad level assessment and recognizes that further detailed assessment will be required through separate studies to satisfy project specific fulfillment of the MEA Class EA requirements for Schedule B and C projects identified within the master plan.

During the next steps of the implementation program, primarily during detailed design of the projects, the following requirements should be considered:

- Refinement of infrastructure locations and alignments
- Review and confirmation of property requirements
- Identification of preferred construction methodologies
- Completion of additional supporting investigations as required (e.g., geotechnical, hydrogeological, etc.)
- Review and mitigation of potential construction related impacts
- Fulfillment of all provincial, municipal and conservation authority approval requirements

With respect to Regional planning and budgeting, this program will be utilized as a high-level baseline estimate for the Region's capital budget. These costs will be further developed and refined during the implementation phases as detailed information becomes available.

The anticipated timing of each project within the preferred wastewater strategy has been established based on the projected population and employment growth within the Region of Peel's lake-based system. The wastewater program's project scheduling has also been cross referenced with the water program to ensure project coordination along common alignments where possible.

Given the growth-related nature of the servicing strategies, the wastewater capital program forms the foundation for the wastewater component of the Region of Peel Development Charges (DC) By-Law.

7.2 Lifecycle Costing

As the Region has grown, so too has their inventory of linear and vertical water and wastewater assets. This has resulted in growing Operation and Maintenance and State of Good Repair (SOGR) needs to ensure the systems continue to function as originally designed. In response to this need, the Region has developed of proactive maintenance and SOGR programs for all existing water and wastewater assets. This master plan capital program adds a significant amount of new infrastructure into the Region's asset inventory and, as such, will add to their overall system operation and maintenance and lifecycle costs.

It is anticipated that the SOGR costs for new infrastructure that is built to service new growth will be predominantly covered by the water and wastewater rates paid by those new residents or businesses.

For the purposes of this master plan program, the increase in lifecycle costs with the new assets in place was estimated along with the net present value of each project based on the in-service date. The following represent base lifecycle cost percentages applied to each project, which are estimated to include the entire lifecycle cost including operation, maintenance, rehabilitation, and replacement:

- New pumping station: 4 percent
- Pumping station upgrade: 1 percent
- Treatment expansion: 2 percent
- Linear: 1 percent

An annual rate of 3 percent was used to discount future costs to present value (2020). The estimated lifecycle costing is shown project by project within the capital program.

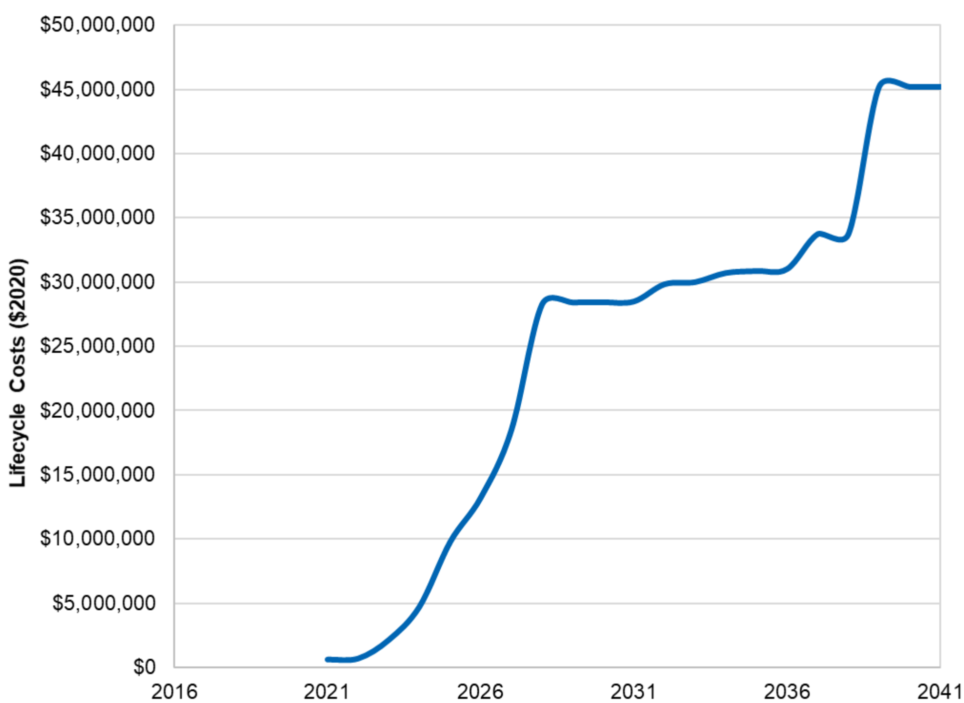


Figure 37 – Approximate annual cost for the operation and maintenance of new wastewater master plan infrastructure.

8.0 Intensification and Post-2041 Growth

8.0 Intensification and Post-2041 Growth

8.1 2041 Intensification

Intensification is currently underway in many parts of the Region of Peel and is captured within the Region's detailed growth projections for the 2041 planning horizon.

There are several locations within the Region that will have focused intensification and infill growth. Through this master plan, these areas were reviewed for their existing servicing capacity, projected 2041 population and employment projections and subsequent wastewater flow. While the 2020 Master Plan Capital Program is focused on servicing the approved 2041 growth, high level impacts of enhanced intensification development beyond 2041 projections were reviewed. It should be noted that these areas may require further detailed analysis to determine precise servicing needs as the detailed growth projections are finalized and the development applications are received. The following areas that were identified to be key intensification areas include, but are not limited to:

- Mississauga City Centre
- Brampton Queen Street Corridor
- Hurontario Corridor
- Dundas Connects
- Inspiration Lakeview
- Uptown Brampton
- Uptown Mississauga (Hurontario and Eglinton)
- Re-imagining the Mall (several locations throughout Peel)

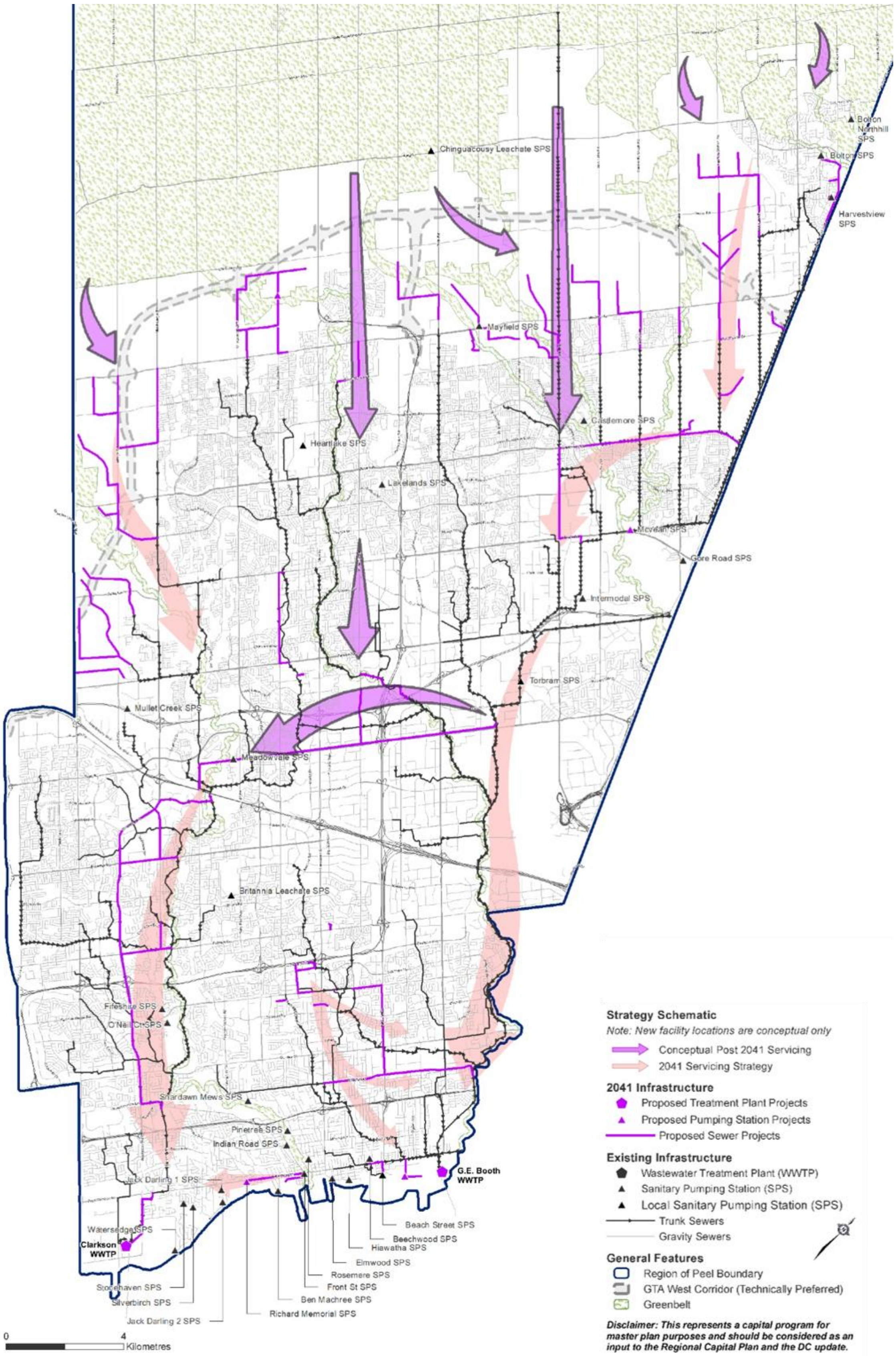
8.2 Post-2041 Vision

The 2020 Master Plan was focused on developing a long-term servicing strategy to meet the needs of future growth to 2041 while supporting the appropriate level of service to existing residents and businesses. While the approved urban boundary and growth targets are to 2041, the master plan also considered implications of potential post-2041 growth on the system.

The preferred water and wastewater servicing strategies address the growth needs to 2041 and provide flexibility within the system to implement post-2041 strategies, once the long-term growth forecasts are confirmed and approved.

Post-2041 growth is anticipated at two levels: intensification and greenfield growth. It is expected that post-2041 greenfield growth will most likely occur as extensions further north into Caledon. Additional extensions to the wastewater collection system will be required to service post-2041 areas. In addition, treatment upgrades may be required as growth increases beyond the 2041 targets.

While intensification is presently occurring within Peel and will continue to 2041, potential post-2041 intensification growth was investigated within the major intensification areas outlined in the previous sections. Since the post-2041 growth projections are not finalized at this time, only a high-level servicing investigation of intensification growth was completed. Detailed analysis of wastewater infrastructure capacity and constraints has not yet been undertaken for the intensification areas. However, the 2041 wastewater servicing strategy establishes flexibility within the wastewater collection system and will support a longer-term post-2041 strategy within the intensification areas. **Figure 38** shows a conceptual representation of post-2041 wastewater servicing.



Note: High resolution image is available in Appendix 4H.

Figure 38 – Post-2041 wastewater servicing strategy.

References

[1] A Place to Grow, Growth Plan for the Greater Golden Horseshoe, 2019

[2] Region of Peel Public Works. Design, Specifications & Procedure Manual – Linear Infrastructure, Sanitary Sewer Design Criteria (Revised July 2019)

[3] Front Street Wastewater Pumping Station Wastewater Diversion. https://www.peelregion.ca/pw/water/environ-assess/pdf/front-street-wastewater/schedule-B-class-environ-assessment.pdf

[4] Mount Pleasant Secondary Plan. Chapter 51(a). https://www.brampton.ca/EN/Business/planning-development/policies-master-plans/secondary%20plans/SPA51%20Mount%20Pleasant.pdf

[5] Huttonville Secondary Plan. Chapters 29(a) and 29(b). https://www.brampton.ca/EN/Business/planning-development/policies-master-plans/secondary%20plans/SPA29%20Huttonville.pdf

[6] The Bram West Secondary Plan. Chapter 40(d). https://www.brampton.ca/EN/Business/planning-development/policies-master-plans/secondary%20plans/SPA40d%20Bram%20West.pdf

4A

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 4A

Design Criteria Memo

Region of Peel
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Public Works

To:	Miriam Polga	**Date:**	27 March 2018
From:	Laura Borowiec	**Subject:**	Water and Wastewater Design Criteria
CC:	Imran Motala, Martin Pendlebury	**Our File:**	

This technical memorandum provides an overview of the derivation of the Region's recommended water and wastewater design criteria. The design criteria will be used to identify water and wastewater infrastructure requirements as part of the Master Plan and will provide input into the next Development Charges Update.

The memorandum is structured as follows:

1. Background
2. Starting Point Methodology
3. Existing Water Design Criteria
    a. Area-Based Water Design Criteria
    b. Analysis of Water Treatment Flows
    c. Non-Revenue Water
    d. Discretization of Residential and Non-Residential Water Design Criteria
4. Existing Wastewater Design Criteria
    a. Analysis of Wastewater Treatment Flows
    b. Analysis of Local Sub-Drainage Area Flows
    c. Discretization of Residential and Non-Residential Wastewater Design Criteria
5. Summary and Recommendations

This water and wastewater review draws from a number of separate related analyses undertaken since the previous Master Plan that involved detailed data analytics involving a wide range of information such as water billing, treatment flow, in-sewer flow monitoring, and precipitation records.

These and other relevant analyses provided the technical inputs to the determination of an appropriate water and wastewater design criteria that strives to:

- Accurately reflects water consumption and wastewater flow generation in Peel based on historical evidence
- Is clear and easy to apply across all land uses
- Incorporates a conservative outlook, considering potential adjustments due to the nature of growth, climate change and economic activity.

BACKGROUND

The Region of Peel has generally utilized "per capita" design criteria for the estimation of future water demands and wastewater flows. The Region has continued, on a regular basis and through Master Plan updates, to review and assess the water and wastewater design criteria.

Based on a historical analysis of water demands in the South Peel (lake based) system, there is evidence to suggest that the average day per capita water consumption is steadily decreasing due to increased efficiency of water fixtures, increased rainfall patterns (which leads to reduced irrigation), and improved public awareness. It is due to this trend observed over the last five years that the Region has undertaken extensive review to assess the current design criteria.

In an ideal world, a reduction in water consumption should also equate to a reduction in wastewater generation. However, flow analysis at the two wastewater treatment plants and local flow meters throughout the system has indicated that extraneous flow is significant. With wet weather events increasing in intensity and frequency, rainfall derived inflow and infiltration will continue to strain the capacity of the wastewater system.

STARTING POINT METHODOLOGY

As with the previous Master Plan, the approach will continue to be based on establishing a yearly starting point, calculated from measured water demands and wastewater flows, and projecting growth demands and flows from this starting point forward. Growth flows will be determined by applying the agreed design criteria to the residential population and employment growth forecasts.

It is important to note that the Region's calibrated hydraulic water and wastewater models will continue to be used to provide a more accurate baseline understanding of existing demands/flows and how these vary by pressure zone/drainage area.

EXISTING WATER DESIGN CRITERIA

The 2013 Master Plan utilized an average day water demand of 280 L/cap/d for both residential and non-residential land use. The residential maximum day peaking factor was 2.0, while the non-residential maximum day peaking factor was 1.4. The peak hour factor was 3.0.

For each water pressure zone, water pumping stations must provide local peak hour demands in the immediate serviced zone and have sufficient capacity to transfer maximum day demands for the subsequent zones to the north.

Transmission mains are required to convey the total pumping capacity requirements of the receiving pumping station to the north.

Analysis of treated water flow at the Lakeview and Lorne Park Water Treatment Plants corroborates the decreasing trend in per capita water consumption, averaging 254 L/cap/d over the past 10 years and 244 L/cap/d over the past 5 years. Adding a 10% safety factor results in a per capita of 264 – 280 L/cap/d.

Area-Based Water Design Criteria

The average day water demand criteria for non-residential users was extensively reviewed as part of a growth management exercise. While the details of this analysis are not discussed in this document, the findings suggest that area-based design criteria will not make a significant difference in the 2041 water demand projection, overall sizing of facilities and could in fact present more challenges than benefits. It was agreed that further consideration of area-based design criteria will not be pursued, at this time.

Analysis of Water Treatment Flows

Analysis of water treatment flows from 2011 to 2016 showed a total average daily demand of approximately 250 L/person or employee/day. Maximum day peaking factors have averaged approximately 1.6 at Lakeview and 1.5 at Lorne Park, however higher peaking factors have been observed particularly during the summer months. Details of these historical water flows are provided in Attachment 1 of this memorandum.

Analysis of Billing Data

Water billing records from 2012 to 2016 were reviewed to determine total volume of water billed to Peel residents and businesses. These figures were compared to water production records from the two lake-based treatment plants. The difference between the “billed water” volume and the “treated water” volume was utilized to estimate the annual percentage of non-revenue water for the last five years. The water billing analysis is summarized in Table 1.

Table 1. Water Billing Analysis Summary

Description	2012	2013	2014	2015	2016	5-YR AVG
Residential Billed Volume (m3)	115,832,091	109,164,359	107,825,427	108,221,737	113,991,516	111,007,026
Employment Billed Volume (m3)	50,562,845	48,184,326	47,987,687	47,882,815	53,050,134	49,533,561
Total Billed Volume (m3)	**166,394,936**	**157,348,685**	**155,813,114**	**156,104,552**	**167,041,650**	**160,540,587**
Non-Revenue Water[1]	***10.9%***	***14.4%***	***14.1%***	***14.7%***	***14.0%***	***13.6%***
Total Lake Based Residential Pop[2]	1,340,513	1,362,266	1,386,385	1,406,804	1,427,500	1,384,694
Total Lake Based Employment Pop[2]	650,015	661,668	674,119	691,010	708,515	677,065
Total Lake Based Population	**1,990,528**	**2,023,934**	**2,060,504**	**2,097,814**	**2,136,015**	**2,061,759**
Residential Use (L/cap/d, incl. NRW)	261.89	251.24	243.21	241.73	248.67	**249.35**
Employment Use (L/emp/d, incl. NRW)	235.76	228.32	222.61	217.75	233.17	**227.52**
Total (L/cap/d, incl. NRW)	**253.36**	**243.75**	**236.47**	**233.83**	**243.53**	**242.19**

[1] Note: Non-revenue water represents water losses through leakage in the distribution system but can also include water use due to operations activities, such as flushing, jetting, etc.
[2] Population determined based on interpolation between 2011 Census and 2016 Projected Population.

Discretization of Residential and Non-Residential Water Design Criteria

As seen in Table 1, analysis of the residential and employment water billing records against residential and employment population provides a breakdown of the per capita consumption by residential and non-residential water users.

In addition to the non-revenue water component, an additional 10% was considered a reasonable factor of safety to apply to the water billing data. Application of the 10% factor of safety to the 5-year averages of 249.35 L/cap/d (residential) and 227.52 L/emp/d (employment), equates to 274 L/cap/d and 250 L/emp/d, respectively. This can be rounded to 270 L/cap/d for residential, and 250 L/emp/d for employment, as shown in Table 2.

Table 2. Proposed Region of Peel Water Design Criteria

Type	Average Day Demand	Maximum Day Peaking Factor	Peak Hour Factor
Residential	270 L/cap/d	1.8	3.0
Employment	250 L/cap/d	1.4	3.0

Application of the 10% to the total flow of 242.19 L/cap/d equates to 266 L/cap/d, which represents a reduction of 5.0% relative to the previous criteria of 280 L/cap/d.

EXISTING WASTEWATER DESIGN CRITERIA

The 2013 Master Plan and current Region of Peel Sanitary Sewer Design Standards outline an average day wastewater flow criteria of 302.8 L/cap/d applied to either residential and non-residential population. The peaking factor was based on the Harmon Formula. The extraneous flow allowance was 0.2 L/s/ha, with provisions in the Design Manual for additional allowances for foundation drainage and/or manhole inflow.

Wastewater sewers and pumping stations are sized to convey peak flow. To calculate the peak dry weather flow, the average day flow is multiplied by the Harmon Peaking Factor for the gross tributary drainage area (minimum of 2, maximum of 4). The Harmon Peaking Factor, M, is calculated as follows:

$$M = 1 + \frac{14}{4 + P^{0.5}}$$

where:
M = Harmon Peaking Factor (ratio of peak flow to average flow)
P = tributary equivalent population in thousands

Wastewater treatment plants are sized to treat average daily flows. The 2013 Master Plan utilized an average wastewater flow criteria of 300 L/person or employee/day for projecting future flows at the treatment plants. This review looks at average daily flows over the past 5 and 10 years to assess the previous 300 L/cap/d design criteria.

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In 2015, the Region completed, through a consultant, a review of the sanitary sewer design criteria and standards for linear wastewater infrastructure. A key component of this study involved analysis of existing wastewater flow data, survey of other municipalities, and assessment of potential financial and other impacts. Findings from this review together with more recent analyses were utilized to inform recommended changes to the wastewater design criteria presented in this documented.

Analysis of Wastewater Treatment Flows

Analysis of wastewater treatment plant flows from 2007 to 2016 showed an average daily flow at the two plants of approximately 287 L/cap/day over the last 10 years and 294 L/cap/day over the last 5 years. Historical wastewater flows at the treatment plants are outlined in Attachment 2 of this memorandum.

As it can be observed, there is an increasing flow trend over time as plant flows include dry weather flow, as well as an element of inflow and infiltration. Using a 10-year average aligns with the previous Master Plan methodology. Adding a 10% factor of safety to the 10-year plant flow average of 287 L/cap/d equates to 315 L/cap/d. This will be the design criteria used for projecting future flows at the plants.

Table 3. Proposed Region of Peel Wastewater Design Criteria for Treatment Plants

Type	Average Day Flow
Residential	315 L/cap/d
Employment	315 L/cap/d

Analysis of Local Sub-Drainage Area Flows

Since the previous Master Plan, the Region has significantly expanded its wastewater flow metering program to monitor both existing and new development areas. There are currently 212 active flow monitors strategically located throughout the Region, which provide real-time data that is continuously analyze to identify any problem areas. There are 49 rain gauges in the Region which provide further precipitation data that is combined with flow data to characterize and quantify wet weather response in the local collection system.

Local sanitary sewer flow monitoring at a sub-drainage level has showed a wide range in average per capita or employee dry weather flows, at times exceeding the design criteria. However, of primary interest was the extent to which inflow and infiltration exceeded typical design allowances. Based on over 130 flow monitoring stations, the average peak unit I/I rates ranged between 0.35 and 0.78 L/s/ha.

Analysis of historical treatment flows corroborates these findings and its cumulative impact at the plants. Given the abundance of evidence and findings of the municipal survey, the Region proposes to increase the design allowance for extraneous flow from 0.20 to 0.26 L/s/ha.

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Discretization of Residential and Non-Residential Wastewater Design Criteria

The wastewater design criteria review has drawn from previous treatment and sub-drainage flow analyses to inform proposed changes to the wastewater design criteria for the collection system. Dry weather flow generation trends in the Region of Peel support the reduction of the average day wastewater design criteria from 302.8 to 285 L/person or employee/day, representing a reduction of 5.9%.

Unlike water, which is metered at the source, wastewater flows cannot be discretized by source (i.e. residential or non-residential). As such, analysis of treatment flow data against total service population is limited to providing an overall per capita wastewater flow generation rate. However, the same proportion used to discretize water can be applied to wastewater. The 285 L/cap/d equates to an average day wastewater flow of 290 L/person/day for residential and 270 L/employee/day for employment, as outlined in Table 4.

Table 4. Proposed Region of Peel Wastewater Design Criteria for Collection System

Type	Average Flow	Peaking Factor	Infiltration
Residential	290 L/cap/d	Harmon (min 2, max 4)	0.26 L/s/ha
Employment	270 L/emp/d	Harmon (min 2, max 4)	0.26 L/s/ha

SUMMARY AND RECOMMENDATIONS

Recent trends in water consumption in the Region of Peel support the reduction of the average day water design criteria from 280 to 266 L/person or employee/day. This represents a reduction of 5.0%. As part of the Growth Management Initiative, discussions with the development industry led to the decision of discretizing a single design criteria into separate residential from non-residential components based on service population. The Region believes this approach is fair and reasonable to both residents and the employment industry.

The residential average day water demand will be 270 L/person/day, while employment will be 250 L/employee/day. The residential maximum day peaking factor will be reduced from 2.0 to 1.8, while the non-residential maximum day peaking factor will remain unchanged at 1.4. The peak hour factor will also remain unchanged at 3.0.

The findings of the analysis undertaken as part of the water billing analysis do not support the position that changing to an area-based water design criteria for non-residential use is reasonable at this time.

Dry weather wastewater flow generation trends in the Region of Peel support the reduction of the average day wastewater design criteria from 302.8 to 285 L/person or employee/day. This represents a reduction of 5.9%. As with water, this single wastewater design criteria was further discretized into separate residential and non-residential components based on the same proportion as water.

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On this basis, the residential average day wastewater flow will be 290 L/person/day, while employment will be 270 L/employee/day. Peak dry weather flow will continue to be calculated using the Harmon formula.

Unlike dry weather flows, however, there is sufficient evidence to support the increase of the extraneous flow allowance of 0.20 L/s/ha. The inflow and infiltration allowance will be 0.26 L/s/ha.

It is important to note that the Region is committed to continuously monitoring, analyzing flows and making adjustments as new and improved information becomes available.

Attachment 1 - Derivation of Average Day Demand **(PRODUCTION DATA)**

Water Design Criteria Average Day

South Peel System

Year	Residential Population (South Peel)	No. of Employees (South Peel)	Total Population	Average Daily Demand, MLD (excl. York)	Per Capita Demand (L/cap/d)
2007	1,205,883	618,216	1,824,099	537.62	294.73
2008	1,229,012	632,297	1,861,309	507.57	272.69
2009	1,251,100	646,149	1,897,249	487.77	257.10
2010	1,275,000	657,858	1,932,858	486.68	251.79
2011	1,321,101	639,639	1,960,739	480.85	245.24
2012	1,337,129	651,724	1,988,854	504.31	253.57
2013	1,353,158	663,810	2,016,968	493.32	244.59
2014	1,369,187	675,896	2,045,082	487.25	238.26
2015	1,385,215	687,982	2,073,197	490.54	236.61
2016	1,400,534	699,267	2,099,801	521.61	248.41
2017					

5 yr average 244.29 L/cap/d

Lakeview

Year	Average Daily Demand, MLD (excl. York)	Maximum Day Demand, MLD	Maximum Day Peak Factor
2007	376.17	586.60	1.56
2008	388.20	569.30	1.47
2009	371.48	597.40	1.61
2010	397.21	690.90	1.74
2011	394.76	677.70	1.72
2012	422.80	675.50	1.60
2013	418.56	634.30	1.52
2014	387.33	559.50	1.44
2015	410.21	637.40	1.55
2016	415.33	672.30	1.62
2017			
5 yr average	410.85	635.80	1.55

Lorne Park

Year	Average Daily Demand, MLD (excl. York)	Maximum Day Demand, MLD	Maximum Day Peak Factor
2007	209.83	292.10	1.39
2008	191.66	261.20	1.36
2009	176.10	236.40	1.34
2010	161.58	224.70	1.39
2011	174.79	299.30	1.71
2012	193.09	291.70	1.51
2013	190.35	267.10	1.40
2014	208.86	277.10	1.33
2015	196.66	288.10	1.46
2016	206.01	317.10	1.54
2017			
5 yr average	198.99	288.22	1.45

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Attachment 2 - Derivation of Average Day Flow **(PLANT DATA)**

Wastewater Design Criteria Average Day

South Peel System

Year	Residential Population (South Peel)	No. of Employees (South Peel)	Total Population	Average Daily Flow, MLD (excl. York & Toronto)	Per Capita Flow (L/cap/d)
2007	1,177,517	565,818	1,743,335	479.98	275.32
2008	1,208,615	586,508	1,795,123	521.26	290.37
2009	1,226,639	589,475	1,816,114	502.83	276.87
2010	1,240,559	593,303	1,833,862	482.01	262.84
2011	1,270,860	597,136	1,867,996	537.24	287.60
2012	1,301,162	600,970	1,902,131	536.07	281.83
2013	1,331,463	604,803	1,936,266	557.90	288.13
2014	1,353,423	619,856	1,973,279	590.69	299.35
2015	1,375,384	634,909	2,010,293	567.66	282.38
2016	1,397,344	649,962	2,047,306	581.54	284.05
2017					

10 yr average	282.87
5 yr average	287.15

G.E. Booth

Year	Residential Population (East)	No. of Employees (East)	Total Population	Average Daily Flow, MLD (excl. York & Toronto)	Per Capita Flow (L/cap/d)
2007	686,815	433,874	1,120,689	306.61	306.61
2008	707,485	450,328	1,157,813	323.41	323.41
2009	719,035	449,219	1,168,254	324.11	324.11
2010	727,504	451,666	1,179,170	339.06	339.06
2011	755,442	450,395	1,205,836	401.66	376.98
2012	783,380	449,123	1,232,503	395.35	375.83
2013	811,318	447,852	1,259,170	429.00	402.65
2014	820,400	457,530	1,277,930	425.13	425.13
2015	829,482	467,209	1,296,691	378.55	378.55
2016	838,564	476,887	1,315,451	398.67	380.10
2017					

10 yr average	363.24
5 yr average	392.45

Clarkson

Year	Residential Population (West)	No. of Employees (West)	Total Population	Average Daily Flow, MLD (excl. York & Toronto)	Per Capita Flow (L/cap/d)
2007	490,703	131,944	622,647	173.24	278.23
2008	501,130	136,180	637,310	197.80	310.37
2009	507,604	140,256	647,860	187.47	289.37
2010	513,055	141,637	654,692	177.27	270.77
2011	515,418	146,741	662,160	160.25	242.02
2012	517,782	151,846	669,628	160.24	239.29
2013	520,145	156,951	677,096	155.24	229.28
2014	533,023	162,326	695,349	165.56	238.10
2015	545,902	167,700	713,602	189.11	265.01
2016	558,780	173,075	731,855	201.44	275.24
2017					

10 yr average	263.77
5 yr average	249.38

4B

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 4B

Cost Estimation Framework Memo

Cost Estimation Framework

2020 Water and Wastewater Master Plan

Prepared by:
GM BluePlan Engineering for:

The Regional Municipality of Peel

Project No. 715022

May 2020

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1 INTRODUCTION

GM BluePlan Engineering was retained by the Region of Peel (the Region) to undertake the 2020 Water and Wastewater Master Plan. The project scope included development of new frameworks and policies related to long-term planning, cost estimation at the Master Plan level, and updated linear and vertical unit rates. This memorandum presents the new Cost Estimation Framework, including updated unit rates, that will be applied to the Region of Peel's capital projects in the 2020 Water and Wastewater Master Plan, and moving forward in the Region's annual capital budget.

The Region of Peel wishes to formalize and document a Cost Estimation Framework that provides a consistent, transparent, and auditable approach to costing capital projects. This memorandum is intended to help the Region develop and adopt a framework that best fits its unique operational structure.

The primary aims of this task are to:

- Provide a formal cost estimation framework for the Region.
- Provide guidance to Regional staff on the use of the framework.

To achieve the aims, the objectives of the task are to:

- Establish and define different levels or classes of cost estimates appropriate to the information that is available, which will relate to the type of study that is being undertaken.
- Identify key information requirements to generate each level of class estimate.

2 REGION OF PEEL'S COST ESTIMATION FRAMEWORK

The proposed Cost Estimation Framework for capital projects at the Master Plan level will follow a similar methodology as the 2013 Water and Wastewater Master Plan based on an overall project unit cost approach. In this approach, project costs are generated from unit rates with added contingency and other additional costs.

The goal of the Cost Estimation Framework is to provide a consistent and traceable approach for estimating capital project costs to minimize the variance between cost estimates and final project budgets. The approach will also improve communication and understanding between stakeholders.

2.1 Approach and Methodology

The total length or capacity needs of the required infrastructure is multiplied by a unit rate, applicable to the size or capacity and particular construction type (e.g., 5-metre depth sewer, 10-metre depth sewer, water main, wastewater force main, tunnelling). Additional costs are added to account for creek, road, railway or utility crossings, valves, tunneling requirements, etc., where applicable.

In cases where construction will occur in built up areas, such as intensification areas, a cost escalation factor is applied to the installation cost. This factor provides additional project costs to account for utility coordination/relocation, urban reinstatement, and urban construction impacts.

The sum of the base cost plus additional cost results in the *Base Construction Cost*.

Soft costs such as geotechnical/hydrogeological, property/easements, engineering and design, contract administration and contingency allowances, are added to the Base Construction Cost to arrive at the *Total Project Cost*.

Figure 1 shows the cost estimating process flow diagram. Each of the key components of the diagram is described below, including:

- Project Type
- Cost Estimate Classification
- Project Complexity
- Unit Rates
- Construction Uplift
- Additional Costs
- Construction Provisional Allowance
- Other Project Costs (Geotechnical, Property, Design, In-house costs, etc.)
- Project Contingency

The unit costs and all the above components are contained in excel spreadsheets that include the Region's project sheets and the Water and Wastewater Capital Programs. The spreadsheet is the working tool that brings all the cost components together to create project cost estimates for the capital programs. The template spreadsheet is provided in Appendix A.

The following sections describe the methodology for each cost component.

Step 1. Define Project Type

Project Type	Project Type Description
New infrastructure	Projects involving construction of new infrastructure, typically funded from DCs.
Replacement	Projects involving replacement, relining, etc. of existing infrastructure (SOGR).

Step 2. Define Project Classification

Estimate Class	Estimate Class Description	End Usage/Major Deliverables
Class 4	Infrastructure Planning Cost Estimate	Study to support investment decisions based on sufficient knowledge to identify high-level risk.
Class 3	Conceptual Design Cost Estimate	Basis for budgeting and approvals.
Class 2	Preliminary Design Cost Estimate	Used for project cost control during design; initial design estimate.
Class 1	Detailed Design Cost Estimate	Final cost review in preparation for construction; tender-ready.

Step 3. Define Project Complexity

Project Complexity	Complexity Description
High complexity	• Complex project details that, in general, have high uncertainty and may potentially change in later stages of the project (EA, scoping study, design, construction) • Multiple options and project details for design & construction (alignment, dimensions, facility layout, construction methodology) that are not yet confirmed
Medium complexity	• Medium complexity projects that have most project details that generally fall in between High and Low complexity • Medium complexity projects may have some elements that fit the High Complexity category, while some elements falling within Low complexity category. (e.g. short section of small diameter watermain constructed within built up area with several utility conflicts)
Low complexity	• Straightforward project details that, in general have low uncertainty and are not likely to change in later stages of the project (EA, scoping study, design, construction) • Most options and project details for design & construction (alignment, dimensions, facility layout, construction methodology) that are generally confirmed at this stage

Step 4. Define Project Details

Project Detail	Detail Description
Diameter/Capacity	Nominal diameter of the proposed water main to provide the required level of service, or proposed capacity of the vertical infrastructure.
Length	Approximate length of the proposed water main based on the alignment (whether assumed or determine through more rigorous analysis).
Construction Methodology	The method by which the water main will be installed (e.g., open cut, trenchless).
Construction Depth	The depth of excavation required to install the water main assuming that open cut construction is chosen (e.g., normal, deep).
Construction Environment	The general environment within which the water main will be constructed (e.g., greenfield, suburban, urban).
Crossings	Identification of the type and number of crossings associated with the water main installation (e.g., creeks, roads, railways, major utilities).
Appurtenances	Identification of the type and number of appurtenances required for the proposed water main (e.g., valves, chambers, hydrants, etc.).
Other Considerations	Coordination with other capital works that could impact schedule and cost.

Step 5. Calculate Total Construction Cost

❶ INSTALLATION COST
Basic cost to install the water main and associated appurtenances calculated using various unit rates for pipe, valve and chamber sizes and type of crossings.

Includes: Water main installation (unit rate x length), crossings (count x unit rate for size and type of crossing), valve and chambers (included in unit rate).
See unit rates for different pipe sizes.

For vertical infrastructure, includes facility construction (unit rate x capacity).

+

❷ CONSTRUCTION UPLIFT
Allowance for the increased cost of constructing in built-up areas, applied to the base construction cost.

Construction Environment		
Greenfield	Suburban	Urban
0%	10%	20%

=

❸ BASE CONSTRUCTION COST
Total cost to construct the actual linear or vertical infrastructure and associated appurtenances, not including tasks such as traffic management, mobilization, inspections, etc.

❸ = ❶ + ❷

+

❹ ADDITIONAL CONSTRUCTION COSTS
Additional costs associated with construction not covered under the base construction cost or the construction uplift, including mobilization, traffic management, inspections, etc.

A percentage is applied to the water main construction cost based on the complexity of the project.

Project Complexity		
Low	Moderate	High
10%	15%	20%

+

❺ PROVISIONAL ALLOWANCE
Provisional allowance for labour and materials over and above the water main construction cost, a standard item on construction tenders.

A provisional allowance of 10% is applied to all projects.

Provisional & Allowance
10%

=

❻ TOTAL CONSTRUCTION COST
Total cost of constructing the water main/facility including all items that make up a construction tender.

❻ = ❸+ ❹+ ❺

Step 6. Calculate Soft Costs

a) For new infrastructure (i.e., growth-related)

❼ GEOTECHNICAL/ HYDROGEOLOGICAL
Allowance for geotechnical/hydrogeological investigations during detailed design.

Linear			Facility
Low Complexity	Med Complexity	High Complexity	
0.5%	1.0%	2.0%	2.0%

+

❽ PROPERTY/EASEMENTS
Allowance for temporary and permanent easements and for property acquisition.

Linear			Facility
Low Complexity	Med Complexity	High Complexity	
1.0%	1.5%	2.0%	2.0%

+

❾ ENGINEERING/DESIGN (INTERNAL)

Total Cost		
<$10m	$10-$50m	>$50m
8.0%	6.0%	4.0%

+

❿ DESIGN/CONTRACT ADMINISTRATION (EXTERNAL)

Total Cost		
<$10m	$10-$50m	>$50m
15.0%	12.0%	10.0%

+

⓫ APPROVALS
Allowance for EA requirements (other than Schedule C), permits and other approvals.

Total Cost		
<$10m	$10-$50m	>$50m
TBD	TBD	TBD

=

⓬ TOTAL SOFT COSTS (GROWTH)

⓬ = ❼ + ❽ + ❾ + ❿ + ⓫

b) For replacement (i.e., SOGR-related)

⓯ ENGINEERING & CONSTRUCTION ADMINISTRATION C Account 37323	4%
+	
⓰ DEVELOP INSPECTORS C Account 37321	4%
+	
⓱ MISC EXP - CAP PROJ Account 23879	14%

=

⓲ TOTAL SOFT COSTS (NON-GROWTH)

⓲ = ⓯ + ⓰ + ⓱

Step 7. Calculate Project Contingency

⓭ PROJECT CONTINGENCY
An allowance for overall project contingency (construction, design, property, etc) that recognizes both the complexity of the project and the project classification in terms of the certainty regarding scope of work, alignment, construction methodology, property requirements, geotechnical/hydrogeological issues, etc. The contingency will become smaller as the project moves closer to implementation.
⓭ = % x (❻ + ⓬)

	Project Complexity		
	Low	Moderate	High
Class 4	**10%**	**15%**	**25%**
Class 3	10%	15%	20%
Class 2	10%	10%	15%
Class 1	10%	10%	10%

Step 8. Calculate Total Project Cost

⓮ TOTAL PROJECT COSTS

⓮ = ❻ + ⓬ + ⓭

Step 9. Determine Funding Source(s)

Determine the funding source or sources based on the key driver(s) of the project.

Growth	
In-Period	Out of By-law (OBL)
DC South Peel R3520	DC Regional R3530
DC South Peel R3620	DC Regional R3630

State of good repair/ system improvement		
CFSR	York-Peel CFSR	Non-DC Growth
R0241	R0271	R1080

External sources		
York Recoveries	Ext. SA Owner's	Other Misc. Rec.
86414	86401	86299

Step 10. Assemble Capital Project in the Database

❻ is entered as the CONSTRUCTION component

⓬ is entereed as the DESIGN/SOFT COST component

Figure 1. Cost Estimation Process Flow Diagram (Sample – Water)

2.2 Project Type

New Infrastructure

New infrastructure projects involve construction of new linear or vertical infrastructure that is are growth related and typically funded from Development Charges (DCs). The majority of the capital projects identified in the Master Plan fall into this category and their cost will be developed using the new cost estimation framework.

Replacement

Projects involving replacement, relining and other works on existing infrastructure. These projects are generally not growth related and fall in the State of Good Repair (SoGR) category. The cost of these projects will not be developed based on the new cost estimation framework. A separate cost estimating process is being developed for SoGR projects which will follow a similar process.

2.3 Cost Estimate Classification

The cost estimation approach uses a classification system to categorize cost estimate classes. These classes represent different phases of planning and design and, therefore, different methods of cost estimation and levels of accuracy. This framework complements the generic approach developed by the Association of Advancement in Cost Estimating (AACE) International, and also has similarities to the Government of Canada (GOC) approach.

For the purposes of the 2020 Water and Wastewater Master Plan, the cost estimates that are derived using this methodology will mostly follow a **Class 4** estimate. If this methodology is further used through subsequent phases of the project, the Class can be updated to reflect the higher level of confidence in the estimate and the additional effort used to develop the estimate.

Table 1 provides descriptions of the proposed estimate classes and their end usage or deliverables. Appendix B includes expanded details on each Class, including the basis for the estimate and the associated accuracy range that can be expected based on the project complexity.

Table 1. Cost Estimation Classes

Estimate Class	Estimate Class Description	End Usage / Major Deliverables
Class 5	Order of Magnitude Estimate	Limited or no available information used in the cost estimate. Used at an early stage in absence of better information.
Class 4	Infrastructure Planning Cost Estimate	Infrastructure Planning/Master Planning. Justification for project planning funding. Limited available information used in the cost estimate.
Class 3	Conceptual Design Cost Estimate	Basis for budgeting and approvals.
Class 2	Preliminary Design Cost Estimate	Used for project cost control during design. Initial detailed estimate.
Class 1	Detailed Design Cost Estimate	Final cost review in preparation for construction; tender ready.

2.4 Project Complexity

A Master Plan level project can vary widely in scope. Past Master Plans and DC updates have included, for example, small diameter (300 mm) and short length (<100 m) water mains as projects as well as multi-disciplinary treatment plant upgrades with construction costs in excess of $100 million. When developing the cost estimate within a Master Plan context, it should be recognized that not all project costs have the same level of complexity. As part of the new cost estimating framework, the project complexity is estimated during development of the project cost estimate. As the anticipated complexity of a project increases from low to high there is a greater risk of unforeseen costs. As such, the contingency and additional cost items are adjusted to reflect the project complexity.

Table 2 provides general definitions of project complexity – high, medium and low – as used in the 2020 Water and Wastewater Master Plan. An estimate of the complexity is made after reviewing the project details that are available at the Master Planning stage. The definitions of high, medium and low complexity are provided to maximize the consistency in complexity selection on a given project and to minimize the subjectivity of the estimate.

The complexity estimate is intended to represent the best assumption of the overall complexity of the project with details available at the time.

Table 2. Project Complexity Descriptions

Project Complexity	Complexity Description

High Complexity	• Large in scale, scope and, ultimately, cost.
	• Uncommon project not frequently constructed.
	• Complex project details that, in general, have high uncertainty and may potentially change in later stages of the project (EA, scoping study, design, construction)
	• Multiple options and project details for design and construction (alignment, dimensions, facility layout, construction methodology) that are not yet confirmed
	• Other anticipated project details that can contribute to consideration as a High Complexity project:
	  ○ Existing utility and linear infrastructure conflicts, that may not be known at the Master Planning Stage
	  ○ Unknown subsurface conditions – Soil, rock, groundwater
	  ○ Significant restoration requirements
	  ○ Environmental features that may require additional approvals and/or mitigation during construction
	  ○ Potentially long construction duration
	  ○ Linear – Deep sewer/water main, force main
	  ○ Linear – Large Diameter
	  ○ Facility – Deep Wet Well
	  ○ Facility – Large Capacity (Reservoir, Elevated Tank, Pumping Station)
	
	The nature of the project details in a high complexity project (e.g. many unknowns, utility conflicts, large diameter, high base construction costs, etc.) necessitate the inclusion of further additional costs to account for the risk of construction cost increases.

Project Complexity	Complexity Description
Medium Complexity	• Moderate in scale, scope and, ultimately, cost. • Medium complexity projects where most project details generally fall in between high and low complexity. • Medium complexity projects may have some elements that fit the High Complexity category, while some elements falling within Low complexity category (e.g., short section of small diameter water main constructed within a built-up area with several utility conflicts).

Low Complexity	• Smaller in scale, scope and, ultimately, cost.
	• Common project frequently constructed.
	• Straightforward project details that, in general, have low uncertainty and are not likely to change in later stages of the project (EA, scoping study, design, construction).
	• Most options and project details for design and construction (alignment, dimensions, facility layout, construction methodology) are generally confirmed at this stage.
	• Other anticipated project details that can contribute to consideration as a Low Complexity project
	    ○ Few existing utility and linear infrastructure conflicts – generally associated with greenfield/rural construction
	    ○ Subsurface conditions are known or assumed with high level of certainty
	    ○ Minimal restoration required or restoration primarily to be coordinated with road construction/widening
	    ○ Little to no environmental features within project construction area
	    ○ Short anticipated construction duration
	    ○ Linear – Shallow sewer, water main, force main
	    ○ Linear – Small diameter
	    ○ Facility – Shallow wet well
	    ○ Facility – Small Capacity (Reservoir, Elevated Tank, Pumping Station)
	
	The nature of project details in a low complexity project (e.g., few unknowns, few utility conflicts, small diameter, low base construction cost, etc.) do not necessitate significant additional costs.

2.5 Unit Rates

Unit rates require periodic updating to ensure they are consistent with current market conditions. GM BluePlan compiled recent tenders for linear and facility projects within the GTA to provide guidance to the update of unit rates. Unit rates are estimated to be high level cost for construction, which is assumed to include General Contractor profit.

The linear unit rate for a given pipe diameter is made up of the following components:

- Excavation ($/m^3)
- Bedding ($/m^3)
- Pipe Supply ($/m)
- Pipe Install ($/m)
- Backfill ($/m^3)
- Restoration ($/m)
- Manhole Allowance ($/m)
- Valve Allowance ($/m)

Each component was broken down to a $/m linear unit rate to generate the total base construction cost for a given diameter of pipe. Unit rates for facilities are not broken down to the same level of detail as linear projects. Facility unit rates are based on $/L/s or $/ML.

For the 2020 Water and Wastewater Master Plan, the linear component and facility costs were updated based on the following considerations:

- 2012 cost – Used as a baseline starting point to ensure costs remained relatively close to previous estimates
- Current pipe cost from suppliers
- Recent Tenders
- Construction cost indexing (Inflation)

Since every construction project is unique, new unit rates were not directly derived from tenders; rather, tenders were deconstructed and used as guidance and as a check to ensure the unit rates are reasonable.

The new unit rates are provided in Appendix D. They are based on a combination of supplier material costs, tender analysis and historic project costs from multiple municipalities across southern Ontario. In this recommended approach, the unit rates are the starting point or base for a cost estimate. Many other factors and criteria are applied to the unit rates. Therefore, caution is advised when comparing recommended unit rates in isolation with those used for previous studies. Only full and complete costs estimates should be compared.

Creeks, roads, railways and utility corridor crossings are also identified during the cost estimating process. The costs associated with these crossings, where applicable, are part of the installation cost. The costs of crossings are calculated as follows:

- Major Creek / Major Road → 150 m x Trenchless Unit Rate
- Minor Road / Utilities Corridor → 60 m x Trenchless Unit Rate
- Minor Creek → 20 m x Trenchless Unit Rate

Costs for crossings are considered a premium over and above the installation cost for the project and, as such, the total length of the water main or sanitary sewer is not adjusted to remove the length of the crossing.

2.6 Construction Uplift

Construction uplift introduces an allowance for the increased cost of constructing in built-up areas and is applied to the installation cost. This uplift accounts for additional costs related to restoration, utility conflicts, traffic management and additional restoration that are often encountered in an urban or suburban area as opposed to greenfield construction.

Table 3 provides a definition and the construction uplift percentages applicable for the different area conditions in the 2020 Water and Wastewater Master Plan.

Table 3. Construction Uplift Descriptions

Construction Environment	Environment Description	Construction Cost Uplift %
Greenfield	Greenfield construction with limited environmental constraints. e.g., Humber Station Road and Healey Road	0%
Suburban	Developed built-up environment. e.g., Bovaird Drive and Mississauga Road	10%
Urban	Heavily developed built-up environment (e.g., downtown area). e.g., Mississauga City Centre	20%

2.7 Additional Construction Costs

Additional construction costs account for costs that are incurred but not included in the base construction cost. These costs generally include mobilization and demobilization, pipe inter-connections, inspection, hydrants, signage, traffic management, bonding, insurance, etc.

Additional construction costs are adjusted based on assumed project complexity, as follows:

- Low Complexity → Additional Construction Costs = 10%
- Medium Complexity → Additional Construction Costs = 15%
- High Complexity → Additional Construction Costs = 20%

2.8 Construction Provisional Allowance

A provisional allowance is applied to the base construction cost in the event of increased construction labour or material costs. The provisional allowance remains separate from the primary project cost but must be accounted for budgeting purposes. Regardless of estimate class or project complexity it is recommended that 10 per cent of the base construction cost is applied as a Provisional Allowance.

2.9 Other Project Costs

Other costs that can be included within a project in addition to the base construction costs are listed in Table 4. If available, actual quoted costs should be used. In the absence of this information, percentages are applied to the base construction costs. Some of these costs are related to project complexity. Table 4 shows the percentages to be applied for high, medium and low complexity projects.

Table 4. Additional Cost Components

Cost Component	High Complexity	Medium Complexity	Low Complexity
Geotechnical / Hydrogeological / Materials	2.0% of construction cost	1.0% of construction cost	0.5% of construction cost
Property / Easements – (applicable to all projects)	2.0% of construction cost	1.5% of construction cost	1.0% of construction cost
Engineering / Design (Internal)			
Total Cost < $10M	8% of construction cost		
Total Cost = $10M - $50M	6% of construction cost		
Total Cost > $50M	4% of construction cost		
Design / Contract Administration (External)			
Total Cost < $10M	15% of construction cost		
Total Cost = $10M - $50M	12% of construction cost		
Total Cost > $50M	10% of construction cost		
Project Contingency	(See section 2.10)		
Non-Refundable HST	**1.76%** of (construction cost + geotechnical/hydrogeological/materials + property requirements + consultant engineering + project contingency)		

2.10 Project Contingency

The associated risk and uncertainty of a project cost estimate is minimized with the addition of a contingency. Contingencies are allowances for risks that are known or anticipated at early stages of the project definition. That is, they represent probable events that are "known unknowns" and, experience has shown, are likely to occur. They cannot be attributed to specific items in the base cost estimate but need to be considered in addition to the base cost. A project contingency does not cover major changes in scope, which would require a re-assessment and re-costing of a project. Project Contingency is applied to all projects that are costed using this methodology.

The Project Contingency for this methodology is adjusted based on the cost estimate classification and project complexity as follows:

Table 5. Project Contingency

	Project Complexity		
	Low	**Moderate**	**High**
Class 5		30%	
Class 4	10%	15%	25%
Class 3	10%	15%	20%
Class 2	10%	10%	15%
Class 1	10%	10%	10%

Appendix A – Cost Estimation Spreadsheet Template

BluePlan

REGION OF PEEL
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

Region of Peel
Working for you

PROJECT NO.:	**WWST001**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**375-mm Sanitary Sewer - Future Street (North of Countryside Drive)**	**VERSION:**	
PROJECT DESCRIPTION:	Sub-Trunk Sewer: 375 mm on future street north of Countryside Drive from Highway 50 to approx. 810m northwest	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	30%	
Area Condition:	Rural	Area Condition uplifts unit cost and restoration

(grey)	= Field has drop down
(yellow)	= Field must be manually populated
(green)	= Field auto-filled based on project details

PROPOSED DIAMETER:		375 mm	
TOTAL LENGTH:		810 m	
	Tunnelled		0%
	Open Cut	810 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Sewer 10m

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	810 m	$2,709	$2,194,562	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	0%					$0	
Minor Creek Crossings			ea.	0	$166,000	$0	
Major Creek Crossings			ea.	0	$985,000	$0	
Road Crossings			ea.	0	$418,000	$0	
Major Road Crossings (Highway)			ea.	0	$985,000	$0	
Utility Crossings			ea.	0	$418,000	$0	
Additional Construction Costs	10%		ea.			$219,456	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$241,402	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$2,655,000**	
Geotechnical / Hydrogeological / Materials	0.5%					$13,300	
Geotechnical Sub-Total Cost						**$13,300**	
Property Requirements	1.0%					$ 26,600	
Property Requirements Sub-Total						**$26,600**	
Consultant Engineering/Design	15%					$ 398,300	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$398,300**	
In House Labour/Engineering/Wages/CA	8%					$ 212,400	
In-house Labour/Wages Sub-Total						**$212,400**	
Project Contingency	10%					$331,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$331,000**	
Non-Refundable HST	1.76%					$60,300	
Non-Refundable HST Sub-Total						**$60,300**	
Total (2016 Dollars)						**$3,697,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$3,697,000**	**2016 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	0%	$0		
Design	Design fees, Town fees for design, contract admin	15%	$554,550		
Construction	Town fees, base costs and project contingency	85%	$3,142,450		
TOTAL			$3,697,000		

Appendix B – Cost Estimate Classes

CLASS 5 ESTIMATE: Order of Magnitude Estimate

Description:

Includes high level cost estimate with a long-term project horizon. Desktop level analysis based on previous similar projects and engineer's informed approximation formed on limited available information.

Example of Typical Study/Design Level:

Master Plan, Infrastructure Plan, Capital Budgeting

End Usage:

Concept screening and feasibility; used at an early stage in absence of better information.

Estimating Methods Used:

Experience and judgement, historical values, rules of thumb, factor estimating base on similar projects, among other basic calculations.

Expected Accuracy Range:

Low Complexity		High Complexity
+/- 40%	→	+/- 70%

CLASS 4 ESTIMATE: Planning Cost Estimate

Description:

Includes high level cost estimate with a long-term project horizon. Desktop level analysis based on preliminary investigations, anticipated project needs, and engineer's best judgement based on limited available information.

Example of Typical Study/Design Level:

Master Plan, Infrastructure Plan, Capital Budgeting

End Usage:

Concept screening; justification for project planning funding. Useful for planning purposes in preparation for project pre-design. Shall be included in Capital Projects List.

Estimating Methods Used:

An approximate method of estimating using an inclusive "all in" unit rates, typically based on historic data. (e.g. sewer cost per meter)

Expected Accuracy Range:

Low Complexity		High Complexity
+/- 20%	→	+/- 40%

CLASS 3 ESTIMATE: Concept Design Cost Estimate	
Description: Includes detailed costing for budgeting purposes. Includes more detailed knowledge of specific criteria to generate more component related costing.	**Estimating Methods Used:** Uses features from both the unit rate method (for low risk items) and first principles method (for high risk items).
Example of Typical Study/Design Level: 5-Year Business Plan Conceptual Design	**Expected Accuracy Range:** Low Complexity → High Complexity +/- 15% → +/- 20%
End Usage: Basis for budgeting and approvals.	

CLASS 2 ESTIMATE: Preliminary Design Cost Estimate	
Description: The cost estimate generated from this class can be used as a basis for fund appropriation. Uses more detailed knowledge and more costing components including more field investigations and preliminary design reports.	**Estimating Methods Used:** Uses features from both the unit rate method (for low risk items) and first principles method (for high risk items).
Example of Typical Study/Design Level: Preliminary Design	**Expected Accuracy Range:** Low Complexity → High Complexity +/- 10% → +/- 15%
End Usage: Used for project cost control during design. Initial detailed estimate.	

CLASS 1 ESTIMATE: Detailed Design Cost Estimate	
Description: This class will generate a cost estimate representing the Engineer's final estimate based on completed plans. The estimated cost will reflect current market conditions in the constructing community. The goal of this cost estimate is to match the median bid received during the bidding process. **Example of Typical Study/Design Level:** Detailed Design **End Usage:** Final cost review in preparation for construction; tender ready.	**Estimating Methods Used:** Project specific costs based on detailed study of work methods, resources and materials. For example, material costs based on current supplier quotes. All project components costed individually. **Expected Accuracy Range:** Low Complexity → High Complexity +/- 5% → +/- 10%

Appendix C – Data Confidence and Availability for Cost Estimate Classes

Linear Projects

General Project Data	Class 5	Class 4	Class 3	Class 2	Class 1
Location	Assumed	Assumed	Preliminary	Defined	Defined
Project Complexity	Assumed	Assumed	Preliminary	Defined	Defined
Area Condition	Assumed	Assumed	Preliminary	Defined	Defined
Diameter/Capacity	Assumed	Preliminary	Defined	Defined	Defined
Length	Assumed	Preliminary	Defined	Defined	Defined
Tunnelled / Open Cut	Assumed	Assumed	Preliminary	Defined	Defined
Construction Assumption (water main, 5m sewer, 10m sewer, force main, tunnel)	Assumed	Preliminary	Preliminary	Defined	Defined
Crossings (Road, Creek, Utilities)	Assumed	Preliminary	Defined	Defined	Defined
Hydraulic Requirements (Valves, Chambers)	Assumed	Preliminary	Preliminary	Defined	Defined
Hydrogeological, Geotechnical	Assumed	Assumed	Preliminary	Defined	Defined
Property Requirements	Assumed	Assumed	Defined	Defined	Defined
Approval Requirements	Assumed	Assumed	Preliminary	Defined	Defined

Vertical Projects

General Project Data	Class 5	Class 4	Class 3	Class 2	Class 1
Location	Assumed	Assumed	Preliminary	Defined	Defined
Hydrogeological, Geotechnical	Assumed	Assumed	Preliminary	Defined	Defined
Building/Structural Type and Requirements	Assumed	Assumed	Preliminary	Defined	Defined
Hydraulic Requirements, Equipment Selection	Assumed	Preliminary	Preliminary	Defined	Defined
Technology	Assumed	Assumed	Preliminary	Defined	Defined
Building Schematics	Assumed	Assumed	Preliminary	Defined	Defined
Property Requirements	Assumed	Assumed	Preliminary	Defined	Defined
Approval Requirements	Assumed	Assumed	Preliminary	Defined	Defined

Appendix D – Updated Unit Rates

Table D.1 Sanitary sewer unit rates for 5-metre deep open cut construction

Diameter	Excavation	Granular Bedding	Pipe Supply + Install	Backfill	Subtotal Unit Cost	Restoration	Manhole Allowance	Total Unit Cost
(mm)	**($/m)**	**($/m)**	**($/m)**	**($/m)**	**($/m)**	**($/m)**	**($/m)**	**(2020$/m)**
300	$160	$67	$143	56	$427	$115	$110	**$651**
375	$176	$67	$165	63	$472	$115	$110	**$697**
450	$192	$74	$199	69	$534	$116	$110	**$760**
525	$208	$81	$230	75	$593	$117	$110	**$820**
600	$224	$94	$288	79	$684	$117	$250	**$1,052**
675	$272	$128	$420	93	$912	$132	$250	**$1,295**
750	$288	$134	$536	98	$1,057	$134	$250	**$1,440**
825	$304	$148	$613	103	$1,167	$135	$250	**$1,552**
900	$304	$161	$723	100	$1,289	$136	$400	**$1,824**
975	$320	$168	$824	105	$1,418	$150	$400	**$1,968**
1050	$368	$208	$935	118	$1,629	$151	$400	**$2,181**
1200	$400	$228	$1,157	128	$1,913	$153	$400	**$2,467**
1350	$432	$262	$1,477	135	$2,306	$156	$333	**$2,795**
1500	$448	$282	$1,794	138	$2,662	$171	$333	**$3,166**
1800	$512	$343	$2,568	153	$3,576	$176	$333	**$4,085**
2100	$560	$403	$3,393	162	$4,517	$179	$400	**$5,097**
2400	$624	$470	$4,491	176	$5,761	$184	$400	**$6,345**
3000	$736	$605	$6,848	197	$8,385	$192	$400	**$8,977**

Table D.2 Sanitary sewer unit rates for 10-metre deep open cut construction

Diameter	Excavation	Granular Bedding	Pipe Supply + Install	Backfill	Subtotal Unit Cost	Restoration	Manhole Allowance	Total Unit Cost
(mm)	**($/m)**	**($/m)**	**($/m)**	**($/m)**	**($/m)**	**($/m)**	**($/m)**	**(2020$/m)**
300	$1,575	$67	$143	478	$2,263	$211	$200	**$2,674**
375	$1,620	$67	$165	492	$2,345	$211	$200	**$2,756**
450	$1,665	$74	$199	505	$2,443	$217	$200	**$2,860**
525	$1,710	$81	$230	517	$2,538	$217	$200	**$2,955**
600	$1,755	$94	$288	529	$2,665	$219	$350	**$3,234**
675	$1,890	$128	$420	564	$3,001	$221	$350	**$3,573**
750	$1,935	$134	$536	576	$3,182	$225	$350	**$3,757**
825	$1,980	$148	$613	588	$3,328	$233	$350	**$3,912**
900	$1,980	$161	$723	585	$3,450	$236	$600	**$4,285**
975	$2,025	$168	$824	598	$3,615	$238	$600	**$4,453**
1050	$2,160	$208	$935	631	$3,935	$241	$600	**$4,776**
1200	$2,250	$228	$1,157	655	$4,291	$244	$600	**$5,134**
1350	$2,340	$262	$1,477	676	$4,755	$244	$567	**$5,566**
1500	$2,385	$282	$1,794	686	$5,147	$244	$567	**$5,957**
1800	$2,565	$343	$2,568	730	$6,205	$252	$567	**$7,024**
2100	$2,700	$403	$3,393	759	$7,255	$266	$733	**$8,254**
2400	$2,880	$470	$4,491	801	$8,643	$274	$733	**$9,651**
3000	$3,195	$605	$6,848	872	$11,519	$295	$733	**$12,548**

Table D.3 Water main and force main unit rates for open cut construction

Diameter	Excavation	Granular Bedding	Pipe Supply + Install	Backfill	Subtotal Unit Cost	Restoration	Total Unit Cost
(mm)	**($/m)**	**($/m)**	**($/m)**	**($/m)**	**($/m)**	**($/m)**	**(2016 $/m)**
400	$168	$128	$414	$47	$757	$116	**$873**
450	$168	$134	$500	$46	$848	$116	**$964**
500	$202	$148	$612	$58	$1,019	$117	**$1,136**
600	$202	$161	$802	$55	$1,220	$117	**$1,337**
750	$286	$168	$856	$90	$1,399	$134	**$1,533**
900	$426	$208	$909	$143	$1,686	$136	**$1,822**
1050	$461	$228	$1,145	$155	$1,990	$151	**$2,141**
1200	$542	$262	$1,387	$183	$2,374	$153	**$2,528**
1350	$660	$282	$1,747	$231	$2,920	$156	**$3,076**
1500	$706	$207	$2,065	$267	$3,245	$171	**$3,416**
1650	$756	$343	$2,435	$260	$3,794	$171	**$3,966**
1800	$882	$233	$2,790	$339	$4,244	$176	**$4,419**
2100	$980	$403	$3,090	$346	$4,819	$179	**$4,998**

Table D.4 Trenchless construction unit rates for water mains or sanitary sewers

Diameter	Total Unit Cost	Diameter	Total Unit Cost	Diameter	Total Unit Cost
(mm)	($/m)	(mm)	($/m)	(mm)	($/m)
150	$1,300	**500**	$6,450	**1200**	$10,600
200	$1,350	**525**	$6,500	**1350**	$11,500
250	$1,400	**600**	$8,000	**1500**	$12,000
300	$1,450	**675**	$8,100	**1650**	$12,500
325	$1,500	**750**	$8,200	**1800**	$13,000
350	$1,550	**825**	$9,800	**2100**	$14,000
375	$6,300	**900**	$10,000	**2400**	$14,500
400	$6,350	**975**	$10,200	**3000**	$16,000
450	$6,400	**1050**	$10,400		

Anticipated trenchless methodology is as follows:

- 1350 mm – 3000 mm: Microtunnel or TBM
- 825 mm – 1200 mm: Microtunnel, Auger Boring, Guided Auger Boring
- 375 mm – 750 mm: Axis Guided Boring, Auger Boring, Guided Auger Boring
- 150 mm – 350 mm: Axis Guided Boring, Horizontal Directional Drilling

Note: Trenchless Cost estimate table provides estimated high level cost for tunnelling, pipe installation and shafts for ranges of diameter. Tunnelling project costs can vary widely depending on project details that are not fully known at the Master Plan / DC stage (e.g., number of shafts, subsurface conditions, site conditions, contractor preferred tunnelling method, depth, location (urban, greenfield) etc.).

Facilities

Facility	Total Unit Cost	Unit
Reservoirs - New Construction	$900,000	($/ML)
New Water / Sewage Pumping Stations ≤ 150L/s	$23,000	($/L/s)
New Water / Sewage Pumping Stations > 150 L/s ≤ 600 L/s	$13,000	($/L/s)
New Water / Sewage Pumping Stations > 600 L/s	$11,000	($/L/s)

Notes: Unit rate is intended to provide the base construction cost for a basic pumping facility. These costs are not assumed to account for force mains (for WWPS) or overflow storage tanks (WWPS) or unique items such as deep wet wells (WWPS), extensive architectural features or extensive site works.

4C

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 4C

Lake-based Wastewater Collection System Schematic

Lake-Based Wastewater Collection System

NETWORK MAP 9.4 (2020)

NOT TO SCALE

Sanitary Trunk Sewers

East Trunk System

- E24.0 Castlemore (future)
- E23.0 Upper East (future)
- E22.0 Bramalea (future)
- E21.0 Kennedy (future)
- E20.2 Wenonah
- E20.1 Port Credit
- E20.0 Lakefront
- E19.0 Erindale
- E18.0 Queensway West
- E17.1 Cooksville
- E17.0 Confederation
- E16.0 Upper Cooksville Creek
- E15.0 Central Parkway
- E15.1 Lower Cooksville Creek
- E14.2 Dundas East
- E14.1 Ogden
- E14.0 Little Etobicoke Creek
- E13.2
- E13.1 Lakeview West
- E13.0 Lakeshore East
- E12.0 Centreview (future)
- E11.2 Burnhamthorpe West (future)
- E11.1 City Centre
- E11.0 Mississauga Centre (future)
- E10.0 Burnhamthorpe East (future)
- E09.1 Bloor (future)
- E09.0 Cawthra (future)
- E08.1 Avondale
- E08.0 Spring Creek
- E07A.3 Hurontario (future)
- E07A.2 Williams Parkway
- E07B.2 Brampton Centre
- E07B.1 Rutherford
- E07A.1 Mississauga Industrial
- E07B.0 Etobicoke Creek (B)
- E07A.0 Etobicoke Creek (A)
- E06.1 East Mississauga
- E06.0 CPR
- E05.0 Queensway East (future)
- E04.0 Dixie (future)
- E03.2 Sandalwood
- E03.1 Automatic Road
- E03.0 Airport
- E02B.2
- E02B.1 Steeles East
- E02A.3 Queen East (future)
- E02A.2 Upper Mimico
- E02A.1 Torbram
- E02B.0 East Brampton (B)
- E02A.0 East Brampton (A)
- E01B.2
- E01B.1 Eglinton East
- E01A.2
- E01A.1 Lakeview East
- E01B.0 East (B)
- E01A.0 East (A)

Intra-System Transfers

- WE01.0 407 Diversion
- EW01.0 Derry Diversion (future)

Inter-System Transfer (to Toronto)

- T01.1 Malton
- T01.0 Lower Mimico

McVean Trunk System

- M06.1 Harvestview
- M06.0 Albion-Vaughan
- M05A.1 Bolton Centre
- M05B.0 Coleraine (B) (future)
- M05A.0 Coleraine (A)
- M04.0 Clarkway
- M03.0 The Gore Road
- M02.1 Goreway
- M02.0 McVean
- M01B.0 Brampton-Bolton (B)
- M01A.0 Brampton-Bolton (A)

Sanitary Trunk Sewers

West Trunk System

- W20.2 Queen West (future)
- W20.1 Harold
- W20.0 McLaughlin-Chinguacousy
- W19.0 Port Credit West (future)
- W18.0 Clarkson Industrial
- W17.0 Argentia (future)
- W16.1 Streetsville North (future)
- W16.0 Britannia West (future)
- W15.1 Streetsville South (future)
- W15.0 Eglinton West (future)
- W14.0 Dundas West (future)
- W13.0 Clarkson Village (future)
- W12.0 Upper West (West Leg) (future)
- W11.0 Lower West (West Leg) (future)
- W10.1 Bram West
- W10.0 Steeles West
- W09.2 Northwest Brampton (future)
- W09.1 Heritage Heights (future)
- W09.0 Credit Valley
- W08.2 Millcreek
- W08.1 Mullett Creek
- W08.0 Meadowvale
- W07.0 Erin Mills North
- W06.2 Erin Mills Centre
- W06.1 Erin Mills South
- W06.0 Sawmill Creek
- W05.0 Lincoln Green (future)
- W04.1 Clarkson Road
- W04.0 Orr Road
- W03.5 Mayfield West
- W03.4 Elgin
- W03.3 Steeles (future)
- W03.2 Old Meadowvale
- W03.1 Creditview
- W03.0 Fletcher's Creek
- W02.2 Streetsville Centre
- W02.1 Carolyn Creek
- W02.0 Upper West (East Leg)
- W01.1 Lakeshore West
- W01.0 Lower West (East Leg)

Sewage Pumping Stations

East Trunk System

- Shardawn Mews
- Dougall Avenue
- Lakelands
- Pinetree
- Rosemere
- Beechwood
- Ben Machree
- Front Street
- Elmwood
- Hiawatha Parkway
- Beach Street
- Mayfield Road
- Caledon East
- Chinguacousy Landfill
- Castlemore
- Intermodal
- 41 Acres-Hauler

West Trunk System

- Meadowvale
- Mullet Creek
- O'Neill Court
- Britannia Landfill
- Fifeshire
- Indian Road
- Richard's Memorial
- Silverbirch
- Stonehaven
- Jack Darling 2
- Jack Darling 1
- Watersedge
- Clarkson

McVean Trunk System

- Bolton North Hill
- Bolton
- The Gore Road
- McVean

Disclaimer

This network map of the Region of Peel's lake-based wastewater collection system is not spatially accurate and is not intended to accurately represent the system in every detail. The purpose of the map is to show a simplified representation of the system that is easier to understand than a geospatially accurate map. This map highlights existing and potential diversions and points of connection between sanitary trunk sewers.

Reference should be made to GIS-based information and as-built drawings. This map is intended to supplement those data sources and not to replace them.

Region of Peel
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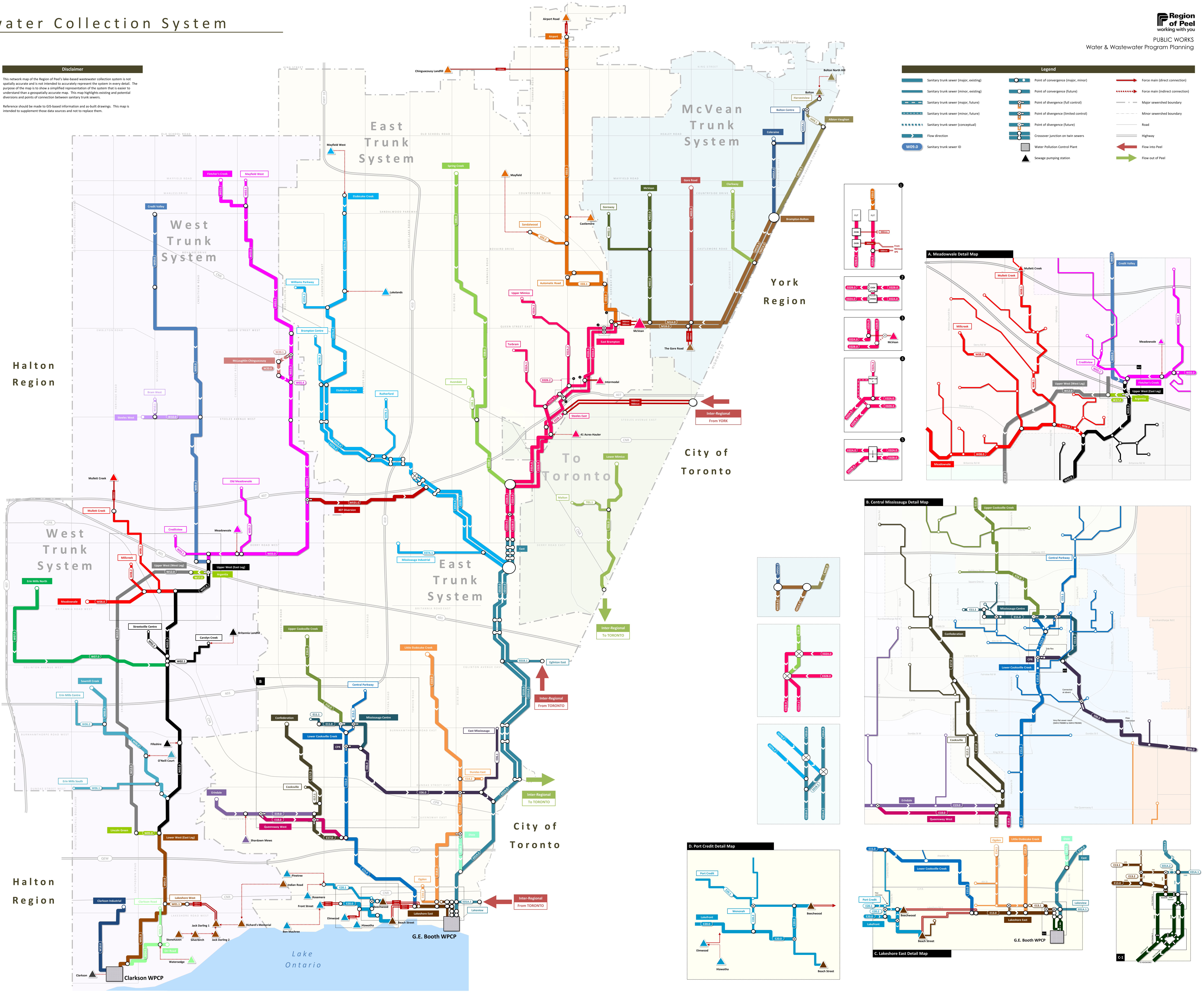
PUBLIC WORKS
Water & Wastewater Program Planning

Legend

- Sanitary trunk sewer (major, existing)
- Sanitary trunk sewer (minor, existing)
- Sanitary trunk sewer (major, future)
- Sanitary trunk sewer (minor, future)
- Sanitary trunk sewer (conceptual)
- Flow direction
- W09.0 Sanitary trunk sewer ID
- Point of convergence (major, minor)
- Point of convergence (future)
- Point of divergence (full control)
- Point of divergence (limited control)
- Point of divergence (future)
- Crossover junction on twin sewers
- Water Pollution Control Plant
- Sewage pumping station
- Force main (direct connection)
- Force main (indirect connection)
- Major sewershed boundary
- Minor sewershed boundary
- Road
- Highway
- Flow into Peel
- Flow out of Peel



4D

REGIONAL MUNICIPALITY OF PEEL

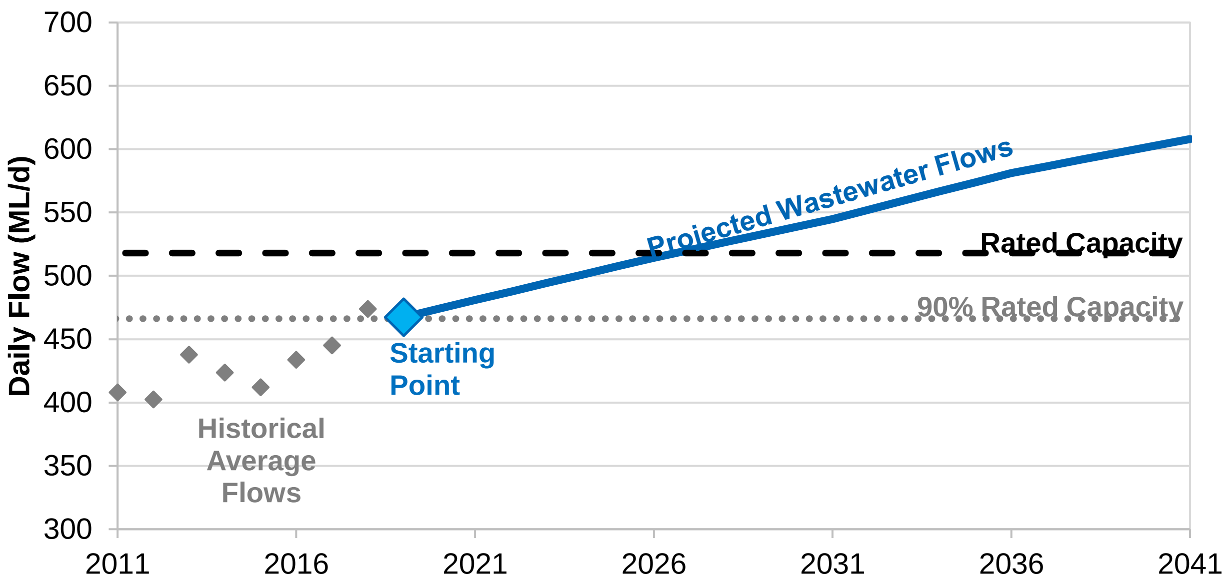
APPENDIX 4D

WWTP Projections and Capacity Assessment

G.E. Booth Projeted Average Flows (Natural Catchment)

Design Criteria 315 Lpcd
Starting Point 2019

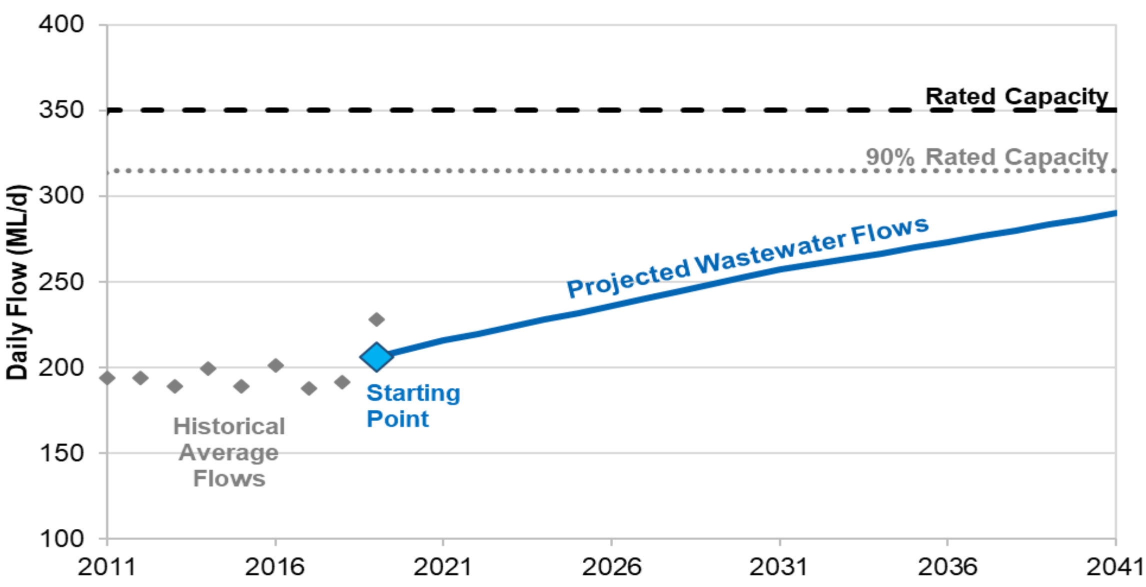
Year	Population	Employment	Pop Growth	Emp Growth	York Agreement Avg Daily Flow (MLD)	Toronto Agreement Avg Daily Flow (MLD)	Projected Avg Daily Flow (MLD)
2019	819,712	489,046	11,521	8,982	43.1	29	467
2020	831,233	498,028	11,521	8,982	43.5	29	474
2021	842,755	507,010	11,522	8,982	43.9	29	481
2022	854,356	513,583	11,601	6,573	44.8	29	488
2023	865,957	520,156	11,601	6,573	45.8	29	494
2024	877,558	526,730	11,601	6,574	46.7	29	501
2025	889,159	533,303	11,601	6,573	47.6	29	508
2026	900,761	539,876	11,602	6,573	48.6	29	514
2027	912,121	545,022	11,360	5,146	49.5	29	520
2028	923,482	550,168	11,361	5,146	50.4	29	527
2029	934,843	555,314	11,361	5,146	51.4	29	533
2030	946,204	560,460	11,361	5,146	52.3	29	539
2031	957,564	565,606	11,360	5,146	53.2	29	545
2032	973,052	573,148	15,488	7,542	53.2	29	552
2033	988,540	580,691	15,488	7,543	53.2	29	559
2034	1,004,028	588,233	15,488	7,542	53.2	29	567
2035	1,019,516	595,776	15,488	7,543	53.2	29	574
2036	1,035,005	603,318	15,489	7,542	53.2	29	581
2037	1,045,907	609,440	10,902	6,122	53.2	29	587
2038	1,056,810	615,562	10,903	6,122	53.2	29	592
2039	1,067,712	621,684	10,902	6,122	53.2	29	597
2040	1,078,615	627,806	10,903	6,122	53.2	29	603
2041	1,089,517	633,928	10,902	6,122	53.2	29	608



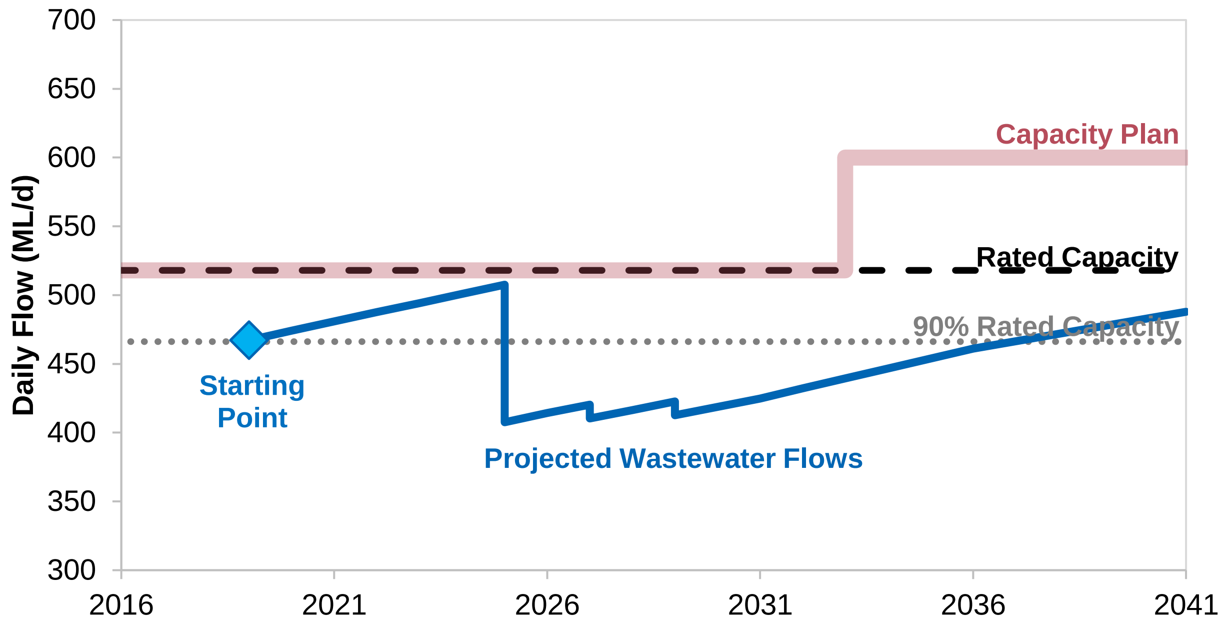
Clarkson Projeted Average Flows (Natural Catchment)

Design Criteria	315	Lpcd
Starting Point	2019	

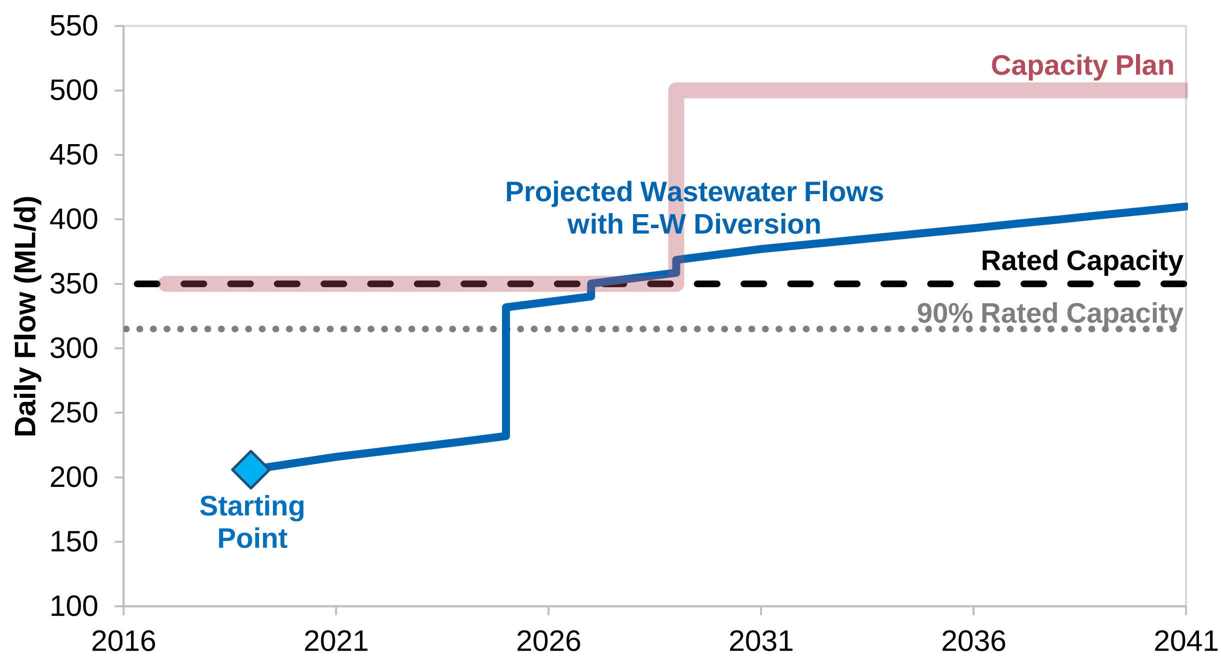
Year	Population	Employment	Pop Growth	Emp Growth	Projected Avg Daily Flow (MLD)
2019	612,540	180,036	11,056	4,474	206.0
2020	623,595	184,510	11,055	4,474	210.8
2021	634,651	188,983	11,056	4,473	215.7
2022	644,185	192,272	9,534	3,289	219.8
2023	653,719	195,561	9,534	3,289	223.8
2024	663,252	198,850	9,533	3,289	227.9
2025	672,786	202,139	9,534	3,289	231.9
2026	682,320	205,428	9,534	3,289	235.9
2027	692,642	208,476	10,322	3,048	240.1
2028	702,965	211,525	10,323	3,049	244.4
2029	713,288	214,573	10,323	3,048	248.6
2030	723,610	217,621	10,322	3,048	252.8
2031	733,933	220,669	10,323	3,048	257.0
2032	741,240	223,657	7,307	2,988	260.2
2033	748,546	226,645	7,306	2,988	263.5
2034	755,853	229,633	7,307	2,988	266.7
2035	763,160	232,621	7,307	2,988	270.0
2036	770,466	235,609	7,306	2,988	273.2
2037	777,294	239,429	6,828	3,820	276.6
2038	784,121	243,249	6,827	3,820	279.9
2039	790,949	247,070	6,828	3,821	283.3
2040	797,776	250,890	6,827	3,820	286.6
2041	804,604	254,710	6,828	3,820	290.0



G.E. Booth WWTP Projeted Average Flows (with E-W Diversion)



Clarkson WWTPProjeted Average Flows (with E-W Diversion)



Historical Average Daily Flows

G.E. Booth WWTP

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
January	384	388	448	471	450	421	413	443	446	466
February	373	403	436	467	474	389	420	418	464	465
March	423	470	410	516	480	404	464	444	420	483
April	406	464	391	531	542	436	482	495	574	517
May	405	500	423	462	501	393	437	554	467	518
June	441	457	418	484	489	473	435	472	461	474
July	402	428	430	508	445	414	433	425	470	443
August	382	408	434	418	420	396	425	434	472	431
September	400	414	463	454	443	411	429	418	462	447
October	404	460	476	458	414	419	420	413	465	464
November	396	439	451	454	424	397	410	423	511	459
December	394	472	456	437	411	393	435	404	474	460
Avg. Flow	**401**	**442**	**436**	**472**	**458**	**412**	**434**	**445**	**474**	**469**

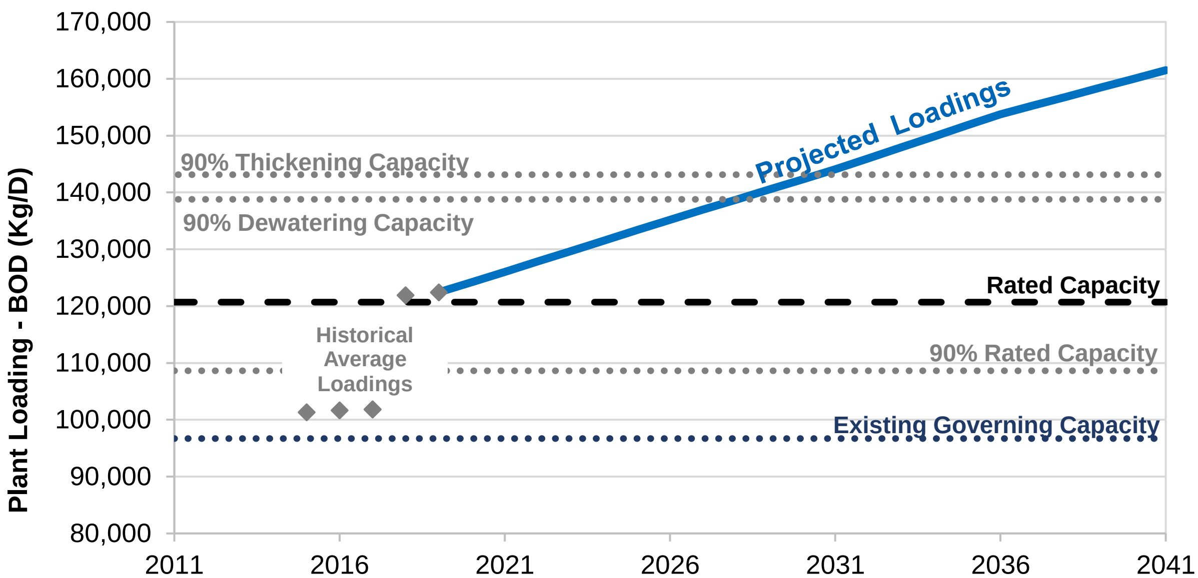
Clarkson WWTP

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
January	136	131	172	171	138	160	210	182	171	196
February	131	143	166	168	137	147	204	174	187	196
March	154	170	163	179	152	161	233	184	170	225
April	143	171	156	183	171	187	225	221	224	251
May	140	180	160	158	161	175	195	214	196	254
June	149	150	168	166	154	215	194	196	188	231
July	141	151	154	156	174	197	200	179	188	214
August	138	162	154	141	173	203	204	185	192	216
September	143	156	160	137	191	212	203	187	180	212
October	147	172	160	137	188	210	191	191	188	231
November	145	162	148	129	177	205	177	179	211	247
December	148	172	162	136	170	196	181	160	200	262
Avg. Flow	**143**	**160**	**160**	**155**	**165**	**189**	**201**	**188**	**191**	**228**

G.E. Booth Projeted Loadings (Natural Catchment)

BOD Average Concentration	233	(mg/L)
BOD Pop Loading - Typical Per cap contribution	75	(g/cap/d)
BOD Emp Loading - Typical Per cap contribution	37.5	(g/cap/d)

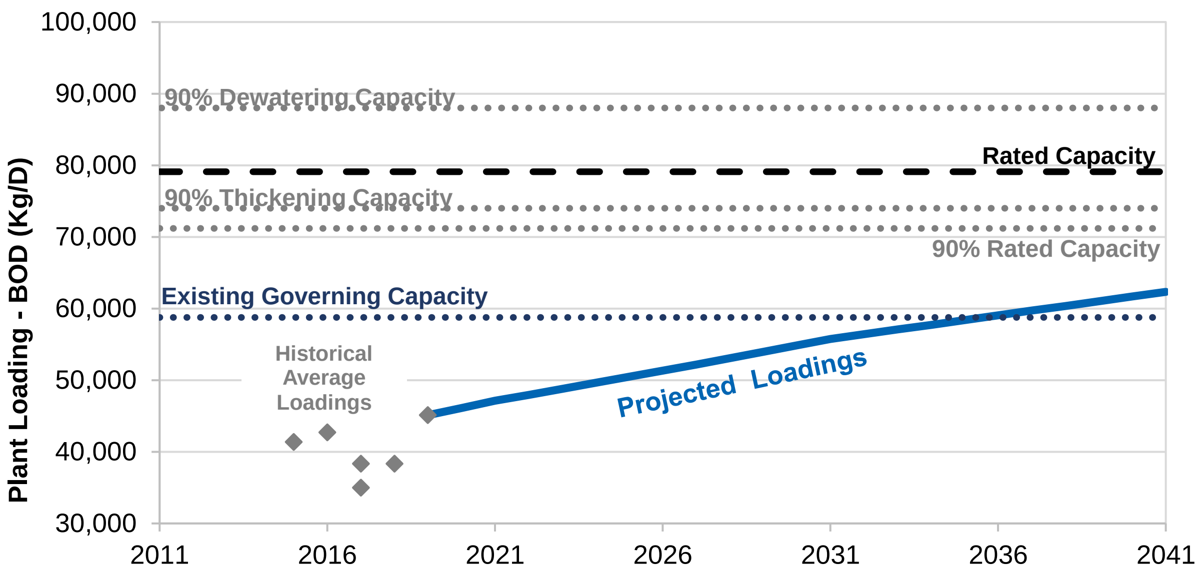
Year	Population	Employment	Pop Growth	Emp Growth	Projected Loadings (kg/d)	Concentration (mg/L)
2019	819,712	489,046	11,521	8,982	122,430	262
2020	831,233	498,028	11,521	8,982	124,221	262
2021	842,755	507,010	11,522	8,982	126,013	262
2022	854,356	513,583	11,601	6,573	127,851	262
2023	865,957	520,156	11,601	6,573	129,690	262
2024	877,558	526,730	11,601	6,574	131,529	263
2025	889,159	533,303	11,601	6,573	133,368	263
2026	900,761	539,876	11,602	6,573	135,207	263
2027	912,121	545,022	11,360	5,146	136,974	263
2028	923,482	550,168	11,361	5,146	138,741	264
2029	934,843	555,314	11,361	5,146	140,508	264
2030	946,204	560,460	11,361	5,146	142,275	264
2031	957,564	565,606	11,360	5,146	144,042	264
2032	973,052	573,148	15,488	7,542	145,987	264
2033	988,540	580,691	15,488	7,543	147,931	264
2034	1,004,028	588,233	15,488	7,542	149,876	264
2035	1,019,516	595,776	15,488	7,543	151,820	265
2036	1,035,005	603,318	15,489	7,542	153,765	265
2037	1,045,907	609,440	10,902	6,122	155,312	265
2038	1,056,810	615,562	10,903	6,122	156,859	265
2039	1,067,712	621,684	10,902	6,122	158,406	265
2040	1,078,615	627,806	10,903	6,122	159,954	265
2041	1,089,517	633,928	10,902	6,122	161,501	266



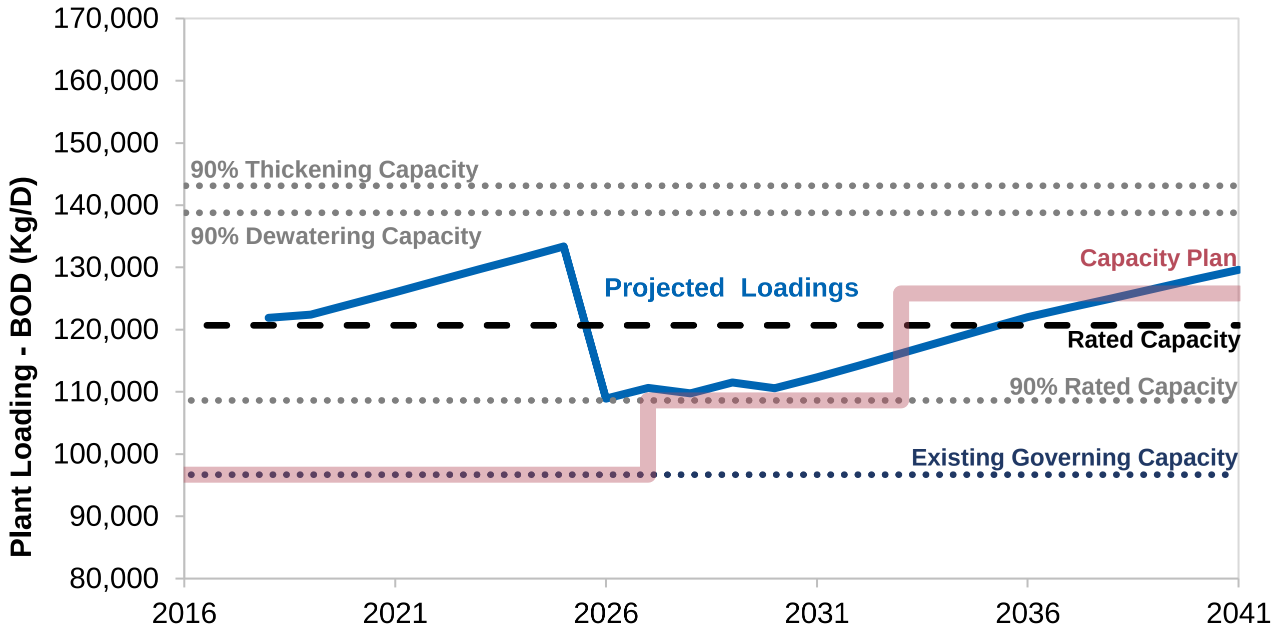
Clarkson Projeted Loadings (Natural Catchment)

BOD Average Concentration	183	(mg/L)
BOD Pop Loading - Typical Per cap contribution	75	(g/cap/d)
BOD Emp Loading - Typical Per cap contribution	37.5	(g/cap/d)

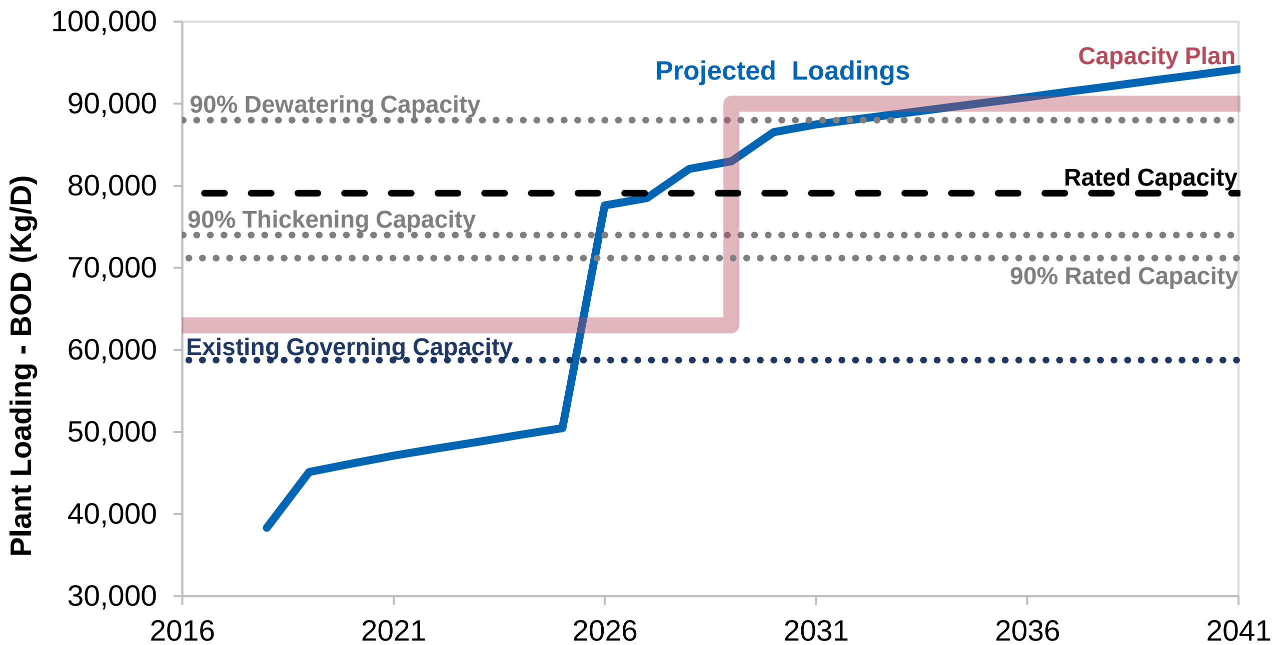
Year	Population	Employment	Pop Growth	Emp Growth	Projected Loadings (kg/d)	Concentration (mg/L)
2019	612,540	180,036	11,056	4,474	45,124	219
2020	623,595	184,510	11,055	4,474	46,121	219
2021	634,651	188,983	11,056	4,473	47,118	218
2022	644,185	192,272	9,534	3,289	47,956	218
2023	653,719	195,561	9,534	3,289	48,795	218
2024	663,252	198,850	9,533	3,289	49,633	218
2025	672,786	202,139	9,534	3,289	50,472	218
2026	682,320	205,428	9,534	3,289	51,310	217
2027	692,642	208,476	10,322	3,048	52,198	217
2028	702,965	211,525	10,323	3,049	53,087	217
2029	713,288	214,573	10,323	3,048	53,975	217
2030	723,610	217,621	10,322	3,048	54,864	217
2031	733,933	220,669	10,323	3,048	55,752	217
2032	741,240	223,657	7,307	2,988	56,412	217
2033	748,546	226,645	7,306	2,988	57,072	217
2034	755,853	229,633	7,307	2,988	57,733	216
2035	763,160	232,621	7,307	2,988	58,393	216
2036	770,466	235,609	7,306	2,988	59,053	216
2037	777,294	239,429	6,828	3,820	59,708	216
2038	784,121	243,249	6,827	3,820	60,363	216
2039	790,949	247,070	6,828	3,821	61,019	215
2040	797,776	250,890	6,827	3,820	61,674	215
2041	804,604	254,710	6,828	3,820	62,329	215



G.E. Booth WWTP Projeted Average Flows (with E-W Diversion)



Clarkson WWTPProjeted Average Flows (with E-W Diversion)



4E

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 4E

Strategy Evaluations

System Wide Servicing Concepts Evaluation

Concept Number	Concept Name	Concept Description / Comments	Advantages	Disadvantages	Rating	Carried Forward / Screened Out
1	**Do Nothing**	No nothing - Existing infrastructure remains as is	- Does not incur capital costs	- Does not meet adequate levels of service for existing and future growth	Low	**Screened Out**
2	**Limit Growth**	Limit community growth so as to not trigger new infrastructure or upgrades	- Reduces extent of upgrades required in system	- Does not comply with Regional Official Plan and Places to Grow Growth targets	Low	**Screened Out**
3	**Satellite Wastewater Treatment**	- Construct several new wastwater treatment facilities within new growth areas - Local and subtrunk sewers to direct flow on a catchment by catchment basis to new WWTPs	- Would meet long term servicing requirements - Would minimize need for expansion of existing WWTPs - Located next to new and potential future growth areas - potential to minimize conveyance required - Potential to divert existing service areas to reduce need for conveyance upgrades in existing system - Potential issues with site availability and dense urban construction would be minimized - Provide servicing flexibility and ability to phase costs over longer timeframe - Potential opportunities to implement aquifer recharge or effluent reuse on a local scale	- Does not make best use of existing infrastructure - Would require new conveyance to deliver flows - Potential for adverse environmental impacts - stringent effluent quality criteria and restrictions across multiple locations - Multiple land acquisitions required - High capital cost - Additional operation and maintenance requirements	Medium	**Screened Out**
4	**New Treatment Plant (Discharging to watercourse or Lake Ontario)**	- Construct new large scale wastewater treatment plant at new location, either along major trunk sewer adjacent to creek/river or near Lake Ontario - Convey increased flow to new WWTP via new and existing trunk sewers	- Would meet long term servicing requirements - Potential to minimize need for expansion of existing WWTP - Potential opportunities for aquifer recharge or water reuse - Potential to locate next to new and potential future growth areas, ability to minimize conveyance required - Potential to divert existing service areas to reduce need for conveyance upgrades in existing system	- New plant on Lakeshore has potential to be considered non-desirable use of lake front real estate - Land acquisition required, potential to be very expensive - Does not make best use of existing infrastructure - Would require new conveyance to deliver flows - Additional operation and maintenance required - New outfall likely required - Significant capital cost for construction	Medium	**Screened Out**
5	**Build off Planned 2031 Infrastructure** **- Expand existing WWTP** **- Diversion of flows**	- Expand existing WWTP as required based on diversion of flows between plants - Extend existing trunk infrastructure into new growth areas	- Would meet long term servicing requirements - Provide flexibility to balance flows between east and west trunk systems - Opportunities for water reuse - Maximizes use of existing facilities and infrastructure - Potential to minimize size of current storage facilities	- Expansion of WWTP may be limited due to site size - Expansion of WWTP likely requires acquisition of new lands or stacked treatment methods, potential to increase capital cost - Likely require new outfall structure - Potential for additional operation and maintenance costs associated with expansion of WWTPs	High	**Carried Forward**
6	**I/I Reduction**	Conduct an I/I reduction program which monitors the sewer network, targets areas of high I/I and takes measures to reduce I/I	- Maximize use of existing infrastructure - Major conveyance upgrades minimized - Would reduce flow in system, potential to create pumping, treatment and future infrastructure savings	- Requires implementation of flow reduction program - Potential to not meet flow reduction targets - Concept dependent on public and private participation and commitment	High	**Carried Forward**
7	**Combined Storage / Conveyance**	Provide in-line and off-line storage within system	- Providing additional storage has potential to minimize level of conveyance improvements, pumping capacity, and treatment capacity required - Opportunities for water reuse - Potential to assist with management of wet weather flows	- May require multiple storage sites - Storage tank assets have potential to reduce long term servicing flexibility - High capital and operation and maintenance costs associated with new storage tanks - Does not maximize existing infrastructure - Locating sufficient land supply for storage tanks may be difficult - Not adequate as stand alone solution	Low	**Screened Out**

System Wide Servicing Strategy Evaluation

		Strategy 1 Build off planned 2031 infrastructure and maximize east system and GE Booth WWTP	Strategy 2 Build off planned 2031 infrastructure and maximize west system and Clarkson WWTP	Strategy 3 Build off planned 2031 infrastructure and balance flows between east and west systems
Description of Strategy		**- Build off planned 2031 infrastructure by expanding conveyance to support development of north growth areas in Brampton and Caledon. - No diversion of flows East to West. WWTP treat flows from their natural catchments. - Multiple staged expansions of G.E. Booth WWTP within period. - No expansion of Clarkson WWTP. - East trunk system conveyance capacity increase for growth flows. - Inflow and infiltration reduction.**	**- Build off planned 2031 infrastructure by expanding conveyance to support development of north growth areas in Brampton and Caledon. - East to West Diversion - Multiple staged expansions of Clarkson WWTP within period. - No expansion of G.E. Booth WWTP. - Inflow and infiltration reduction.**	**- Build off planned 2031 infrastructure by expanding conveyance to support development of north growth areas in Brampton and Caledon. - East to West Diversion - Expansion of Clarkson WWTP and G.E. Booth WWTP within period. - Inflow and infiltration reduction.**
Technical	Increase spare capacity in existing system Improve/maintain level of service of existing users Provide opportunity to decommission existing SPS Avoid/minimize proximity and/conflicts with existing infrastructure Consider constructability and technical feasibility to build and maintain infrastructure Provide opportunity for operational flexibility and security Integration with road/transportation projects Integration with water projects Avoid/minimize construction in areas with limited access Avoid/minimize environmental/roads/utility crossings Ability to maintain existing services during construction/implementation Maximize alignments along road rights of way and/or easements Apply I&I reduction measures Extend wastewater servicing to new growth areas Support intensification growth Support post-2041 growth Incremental extension of infrastructure as growth progresses Allow for gravity solution versus pumping flows Ability to adapt to changes on wastewater effluent requirements Ability to provide/maintain desired level of service under climate change conditions	×	✓	✓✓
	Technical Comments	- Does not maximize capacity at Clarkson WWTP and conveyance of the West Trunk System - Does not provide operational flexibility -Site capacity constraints at G.E. Booth WWTP	- Does not maximize capacity at G.E. Booth WWTP - Provides some operational flexibility limited by the capacity at G.E. Booth WWTP	- Balances capacity of G.E. Booth WWTP and Clarkson WWTP - Provides greater operational flexibility - Allows for incremental capacity expansion of WWTPs
Environmental	Minimize risk of basement flooding Minimize risk of untreated sewage entering the natural environment Minimize impact on nearby agricultural lands Avoid/minimize environmental crossings Avoid/minimize impact on environmental sensitive/protected areas Avoid/minimize impact on local aquatic/terrestrial species at risk and habitats Avoid/minimize potential impact on groundwater quantity and quality during construction Consider resiliency and adaption to climate change	✓	✓✓	✓✓
	Environmental Comments	- Dows not provide for option to divert flows from the East system to the West system as required. - Does not provide flexibility to deal with high strength users in the WWTP natural catchment areas.	- Provides for better capacity for adaption to climate change with option to divert flows from the East to the West system as required to assist with management of wet weather flows. - Provides flexibility to deal with high strength users in the WWTP natural catchment areas.	- Provides for better capacity for adaption to climate change with option to divert flows from the East to the West system as required to assist with management of wet weather flows. - Provides flexibility to deal with high strength users in the WWTP natural catchment areas.
Socio/Cultural	Minimize short/long term noise & odour Issues Consider visual aesthetics of the proposed infrastructure Consider potential community resistance to alternative/strategy/alignment Minimize traffic disruption Avoid/minimize impact on archaeological sites/resources Minimize impact during construction and operation Minimize impact on surrounding properties Minimize construction impact on traffic, local businesses and residents Avoid/minimize impact on heritage sites	✓	✓	✓
	Socio/Cultural Comments	- More potential for odour issues and community resistnace at G.E Booth WWTP - More potential for land acquisition conflicts. G.E. Booth WWTP property currently has limited site capacity for future expansion and is surrounded by valuable land. - Less construction disruptions (Concentrate capacity expansion to one WWTP site)	- Less potential for odour issues and community resistance by minimizing flows and expansions at G.E Booth WWTP - Less construction disruptions (Concentrate capacity expansion to one WWTP site)	- Some potential for odour issues and community resistance at G.E Booth WWTP - More potential for construction disruptions with capacity expansion at both WWTP
Legal/ Jurisdictional	Maximizes worker safety and operability Does not require land acquisition or easement Minimizes approvals/coordination	×	✓	✓✓
	Legal/ Jurisdictional Comments	- Requires land acquisition for WWTP expansion (Site capacity constraints at G.E. Booth WWTP property)	- May require land acquisition for increased expansion at Clarkson WWTP	-Does not require land acquisition for WWTP expansion within 2041 needs - Balances WWTP expansions within current WWTP sites capacity
Financial	Maximize use of existing infrastructure Avoid/minimize introducing new infrastructure Avoid/minimize upgrading existing infrastructure Minimize life cycle cost of providing wastewater services Minimize long term energy costs Lower capital cost relative to other options Reduce/eliminate operation & maintenance costs Support long-term financial sustainability Integration with SOGR program Support phasing and implementation of capital projects over time	×	✓	✓✓
	Financial Comments	- Does not maximize use of Clarkson WWTP and West Trunk System. Will require conveyance capacity upgrades of the East Trunk System. - Requires potential significant investment in new land for expansion of G.E. Booth WWTP beyond the existing property limits - Concentrate capacity upgrades a G.E. Booth WWTP which may represent a challenge for implementation and phasing	- Does not maximize use of G.E. Booth WWTP and East Trunk System, but provides for some operational flexibility between the East and West systems - Requires significant investment in new infrastructure (East to West Diversion) - Concentrate capacity upgrades a Clarkson WWTP which may represent a challenge for implementation and phasing	- Maximizes and balance use of WWTPs and provides operational flexibility between the East and West systems - Requires significant investment in new infrastructure (East to West Diversion) - Support phasing and implementation of capital projects over time
Innovation/ Adaptation	Apply innovation and/or new technologies Use of data for evidence based decision making process Operational flexibility to adapt to climate change Establish a baseline and a process to measure results and desire outcomes Incorporate water conservation and reuse practices Maximize energy efficiency Avoid energy-intensive infrastructure Consider performance of the system under power outage conditions Consider opportunity for renewable energy production and use	×	✓	✓✓
	Innovation/ Adaptation Comments	- Opportunity for application of innovation in new treatment technologies and construction practices - Leverage the use of real data and wastewater hydraulic flows and projections for decision-making	- Opportunity for application of innovation in new treatment technologies and construction practices - Leverage the use of real data and wastewater hydraulic flows and projections for decision-making - Innovative solution that defies the status quo - Provides less operational flexibility to assist with management of wet weather flows and adapt to climate change than strategy 3	- Opportunity for application of innovation in new treatment technologies and construction practices at both WWTPs - Leverage the use of real data and wastewater hydraulic flows and projections for decision-making - Innovative solution that defies the status quo - Provides operational flexibility to assist with management of wet weather flows adapt to climate change
Preferred Strategy		×	✓	✓✓

LEGEND

N/A	Not Applicable
×	Adverse impacts
✓	Beneficial Impacts
✓✓	Very Beneficial Impacts

Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
Wastewater Treatment and East to West Diversion	Both of the Regional Wastewater Treatment plants are anticipated to require capacity upgrades to meet the projected wastewater flows for the Region up to 2041. The servicing solutions based on the system-wide servicing strategy to balance flows between East and West systems includes the implementation of the East to West Diversion trunk sewer as well as various treatment plant upgrade components	New East to West Diversion Sanitary Trunk Sewer G.E. Booth WWTP - Major capital improvements at the treatment plant to replace Plant 1 and support future expansion of the facility . - Capacity Restoration (recovery of 40 ML/d of liquid treatment capacity) . - Various Improvements to the facility to maintain plant efficiency . - Expansion of the facility from 518 ML/d to 600 ML/d, including construction of additional biosolids capacity and a new outfall to accommodate new capacity. Clarkson WWTP - Expansion of the facility from 350 ML/s to 500 ML/d. - Expansion of the biosolids process. G.E. Booth and Clarkson - Standby Power Expansion .

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Key driver for WWTP capcity upgrades is servicing the Region's planned growth to 2041	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Upgrades to be planned with consideration for assumed growth beyond 2041	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations for WWTP upgrades
Flexibility / Optimization	✓	- Key driver for plant expansion strategy is flexibility needed to balance flows and loading between the plants	Design Criteria - Water and Wastewater	- Plant level: 315 L/cap/d for population and employment growth flow projections
Maximize capacity of existing / planned infrastructure	✓	- Strategy makes use of upgrades to WWTPs and trunk conveyance	DC	- Certain projects provide Benefit to Existing (BTE) and post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints	✓	- Strategy will balance flows between planst to relieve any interim treatment constraints	WWTP Strategy	- Detailed review of the capacity constraints of each WWTP process informs the scope of potential upgrades
Minimize pumping, energy, O&M costs			York W WW Needs	- York flows to be conveyed and treated by Peel may require MP infrastructure. York Demand and Flow make up part of the long term W WW needs
Alignment with SOGR or other programs	✓	- Strategy will align with G.E. Booth WWTP SOGR upgrades at Plant 1	WWTP Biosolids Strategy	- Peel's WWTP Biosolids Strategy informs the overall WWTP upgrade approach and evaluation
Capacity Resiliency / Climate Change	✓	- Strategy will provide opportunity for added resiliency for potential climate change impacts	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Source Water Protection	✓	- Strategy ensures treatment capacity is in place to meet growth needs and Provincial requirements for Source Water Protection	Existing Studies, Design or Analysis	- G.E. Booth, Clarkson WWTP Class EA

Area Overview Map

Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
Bolton SPS & Albion/Vaughan Road Trunk Sewer	Servicing solutions for this area consist of upgrades to the Bolton Sewage Pumping Station, a new forcemain and continued extension of the Albion-Vaughan Trunk Sewer to handle projected growth in the north end of the Bolton catchment area. Key issues in this area include: - Potential capacity constraints at the Coleraine Drive sewer to service growth to 2041. - State of good repair improvements required a Bolton SPS - Spare capacity at Albion-Vaughan trunk sewer	- Albion-Vaughan Road Sanitary Trunk Sewer extension - Bolton Sewage Pumping Station Force Main Twinning - Decommissioning of the Harvestview Sewage Pumping Station - Construction of several growth-related sanitary sewers to service future Bolton development

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Intensification growth of ~4,000 pop+jobs within SPS Catchment - Greenfield growth of ~18,000 in West Bolton, adding to Coleraine Dr sewer	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Buildout growth anticipated northwest of Humber Station and King St W and north of Columbia Way	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	- Flexibility needed to free up capacity in the Coleraine Dr Sewer	Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- New Albion/Vaughan Rd trunk sewer constructed with capacity for large growth areas	Existing Studies, Design or Analysis	- Bolton SPS F/M Design - *pending* - Bolton WWPS Capital Needs Assessment to Meet Future Projected Flows
Alleviate existing capacity constraints			SPS Strategies - Decommissioning	- Decommission of Harvestview SPS
Minimize pumping, energy, O&M costs	✓	- Enables decommission of existing Harvestview SPS	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Alignment with SOGR or other programs	✓	- Strategy takes into account SOGR needs previously identified for the Bolton SPS		
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events and system flexibility to deal with increased wet weather flows		
Source Water Protection				

Area Overview Map

Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
West Bolton / Coleraine Drive	Significant growth to 2041 is projected in West Bolton, West of Coleraine Drive and North of Mayfield Road. Servicing solutions for this area consist of: - Extending servicing into the new growth areas and directing flows to existing sanitary sewers.	- New sanitary trunk sewer of Humber Station Road - New sanitary sewer on Coleraine Drive - Various new sanitary sewers along future roads to service future development in West Bolton - Extension of servicing through a flow split between Coleraine Drive Sewer and New Humber Station Road Sewer

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Significant growth (~42,000) West of Coleraine Dr and North of Mayfield Rd	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Potential Post-2041 growth anticipated northwest of Humber Station and King St W	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	- Flexibility to balance flows between the Coleraine Dr sewer and Humber Station Rd sewer	Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximizes the capacity of the Coleraine Dr sewer	DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints			GTA West	- Preferred GTA West Corridor alignment crosses through southwest Bolton
Minimize pumping, energy, O&M costs	✓	- Strategy does not recommend new SPS project(s)	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Alignment with SOGR or other programs			Existing Studies, Design or Analysis	
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events and system flexibility to deal with increased wet weather flows		
Source Water Protection				

Area Overview Map

Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
McVean SPS	Significant growth to 2041 and post-2041 is projected for the McVean SPS catchment area, which will potentially exceed the current and planned pumping station capacity and require SPS expansion beyond existing site limits. Key issues in this area include: - Significant growth in the catchment area to 2041. - Potential requirement for SPS expansion beyond existing site limits. - Life cycle cost of additional pumping. - Long-term growth beyond the station's planned capacity to 2041.	- Bypass McVean SPS with Gravity Sewer (Bypass catchment area north of Castlemore Road) The proposed McVean SPS diversion along Castlemore Road will require the completion of a Schedule C Class Environmental Assessment prior to proceeding with Design and Implementation.

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Projected growth to 2041 >100,000 pop+jobs	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Post-2041 growth anticipated northwest of Humber Station and King St W, north of Columbia Way, north of Mayfield Rd between Torbram Rd and The Gore Rd	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	- Optimizes flows to existing SPS and provides flexibility to divert significant flows past the SPS catchment	Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximizes the capacity of trunk sewers north of Castlemore rd	DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints	✓	- Significantly reduces the flows to McVean SPS which will be deficient before 2041	Long Term SOGR	- SOGR needs for SPS/FM
Minimize pumping, energy, O&M costs	✓	- Significant energy and O&M savings expected with the re-rating of the SPS and reduction of pumped flow	GTA West	- Preferred GTA West Corridor alignment crosses through service area
Alignment with SOGR or other programs	✓	- Informs the SOGR program for the SPS/FM	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events and system flexibility to deal with increased wet weather flows	Existing Studies, Design or Analysis	
Source Water Protection				

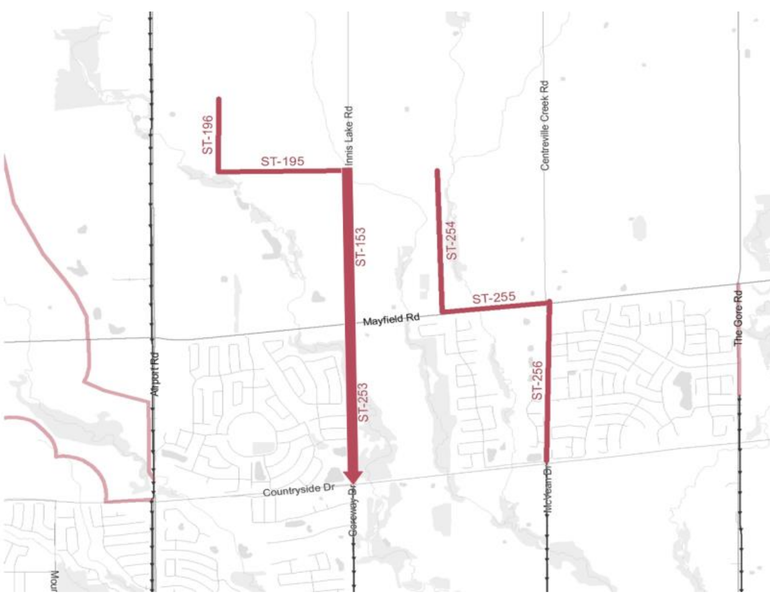
Area Overview Map

Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
Tullamore / Airport Road	Growth is projected in the Tullamore and Airport Road area north of Mayfield Road between Airport Road and Centreville Creek Road. Servicing solutions for this area consist of extending servicing into new growth areas and directing flows to existing sewers on McVean Drive to service the projected growth to 2041.	- New sanitary sewer on McVean Drive. - New sanitary sewer on Innis Lake Drive and Goreway Drive.

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Greenfield growth of ~9,000 pop+jobs North of Mayfield Rd	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Post-2041 growth anticipated to the North and East of 2041 service boundary	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization			Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximizes existing sewers and future Castlemore Bypass	DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints			GTA West	- Preferred GTA West Corridor alignment crosses through service area
Minimize pumping, energy, O&M costs	✓	- Gravity solution eliminates need for new SPS/FM	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Alignment with SOGR or other programs			Existing Studies, Design or Analysis	
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events		
Source Water Protection				

Area Overview Map

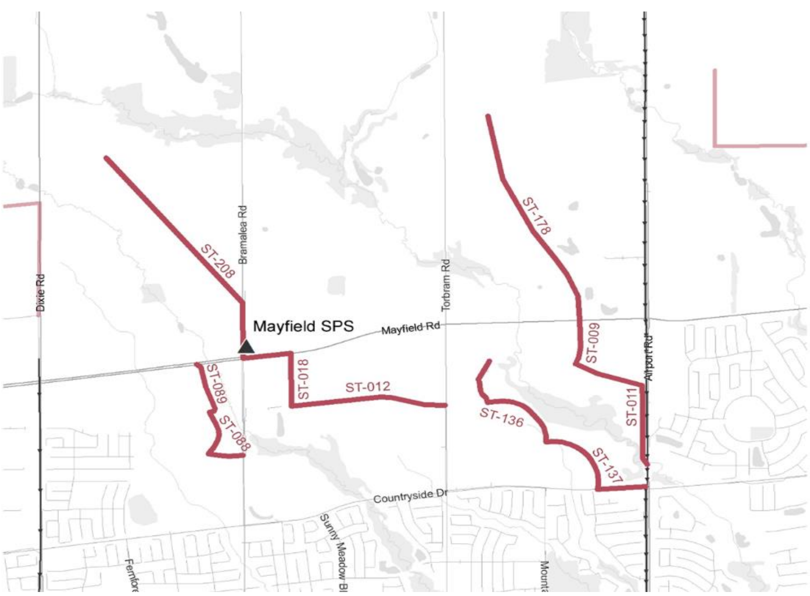


Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
Countryside Villages / North of Mayfield Road	Growth is projected in the Countryside Villages area and north of Mayfield Road between Dixie Road and Airport Road (e.g. Mayfield West Phase 4, Tullamore Industrial). Servicing solutions for these areas mainly consists of new gravity sewers along future roads and the decommissioning of the existing Mayfield sewage pumping station.	- New sanitary sewer in a future street to service future development in Mayfield West Phase 4. - New gravity sewers to service future development in the Countryside Villages. - Decommissioning of the existing Mayfield SPS and directing flows to new gravity sewer that will service Mayfield West Phase 4 future development.

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Significant growth of ~28,000 north of Countryside Rd between Dixie Rd and Airport Rd	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Post-2041 growth anticipated northwest of Airport Rd/Tullamore Industrial Area	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization			Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximize capacity of existing sewers along Bramalea Rd, Torbram Rd and Airport Rd	DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints			GTA West	- Preferred GTA West Corridor alignment crosses through service area
Minimize pumping, energy, O&M costs	✓	- Potential to decommission existing Mayfield SPS	Existing Studies, Design or Analysis	- Countryside Villages Secondary Plan, Block 48-2 Functional Servicing Report
Alignment with SOGR or other programs			Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events		
Source Water Protection				

Area Overview Map

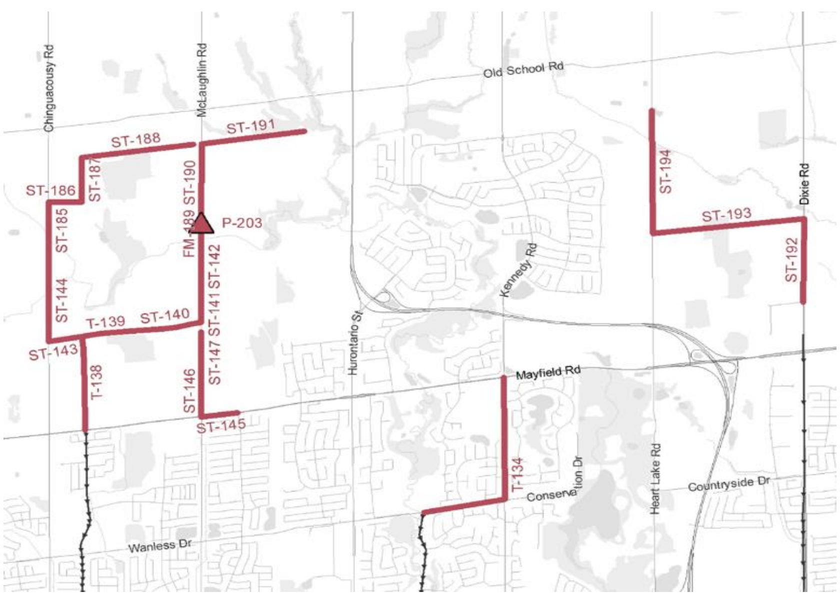


Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
Mayfield West	The servicing solution for this area mainly consists of new gravity sewers to connect to existing sewers south of Mayfield Road, and new sewage pumping station and forcemain to service lands north of this area. There are several key servicing issues in this area including the distance to existing trunk sewers and the environmental features including the Etobicoke Creek and Humber River Tributary.	- New sanitary trunk sewer on Kennedy Road/Conservation Drive. - New sanitary sewers on McLaughlin Road to service future development in Mayfield West 3. - New sanitary sewer network connecting to existing sewer on Edenbrook Hill Drive to service future development in Mayfield West Phase 2 . - New sanitary sewers, sewage pumping station and forcemain near McLaughlin Road and the Etobicoke Creek to service future development in Mayfield West Phase 3. - New sanitary sewers near Chinguacousy Road to service future development in Mayfield West Phase 3. - New sanitary sewers on various roads to service future development in Mayfield West (Future Phase).

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Significant growth ~50,000 projected for the Mayfield West area	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth		- Sizing of infrastructure does not account for Post-2041 growth outside of this area	Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Flexibility / Optimization			GTA West	- Preferred GTA West Corridor alignment crosses through service area
Maximize capacity of existing / planned infrastructure	✓	- Maximize capacity of existing sewers along Edenbrook Hill Dr, Van Kirk Dr and Dixie Rd	Existing Studies, Design or Analysis	- Mayfield West Secondary Plan
Alleviate existing capacity constraints			Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Minimize pumping, energy, O&M costs				
Alignment with SOGR or other programs				
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events		
Source Water Protection				

Area Overview Map



Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
North-West Brampton (Mount Pleasant West)	Servicing solutions for this area consist of several new gravity sewers along existing and future roads to connect to the existing Mississauga Road sanitary trunk sewer. Some key issues for this strategy include the distance to existing trunk sewers and the environmental features in the area (Huttonville Creek and Credit River Tributary).	- New Credit Valley sanitary trunk sewer. - New Northwest Brampton sanitary trunk sewer. - New Mount Pleasant sanitary trunk sewer network connecting to the future northwest Brampton sanitary trunk sewer.

Project(s) Drivers	Project(s) Drivers - Details		Project Influence(s)	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Significant growth of ~28,000 west of Mississauga Rd, south of the Mayfield Rd and north of the CN Railway	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Post-2041 growth anticipated northwest of Airport Rd/Tullamore Industrial Area	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization			Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximize capacity of existing sewer along Mississauga Rd	DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints			GTA West	- Preferred GTA West Corridor alignment crosses through service area
Minimize pumping, energy, O&M costs	✓	- Strategy does not recommend new SPS project(s)	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Alignment with SOGR or other programs				
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events		
Source Water Protection				

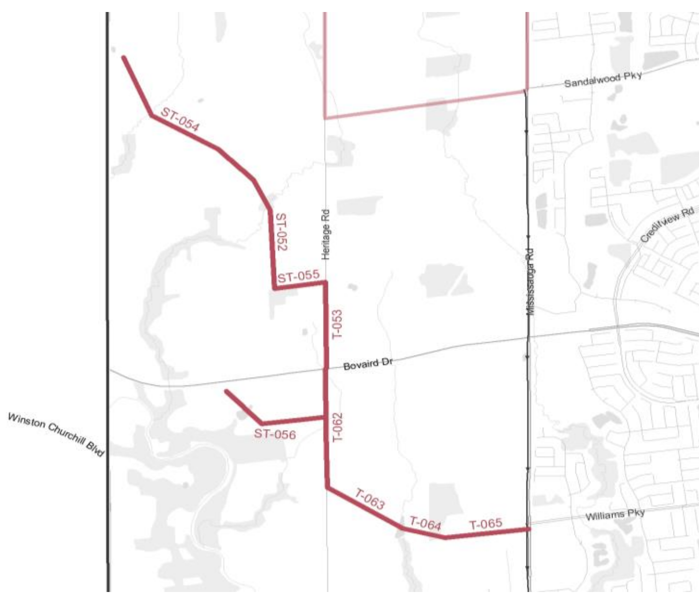
Area Overview Map

Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
North-West Brampton (Huttonville North)	Servicing solutions for this area consist of several new gravity sewers along roads right of way and future roads to connect to the existing Mississauga Road sanitary trunk sewer. Some key issues for this strategy include the distance to existing trunk sewers and the environmental features in the area (Credit River and Tributaries).	- New Heritage Heights sanitary trunk sewer. - New Huttonville sanitary sewer network connecting to the future Heritage Heights Sanitary Trunk Sewer.

Project(s) Drivers		Project(s) Drivers - Details	Project Influence(s)	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Significant growth of ~34,000 west of Mississauga Rd, south of the CN Railway and north of the Credit River	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth			Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Flexibility / Optimization			GTA West	- Preferred GTA West Corridor alignment crosses through service area
Maximize capacity of existing / planned infrastructure	✓	- Maximize capacity of existing sewer along Mississauga Rd	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Alleviate existing capacity constraints			Existing Studies, Design or Analysis	
Minimize pumping, energy, O&M costs	✓	- Strategy does not recommend new SPS project(s)		
Alignment with SOGR or other programs				
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events		
Source Water Protection				

Area Overview Map

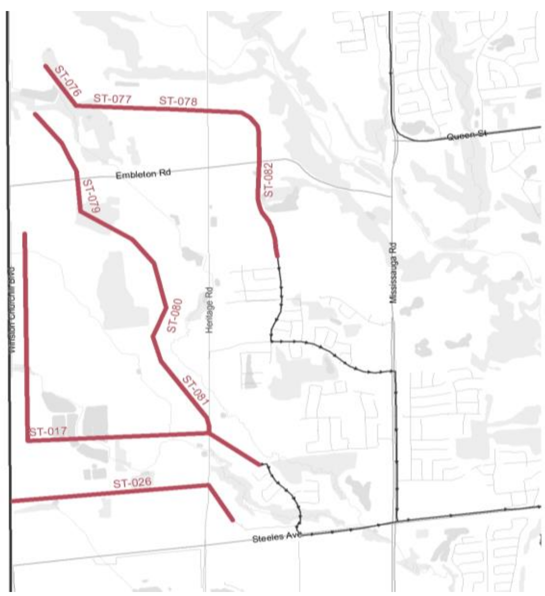


Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
West Brampton (Bram West)	Servicing solutions for this area consist of new gravity sewers along roads right of way and future roads to connect to the existing Rivermont Road and Steeles Avenue sanitary trunk sewers. Some key issues for this strategy include the distance to existing trunk sewers and the environmental features in the area (Credit River and Tributaries).	- New Brampton West sanitary sewer network connecting to the existing Steeles West sanitary trunk sewer.

Project(s) Drivers: *Why do we need the project(s)?*	Project(s) Drivers - Details		Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Significant growth of ~34,000 west of Mississauga Rd, south of the Credit River and north of Steeles Ave	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth			Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Flexibility / Optimization			GTA West	- Preferred GTA West Corridor alignment crosses through service area
Maximize capacity of existing / planned infrastructure	✓	- Maximize capacity of existing sewer along Mississauga Rd	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Alleviate existing capacity constraints			Existing Studies, Design or Analysis	
Minimize pumping, energy, O&M costs	✓	- Strategy does not recommend new SPS project(s)		
Alignment with SOGR or other programs				
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events		
Source Water Protection				

Area Overview Map

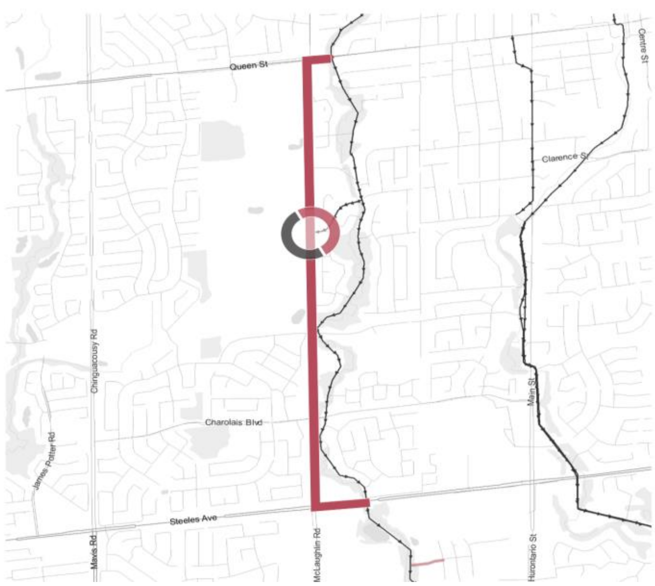


Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
Fletcher's Creek	Significant growth is projected in the catchment area of the Fletchers Creek trunk sewer which will require infrastructure expansions. There are some key issues in the Fletchers Creek area including: - Capacity constraints within the trunk sewer due to growth in the northern catchment area. - Environmental Features in the area (Fletchers Creek). The proposed servicing solution for the Fletchers Creek area includes a sanitary trunk sewer twinning .	The proposed servicing solution for the Fletchers Creek area includes a new twin sewer along Mclaughlin Road from Queen Street to Steeles Avenue. This proposed sanitary trunk sewer twinning will require the completion of a Schedule 'B' Class Environmental Assessment.

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Significant growth of ~55,000 in the catchment area	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Post-2041 growth anticipated north of Mayfield Rd west of Chinguacousy Rd	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	Flexibility to connect to sections of the existing sewer and potential to connect to the E-W Diversion	Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Maximize capacity of existing / planned infrastructure	✓		DC	- Project provides post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints			Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Minimize pumping, energy, O&M costs	✓	- Strategy does not recommend new SPS project(s)	Existing Studies, Design or Analysis	
Alignment with SOGR or other programs				
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events and system flexibility to deal with increased wet weather flows		
Source Water Protection				

Area Overview Map

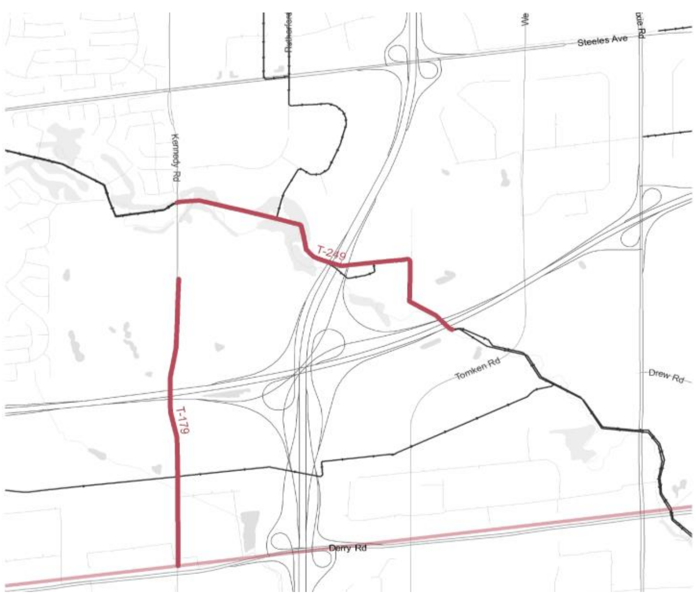


Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
Etobicoke Creek	Significant growth is expected in the Etobicoke Creek area that will require additional infrastructure to service the additional flows. There are several key issues in the area including: - Existing and future capacity constraints - Existing condition / performance issues including hydraulic restrictions in conveyance capacity - Limited and/or challenging access to sections of the trunk sewer - Exposure of the linear infrastructure due to erosion.	The servicing solutions in this area include: - Twinning the Etobicoke Creek sewers along the existing alignment - New Kennedy Road gravity trunk sewer to connect to the proposed East to West Diversion The servicing solutions through this area will be further developed and evaluated through a separate Class EA study currently underway.

Project(s) Drivers: *Why do we need the project(s)?*	Project(s) Drivers - Details		Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Significant growth of ~85,000 is expected in the service area including Downtown and Uptown Brampton areas, Mayfield West	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Post-2041 growth anticipated beyond 2041 north of Old School Rd.	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	- Provide flexibilty to re-direct flows to multiple downstream sewers	Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximize the capacity of existing Etobicoke Creek sewers and planned E-W Diversion trunk sewer	DC	- Project provides post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints	✓	- Alleviate constraints on existing Etobicoke Creek sewers	Existing Studies, Design or Analysis	- Ongoing Etobicoke Creek Class EA
Minimize pumping, energy, O&M costs	✓	- Strategy does not recommend new SPS project(s)	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Alignment with SOGR or other programs	✓	- Alleviate existing condition and performance issues		
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events and system flexibility to deal with increased wet weather flows		
Source Water Protection				

Area Overview Map

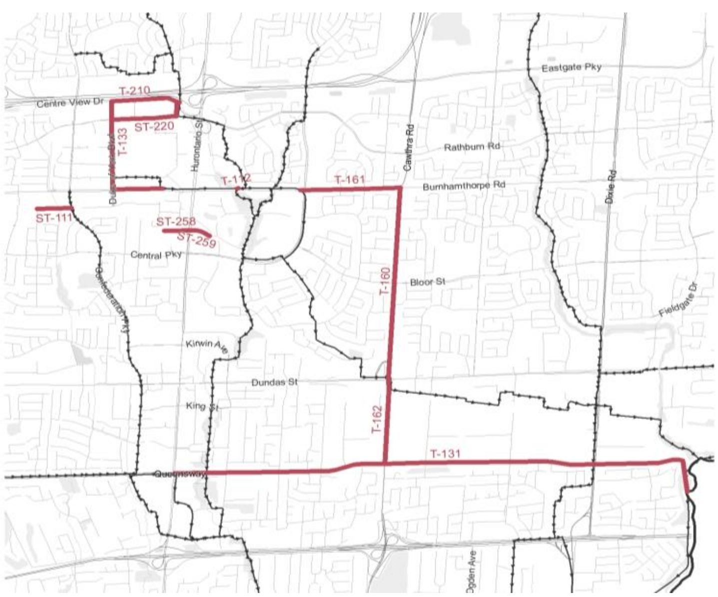


Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
Central Mississauga	Several key issues in this area exist including the following: - Capacity constraints within the system to manage increased wet weather flows and future growth - Hydraulic restrictions along existing trunk sewers - Operational flexibility to divert flows for sewer rehabilitation, emergency operations and CCTV	The servicing solutions for this area include several new sanitary sewers and sanitary trunk sewers as well as several other growth-related sewer improvements. The servicing solutions for this are will be further developed and evaluated through a separate Class EA study.

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Significant growth in intensification areas including the Mississauga City Centre and the Hurontario Corridor	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Sizing of infrastructure accounts for Post-2041 growth	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	- Provide flexibilty to re-direct flows to multiple downstream sewers	Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximize the capacity of existing CPR and Cooksville Creek sewer and potential Queensway diversion	DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints	✓	- Alleviate capacity constraints in existing system	Existing Studies, Design or Analysis	- Ongoing Central Mississauga Class EA ' - Upper Cooksville Creek & Central Parkway Feasibility Study
Minimize pumping, energy, O&M costs	✓	- Strategy does not recommend new SPS project(s)	Internal FSRs - Insp Lakeview, 91 Eg	- 91 Eglinton Avenue East Analysis
Alignment with SOGR or other programs	✓	- Alleviate existing condition and performance issues	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events and system flexibility to deal with increased wet weather flows		
Source Water Protection				

Area Overview Map



Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
Hurontario / Eglinton	There are several current development applications for this area that include high growth projections which will require additional servicing. The servicing solutions for this area include new gravity sewers, maximizing the use of existing infrastructure and monitoring flows as development occurs in the area, considering potential post-2041 growth, and coordinating with other planned infrastructure work in the area.	- New gravity sewers from the existing sanitary sewer on Eglinton Ave East to proposed development at 91 Eglinton.

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Significant growth in intensification areas at the Hurontario Corridor	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Sizing of infrastructure accounts for Post-2041 growth	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization			Design Criteria - Water and Wastewater	- Wastewater - 285 L/cap/d, 285 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximized the capacity of existing trunk sewers	DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints	✓	- Alleviate capacity constraints in existing system	Internal FSRs - Insp Lakeview, 91 Eg	- 91 Eglinton Avenue East Analysis
Minimize pumping, energy, O&M costs	✓	- Strategy does not recommend new SPS project(s)	Existing Studies, Design or Analysis	- Upper Cooksville Creek & Central Parkway Feasibility Study
Alignment with SOGR or other programs	✓	- Potential alignment with LRT projects on Hurontario	Metrolinx MTO External Ongoing Works - LRT	- LRT will impact infrastructure along Hurontario corridor
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events and system flexibility to deal with increased wet weather flows	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Source Water Protection				

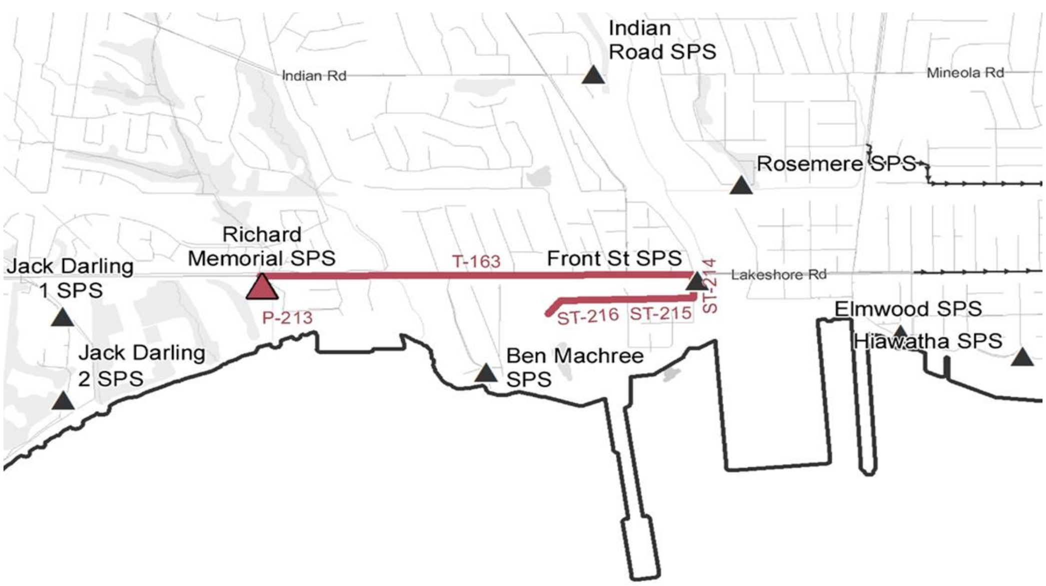
Area Overview Map

Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
Lakeshore/ Front Street	Growth is projected along Lakeshore Road in Mississauga including intensification and new growth in development areas such as the Port Credit West Village. Several key issues in this area exist including the following: - Requirement for Front Street Sewage Pumping Station equipment replacement - Requirement for Richard's Memorial Sewage Pumping Station reconstruction with capacity expansions - Balance of wastewater flows between G.E. Booth and Clarkson WWTPs	- Decommission of the existing Front Street SPS - Decommission of existing Ben Machree SPS - Construction of new gravity trunk sewer along Lakeshore Road - New pumping station to be located within the Richard's Memorial Park with expanded capacity to take new flows from proposed Lakeshore Road gravity sewer

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Intensification growth of ~10,000 within Lakeshore Rd catchment area serviced by Front St SPS and Richard's Memorial SPS	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Sizing of infrastructure will provide capacity for growth post 2041	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization			Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximize capacity of planned Richard's Memorial and existing infrastructure downstream to the Clarkson WWTP	DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints	✓	- Capacity constraints at existing Richard's Memorial SPS	Existing Studies, Design or Analysis	- Front Street Station Wastewater Diversion Project Schedule B Class EA
Minimize pumping, energy, O&M costs	✓	- Decommission of existing Front St SPS and Ben Machree SPS	SPS Strategies - Decommissioning	- Decommission of Front St SPS and Ben Machree SPS
Alignment with SOGR or other programs	✓	- Align projects with condition issues and asset renewal requirements	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events and system flexibility to deal with increased wet weather flows		
Source Water Protection				

Area Overview Map



Focus Areas Servicing Solutions

Focus Area	Wastewater Strategy & Key Issues	Servicing Solution Components
Inspiration Lakeview	Significant growth is projected in the development area known as Inspiration Lakeview (also known as Lakeview Village). The existing site grading of the Inspiration Lakeview development area does not allow for servicing of the entire site by gravity to the existing sewers Some flows generated on-site will require pumping to Lakeshore Road East.	The servicing solutions proposed for this area include a new network of local gravity sewers and new on-site local sewage pumping station and forcemain discharging to the lakeshore Road East sanitary sewer.

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Servicing strategy is required to service growth within 2041 population and employment projections.	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth			Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization			Design Criteria - Water and Wastewater	- Wastewater - 290 L/cap/d, 270 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximize the capacity of the existing sewers along Lakeshore Road East and Rangeview Road	DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints			Existing Studies, Design or Analysis	- Inspiration Lakeview Master Plan, Lakeview Village Development Master Plan
Minimize pumping, energy, O&M costs			Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Alignment with SOGR or other programs				
Capacity Resiliency / Climate Change	✓	-Sizing of infrastructure takes into consideration more frequent and intense storm events and system flexibility to deal with increased wet weather flows		
Source Water Protection				

Area Overview Map

Focus Area
West Bolton / Coleraine Drive

Description of Strategy		West Bolton / Coleraine Drive Option 1: Flow split between Coleraine Dr. sewer and new Humber Station Rd sewer	Option 2: Flow split between Coleraine Dr. sewer and new Humber Station Rd sewer (Modified)	Option 2: Flow to Humber Station Rd trunk sewer
Technical	Increase spare capacity in existing system	✓✓	✓✓	✓
	Improve/maintain level of service of existing users	✓✓	✓✓	✓
	Provide opportunity to decommission existing SPS			
	Avoid/minimize proximity and/conflicts with existing infrastructure	✓✓	✓✓	✓
	Consider constructability and technical feasibility to build and maintain infrastructure	✓✓	✓✓	✓
	Provide opportunity for operational flexibility and security	✓✓	✓✓	✗
	Integration with road/transportation projects			
	Integration with water projects			
	Avoid/minimize construction in areas with limited access	✓	✓	✓✓
	Avoid/minimize environmental/roads/utility crossings	✓✓	✓✓	✓✓
	Ability to maintain existing services during construction/implementation			
	Maximize alignments along road rights of way and/or easements			
	Apply I&I reduction measures			
	Extend wastewater servicing to new growth areas	✓✓	✓✓	✓
	Support intensification growth	✓✓	✓✓	✓
	Support post-2041 growth	✓	✓	✗
	Incremental extension of infrastructure as growth progresses	✓✓	✓✓	✗
	Allow for gravity solution versus pumping flows	✓✓	✓✓	✓✓
	Ability to adapt to changes on wastewater effluent requirements			
	Ability to provide/maintain desired level of service under climate change conditions			
	Technical Comments	- Incremental extension of infrastructure as required - Areas north of Healey can develop without the need to build the Humber Station Rd sewer - Provides for opportunity for future flow splits and operational flexibility - Maximizes capacity of existing Coleraine Drive Sewer - Trunk sewer extension along Gore Road will be required post-2041	- Incremental extension of infrastructure as required - Areas north of Healey can develop without the need to build the Humber Station Rd sewer. - Provides for opportunity for future flow splits and operational flexibility	The Humber Station Rd sewer will be required to be in place to service the growth areas north of Healey Rd -Flow split with The Gore Road sewer will be required - Does not maximize capacity of existing Coleraine Drive Sewer - Eliminates need for twinning existing Coleraine Drive Sewer
Environmental	Minimize risk of basement flooding	✓✓	✓✓	✓✓
	Minimize risk of untreated sewage entering the natural environment	✓✓	✓✓	✓✓
	Minimize impact on nearby agricultural lands	✓	✓	✓
	Avoid/minimize environmental crossings	✓✓	✓✓	✓✓
	Avoid/minimize impact on environmental sensitive/protected areas	✓✓	✓✓	✓✓
	Avoid/minimize impact on local aquatic/terrestrial species at risk and habitats			
	Avoid/minimize potential impact on groundwater quantity and quality during construction			
	Consider resiliency and adaption to climate change			
	Environmental Comments	- Comparable potential environmental risks and impacts between all options - Environmental impact avoidance / mitigation will be required for all options	- Comparable potential environmental risks and impacts between all options - Environmental impact avoidance / mitigation will be required for all options	- Comparable potential environmental risks and impacts between all options - Environmental impact avoidance / mitigation will be required for all options
Socio/Cultural	Minimize short/long term noise & odour Issues	✓	✓	✓✓
	Consider visual aesthetics of the proposed infrastructure	✓✓	✓✓	
	Consider potential community resistance to alternative/strategy/alignment	✓	✓	✓✓
	Minimize traffic disruption	✓	✓	✓✓
	Avoid/minimize impact on archaeological sites/resources			
	Minimize impact during construction and operation			
	Minimize impact on surrounding properties	✓		✓✓
	Minimize construction impact on traffic, local businesses and residents	✓		✓✓
	Avoid/minimize impact on heritage sites			
	Socio/Cultural Comments	- Potential for more disruption with construction on Coleraine	- Potential for more disruption with construction on Coleraine	- No disruption to surrounding properties due to lack of construction
Legal/ Jurisdictional	Maximizes worker safety and operability	✓	✓	✓
	Does not require land acquisition or easement			
	Minimizes approvals/coordination	✓	✓	✓
	Legal/ Jurisdictional Comments	- Strategy will need to take in consideration the future GTA West Hwy	- Strategy will need to take in consideration the future GTA West Hwy	- Strategy will need to take in consideration the future GTA West Hwy
Financial	Maximize use of existing infrastructure	✓✓	✗	✗
	Avoid/minimize introducing new infrastructure	✓✓	✓	✓✓
	Avoid/minimize upgrading existing infrastructure	✓✓	✓	✗
	Minimize life cycle cost of providing wastewater services			
	Minimize long term energy costs			
	Lower capital cost relative to other options	✓	✓✓	✓
	Reduce/eliminate operation & maintenance costs	✓	✓	✓
	Support long-term financial sustainability	✓✓	✓✓	✗
	Integration with SOGR program			
	Support phasing and implementation of capital projects over time	✓✓	✓✓	✗
	Financial Comments	- Larger size and longer length required for twinning sewer than Option 2, higher capital cost - Facilitates phasing of northern area connecting to the existing sewer on Coleraine Drive	- Does not maximize the capacity of the Coleraine Dr sewer as much as option 1 - Smaller size and shorter length required for twinning than Option 1, less capital cost intensive	- Does not maximize the Corelaine Dr sewers and strategies to free up capacity on that sewer - Does not support phasing and implementation of capital projects over time
Innovation / Adaptation	Apply innovation and/or new technologies	✓✓	✓✓	✓✓
	Use of data for evidence based decision making process			
	Operational flexibility to adapt to climate change			
	Establish a baseline and a process to measure results and desire outcomes			
	Incorporate water conservation and reuse practices			
	Maximize energy efficiency			
	Avoid energy-intensive infrastructure	✓✓	✓✓	✓✓
	Consider performance of the system under power outage conditions			
	Consider opportunity for renewable energy production and use			
	Innovation/ Adaptation Comments			
Preferred Option		✓✓	✗	✗

Legend

N/A	Not Applicable
✗	Adverse impacts
✓	Beneficial Impacts
✓✓	Very Beneficial Impacts

Focus Area
McVean SPS

Description of Strategy		McVean SPS – Option 1: New Sewage Pumping Station, additional forcemains and overflow storage	McVean SPS – Option 2: Bypass McVean SPS with Gravity Sewer (Bypass catchment area north of Mayfield Rd)	McVean SPS – Option 3: Bypass McVean SPS with Gravity Sewer (Bypass catchment area north of Castlemore Rd)
Technical	Increase spare capacity in existing system	✓	✓✓	✓✓
	Improve/maintain level of service of existing users			
	Provide opportunity to decommission existing SPS	×	✓✓	✓✓
	Avoid/minimize proximity and/conflicts with existing infrastructure	×		
	Consider constructability and technical feasibility to build and maintain infrastructure	×	✓✓	✓✓
	Provide opportunity for operational flexibility and security	×	✓✓	✓✓
	Integration with road/transportation projects			
	Integration with water projects			
	Avoid/minimize construction in areas with limited access	✓	✓	
	Avoid/minimize environmental/roads/utility crossings	✓	✓	
	Ability to maintain existing services during construction/implementation		✓✓	
	Maximize alignments along road rights of way and/or easements			
	Apply I&I reduction measures			
	Extend wastewater servicing to new growth areas	✓		
	Support intensification growth	✓	✓	✓✓
	Support post-2041 growth	✓		
	Incremental extension of infrastructure as growth progresses			✓✓
	Allow for gravity solution versus pumping flows	×	✓✓	✓✓
	Ability to adapt to changes on wastewater effluent requirements			
	Ability to provide/maintain desired level of service under climate change conditions	✓	✓✓	✓✓
	Technical Comments	- New SPS requires expansion beyond the existing site limits - Requires significant new SPS infrastructure - Requires additional Humber River force main crossing(s) - Requires additional pumping - Upgrades can be partially phased over time as growth progresses	- Provide opportunity for SPS de-rating - Provide opportunity for operational flexibility and security - Integrates with future buildout strategy - Allow for gravity solution versus pumping flows	- Provide opportunity for SPS de-rating - Provide opportunity for operational flexibility and security - Integrate with future buildout strategy - Allow for gravity solution versus pumping flows
Environmental	Minimize risk of basement flooding	✓	✓✓	✓✓
	Minimize risk of untreated sewage entering the natural environment	✓		✓✓
	Minimize impact on nearby agricultural lands			
	Avoid/minimize environmental crossings		✓	
	Avoid/minimize impact on environmental sensitive/protected areas	✓		
	Avoid/minimize impact on local aquatic/terrestrial species at risk and habitats	✓		
	Avoid/minimize potential impact on groundwater quantity and quality during construction	✓	✓✓	✓✓
	Consider resiliency and adaption to climate change	×	✓	✓✓
	Environmental Comments	- Greater potential risk of overflows to environment from SPS - Potential for disruptions contained within the site of the new SPS - Does not reduce greenhouse gas emissions - Does not provide operational flexibility to adapt to climate change impacts	- Provide for better adaption to climate change - Reduces GHG and potential SPS overflows to the environment	- Provide for better adaption to climate change - Reduces GHG and potential SPS overflows to the environment
Socio/Cultural	Minimize short/long term noise & odour Issues	✓✓	✓	✓
	Consider visual aesthetics of the proposed infrastructure			
	Consider potential community resistance to alternative/strategy/alignment			
	Minimize traffic disruption	✓✓	✓	✓
	Avoid/minimize impact on archaeological sites/resources			
	Minimize impact during construction and operation	✓✓	✓	✓
	Minimize impact on surrounding properties	✓✓	✓	✓
	Minimize construction impact on traffic, local businesses and residents	✓✓	✓	✓
	Avoid/minimize impact on heritage sites			
	Socio/Cultural Comments	- Potential for disruptions contained within site of new SPS - minimal disruption to land surrounding site	- Potential for greater disruptions during construction due to longer alignment	- Potential for disruptions during construction due to gravity alignment
Legal/ Jurisdictional	Maximizes worker safety and operability	✓	✓	✓
	Does not require land acquisition or easement			
	Minimizes approvals/coordination	✓	✓	✓
	Legal/ Jurisdictional Comments	- New SPS require expansion beyond the existing site limits	- Significant requirements for large scale project - Potential land acquisition (temporary and/or permanent) for tunnel shaft locations	- Significant requirements for large scale project - Potential land acquisition (temporary and/or permanent) for tunnel shaft locations
Financial	Maximize use of existing infrastructure	✓	✓	✓✓
	Avoid/minimize introducing new infrastructure			
	Avoid/minimize upgrading existing infrastructure			
	Minimize life cycle cost of providing wastewater services	×	✓	✓✓
	Minimize long term energy costs	×	✓✓	✓✓
	Lower capital cost relative to other options	✓✓	×	✓
	Reduce/eliminate operation & maintenance costs	×	✓	✓
	Support long-term financial sustainability		✓	✓✓
	Integration with SOGR program			
	Support phasing and implementation of capital projects over time	✓		
	Financial Comments	- Lower capital cost but higher operational and maintenance costs than other options due to continued pumping requirements	- Bypass will have higher capital cost than new SPS, however, O&M savings over the life of station may partially offset additional cost - Higher cost than option along Castlemore Rd	- Bypass will have higher capital cost than new SPS, however, O&M savings over the life of station will offset additional cost - Better support of phasing when compared to Option 2
Innovation / Adaptation	Apply innovation and/or new technologies	✓	✓✓	✓✓
	Use of data for evidence based decision making process			
	Operational flexibility to adapt to climate change		✓✓	✓✓
	Establish a baseline and a process to measure results and desire outcomes			
	Incorporate water conservation and reuse practices			
	Maximize energy efficiency		✓✓	✓✓
	Avoid energy-intensive infrastructure			
	Consider performance of the system under power outage conditions			
	Consider opportunity for renewable energy production and use			
	Innovation/ Adaptation Comments		- Innovative solution that challenges the status quo - Avoids new SPS - Provides operational flexibility to adapt to climate change	- Innovative solution that challenges the status quo - Avoids new SPS - Provides operational flexibility to adapt to Climate Change
Preferred Option		×	×	✓✓

Legend

N/A	Not Applicable
×	Adverse impacts
✓	Beneficial Impacts
✓✓	Very Beneficial Impacts

Focus Area
Tullamore / Airport Road

Description of Strategy		Tullamore / Airport Road: Option 1: New Sewage Pumping Station to Airport Road	Tullamore / Airport Road: Option 2: Gravity to McVean Drive, Sub-Trunk and Castlemore Bypass
Technical	Increase spare capacity in existing system	✓	✓✓
	Improve/maintain level of service of existing users	✓✓	✓✓
	Provide opportunity to decommission existing SPS		
	Avoid/minimize proximity and/conflicts with existing infrastructure		
	Consider constructability and technical feasibility to build and maintain infrastructure	✓✓	✓✓
	Provide opportunity for operational flexibility and security		✓✓
	Integration with road/transportation projects		
	Integration with water projects		
	Avoid/minimize construction in areas with limited access		
	Avoid/minimize environmental/roads/utility crossings	✓	✓✓
	Ability to maintain existing services during construction/implementation		
	Maximize alignments along road rights of way and/or easements		
	Apply I&I reduction measures		
	Extend wastewater servicing to new growth areas	✓✓	✓✓
	Support intensification growth		
	Support post-2041 growth	✓✓	✓✓
	Incremental extension of infrastructure as growth progresses	✓✓	✓✓
	Allow for gravity solution versus pumping flows	×	✓✓
	Ability to adapt to changes on wastewater effluent requirements		
	Ability to provide/maintain desired level of service under climate change conditions	✓	✓✓
	Technical Comments	- New SPS and FM solution vs. gravity solution	- Gravity solution is preferable compared to SPS/FM solution - Good for phasing of infrastructure as growth progresses
Environmental	Minimize risk of basement flooding	✓	✓✓
	Minimize risk of untreated sewage entering the natural environment	✓	✓✓
	Minimize impact on nearby agricultural lands		
	Avoid/minimize environmental crossings	✓	✓✓
	Avoid/minimize impact on environmental sensitive/protected areas		
	Avoid/minimize impact on local aquatic/terrestrial species at risk and habitats		
	Avoid/minimize potential impact on groundwater quantity and quality during construction	✓	✓✓
	Consider resiliency and adaption to climate change	✓	✓✓
	Environmental Comments	- Higher risk for overflows to environment due to new SPS - Creek crossing required east of Airport Rd	- No SPS, therefore minimize the risk of overflows to the environment - Alignments minimize creek crossings
Socio/Cultural	Minimize short/long term noise & odour Issues	✓	✓✓
	Consider visual aesthetics of the proposed infrastructure	✓	✓✓
	Consider potential community resistance to alternative/strategy/alignment	✓	✓✓
	Minimize traffic disruption		
	Avoid/minimize impact on archaeological sites/resources		
	Minimize impact during construction and operation		
	Minimize impact on surrounding properties		
	Minimize construction impact on traffic, local businesses and residents		
	Avoid/minimize impact on heritage sites		
	Socio/Cultural Comments	- Comparable potential disruption during construction	- Minimize potential short/long term noise & odour Issues associated with SPS operation - Comparable potential disruption during construction
Legal/ Jurisdictional	Maximizes worker safety and operability	✓	✓✓
	Does not require land acquisition or easement	✓	✓✓
	Minimizes approvals/coordination	✓	✓✓
	Legal/ Jurisdictional Comments	- Land acquisition requried for SPS	- No land/property requirements for SPS
Financial	Maximize use of existing infrastructure	✓	✓✓
	Avoid/minimize introducing new infrastructure	✓	✓✓
	Avoid/minimize upgrading existing infrastructure		
	Minimize life cycle cost of providing wastewater services	✓	✓✓
	Minimize long term energy costs	×	✓✓
	Lower capital cost relative to other options		
	Reduce/eliminate operation & maintenance costs	×	✓✓
	Support long-term financial sustainability		
	Integration with SOGR program		
	Support phasing and implementation of capital projects over time		
	Financial Comments	- Higher O&M and energy costs due to new SPS and FM - Does not maximize the capacity of existing sewers on Goreway Drive and McVean Drive	- Less O&M costs than SPS/FM solution - Maximizes the use of existing infrastructure
Innovation / Adaptation	Apply innovation and/or new technologies	✓	✓✓
	Use of data for evidence based decision making process		
	Operational flexibility to adapt to climate change		
	Establish a baseline and a process to measure results and desire outcomes		
	Incorporate water conservation and reuse practices		
	Maximize energy efficiency	×	✓✓
	Avoid energy-intensive infrastructure	×	✓✓
	Consider performance of the system under power outage conditions		
	Consider opportunity for renewable energy production and use		
	Innovation/ Adaptation Comments	- Less energy efficient due to SPS operational requirements	- Provides system flexibility
Preferred Option		×	✓✓

Legend

N/A	Not Applicable
×	Adverse impacts
✓	Beneficial Impacts
✓✓	Very Beneficial Impacts

Focus Area
Fletchers Creek

Description of Strategy		Fletchers Creek: Option 1: New Twin Sewer along Mclaughlin Rd from Queen St to Steeles Ave	Fletchers Creek: Option 2: New Twin Sewer along McMurchy Ave from Queen St to Steeles Ave
Technical	Increase spare capacity in existing system	✓✓	✓
	Improve/maintain level of service of existing users	✓✓	✓✓
	Provide opportunity to decommission existing SPS		
	Avoid/minimize proximity and/conflicts with existing infrastructure	✓✓	✓✓
	Consider constructability and technical feasibility to build and maintain infrastructure	✓	✓
	Provide opportunity for operational flexibility and security	✓✓	✓
	Integration with road/transportation projects		
	Integration with water projects		
	Avoid/minimize construction in areas with limited access	✓	✓
	Avoid/minimize environmental/roads/utility crossings	✓	✓✓
	Ability to maintain existing services during construction/implementation	✓✓	✓✓
	Maximize alignments along road rights of way and/or easements	✓✓	✓✓
	Apply I&I reduction measures		
	Extend wastewater servicing to new growth areas		
	Support intensification growth	✓✓	✓✓
	Support post-2041 growth	✓✓	✓✓
	Incremental extension of infrastructure as growth progresses	✓✓	✓
	Allow for gravity solution versus pumping flows		
	Ability to adapt to changes on wastewater effluent requirements		
	Ability to provide/maintain desired level of service under climate change conditions	✓✓	✓✓
	Technical Comments	- Alignment provides greater opportunity for potential future extension south to the E-W Diversion - Provides opportunity for connection to the middle section of the existing twin which can be used for phasing of the project - Wide road ROW and availability of potential shaft locations will facilitate construction	- Potential conflicts within built up residential street, narrow road ROW and existing infrastructure along this alignment - Does not provide as much flexibility as option 1 - Does not allow for potential interconnection with middle section of the existing twin
Environmental	Minimize risk of basement flooding	✓	✓✓
	Minimize risk of untreated sewage entering the natural environment		
	Minimize impact on nearby agricultural lands		
	Avoid/minimize environmental crossings	✓	✓✓
	Avoid/minimize impact on environmental sensitive/protected areas		
	Avoid/minimize impact on local aquatic/terrestrial species at risk and habitats		
	Avoid/minimize potential impact on groundwater quantity and quality during construction		
	Consider resiliency and adaption to climate change		
	Environmental Comments	- Requires two crossing of Fletcher's Creek at Queen St and Steeles Ave	- Avoids the need for crossings of Fletcher's Creek
Socio/Cultural	Minimize short/long term noise & odour Issues	✓	✓
	Consider visual aesthetics of the proposed infrastructure	✓	✓
	Consider potential community resistance to alternative/strategy/alignment	✓	✓
	Minimize traffic disruption	✓	✓
	Avoid/minimize impact on archaeological sites/resources		
	Minimize impact during construction and operation	✓	✓
	Minimize impact on surrounding properties	✓	✓
	Minimize construction impact on traffic, local businesses and residents	✓	✓
	Avoid/minimize impact on heritage sites		
	Socio/Cultural Comments	- Potential for less disruption during construction. McLaughlin Rd is less populated than McMucrchy Ave - Requires railway crossing	- Significant potential disruption during construction in built up residential street - Requires railway crossing
Legal/ Jurisdictional	Maximizes worker safety and operability	✓	✓
	Does not require land acquisition or easement	✓	✓
	Minimizes approvals/coordination	✓	✓
	Legal/ Jurisdictional Comments	- Potential land requirement for tunnel shafts	- Potential land requirement for tunnel shafts which might be difficult due to buildout area
Financial	Maximize use of existing infrastructure	✓✓	✓
	Avoid/minimize introducing new infrastructure	✓	✓
	Avoid/minimize upgrading existing infrastructure	✓✓	✓✓
	Minimize life cycle cost of providing wastewater services		
	Minimize long term energy costs		
	Lower capital cost relative to other options	✓✓	✓
	Reduce/eliminate operation & maintenance costs		
	Support long-term financial sustainability		
	Integration with SOGR program		
	Support phasing and implementation of capital projects over time	✓✓	×
	Financial Comments	- Supports phasing. Can be constructed in two separate sections if required - Wide road ROW and availability of potential shaft locations will facilitate construction and likely reduce capital cost	- Slightly longer alignment - Greater potential impacts and mitigation measures required along narrow road ROW within built up residential area will likely increase capital cost
Innovation / Adaptation	Apply innovation and/or new technologies		
	Use of data for evidence based decision making process		
	Operational flexibility to adapt to climate change		
	Establish a baseline and a process to measure results and desire outcomes		
	Incorporate water conservation and reuse practices		
	Maximize energy efficiency		
	Avoid energy-intensive infrastructure		
	Consider performance of the system under power outage conditions		
	Consider opportunity for renewable energy production and use		
	Innovation/ Adaptation Comments	- Comparable opportunities for Innovation/Adaptation between Options	- Comparable opportunities for Innovation/Adaptation between Options
Preferred Option		✓✓	✓

Legend

N/A	Not Applicable
×	Adverse impacts
✓	Beneficial Impacts
✓✓	Very Beneficial Impacts

4F

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 4F

McVean SPS Memo

McVean SPS Feasibility Study

2020 Water and Wastewater Master Plan

Prepared by:
GM BluePlan Engineering for:

The Regional Municipality of Peel

Project No. 715022

May 2020

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1 INTRODUCTION

As part of the Region of Peel Water and Wastewater Master Plan, a review of the 2041 model identified capacity constraints at various locations of the Peel sanitary sewer system. This memo summarizes the feasibility study undertaken for the McVean Sewage Pumping Station (SPS) and catchment area.

A preliminary analysis was undertaken of projected 2041 peak wet weather flows within the McVean catchment. Based on growth projections within the overall McVean SPS catchment, the station is due to reach its current capacity by approximately 2025. Upgrades to the station (new 900 mm forcemain and new pump) are planned in order to increase capacity and keep up with growth in the drainage area. However, the station is scheduled to reach its planned maximum capacity prior to 2041, which would trigger major expansions and/or a new station. On this basis, the primary objective of the analysis undertaken was to assess servicing strategy alternatives for the McVean SPS that minimizes future upgrades at the station while limiting expansion beyond the existing site limits.

Additionally, the study aimed to:

- Assess the flows to the McVean SPS and when capacity upgrades are triggered.
- Determine the preliminary preferred servicing alternative for the McVean SPS catchment.

The following are identified as opportunities from this study:

- Remove flow from existing drainage area in order to potentially de-rate McVean SPS.
- Avoid conveyance upgrades within existing McVean catchment area.
- Integrate McVean strategy with future buildout strategy – Airport Rd Sewer.
- Avoid additional pumping stations in the system.
- Maximize use of available conveyance capacity.

2 STUDY AREA AND SYSTEM DESCRIPTION

The study area consists of the catchment area upstream of and including the McVean SPS as shown in Figure 1. The following trunk sewers are within the McVean SPS catchment area: Goreway Drive, McVean Road, The Gore Road, Clarkway Drive, Coleraine Drive, Albion-Vaughan, and Brampton-Bolton. In addition, there are three pumping stations within the McVean SPS catchment area, namely: The Gore Road SPS, Bolton SPS and Bolton North Hills SPS.

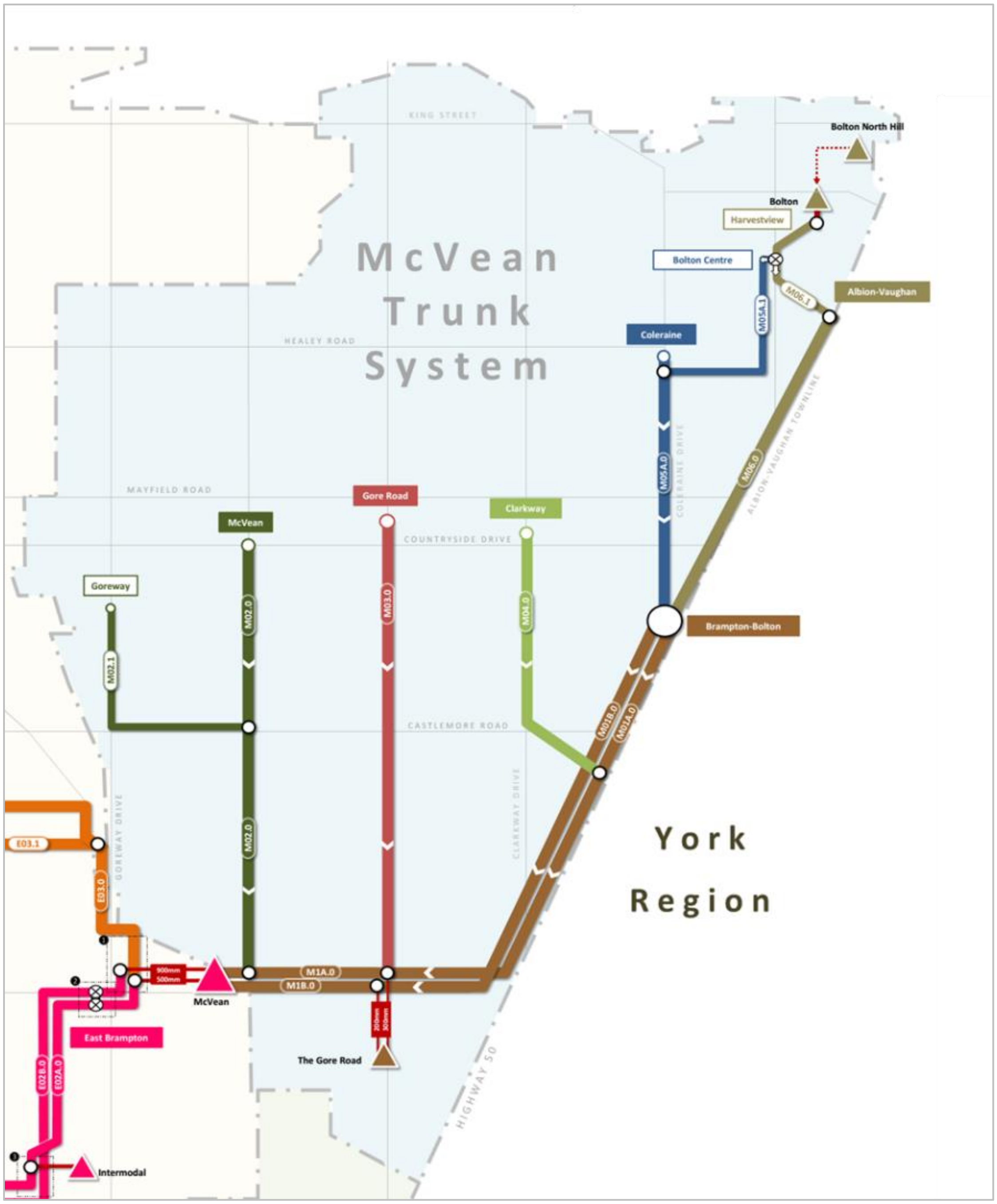


Figure 1. McVean SPS Catchment Area

3 PLANNING PROJECTIONS

The McVean SPS catchment area is projected to experience significant growth to 2041. Projected growth within the catchment area includes intensification within existing built areas and new greenfield growth. A summary of the population and employment projections within the McVean SPS catchment by milestone years is presented in Table 1.

Table 1. McVean SPS Catchment Area Population and Employment Projections

Milestone Year	Population(1)	Employment(1)
2016	91,690	22,627
2021	98,740	27,275
2026	119,484	37,467
2031	138,707	48,989
2036	153,359	56,563
2041	168,315	61,328
Buildout(2)	311,212	126,574

(1) Data source: SguPeelScen15sept6.shp, received September 6, 2017.

(2) Data source for post period growth area: SGU20160225_v2.shp, received February 25, 2016.

4 MCVEAN SPS CAPACITY ASSESSMENT

Existing and planned future capacity upgrades of the McVean SPS are presented in Table 2. The existing capacity of the McVean SPS is approximately 1,400 L/s with current flows at the station estimated at approximately 970 L/s. Projected theoretical and modelled flows to 2041 and buildout are presented in Figure 2.

Table 2. McVean SPS Existing and Planned Capacity Upgrades

Upgrade Alternatives		Approximate Capacity (L/s)	Capacity Based On:	
			Forcemain	**Pumps**
Existing conditions		1,400	1 x 900mm	2 x duty 1 x standby
Planned	Additional pump. 500mm force main not upgraded	1,700	1 x 900mm	3 x duty 1 x standby
	Additional pump 500mm force main upgraded	1,900	1 x 900mm 1 x 500mm	3 x duty 1 x standby
	Additional pump. 500mm force main replaced with 900mm	2,100 - 2,400	1 x 900mm 1 x 900mm	3 x duty 1 x standby

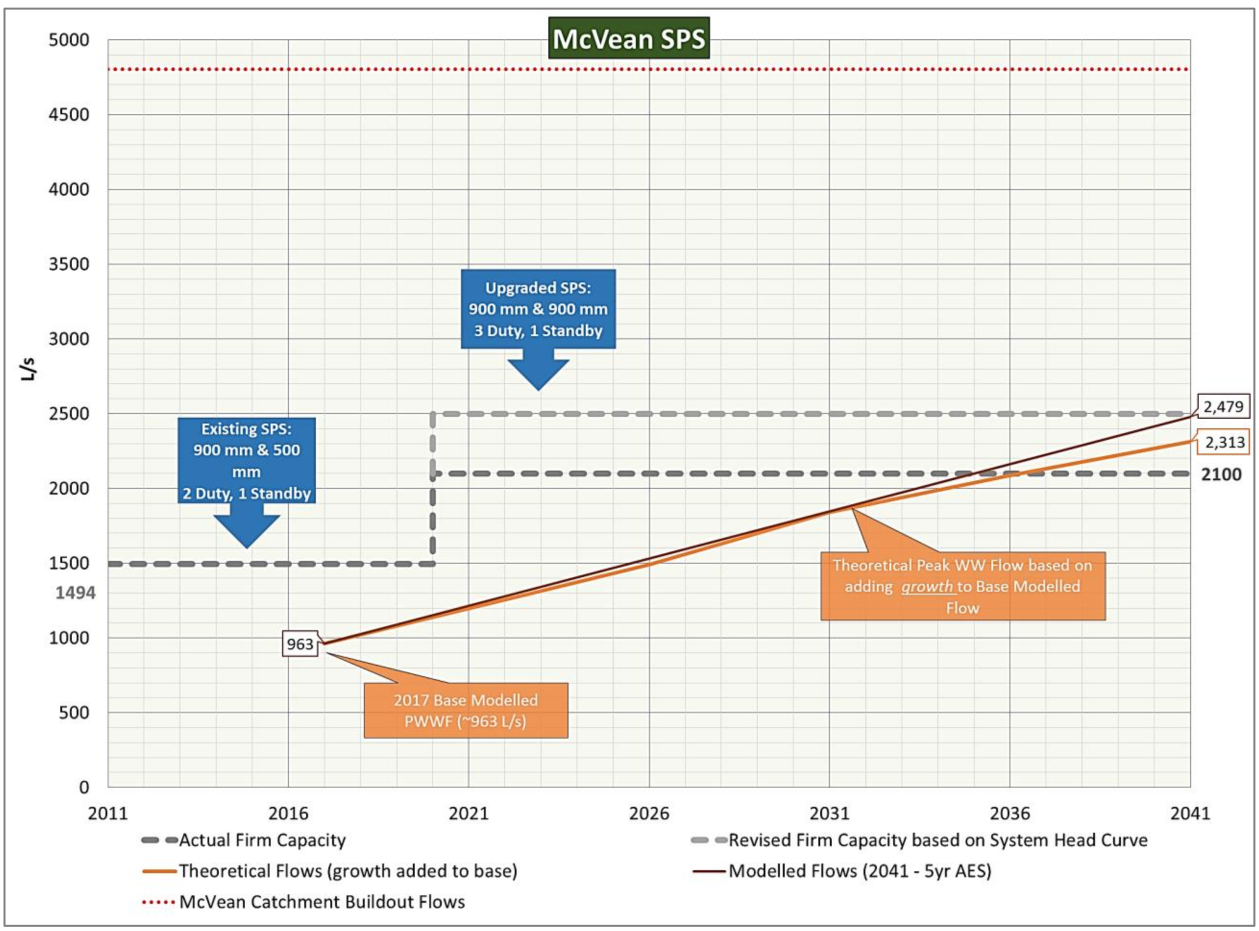


Figure 2. McVean SPS Capacity and Flows

Based on the projected flows and planned infrastructure the following constraints were identified:

- Existing firm capacity is projected to be reached by 2025 (1,400 L/s).
- Additional pump will provide enough capacity to 2029 (1,700 L/s).
- Upgrades to the 500mm existing forcemain will provide enough capacity to 2032 (1,900 L/s).
- Additional pump and new 900mm force main will increase the capacity of the pumping station to 2,100-2,400 L/s which is projected to be reached by 2041.
- Buildout flows are projected to reached up to 4,800 L/s (assuming drainage area to Airport Road).
- In order for the McVean SPS to meet projected buildout flows, additional pumping capacity or a new gravity solution will be required.

5 MCVEAN SPS SERVICING STRATEGY

5.1 McVean SPS Servicing Alternatives

In order for the McVean SPS to meet projected buildout flows, two servicing alternatives were explored:

1. New sewage pumping station
   New SPS beyond existing McVean SPS site limits.
   - Capacity 2,700 L/s SPS
   - Two additional force mains total of 4 x 900 mm force mains
   - Overflow (2hr) storage basin of 35,000m^3

2. By-pass McVean SPS with new Gravity Sewer
   By-pass gravity sewer to minimize future upgrades and expansion of the McVean SPS beyond the existing site limits. The following by-pass options were explored:
   - By-pass of flows north of Castlemore Road (Figure 3)
   - By-pass of flows north of Mayfield Road (Figure 4)

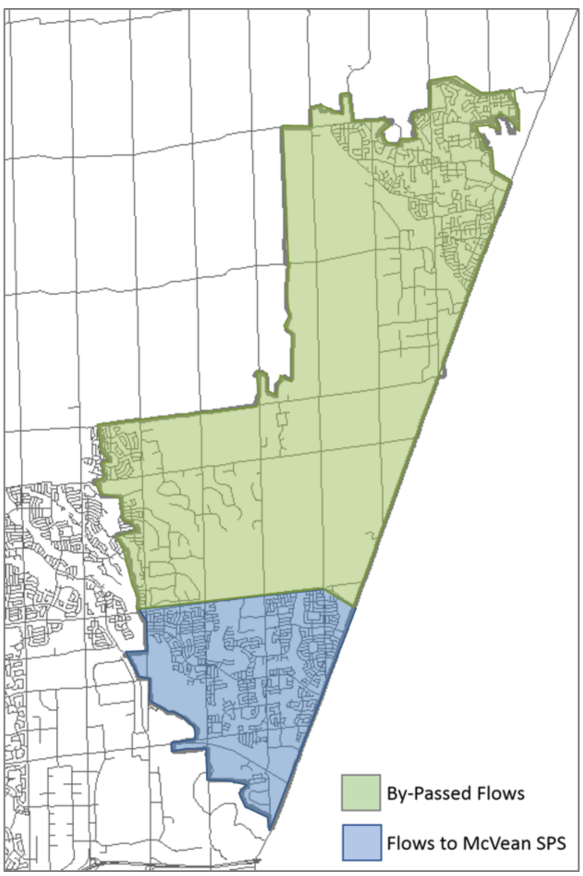


Figure 3. Catchments Areas – By-pass North of Castlemore Road

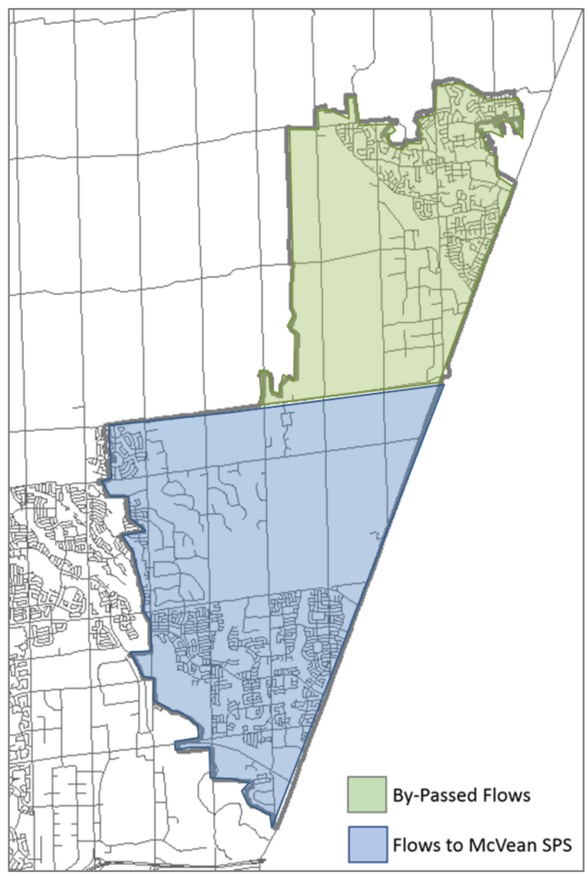


Figure 4. Catchments Areas – By-pass North of Mayfield Road

Analysis of the projected flows for the proposed by-pass alternatives and remaining McVean SPS catchment area are presented in Table 3 and Table 4.

Table 3. By-pass North of Castlemore Road and McVean SPS Catchment Area Flows

Section		2017 Flows (L/s)	2041 Flows (L/s)
Flows to McVean (no Bypass)		**963**	**2,479**
1	McVean Dr.	6	177
2	Castlemore Rd.	75	85
3	The Gore Rd.	8	229
4	Clarkway Dr.	9	803
5	Hwy 50 south of Castlemore Rd. (includes Clarkway Flows of 803 L/s)	534	1,487
By-passed Flows (north of Castlemore Rd.)		**622**	**1,978**
Flow to McVean (with By-Pass)		**341**	**502**

Table 4. By-pass North of Mayfield Road and McVean SPS Catchment Area Flows

Section		2017 Flows (L/s)	2041 Flows (L/s)
Flows to McVean (no Bypass)		**963**	**2,479**
1	Clarkway Dr.	-	302
2	Coleraine Dr.	244	382
3	Albion Vaughan Rd.	249	404
By-passed Flows (north of Mayfield Rd.)		**493**	**1,088**
Flow to McVean (with By-Pass)		**470**	**1,391**

5.1.1 By-pass Options – Alignments (Long List)

By-pass alignments and location of connection points were selected based on existing inverts where upstream and downstream connections were feasible. The upstream connection point for each by-pass alignment was selected based on invert elevations of the sewers to be intercepted. The downstream connection point was selected based on invert elevations along the East trunk sewer. The following are downstream connection points for the gravity sewer alignments were considered:

- Queen/Goreway at the existing McVean SPS discharge - elevation of 180.3 m
- Auction lane, just downstream of the existing McVean SPS discharge - elevation of 178.8 m
- Intermodal West for connections via Airport Rd. - elevation of 172.5 m
- Intermodal North - elevation of 173.5 m
- Intermodal South - elevation of 173.3 m

A total of nine alignments were considered between the two by-pass options. Figure 5, Figure 6 and Figure 7 present alignments for by-pass options north of Castlemore Road and north of Mayfield Rd.

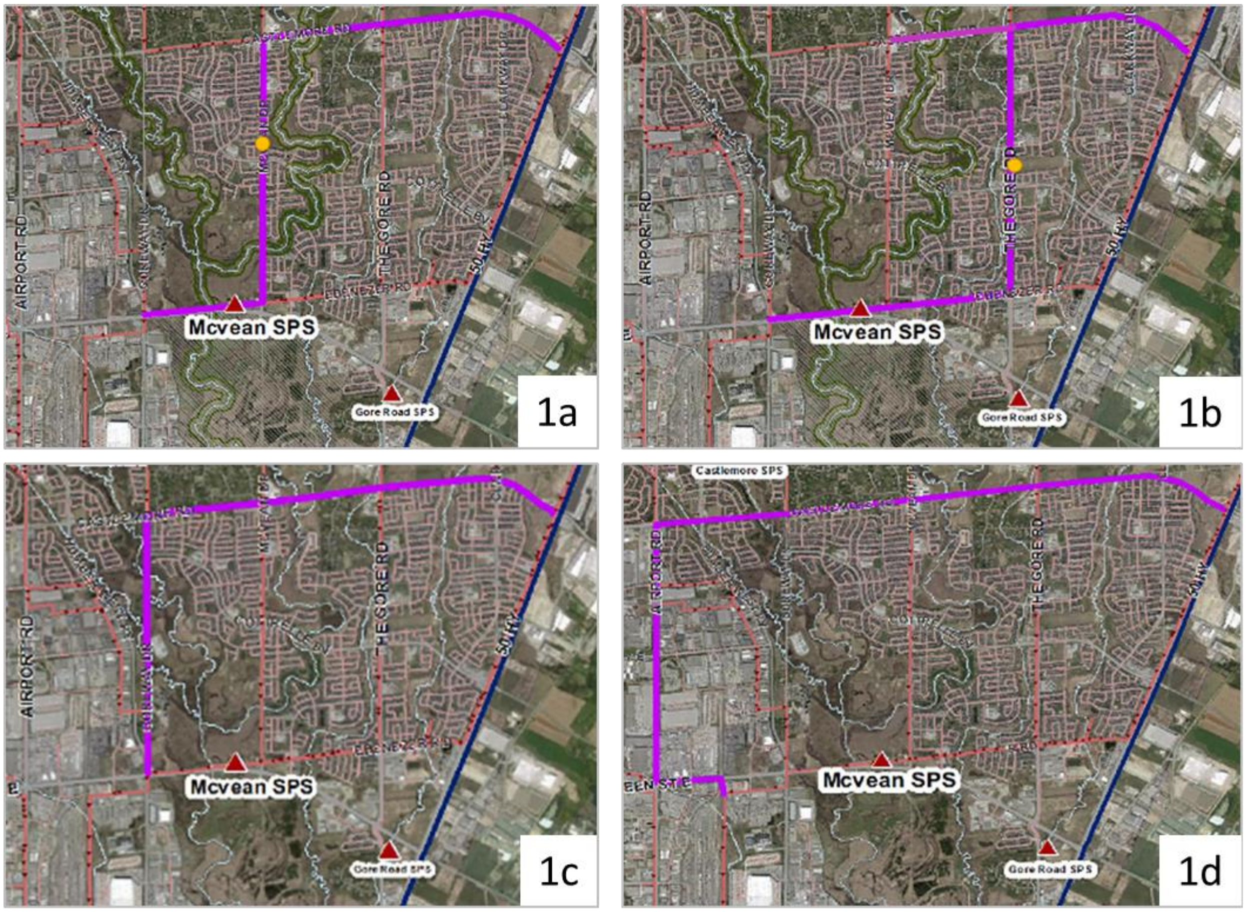


Figure 5. By-pass Alignment Options North of Castlemore Road (Queen St Connection)

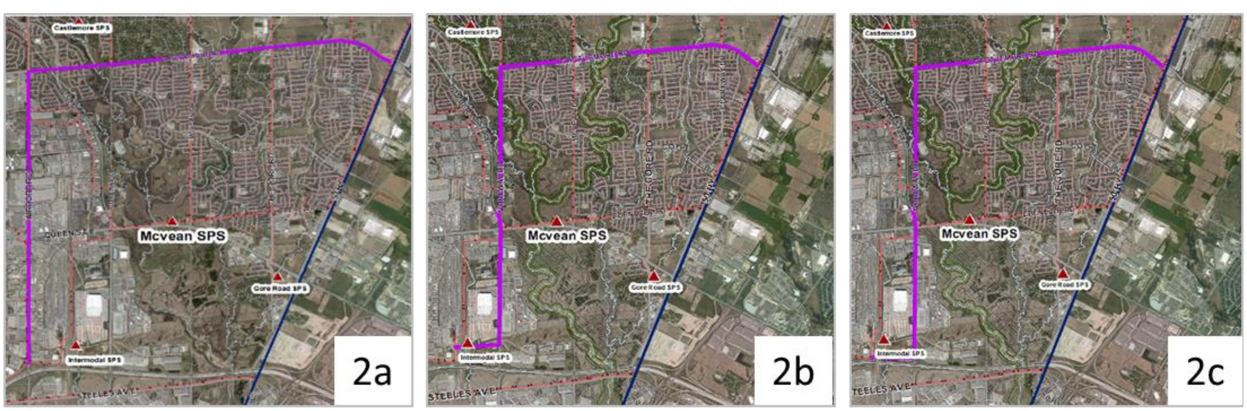


Figure 6. By-pass Alignment Options North of Castlemore Road (Intermodal Connection)

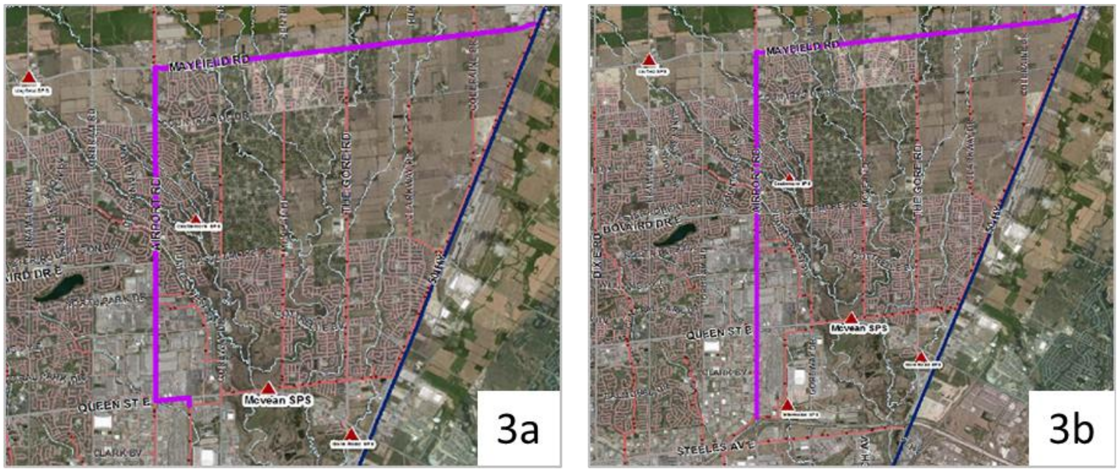


Figure 7. By-pass Alignment Options North of Mayfield Road

By-pass alignments and profiles are presented in more detail in Appendix A.

5.1.2 By-pass Options – Cost Estimates Analysis

A cost estimate analysis was undertaken for the by-pass options, a summary of which is presented in Table 5. The following assumptions were made for the by-pass options based on preliminary calculations:

- Size of the intercepting sewers either along Castlemore Road or Mayfield Road: 1,500 mm
- Size of the conveying sewer from the intercepting sewer either along Castlemore Road or Mayfield Road to the East Trunk: 2,400 mm
- Assumed installation method for intercepting sewer either along Castlemore Road or Mayfield Road: Microtunnelling
- Assumed installation method for the conveying sewer from the intercepting sewer either along Castlemore Road or Mayfield Road to the East Trunk: Large Scale Rock TBM

Details of the cost estimate along with additional unit cost assumptions are presented in Appendix B.

Table 5. McVean Gravity By-Pass Cost Comparison

Option	Length of 1500 mm Sewer	Length of 2400 mm Sewer	Number of Shafts	Capital Cost($M)
Option 1a: Castlemore - McVean - Queen/Goreway	3.5	4.4	6	88.7
Option 1b: Castlemore - The Gore - Queen/ Goreway	3.5	5.8	5	107.5
Option 1c: Castlemore - Goreway - Queen/Goreway	4.8	3.1	7	79.8
Option 1d: Castlemore - Airport - Auction Ln	6.2	4.0	9	106.7
Option 2a: Castlemore - Airport - Intermodal West	6.2	5.4	9	130.8
Option 2b: Castlemore- Goreway - Intermodal North	4.8	6.1	8	124.3
Option 2c: Castlemore - Goreway - Intermodal South	4.8	6.4	8	125.6
Option 3a: Mayfield - Airport - Auction Ln	8.2	8.3	10	185.2
Option 3b: Mayfield - Airport - Intermodal West	8.2	9.8	9	203.9

5.1.3 By-pass Options – Alignments (Long-List)

A high-level evaluation of all the by-pass alignments was undertaken to narrow down the long-list into a short-list as shown in Table 6.

Table 6. High-level Evaluation of By-pass Alignments

Option	Capital Cost ($M)	Evaluation Comments
Option 1a: Castlemore - McVean - Queen/Goreway	88.7	- Requires a dedicated sewer bridge to intercept the McVean trunks and connect to the East trunk at the downstream end.
Option 1b: Castlemore - The Gore - Queen/ Goreway	107.5	- Requires a dedicated sewer bridge to intercept the McVean trunks and connect to the East trunk at the downstream end. - Most expensive capital cost of all option 1 alignments.
Option 1c: Castlemore - Goreway - Queen/Goreway	79.8	- Lowest capital cost of all options. - Goreway Drive alignment might be constrained due to the significant amounts of other infrastructure such as watermains and utilities along this road. - **Carried Forward**
Option 1d: Castlemore - Airport - Auction Ln	106.7	- Potential to integrate with Buildout servicing strategy that requires new gravity trunk sewer along Airport Rd. - Longer alignment than option 1c. - Second most expensive capital cost of all option 1 alignments. - **Carried Forward**
Option 2a: Castlemore - Airport - Intermodal West	130.8	- More expensive of all the Castlemore Rd. options. - Longer alignment than option 1 d with same catchment area north of Castlemore Rd. - Potential to integrate with Buildout servicing strategy that requires new gravity trunk sewer along Airport Rd
Option 2b: Castlemore-Goreway - Intermodal North	124.3	- Goreway Drive alignment might be constrained due to the significant amounts of other infrastructure such as watermains and utilities along this road. - More expensive than option 1c with same catchment area north of Castlemore Rd.
Option 2c: Castlemore - Goreway - Intermodal South	125.6	- Goreway Drive alignment might be constrained due to the significant amounts of other infrastructure such as watermains and utilities along this road. - More expensive than option 1c with same catchment area north of Castlemore Rd.
Option 3a: Mayfield - Airport - Auction Ln	185.2	- By-Pass option along Mayfield Rd., significantly longer and more expensive than options along Castlemore Rd. - Potential to integrate with Buildout servicing strategy that requires new gravity trunk sewer along Airport Rd
Option 3b: Mayfield - Airport - Intermodal West	203.9	- By-Pass option along Mayfield Rd., significantly longer and more expensive than options along Castlemore Rd. - Potential to integrate with Buildout servicing strategy that requires new gravity trunk sewer along Airport Rd

5.2 McVean SPS Lifecycle Cost Analysis

Based on the high-level evaluation of the long-list of by-pass alignments the following short-list for was carried forward for further consideration:

- Servicing Alternative 1 – New SPS
- Servicing Alternative 2 – By-pass Gravity Sewer
    - Option 1c: Castlemore - Goreway - Queen/Goreway
    - Option 1d: Castlemore - Airport - Auction Ln

5.2.1 Lifecycle Cost Analysis Assumptions

SPS Upgrades Implementation Options

To better assess the timing of proposed McVean SPS upgrades, the lifecycle cost analysis was undertaken for the following two implementation options of imminent upgrades:

1. Imminent upgrades to the McVean SPS to move forward as planned. Upgrades include addition of a new pump, new 900mm forcemain and chamber.
2. Imminent upgrades to McVean SPS to be limited to the addition of a new pump and chamber only, with the 900mm forcemain being deferred. This option would require the proposed by-pass sewer sooner and puts the new 900 mm forcemain further out in the program.

Lifecycle Cost Assumptions

The following table summarized lifecycle cost assumptions used in the analysis.

Table 7. Lifecycle Cost Assumptions

Infrastructure	O&M Item	Maintenance Frequency	Capital Cost	% of Asset Value	Annual O&M Cost
SPS Example			**~50,000,000**		
	Major Maintenance - 5 years	5		5.0%	$ 500,000
	Minor Maintenance (annual)	1		0.5%	$ 250,000
	Operation (annual)	1		1.5%	$ 750,000
	Full Cost Replacement	1		2.0%	$ 1,000,000
					$ 2,500,000
Gravity Sewer Example			**~100,000,000**		
	Major Maintenance	10		1.0%	$ 100,000
	Minor Maintenance & Operation (annual)	1		0.2%	$ 200,000
	Full Cost Replacement	1		0.25%	$ 500,000
					$ 800,000

5.2.2 Lifecycle Cost Analysis Results

The results of the lifecycle cost analysis for the is presented in Table 8, Figure 8 and Figure 9. The results summarize capital cost and operation and maintenance (O&M) for each servicing alternative, as well as 100-year net present value (NPV) for the two implementation options.

Table 8. Lifecycle Cost Analysis

	Implementation Option 1 Includes additional pump, chamber and forcemain to existing SPS by 2023			**Implementation Option 2** Includes additional pump and chamber. Does *NOT* include forcemain to existing SPS by 2023		
	Servicing Alternative 1 *New SPS*	**Servicing Alternative 2 Option 1c *Goreway***	**Servicing Alternative 2 Option 1d *Airport***	**Servicing Alternative 1 New SPS**	**Servicing Alternative 2 Option 1c Goreway**	**Servicing Alternative 2 Option 1d *Airport***
Total Capital Cost	$75 M	$85 M	S112 M	$75 M	$80 M	$107 M
Annual O&M	$4.7 M	$2.3 M	$2.5 M	$4.7 M	$2.2 M	$2.4 M
100 Year Life Cycle NPV	$162 M	$123 M	$152 M	$162 M	$117 M	$146 M

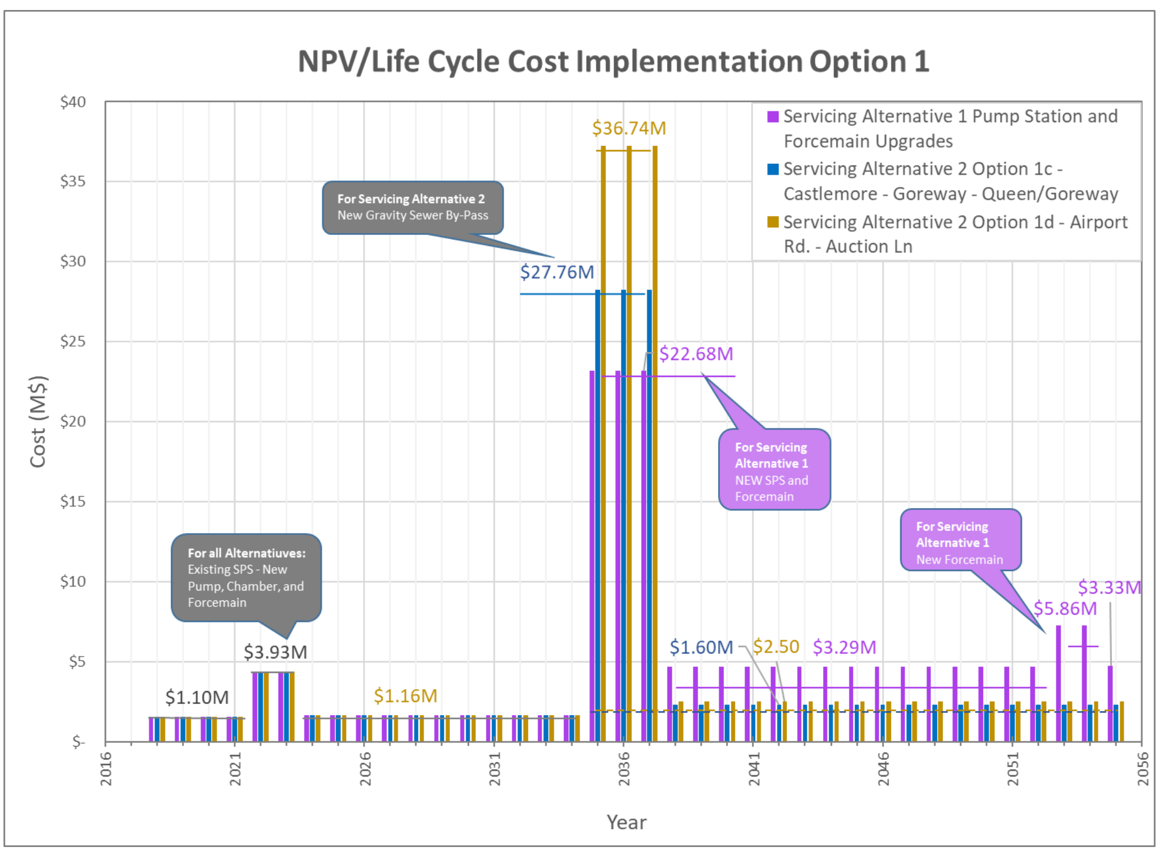


Figure 8. Lifecycle Cost Implementation Option 1

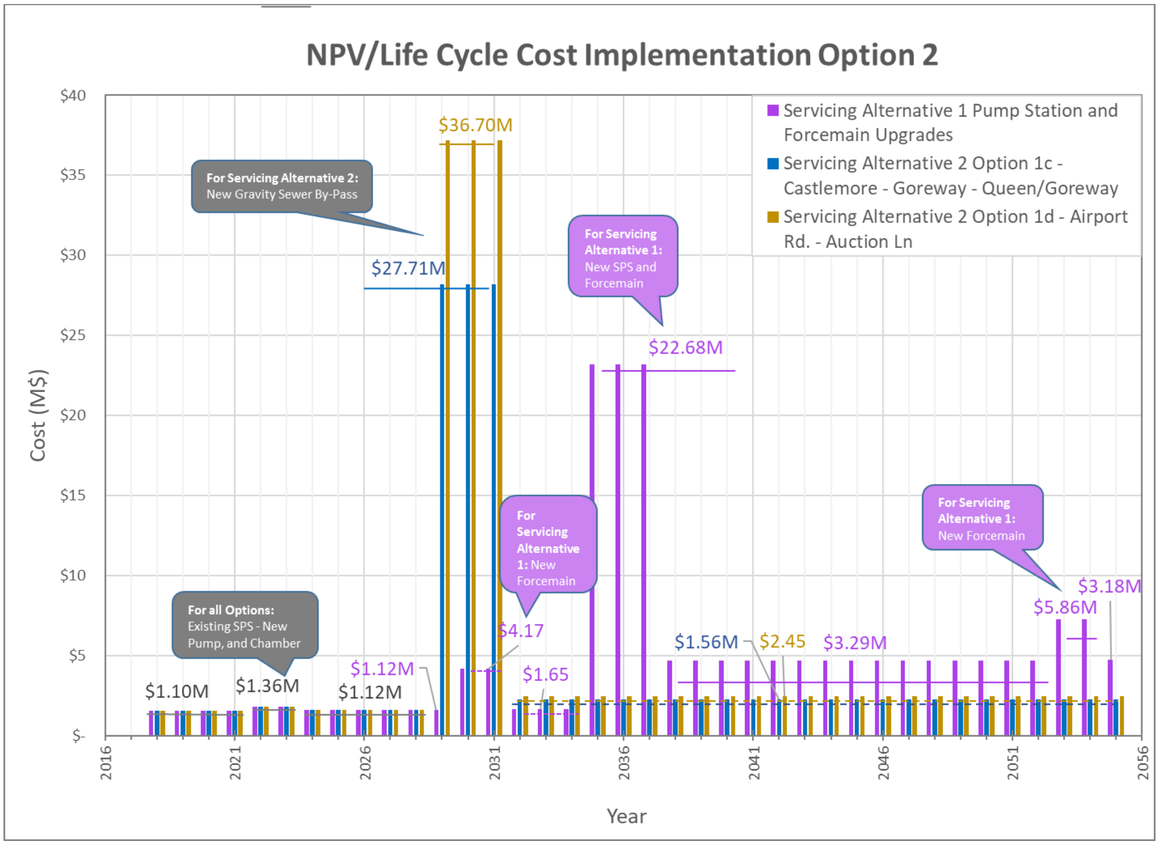


Figure 9. Lifecycle Cost Implementation Option 2

<u>Analysis Discussion</u>

The analysis results show that:

- In general, net present value were the lowest for servicing alternatives under implementation option 2 which does not include a new 900mm force main for the existing McVean SPS in 2023.
- Servicing Alternative 1 (New SPS) has the lowest capital cost, but higher O&M cost and net present value than servicing alternatives 2.
- Servicing Alternative 2 Option 1c presents the lowest capital cost, O&M and net present value.
- Servicing Alternative 2 Option 1d presents higher cost than Option 1c, and lower O&M cost and NPV than Servicing Alternative 1.
- Overall, both Implementation Options reviewed are feasible and provide benefits to the Region; further review of preferred Implementation Option will be required

6 CONCLUSIONS AND RECOMMENDATIONS

This technical analysis was undertaken to assess servicing strategy alternatives for the McVean sewage pumping station in order to minimize future upgrades at the station while limiting expansion beyond the existing site limits.

Based on projected flows and planned infrastructure upgrades, the maximum capacity of the pumping station within the existing site limits (2,100 – 2,400 L/s) would be reached by 2041. In addition, projected buildout flows would require additional pumping capacity or a new gravity solution for the service area.

Two long term servicing alternatives for the McVean SPS were identified:

1. New sewage pumping station
2. By-pass McVean SPS with new Gravity Sewer

A long-list of by-pass options and alignments were considered and narrowed down to two options:

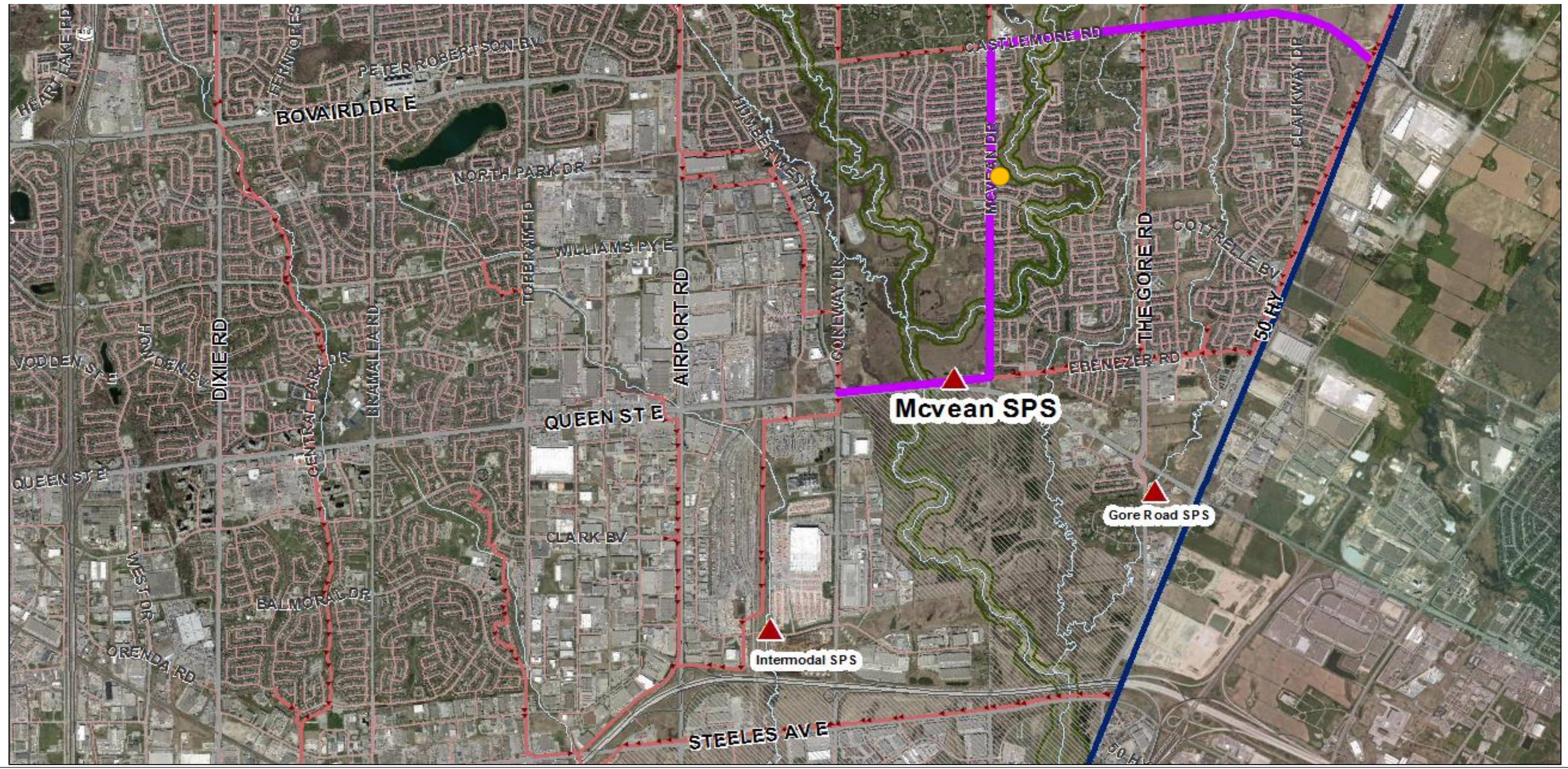
- Option 1c: Castlemore - Goreway - Queen/Goreway
- Option 1d: Castlemore - Airport - Auction Ln

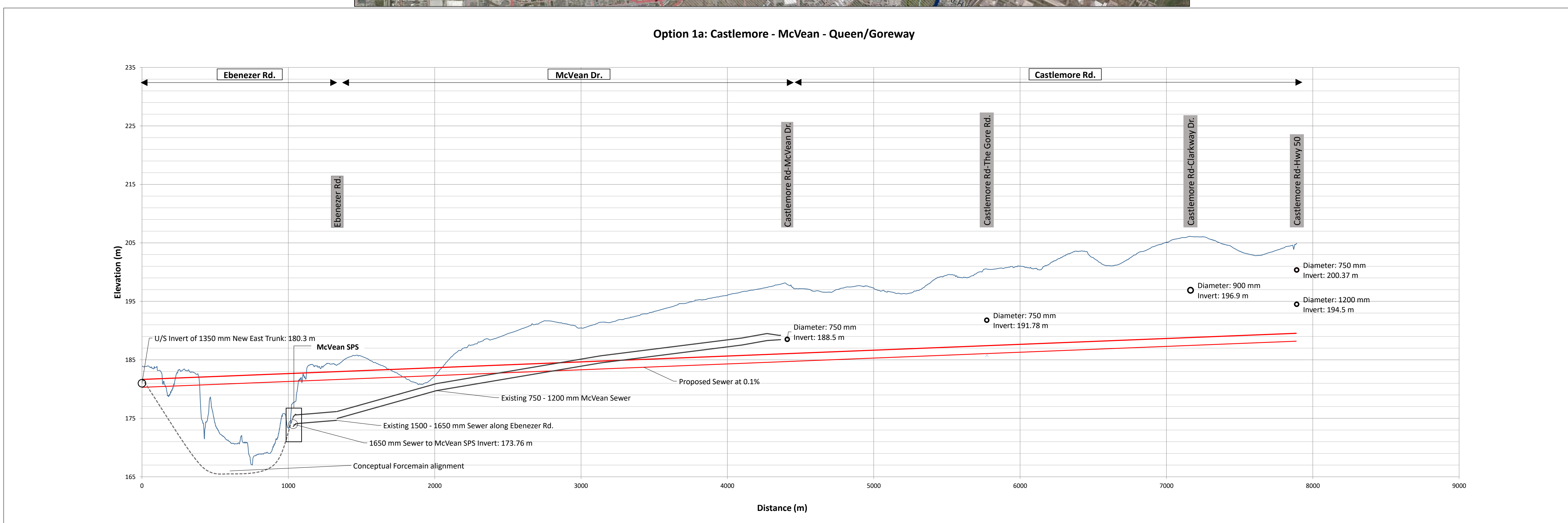
Lifecycle cost analysis determined that Servicing Alternative 2 (By-pass McVean SPS with new Gravity Sewer) resulted in the lowest operation and maintenance cost, as well as lowest net present value when compare to Servicing Alternative 1 (New SPS).

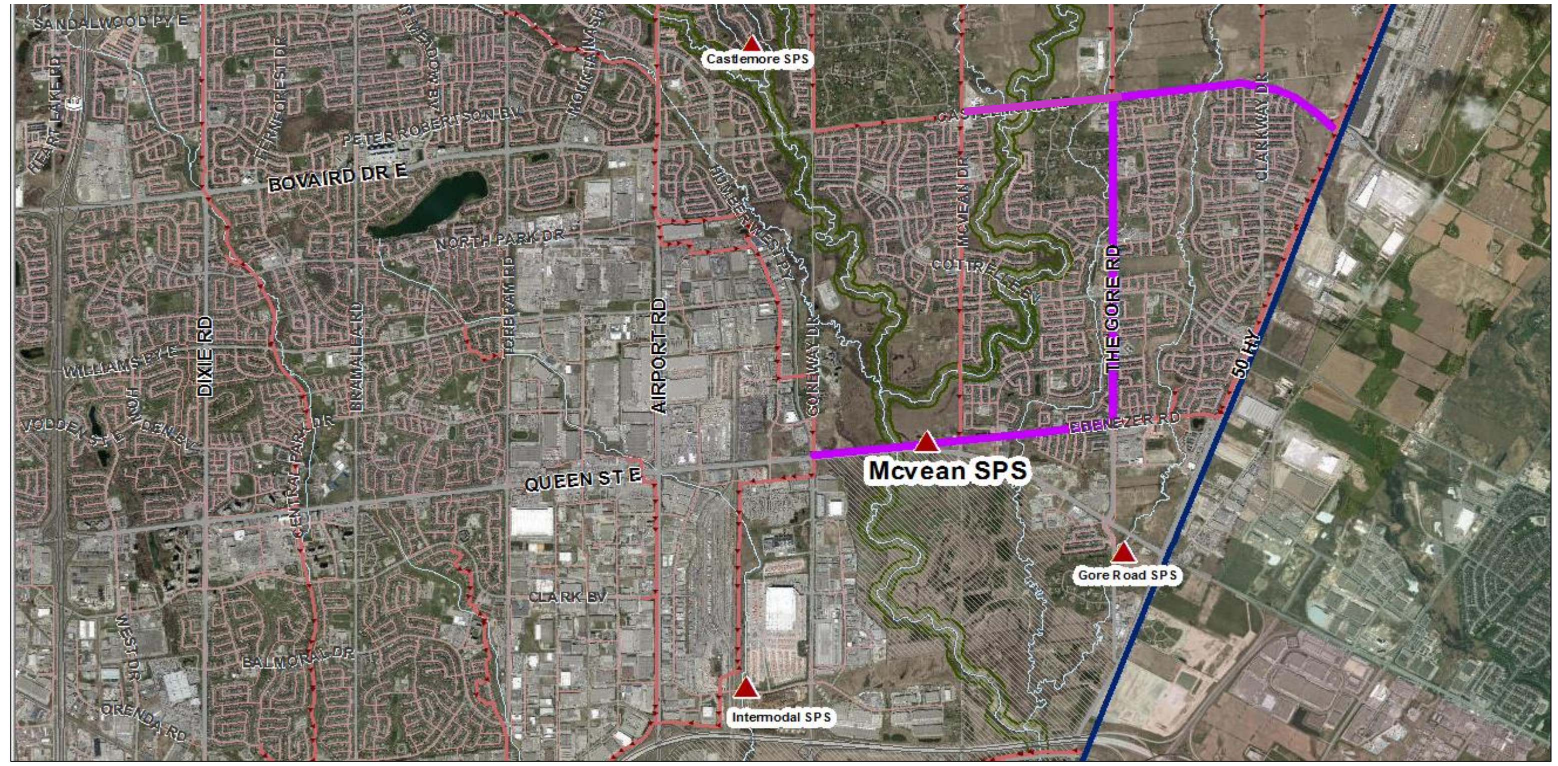
Servicing Alternative 2 Option 1c (Castlemore - Goreway - Queen/Goreway) presented the lowest cost among the two by-pass options analyzed. However, it is recognized that the Goreway Drive alignment might be constrained due to the significant amounts of other infrastructure such as watermains and utilities along this road.

It is recommended that **Option 1d (Castlemore - Airport - Auction Ln)** is carried forward as the preferred servicing alternative for the McVean SPS due to its potential to integrate with the Region's Buildout Servicing Strategy that requires a new gravity trunk sewer along Airport Rd. Further review of Preferred Implementation Option (construction of 900 mm Forcemain vs accelerating the timing of the By-pass sewer) will be required.

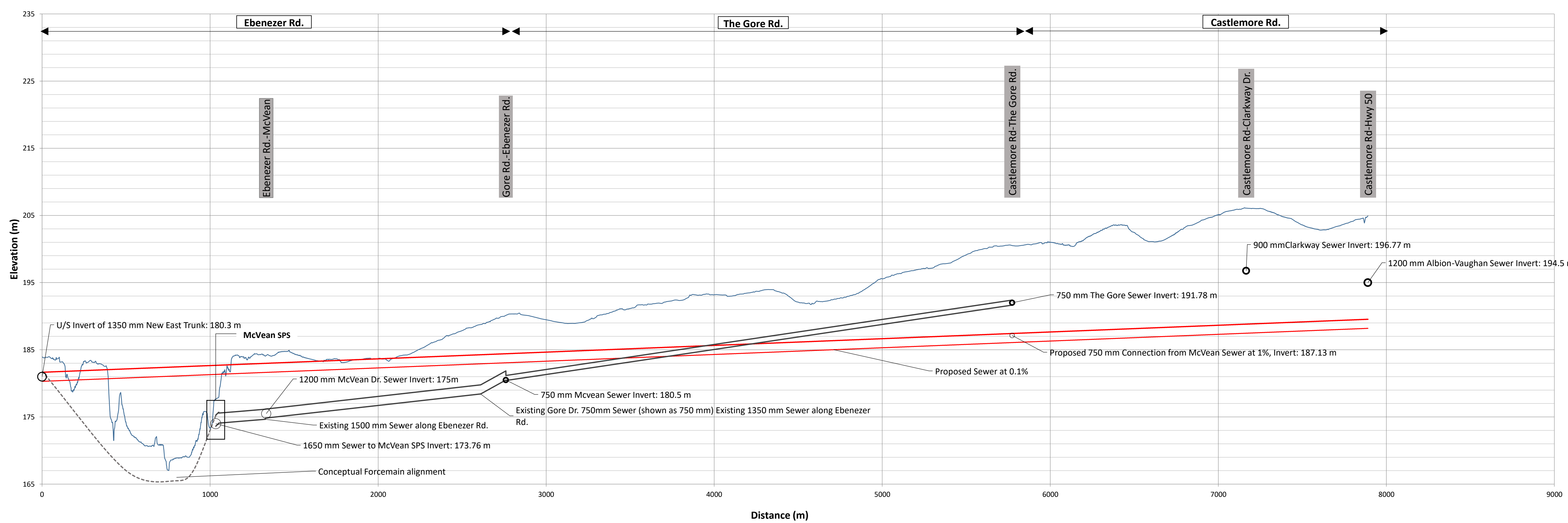
Appendix A – By-pass Options Profiles

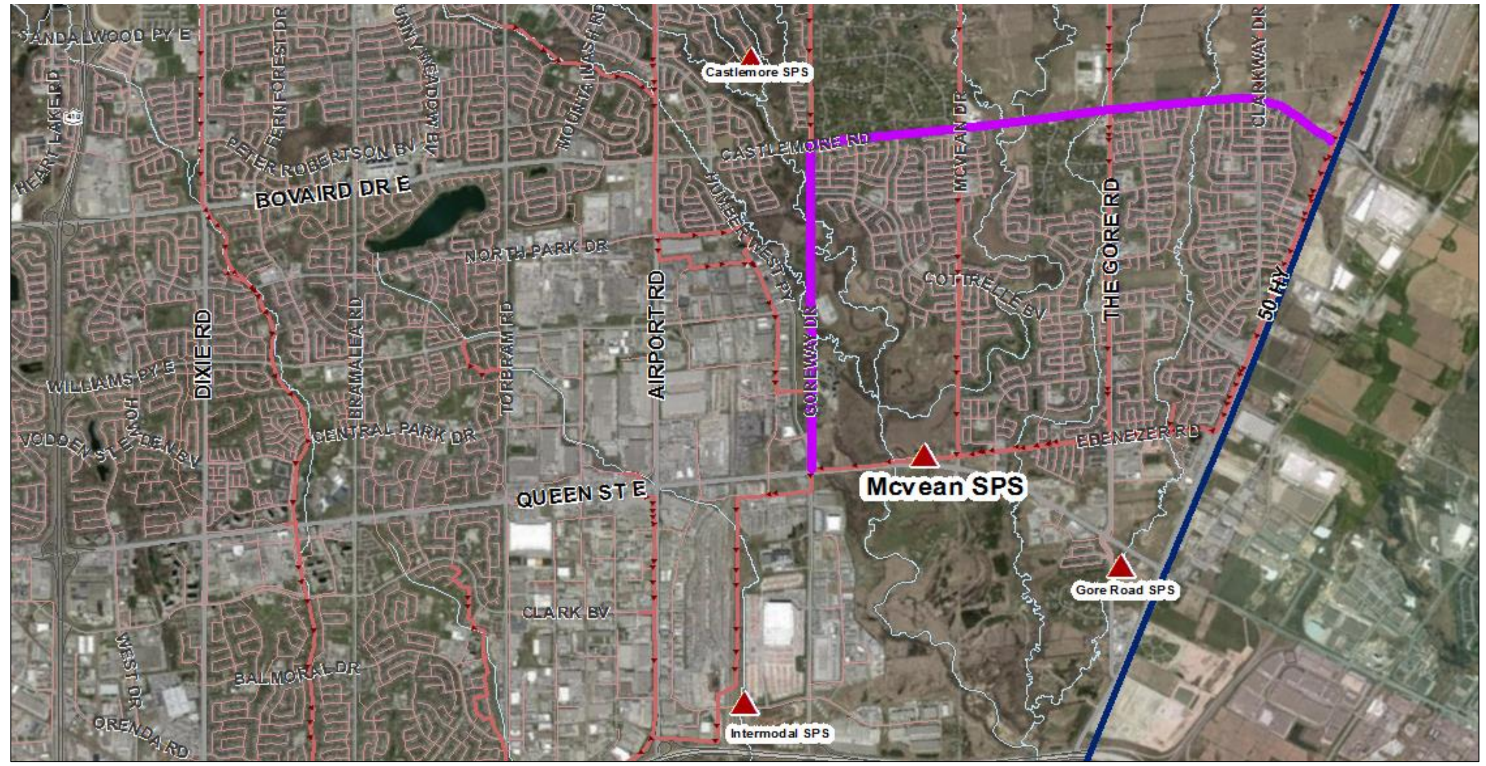

BOVAIRD DR E
QUEEN ST E
DIXIE RD
AIRPORT RD
THE GORE RD
STEELES AVE
Mcvean SPS
Gore Road SPS
Intermodal SPS


Option 1a: Castlemore - McVean - Queen/Goreway
Ebenezer Rd.
McVean Dr.
Castlemore Rd.
Ebenezer Rd.
Castlemore Rd-McVean Dr.
Castlemore Rd-The Gore Rd.
Castlemore Rd-Clarkway Dr.
Castlemore Rd-Hwy 50
Diameter: 750 mm
Invert: 200.37 m
Diameter: 900 mm
Invert: 196.9 m
Diameter: 1200 mm
Invert: 194.5 m
Diameter: 750 mm
Invert: 191.78 m
Diameter: 750 mm
Invert: 188.5 m
U/S Invert of 1350 mm New East Trunk: 180.3 m
McVean SPS
Proposed Sewer at 0.1%
Existing 750 - 1200 mm McVean Sewer
Existing 1500 - 1650 mm Sewer along Ebenezer Rd.
1650 mm Sewer to McVean SPS Invert: 173.76 m
Conceptual Forcemain alignment
Elevation (m)
Distance (m)
235
225
215
205
195
185
175
165
0
1000
2000
3000
4000
5000
6000
7000
8000
9000

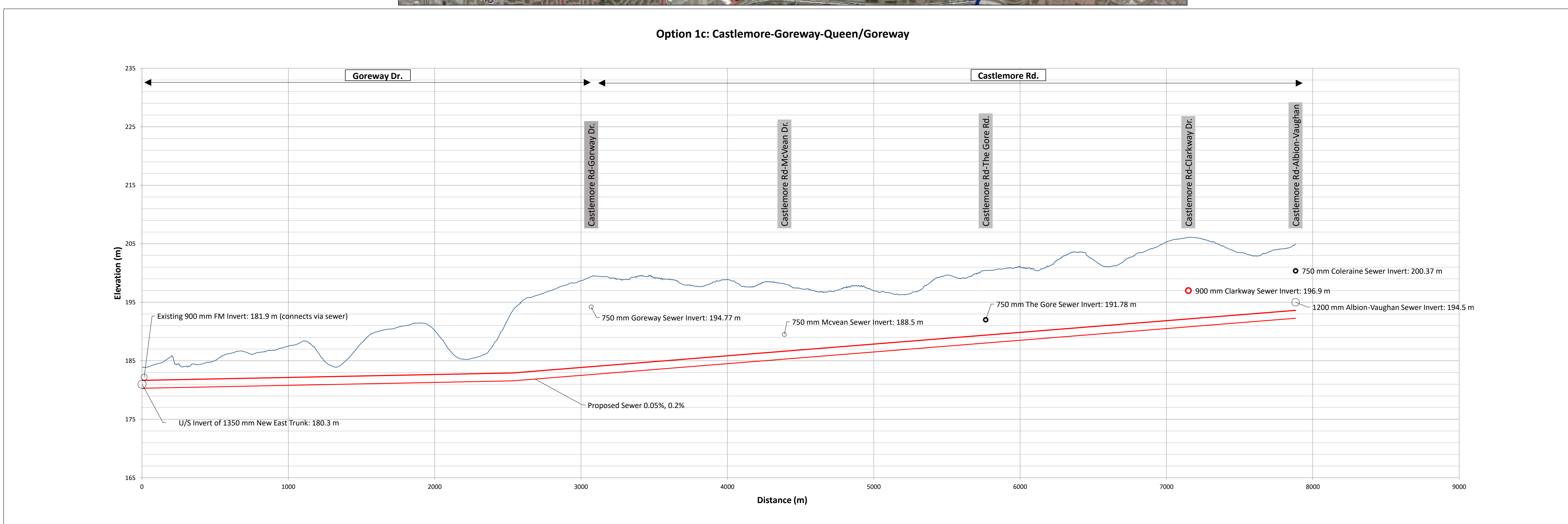


Option 1b: Castlemore - The Gore - Queen/Goreway

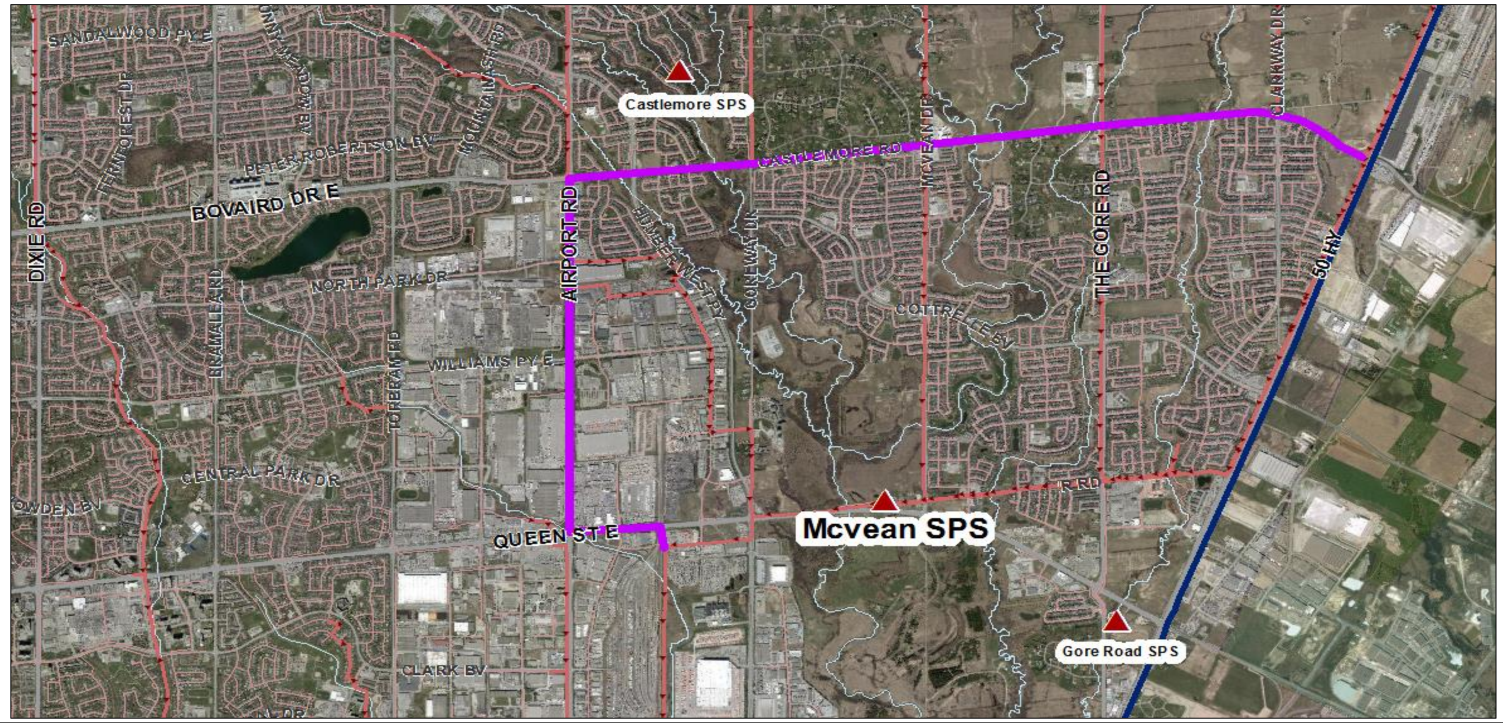




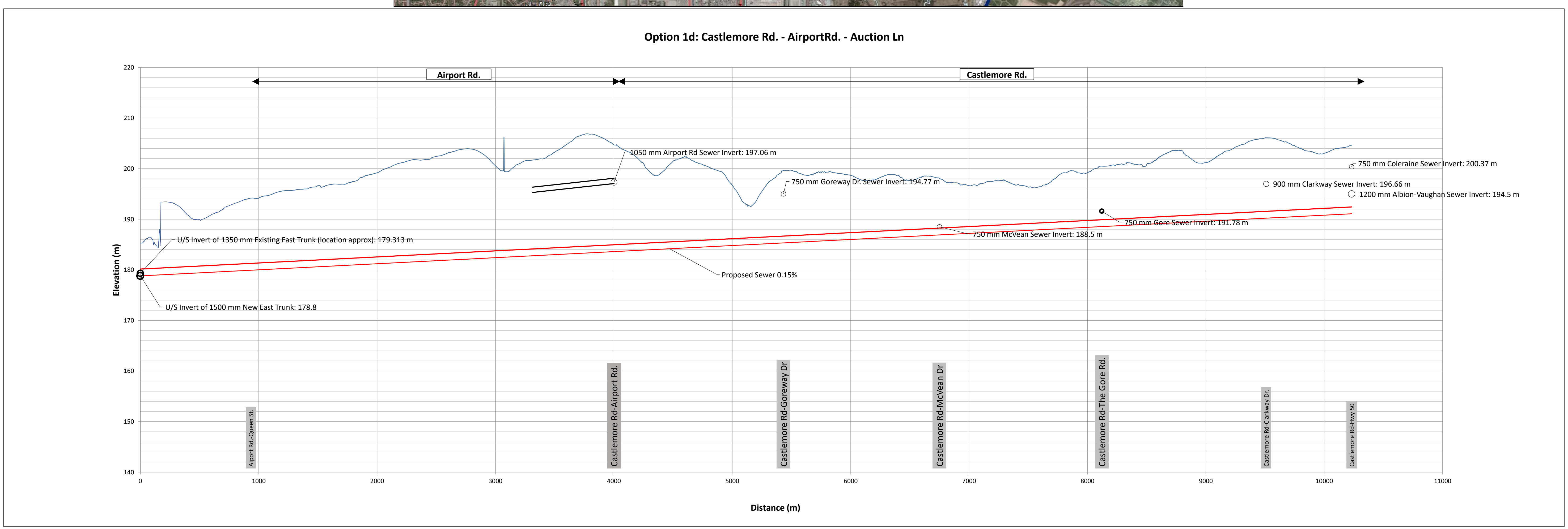
Castlemore SPS
CASTLEMORE RD
BOVAIRD DR E
NORTH PARK DR
AIRPORT RD
DIXIE RD
WILLIAMS PY E
QUEEN ST E
CENTRAL PARK DR
CLARK BV
BALMORAL DR
GOREWAY DR
MCVEAN DR
THE GORE RD
CLARKWAY DR
COTTRELLE BV
EBENEZER RD
50 HY
Mcvean SPS
Gore Road SPS
Intermodal SPS



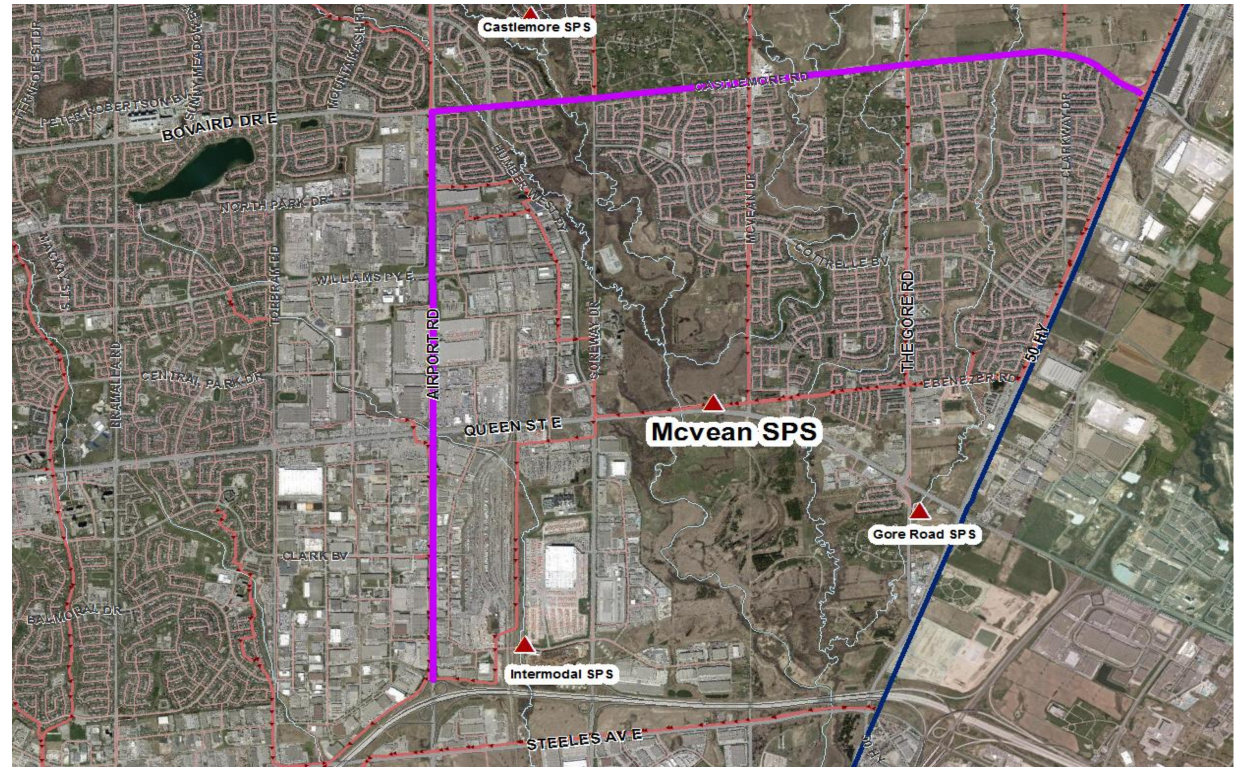
Option 1c: Castlemore-Goreway-Queen/Goreway
Goreway Dr.
Castlemore Rd.
Castlemore Rd-Gorway Dr.
Castlemore Rd-McVean Dr.
Castlemore Rd-The Gore Rd.
Castlemore Rd-Clarkway Dr.
Castlemore Rd-Albion-Vaughan
750 mm Coleraine Sewer Invert: 200.37 m
900 mm Clarkway Sewer Invert: 196.9 m
750 mm The Gore Sewer Invert: 191.78 m
1200 mm Albion-Vaughan Sewer Invert: 194.5 m
750 mm Goreway Sewer Invert: 194.77 m
750 mm Mcvean Sewer Invert: 188.5 m
Existing 900 mm FM Invert: 181.9 m (connects via sewer)
Proposed Sewer 0.05%, 0.2%
U/S Invert of 1350 mm New East Trunk: 180.3 m
Elevation (m)
Distance (m)
235
225
215
205
195
185
175
165
0
1000
2000
3000
4000
5000
6000
7000
8000
9000

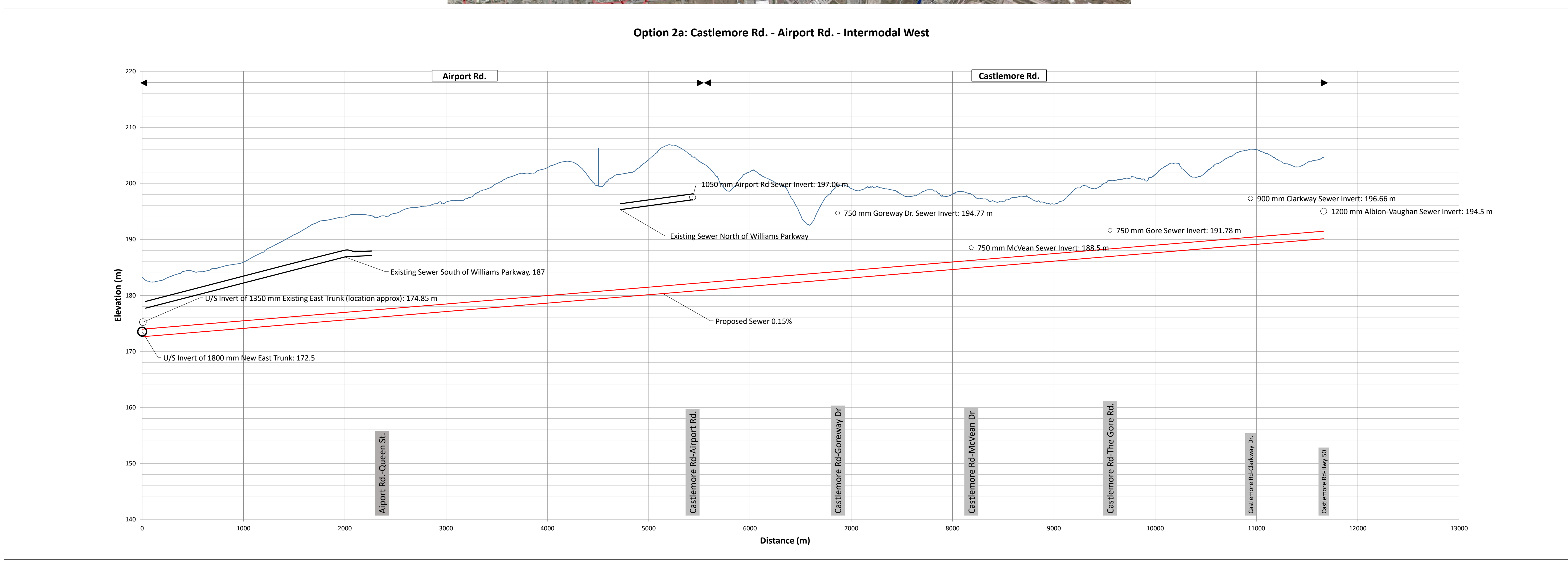


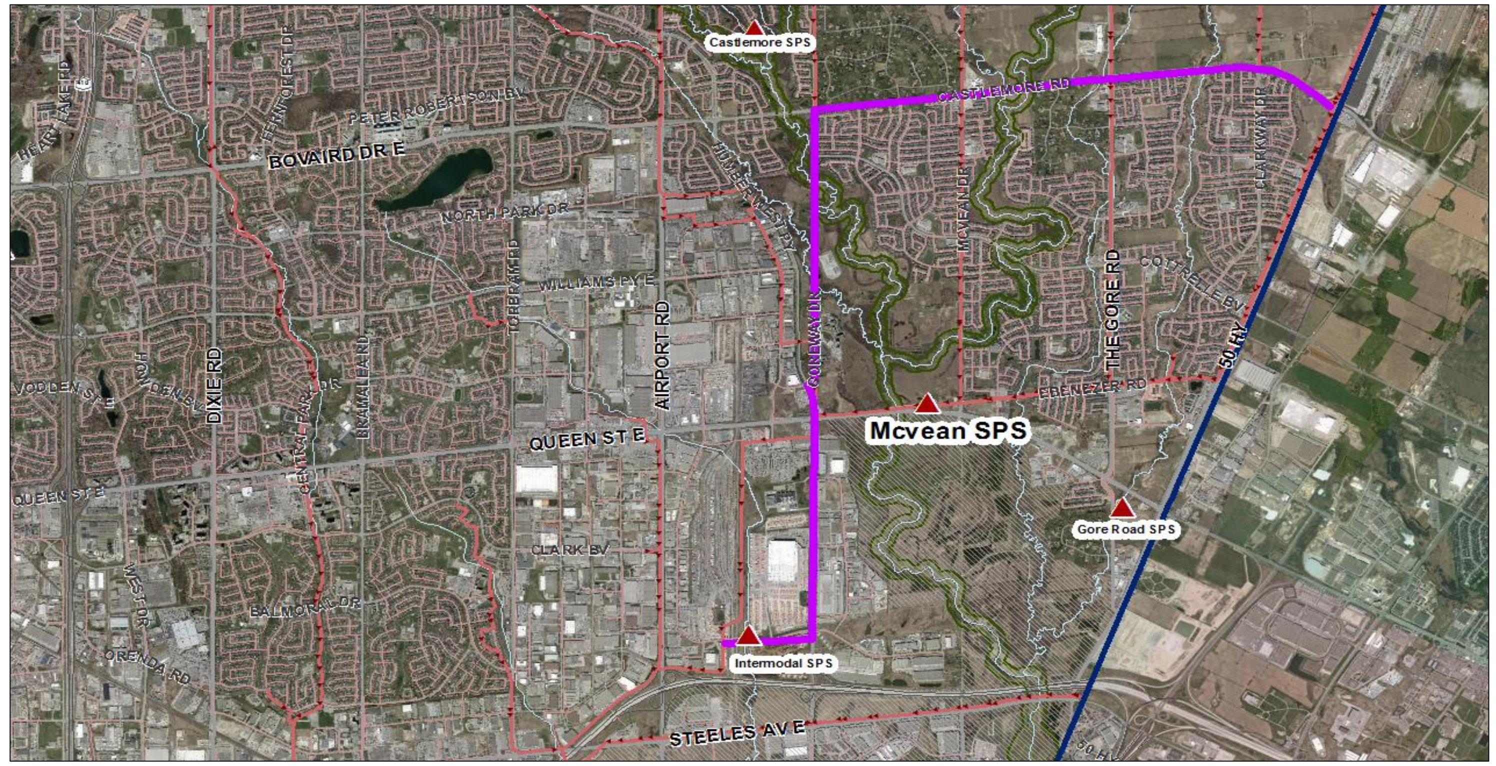
Castlemore SPS
BOVAIRD DR E
DIXIE RD
AIRPORT RD
THE GORE RD
NORTH PARK DR
WILLIAMS PY E
CENTRAL PARK DR
QUEEN ST E
Mcvean SPS
Gore Road SPS
CLARK BV
50 HY

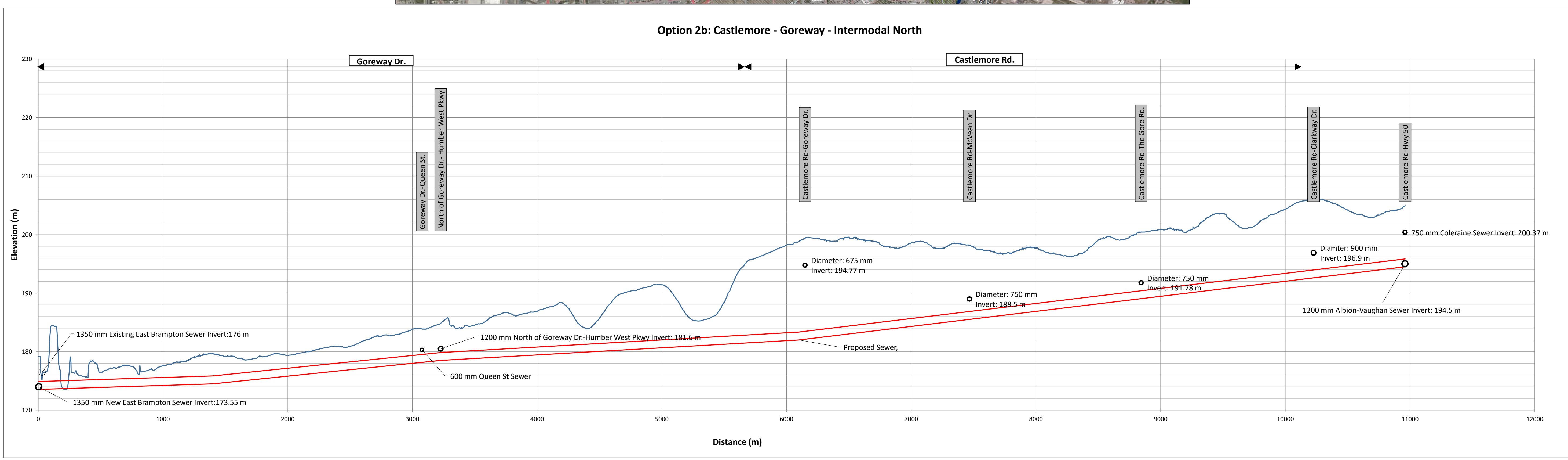


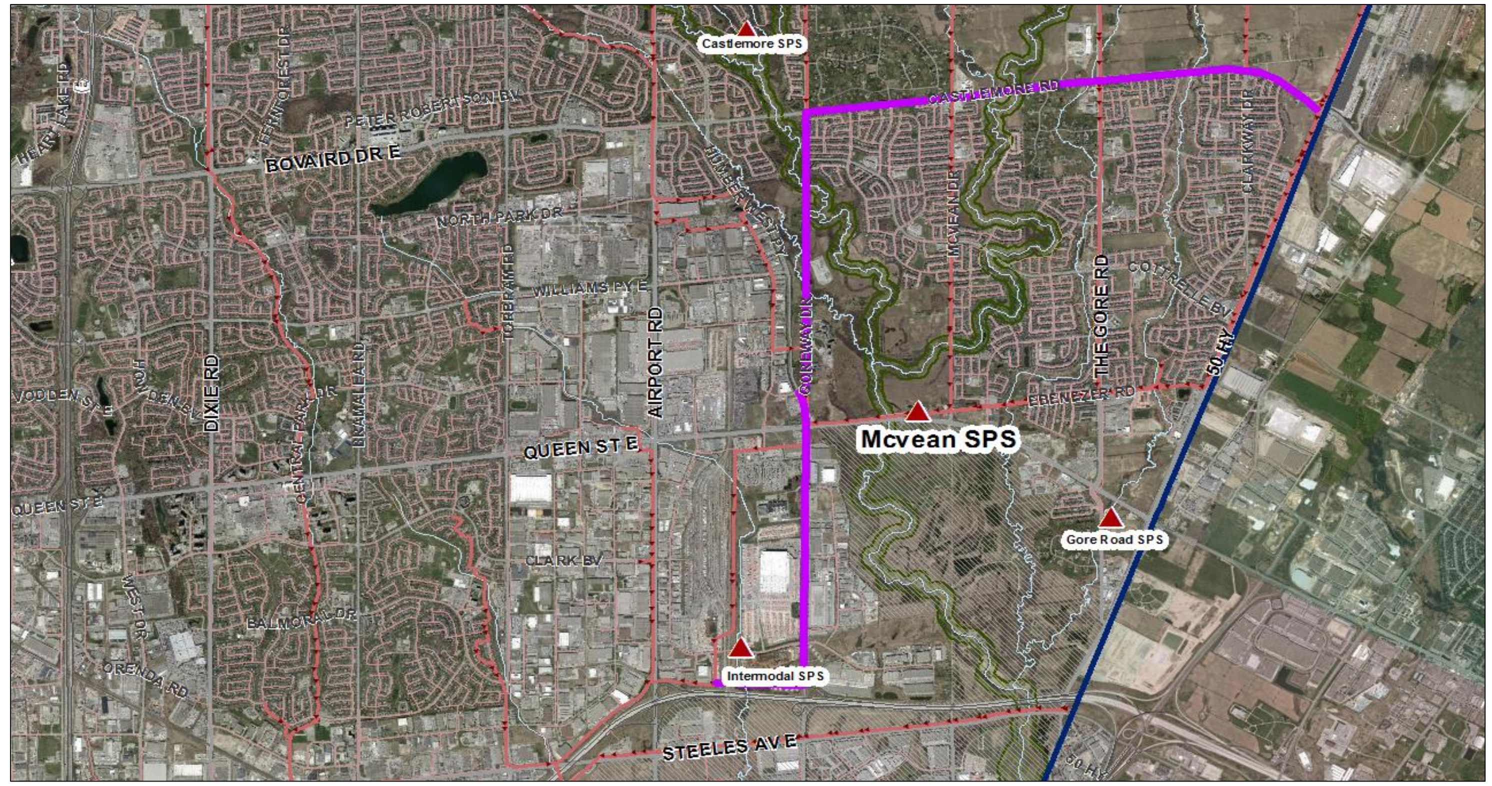
Option 1d: Castlemore Rd. - AirportRd. - Auction Ln
Airport Rd.
Castlemore Rd.
1050 mm Airport Rd Sewer Invert: 197.06 m
750 mm Goreway Dr. Sewer Invert: 194.77 m
750 mm Coleraine Sewer Invert: 200.37 m
900 mm Clarkway Sewer Invert: 196.66 m
1200 mm Albion-Vaughan Sewer Invert: 194.5 m
750 mm Gore Sewer Invert: 191.78 m
750 mm McVean Sewer Invert: 188.5 m
U/S Invert of 1350 mm Existing East Trunk (location approx): 179.313 m
Proposed Sewer 0.15%
U/S Invert of 1500 mm New East Trunk: 178.8
Elevation (m)
Distance (m)
Airport Rd.-Queen St.
Castlemore Rd-Airport Rd.
Castlemore Rd-Goreway Dr
Castlemore Rd-McVean Dr
Castlemore Rd-The Gore Rd.
Castlemore Rd-Clarkway Dr.
Castlemore Rd-Hwy 50
220
210
200
190
180
170
160
150
140
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000

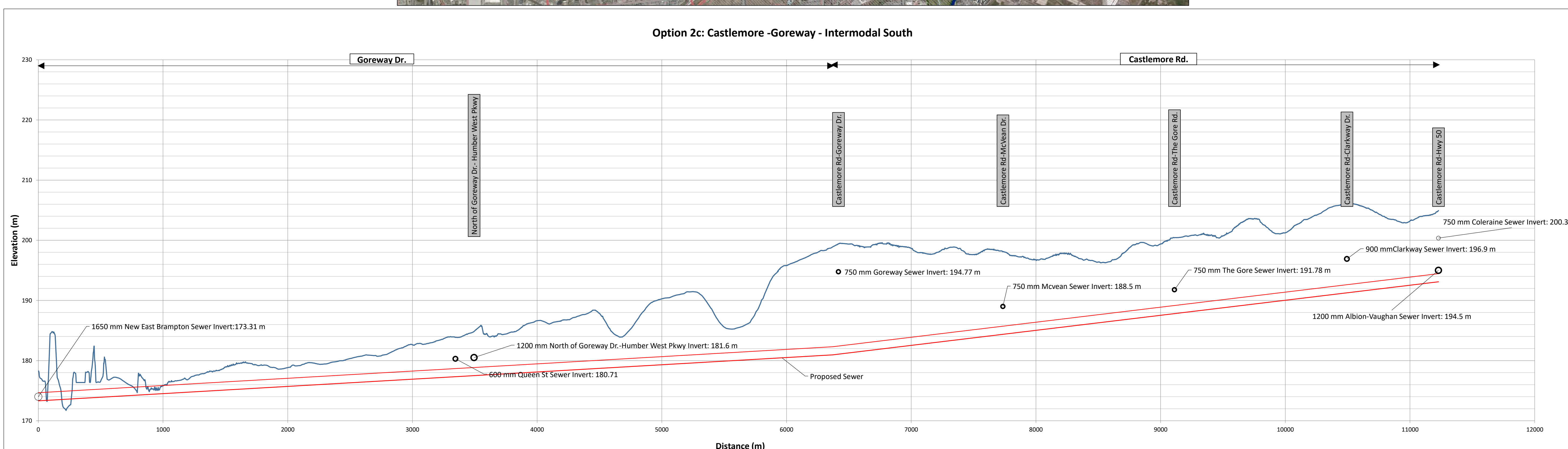

Castlemore SPS
BOVAIRD DR E
AIRPORT RD
QUEEN ST E
Mcvean SPS
THE GORE RD
Gore Road SPS
Intermodal SPS
STEELES AV E

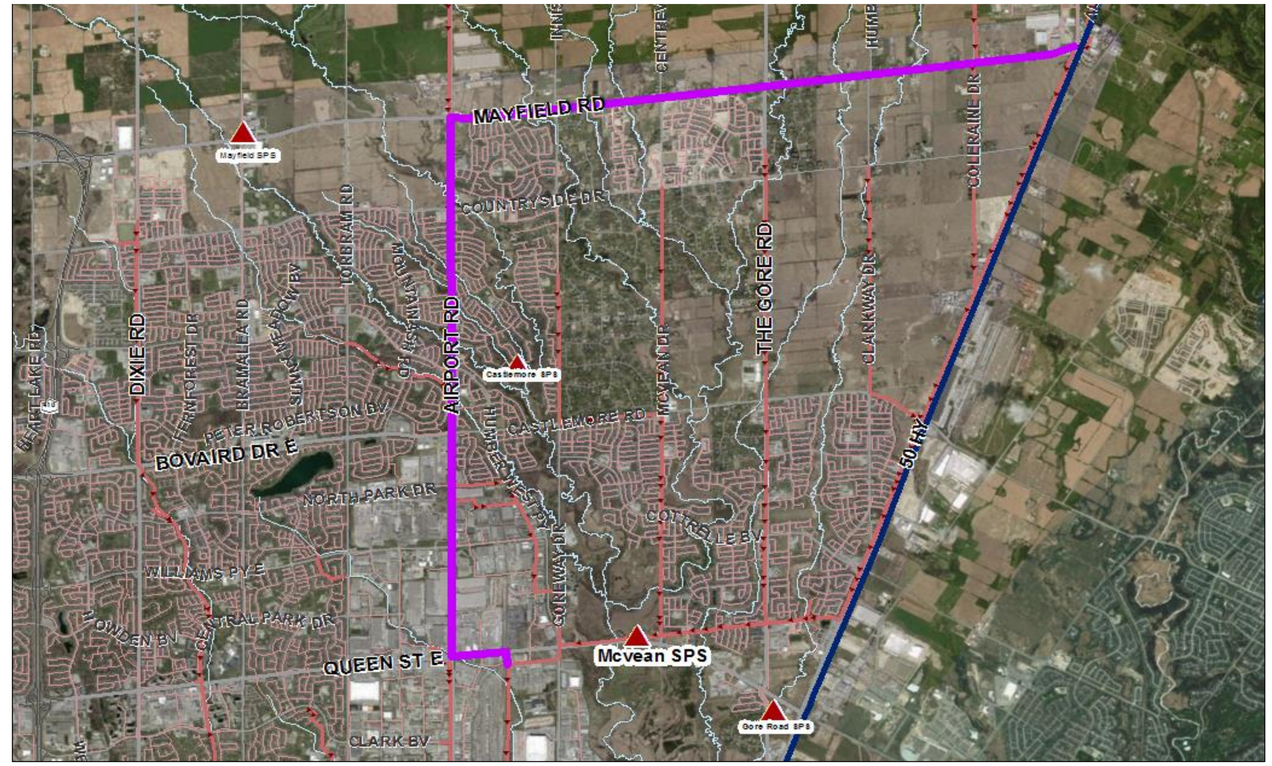

Option 2a: Castlemore Rd. - Airport Rd. - Intermodal West
Airport Rd.
Castlemore Rd.
1050 mm Airport Rd Sewer Invert: 197.06 m
900 mm Clarkway Sewer Invert: 196.66 m
1200 mm Albion-Vaughan Sewer Invert: 194.5 m
750 mm Goreway Dr. Sewer Invert: 194.77 m
750 mm Gore Sewer Invert: 191.78 m
750 mm McVean Sewer Invert: 188.5 m
Existing Sewer North of Williams Parkway
Existing Sewer South of Williams Parkway, 187
U/S Invert of 1350 mm Existing East Trunk (location approx): 174.85 m
Proposed Sewer 0.15%
U/S Invert of 1800 mm New East Trunk: 172.5
Elevation (m)
Distance (m)
Aiport Rd.-Queen St.
Castlemore Rd-Airport Rd.
Castlemore Rd-Goreway Dr
Castlemore Rd-McVean Dr
Castlemore Rd-The Gore Rd.
Castlemore Rd-Clarkway Dr.
Castlemore Rd-Hwy 50
220
210
200
190
180
170
160
150
140
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000

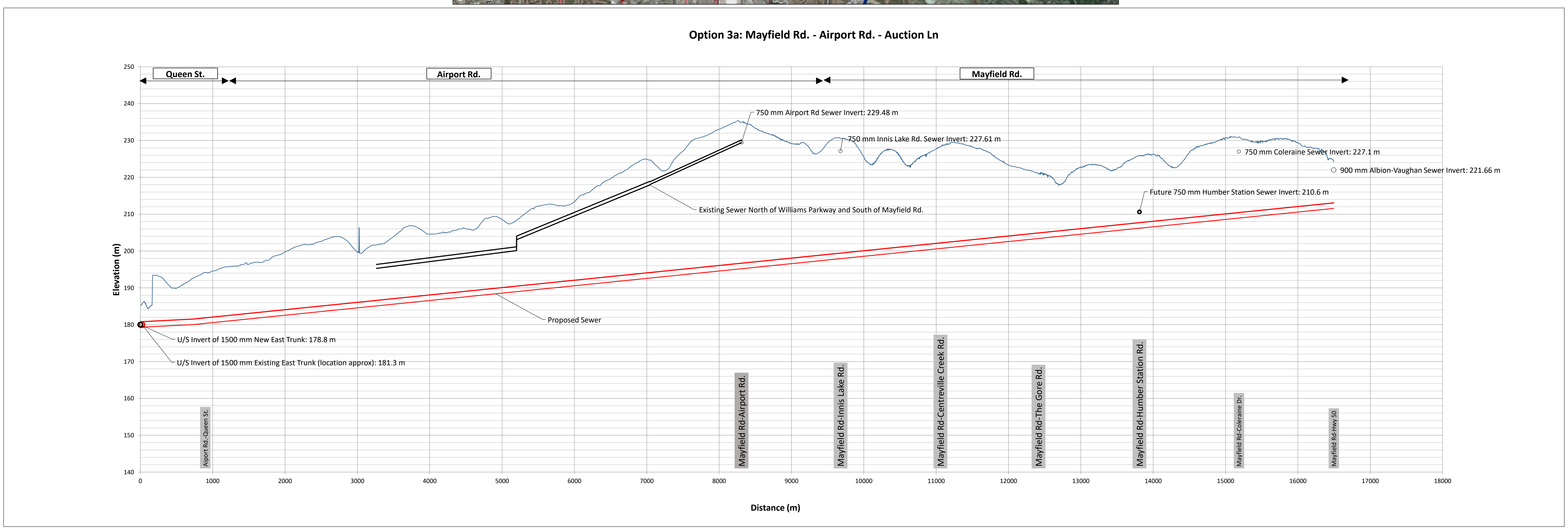

Castlemore SPS
CASTLEMORE RD
BOVAIRD DR E
PETER ROBERTSON BV
NORTH PARK DR
WILLIAMS PY E
AIRPORT RD
DIXIE RD
QUEEN ST E
THE GORE RD
EBENEZER RD
50 HY
Mcvean SPS
Gore Road SPS
Intermodal SPS
CLARK BV
BALMORAL DR
ORENDA RD
STEELES AVE E

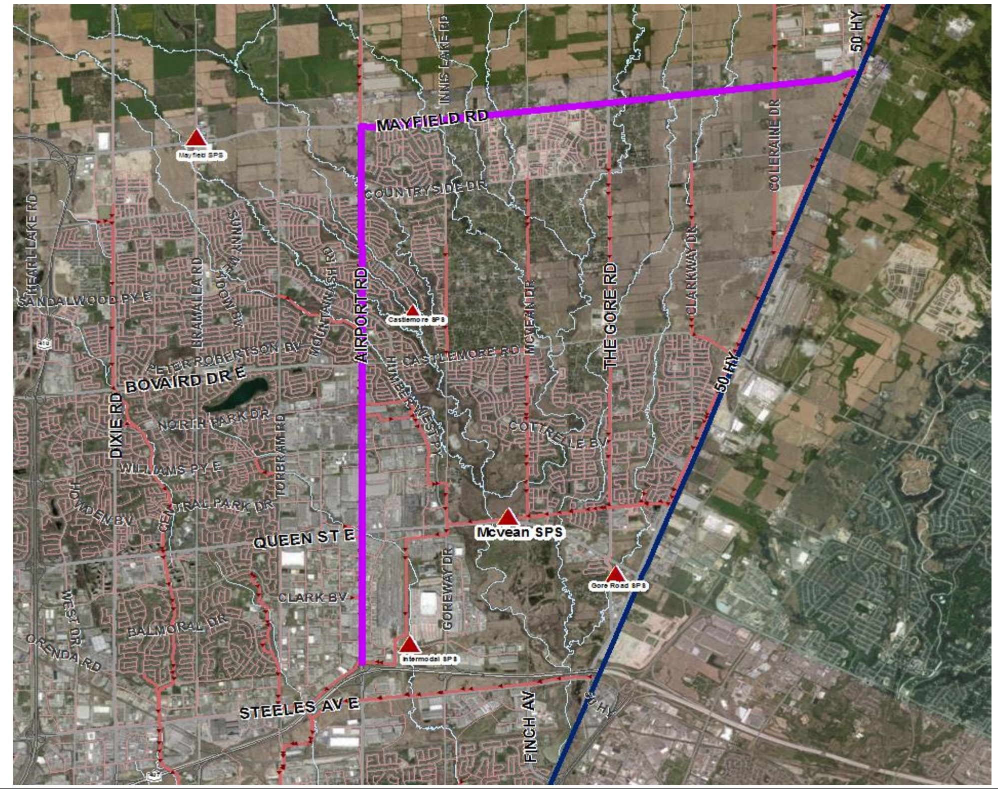

Option 2b: Castlemore - Goreway - Intermodal North
Goreway Dr.
Castlemore Rd.
Goreway Dr.-Queen St.
North of Goreway Dr.- Humber West Pkwy
Castlemore Rd-Goreway Dr.
Castlemore Rd-McVean Dr.
Castlemore Rd-The Gore Rd.
Castlemore Rd-Clarkway Dr.
Castlemore Rd-Hwy 50
Elevation (m)
Distance (m)
230
220
210
200
190
180
170
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
1350 mm Existing East Brampton Sewer Invert:176 m
1350 mm New East Brampton Sewer Invert:173.55 m
600 mm Queen St Sewer
1200 mm North of Goreway Dr.-Humber West Pkwy Invert: 181.6 m
Proposed Sewer,
Diameter: 675 mm
Invert: 194.77 m
Diameter: 750 mm
Invert: 188.5 m
Diameter: 750 mm
Invert: 191.78 m
Diameter: 900 mm
Invert: 196.9 m
750 mm Coleraine Sewer Invert: 200.37 m
1200 mm Albion-Vaughan Sewer Invert: 194.5 m


Castlemore SPS
Mcvean SPS
Gore Road SPS
Intermodal SPS
BOVAIRD DR E
QUEEN ST E
STEELES AV E
DIXIE RD
AIRPORT RD
THE GORE RD
NORTH PARK DR
WILLIAMS PKY
CLARK BV
EBENEZER RD
50 HY

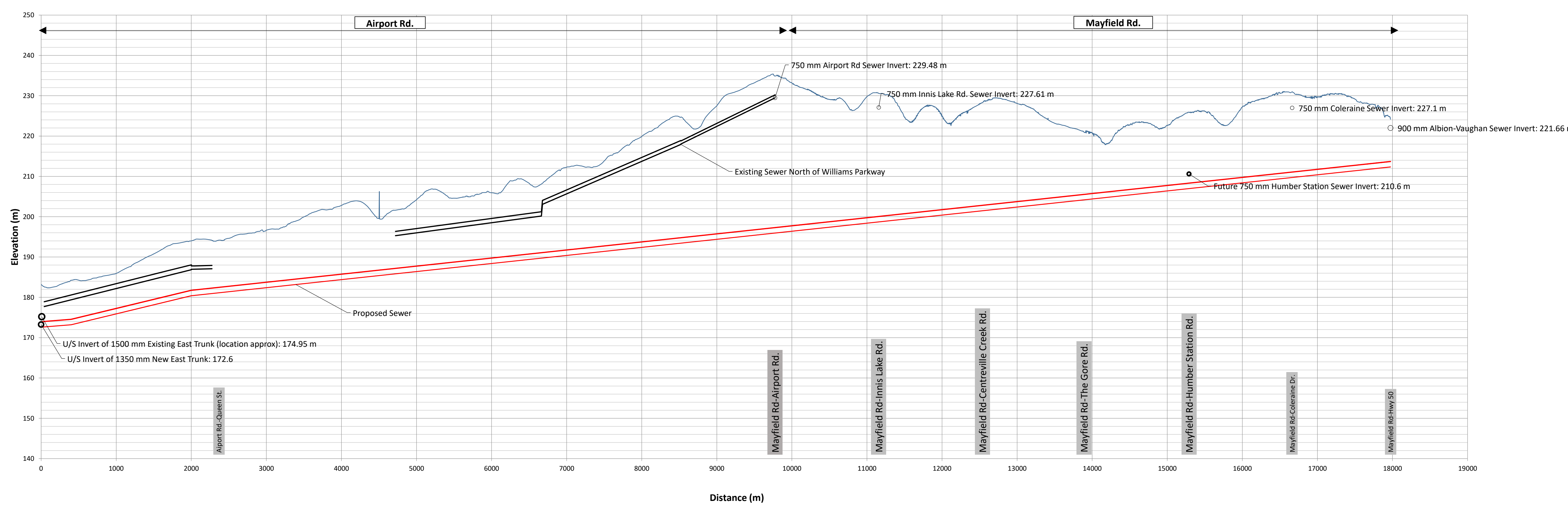

Option 2c: Castlemore -Goreway - Intermodal South
Goreway Dr.
Castlemore Rd.
North of Goreway Dr.- Humber West Pkwy
Castlemore Rd-Goreway Dr.
Castlemore Rd-McVean Dr.
Castlemore Rd-The Gore Rd.
Castlemore Rd-Clarkway Dr.
Castlemore Rd-Hwy 50
750 mm Coleraine Sewer Invert: 200.37 m
900 mmClarkway Sewer Invert: 196.9 m
750 mm The Gore Sewer Invert: 191.78 m
750 mm Goreway Sewer Invert: 194.77 m
750 mm Mcvean Sewer Invert: 188.5 m
1200 mm Albion-Vaughan Sewer Invert: 194.5 m
1650 mm New East Brampton Sewer Invert:173.31 m
1200 mm North of Goreway Dr.-Humber West Pkwy Invert: 181.6 m
600 mm Queen St Sewer Invert: 180.71
Proposed Sewer
Elevation (m)
Distance (m)
230
220
210
200
190
180
170
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000


MAYFIELD RD
Mayfield SPS
DIXIE RD
AIRPORT RD
BOVAIRD DR E
NORTH PARK DR
COUNTRYSIDE DR
Castlemore SPS
CASTLEMORE RD
THE GORE RD
COLERAINE DR
50 HWY
QUEEN ST E
Mcvean SPS
Gore Road SPS
CLARK BV


Option 3a: Mayfield Rd. - Airport Rd. - Auction Ln
Queen St.
Airport Rd.
Mayfield Rd.
Elevation (m)
Distance (m)
750 mm Airport Rd Sewer Invert: 229.48 m
750 mm Innis Lake Rd. Sewer Invert: 227.61 m
750 mm Coleraine Sewer Invert: 227.1 m
900 mm Albion-Vaughan Sewer Invert: 221.66 m
Future 750 mm Humber Station Sewer Invert: 210.6 m
Existing Sewer North of Williams Parkway and South of Mayfield Rd.
Proposed Sewer
U/S Invert of 1500 mm New East Trunk: 178.8 m
U/S Invert of 1500 mm Existing East Trunk (location approx): 181.3 m
Airport Rd.-Queen St.
Mayfield Rd-Airport Rd.
Mayfield Rd-Innis Lake Rd.
Mayfield Rd-Centreville Creek Rd.
Mayfield Rd-The Gore Rd.
Mayfield Rd-Humber Station Rd.
Mayfield Rd-Coleraine Dr.
Mayfield Rd-Hwy 50
250
240
230
220
210
200
190
180
170
160
150
140
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
15000
16000
17000
18000



Option 3b: Mayfield Rd. - Airport Rd. - Intermodal West



Appendix B – Cost Estimates

McVean Graivty By-Pass Cost Estimate

ASSUMPTIONS

Microtunnel			
Microtunnelnel Sewer Costs - 1500 mm	$	5,000	$/m length
Microtunnelnel Sewer Costs - 750 mm	$	3,000	$/m length
Open Cut Sewer Costs - 1350 mm	$	2,500	$/m length
Shafts			
0-10 m	$	35,000	/m
10+ m	$	50,000	/m
Shafts within Creeks		200%	Access Premium
Shaft Spacing	~700-1000		m
TBM - 2400mm			
Shafts			
0-10 m	$	70,000	/m
10+ m	$	100,000	/m
Sewer			
Tunnelling Costs	$	10,000	/m
Shaft Spacing	1000 - 2000 m		

PROPERTY COSTS			
Low Density	$	600,000	$/acre
Apartment	$	2,000,000	$/acre
Industrial	$	850,000	$/acre
Commercial	$	1,500,000	$/acre
Permanent Easement, 50% of the acreage rate is assumed		50%	/acre
Temp. Easement, 10% of the rate per year was assumed based on 2 years		10%	/acre /2 years
Land Contingency Cost		15%	

Temporary Easements - assumed 50 m x 50 m (0.618 acres) for 2 years
Permanent Easements - assumed 10 m x 50 m (0.124 acres)

General Construction Contingency	25%
Engineering (as % of Base Construction Cost)	10%

SPS Property	Assume 1 ha (2.47 acres) Temporary	2.47	$	419,900
	Assume 0.5 ha (1.23 acres) Purchased	1.23	$	1,045,500
Concept 1 Property	Assumed 1/2 of Concept 2 (smaller sites, half distance)		$	-

McVean Upgrades

$	**511,000**	McVean Pump Cost - Master Plan Capital Program
$	**5,153,000**	McVean 900mm Forcemain Cost - Master Plan Capital Program

McVean Graivty By-Pass Cost Estimate

OPTION 1a - Gravity Alignment - Castlemore - McVean- Queen/Goreway

Sewer Installation Method	Manhole /Shaft	Sewer Section		Depth	Distance	Shaft Cost: Unit Cost	Shaft Cost: Shaft Cost	Sewer Cost: Unit Cost	Sewer Cost: Sewer Cost
				(m)	(m)	($/m)			
	1			17		$ 50,000	$ 836,338		
Microtunnel		1	2		726			$ 5,000	$ 3,628,000
	2			19		$ 50,000	$ 931,371		
Microtunnel		2	3		1392			$ 5,000	$ 6,960,000
	3			14		$ 50,000	$ 722,705		
Microtunnel		3	4		1364			$ 5,000	$ 6,817,500
	4			13		$ 100,000	$ 1,316,979		
TBM		4	5		3076			$ 10,000	$ 30,755,000
	5			3		$ 70,000	$ 175,388		
TBM		5	6		1334			$ 10,000	$ 13,340,000
	6			4		$ 70,000	$ 254,158		
					7,891				

Total Cost - Sewer			$ 61,500,500
Total Cost - Shafts		$ 4,236,939	
Subtotal Construction			$ 65,737,439
Construction Contingency	25%		$ 16,434,360
Total Construction Cost			**$ 82,171,798**
Engineering Cost	10%		**$ 6,573,744**
Property Cost			**$ -**
Total Cost - Gravity Option 1a			***$ 88,745,542***

Average per meter construction $ 8,300.00

CONCEPT 1b - Gravity Alignment - Castlemore – The Gore – Queen/Goreway

Sewer Installation Method	Manhole /Shaft	Sewer Section		Depth	Distance	Shaft Cost: Unit Cost	Shaft Cost: Shaft Cost	Sewer Cost: Unit Cost	Sewer Cost: Sewer Cost
				(m)	(m)	($/m)			
	0			17		$ 50,000	$ 836,342.00		
Microtunnel		0	1		724.6184181			$ 5,000	$ 3,623,092
	1			19		$ 50,000	$ 930,935		
Microtunnel		1	2		1392.39			$ 5,000	$ 6,961,950
	2			14		$ 100,000	$ 1,444,338		
TBM		2	3		3013.51			$ 10,000	$ 30,135,100
	3			7		$ 70,000	$ 492,248		
TBM		3	4		2760			$ 10,000	$ 27,600,000
	4			4		$ 70,000	$ 254,158		
Microtunnel (McVean to Gore)	6			10		$ 50,000	$ 475,000		
		6	3		1375			$ 5,000	$ 6,875,000
	3								
					9,266				

Total Cost - Sewer			$ 75,195,142
Total Cost - Shafts		$ 4,433,020	
Subtotal			$ 79,628,162
Construction Contingency	25%		$ 19,907,000
Total Construction Cost			**$ 99,535,162**
Engineering Cost	10%		**$ 7,962,816**
Property Cost			
Total Cost - Gravity Option 1b			***$ 107,497,979***

McVean Graivty By-Pass Cost Estimate

OPTION 1c - Gravity Alignment - Castlemore - Goreway - Queen/Goreway

Sewer Installation Method	Manhole /Shaft	Sewer Section		Depth	Distance	Shaft Cost		Sewer Cost	
						Unit Cost	Shaft Cost	Unit Cost	Sewer Cost
				(m)	(m)	($/m)			
	1			12		$ 50,000	$ 595,500		
Microtunnel		1	2		733			$ 5,000	$ 3,663,000
	2			14		$ 50,000	$ 708,000		
Microtunnel		2	3		1,385			$ 5,000	$ 6,925,000
	3			11		$ 50,000	$ 529,235		
Microtunnel		3	4		1,376			$ 5,000	$ 6,880,000
	4			10		$ 50,000	$ 515,581		
Microtunnel		4	5		1,320			$ 5,000	$ 6,600,000
	5			14		$ 100,000	$ 1,357,368		
TBM		5	6		2,326			$ 10,000	$ 23,260,000
	6			5		$ 70,000	$ 383,126		
TBM		6	7		743			$ 10,000	$ 7,430,000
	7			4		$ 70,000	$ 248,958		
TBM									
					7,883				
	Total Cost - Sewer								$ 54,758,000
	Total Cost - Shafts						$ 4,337,768		
	Subtotal Construction Cost								*$ 59,095,768*
	Construction Contingency			25%					$ 14,774,000
	Total Construction Cost								**$ 73,869,768**
	Engineering Cost			10%					**$ 5,909,577**
	Property Cost								**$ -**
	Total Cost - Gravity Alingment Option 1c								***$ 79,779,345***

OPTION 1d - Gravity Alignment - Airport Rd. - Auction Ln

Sewer Installation Method	Manhole /Shaft	Sewer Section		Depth	Distance	Shaft Cost		Sewer Cost	
						Unit Cost	Shaft Cost	Unit Cost	Sewer Cost
				(m)	(m)	($/m)			
	1			14		$ 50,000	$ 677,902		
Microtunnel		1	2		722			$ 5,000	$ 3,610,000
	2			16		$ 50,000	$ 794,154		
Microtunnel		2	3		1,389			$ 5,000	$ 6,945,000
	3			12		$ 50,000	$ 597,642		
Microtunnel		3	4		1,371			$ 5,000	$ 6,855,000
	4			11		$ 50,000	$ 558,235		
Microtunnel		4	5		1,317			$ 5,000	$ 6,585,000
	5			14		$ 50,000	$ 716,209		
Microtunnel		5	6		1,432			$ 5,000	$ 7,160,000
	6			21		$ 100,000	$ 2,108,314		
TBM		6	7		3,067			$ 10,000	$ 30,670,000
	7			14		$ 100,000	$ 1,425,810		
TBM		7	8		759			$ 10,000	$ 7,590,000
	8			8		$ 70,000	$ 568,636		
TBM		8	9		175			$ 10,000	$ 1,750,000
	9			6		$ 70,000	$ 452,635		
					10,232				
	Total Cost - Sewer								$ 71,165,000
	Total Cost - Shafts						$ 7,899,537		
	Subtotal Construction Cost								*$ 79,064,537*
	Construction Contingency			25%					$ 19,766,000
	Total Construction Cost								**$ 98,830,537**
	Engineering Cost			10%					**$ 7,906,454**
	Property Cost								$ -
	Total Cost - Gravity Alingment Option 1d								***$ 106,736,991***

McVean Graivty By-Pass Cost Estimate

CONCEPT 2a - Gravity Alignment - Castlemore – Airport Rd. - Intermodal West

Sewer Installation Method	Manhole /Shaft	Sewer Section		Depth	Distance	Shaft Cost: Unit Cost	Shaft Cost: Shaft Cost	Sewer Cost: Unit Cost	Sewer Cost: Sewer Cost
				(m)	(m)	($/m)			
	1			15		$ 50,000	$ 726,955		
microtun		0	1		722.79			$ 5,000	$ 3,613,950
	2			17		$ 50,000	$ 853,818		
microtun		1	2		1387			$ 5,000	$ 6,935,000
	3			14		$ 50,000	$ 678,122		
microtun		2	3		1370.2			$ 5,000	$ 6,851,000
	4			13		$ 50,000	$ 659,493		
microtun		4	5		1318.8			$ 5,000	$ 6,594,000
	5			17		$ 50,000	$ 837,242		
microtun		5	6		1432			$ 5,000	$ 7,160,000
	6			24		$ 100,000	$ 2,393,342		
TBM		6	7		1551.63			$ 10,000	$ 15,516,300
	7			23		$ 100,000	$ 2,349,120		
TBM		7	8		1515.37			$ 10,000	$ 15,153,700
	8			18		$ 100,000	$ 1,802,860		
TBM		8	9		2367			$ 10,000	$ 23,670,000
	9			11		$ 100,000	$ 1,062,456		
					11,665				
	Total Cost - Sewer								$ 85,493,950
	Total Cost - Shafts						$ 11,363,408		
	Subtotal								$ 96,857,358
	Construction Contingency			25%					$ 24,214,000
	Total Construction Cost								**$ 121,071,358**
	Engineering Cost			10%					**$ 9,685,736**
	Property Cost								
	Total Cost - Gravity Option 2a								***$ 130,757,094***

CONCEPT 2b - Gravity Alignment - Castlemore - Goreway - Intermodal North

Sewer Installation Method	Manhole /Shaft	Sewer Section		Depth	Distance	Shaft Cost: Unit Cost	Shaft Cost: Shaft Cost	Sewer Cost: Unit Cost	Sewer Cost: Sewer Cost
				(m)	(m)	($/m)			
	1			18		$ 50,000	$ 885,692		
Microtunnel		1	2		734			$ 5,000	$ 3,670,000
	2			20		$ 50,000	$ 994,818		
Microtunnel		2	3		1,383			$ 5,000	$ 6,915,000
	3			16		$ 50,000	$ 808,765		
Microtunnel		3	4		1,376			$ 5,000	$ 6,880,000
	4			17		$ 50,000	$ 874,748		
Microtunnel		4	5		1,319			$ 5,000	$ 6,595,000
	5			20		$ 100,000	$ 1,984,650		
TBM		5	6		3,071			$ 10,000	$ 30,710,000
	6			7		$ 70,000	$ 474,629		
TBM		6	7		2,277			$ 10,000	$ 22,766,950
	7			2		$ 70,000	$ 143,950		
TBM		7	8		801			$ 10,000	$ 8,013,050
	8			6		$ 70,000	$ 393,515		
					10,961				
	Total Cost - Sewer								$ 85,550,000
	Total Cost - Shafts						$ 6,560,768		
	Subtotal Construction Cost								*$ 92,110,768*
	Construction Contingency			25%					$ 23,028,000
	Total Construction Cost								**$ 115,138,768**
	Engineering Cost			10%					**$ 9,211,077**
	Property Cost								**$ -**
	Total Cost - Gravity Option 2b								***$ 124,349,845***

McVean Graivty By-Pass Cost Estimate

CONCEPT 2c - Gravity Alignment - Castlemore -Goreway - Intermodal South

Sewer Installation Method	Manhole /Shaft	Sewer Section		Depth	Distance	Shaft Cost		Sewer Cost	
						Unit Cost	Shaft Cost	Unit Cost	Sewer Cost
				(m)	(m)	($/m)			
	1			11		$ 50,000	$ 536,046		
Microtunnel		1	2		734			$ 5,000	$ 3,670,000
	2			13		$ 50,000	$ 667,023		
Microtunnel		2	3		1,383			$ 5,000	$ 6,915,000
	3			10		$ 50,000	$ 522,636		
Microtunnel		3	4		1,376			$ 5,000	$ 6,880,000
	4			11		$ 50,000	$ 543,393		
Microtunnel		4	5		1,319			$ 5,000	$ 6,595,000
	5			15		$ 100,000	$ 1,480,947		
TBM		5	6		3,071			$ 10,000	$ 30,710,000
	6			7		$ 70,000	$ 457,591		
TBM		6	7		2,544			$ 10,000	$ 25,443,750
	7			3		$ 70,000	$ 219,009		
TBM		7	8		801			$ 10,000	$ 8,013,050
	8			5		$ 70,000	$ 351,843		
					11,229				
	Total Cost - Sewer								$ 88,226,800
	Total Cost - Shafts						$ 4,778,487		
	Subtotal Construction Cost								*$ 93,005,287*
	Construction Contingency			25%					$ 23,251,000
	Total Construction Cost								**$ 116,256,287**
	Engineering Cost			10%					**$ 9,300,529**
	Property Cost								**$ -**
	Total Cost - Gravity Option 2c								***$ 125,556,816***

CONCEPT 3a - Gravity Alignment - Mayfield Rd.-AirportRd.

Sewer Installation Method	Manhole /Shaft	Sewer Section		Depth	Distance	Shaft Cost		Sewer Cost	
						Unit Cost	Shaft Cost	Unit Cost	Sewer Cost
				(m)	(m)	($/m)			
	1			12		$ 50,000	$ 576,254		
microtun		0	1		1311			$ 5,000	$ 6,555,000
	2			20		$ 50,000	$ 1,013,339		
microtun		1	2		1373			$ 5,000	$ 6,865,000
	3			17		$ 50,000	$ 862,749		
microtun		2	3		4133			$ 5,000	$ 20,665,000
	4			28		$ 50,000	$ 1,408,965		
microtun		4	5		1368			$ 5,000	$ 6,840,000
	5			35		$ 100,000	$ 3,453,943		
TBM		5	6		1280			$ 10,000	$ 12,800,000
	6			26		$ 100,000	$ 2,622,953		
TBM		6	7		3075			$ 10,000	$ 30,745,500
	7			11		$ 100,000	$ 1,084,611		
TBM		7	8		3070			$ 10,000	$ 30,702,500
	8			5		$ 70,000	$ 346,845		
TBM		8	9		706			$ 10,000	$ 7,055,000
	9			14		$ 100,000	$ 1,392,953		
TBM		9	10		180			$ 10,000	$ 1,797,000
	10			6		$ 70,000	$ 417,635		
					16,495				
	Total Cost - Sewer								$ 124,025,000
	Total Cost - Shafts						$ 13,180,248		
	Subtotal								$ 137,205,248
	Construction Contingency			25%					$ 34,301,000
	Total Construction Cost								**$ 171,506,248**
	Engineering Cost			10%					**$ 13,720,525**
	Property Cost								
	Total Cost - Gravity Option 3a								***$ 185,226,773***

McVean Graivty By-Pass Cost Estimate

CONCEPT 3b - Gravity Alignment - Mayfield Rd. - AirportRd.

Sewer Installation Method	Manhole /Shaft	Sewer Section		Depth (m)	Distance (m)	Shaft Cost Unit Cost ($/m)	Shaft Cost	Sewer Cost Unit Cost	Sewer Cost
	1			11		$ 50,000	$ 560,673		
microtun		0	1		1311			$ 5,000	$ 6,553,227
	2			20		$ 50,000	$ 997,757		
microtun		1	2		1373			$ 5,000	$ 6,865,000
	3			17		$ 50,000	$ 849,361		
microtun		2	3		4133			$ 5,000	$ 20,666,500
	4			28		$ 50,000	$ 1,393,384		
microtun		4	5		1380			$ 5,000	$ 6,902,000
	5			34		$ 100,000	$ 3,425,805		
TBM		5	6		1272			$ 10,000	$ 12,723,000
	6			26		$ 100,000	$ 2,598,826		
TBM		6	7		3073			$ 10,000	$ 30,730,000
	7			11		$ 100,000	$ 1,058,833		
TBM		7	8		3064			$ 10,000	$ 30,640,000
	8			5		$ 70,000	$ 324,077		
TBM		8	9		2367			$ 10,000	$ 23,670,000
	9			11		$ 100,000	$ 1,062,456		
					17,974				

Total Cost - Sewer							$ 138,749,727
Total Cost - Shafts					$ 12,271,172		
Subtotal							$ 151,020,899
Construction Contingency		25%					$ 37,755,000
Total Construction Cost							**$ 188,775,899**
Engineering Cost		10%					**$ 15,102,090**
Property Cost							
Total Cost - Gravity Option 3b							***$ 203,877,989***

Pump Station and Forcemain Upgrades

Existing SPS - Additional SPS (Capital Project)				$ 511,000
New 900mm Foremain (Capital Project) (900 mm FM #2)				$ 5,153,000
New SPS (estimate by AE, see breakdown)				$ 59,400,000
New 900 mm Force main (900 mm FM #3)				$ 5,153,000
Additional 900mm Forcemain (900 mm FM #4)				$ 5,153,000
Subtotal				$ 75,370,000
Construction Contingency	Included in Capital Program Estimate			
Total Construction Cost	Included in Capital Program Estimate			
Engineering Cost	Included in Capital Program Estimate			
Property Cost	Included in Capital Program Estimate			
Total Cost - CONCEPT 5 - Additional Pump Station and Forcemain				***$ 75,370,000***

4G

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 4G

WWTP Memoranda

Date:	11/20/2019	File:	717010
To:	John Glass		
Prepared by:	Mark Zamojc		
Project:	Water and Wastewater Master Plan Peel WWTP Long Term Loading and Hydraulic Strategy		
Version:	Final – Version 2		

TECHNICAL MEMO

1. Introduction

GM BluePlan is currently undertaking the Region of Peel Water and Wastewater Master Plan Update, which sets the infrastructure strategies to service population and employment growth within the lake-based systems to 2041. As part of the Master Plan, a review of the wastewater treatment plant (WWTP) capacities, flow projections and upgrade requirements was completed.

Throughout the Master Plan, GM BluePlan worked with the Region and CIMA+ to develop and refine the projected hydraulic demands, loading and the upgrade strategy. In order to manage the flows and loadings between the Clarkson WWTP and G.E. Booth WWTP, the East to West Wastewater Diversion (currently under detailed design) will be designed to moderate the flows from several locations and direct flows from the East Trunk catchment to the new West Trunk.

The amount of flow to be diverted will be managed in future in order to optimize several factors:

- Conveyance capacity within East Trunk, West Trunk and Credit Trunk Sewers
- Hydraulic Treatment Capacity
- Loading Capacity
- Incineration / Biosolids
- Energy optimization
- Maintenance activities

The following memo outlines the how the hydraulic and loading flow projections are derived and describes the preliminary diversion strategy.

2. Hydraulic Flow Projections

The main focus of the WWTP projections at the Master Plan level is the hydraulic or liquid capacity of the plants. The G.E. Booth and Clarkson WWTPs have a rated liquid capacity of 518 MLD and 350 MLD, respectively. This section outlines the calculations for liquid/hydraulic projections.

2.1. Historical WWTP Flow and Starting Point for WWTP Projections

The first step in creating the WWTP flow projections is establishing a "Starting Point" for the current year. Flow from population and employment growth is calculated and added to the Starting Point. As such the Starting Point is a critical calculation that is updated annually as new flow data is collected. The Starting Point methodology is summarized in the following steps:

1. Historical average daily flow to the plant is calculated for the past 5 years.
2. Each year's average daily flow is divided by that year's equivalent population to obtain a per capita equivalent criteria.
3. The average of the past 5 year's criteria is calculated.
4. The average criteria is multiplied by the current year's equivalent population to obtain the current year starting point flow.

2.2. Projection Criteria and 2041 Projections

Plant Level average daily flow per capita criteria was updated as part of the Master Plan. The value applied to population growth and employment growth is **315 L/cap/d**. This value is applied to population and employment growth within both the Clarkson and Booth catchments and provides an average daily flow at the treatment plants with an average level of extraneous flow accounted for (i.e. no plant-specific criteria, no additional factor added to account for Inflow and Infiltration).

The preliminary preferred 2041 growth projections for the Region were developed and refined over several iterations by the Region with input and collaboration from several stakeholders including the lower tier municipalities. The preferred growth projections for the purposes of the plant analysis and the Master Plan was named: “Scenario 16”.

The Scenario 16 growth flow projections were calculated for each plant based on the plant’s natural drainage area (no east to west or west to east flow diversions). Additionally, the York and Toronto Agreement flows were added and accounted for in the projections.

The natural catchments for each plant are shown in Figure 1 and each plant’s *hydraulic* projections are shown in Figure 2 and Figure 3.

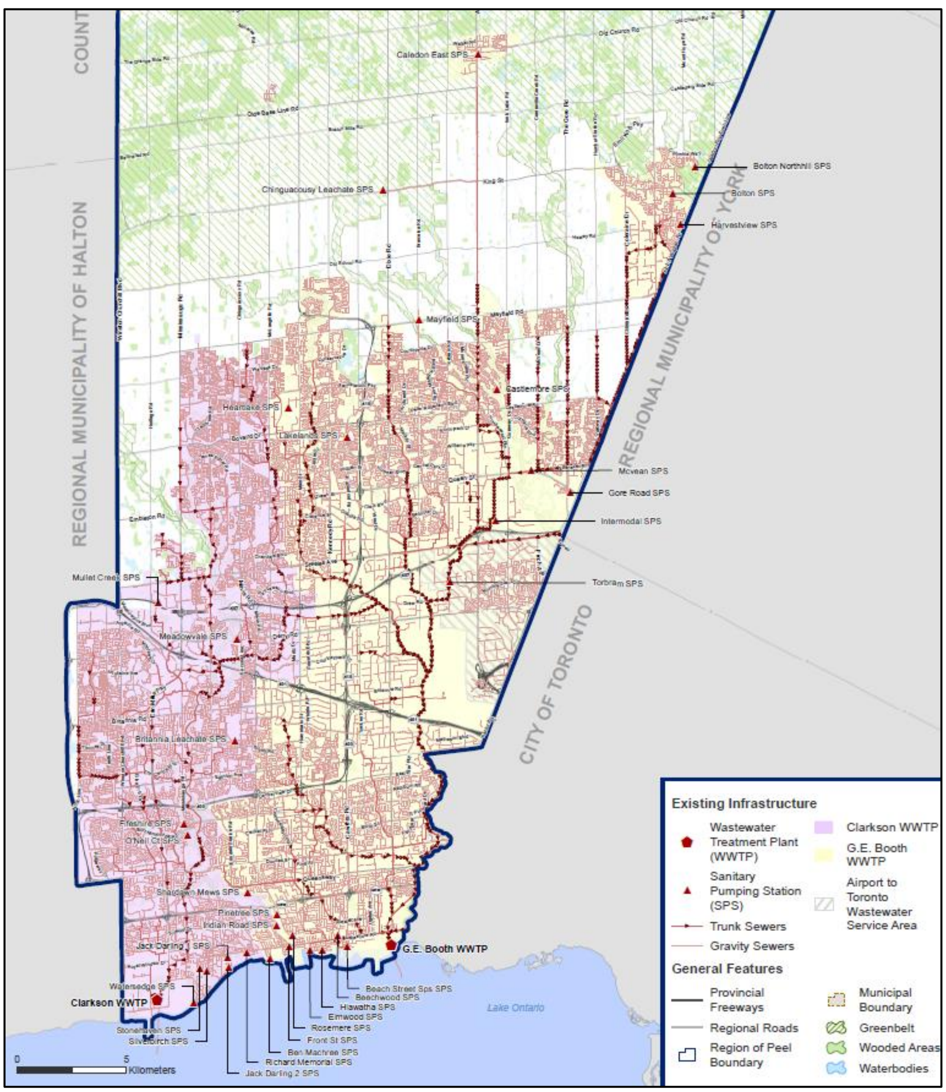


Figure 1 – Peel Existing WW Infrastructure and WWTP Natural Catchments

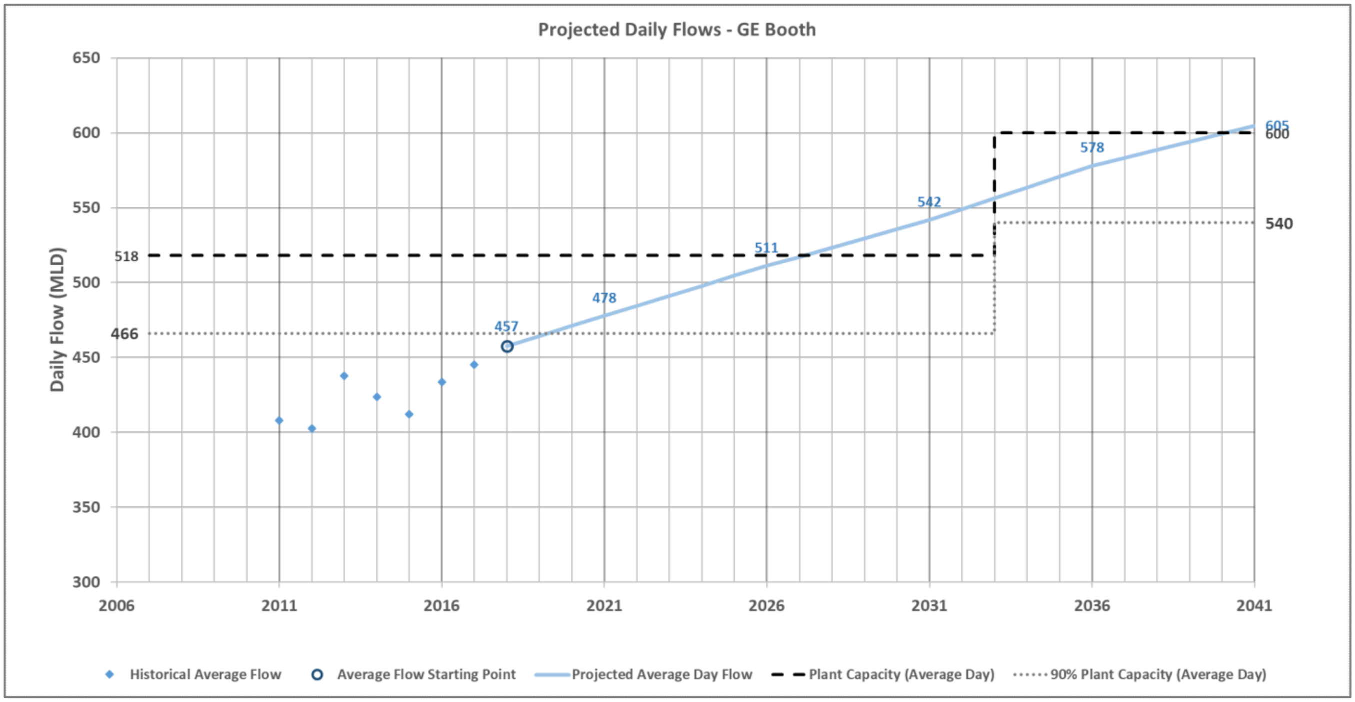


Figure 2 – G.E. Booth Hydraulic Flow Projections – Natural Catchment

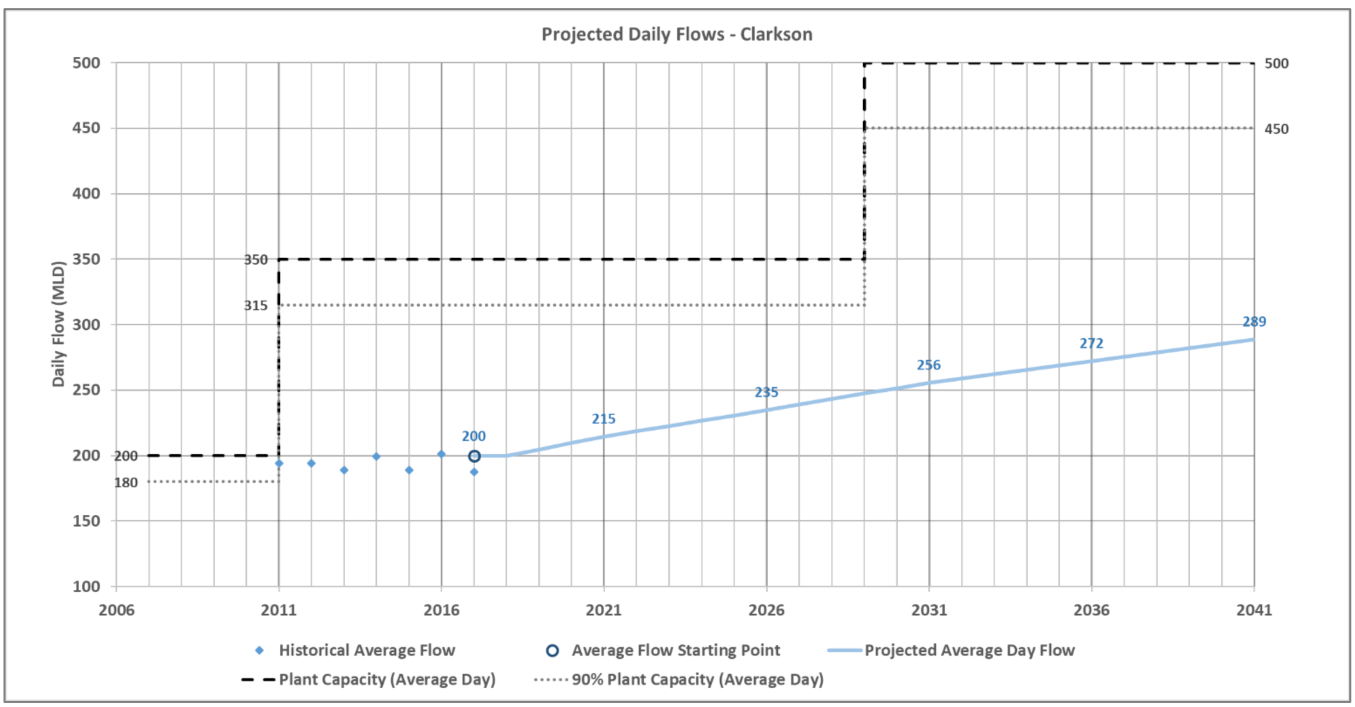


Figure 3 – Clarkson Hydraulic Flow Projections – Natural Catchment

3. Loading Projections

Review of projected 2041 loading capacity and demands at the WWTPs is also required to properly plan for plant upgrades. This section outlines the assumptions, criteria and calculations for *loading* projections

3.3. Historical WWTP Loadings and Starting Point for Projections

Four years (2015, 2016, 2017, 2018) of measured historical BOD loadings (kg/d) and average concentration for each WWTP were received from the Region. The Starting Point for loading projection was assumed to be equivalent to the measured 2018 loading (G.E. Booth: 121,878 kg/d, Clarkson: 38,322 kg/d) . A five-year average method was not used for loading projections.

3.4. High Strength Users and Geographical Distribution,

High strength users were identified by the Region and are required to pay a surcharge for their high strength sewage discharge. For 2018, there were 119 high strength users identified within the G.E. Booth WWTP catchment and 16 within the Clarkson WWTP Catchment. These users make up 42,325 kg/d out of the total 121,878 kg/d at G.E. Booth (35%) and 1,652 kg/d out of the total 38,322 kg/d at Clarkson (4%). G.E. Booth receives significantly higher BOD loading and concentration than Clarkson.

The distribution of the Clarkson and G.E. Booth high strength users is shown in Figure 4.

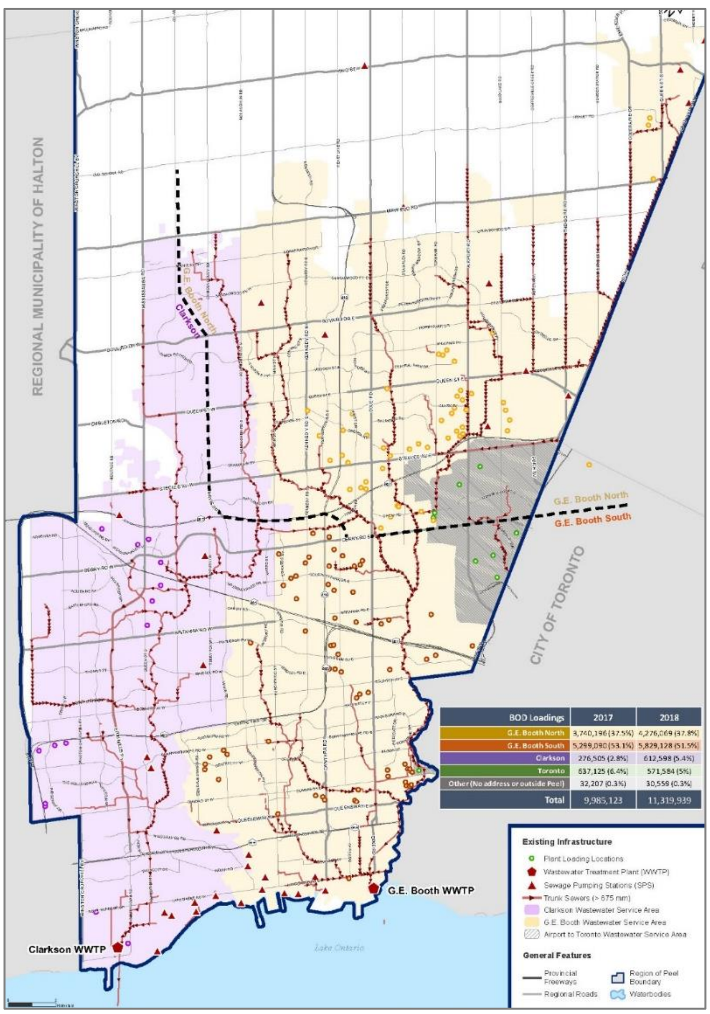


Figure 4 – 2018 High Strength Users Distribution

3.5. Projection Criteria and 2041 Projections

Similar to liquid projections, the BOD loadings are projected to 2041 and require design criteria to estimate the future additional loadings over and above existing. Loading criteria was developed through discussions with Region and Cima.

Per capita loading for all population growth is **75 g/cap/d**. This criteria was applied to the residential growth increase between existing 2018 starting point to 2041

General employment criteria of **37.5 g/employee/d** was applied to all employment growth from the2018 starting point to 2041.

In addition, the Region has high loading users that have been identified in section 3.4 that contribute significant BOD to the wastewater system. There is potential that these high users could increase loadings and that new high users could come online and contribute to the plant in excess of the 37.5 /d allowance for general employment use.

To account for high users, these projections have assumed a High Strength User BOD annual increase of **500 kg/d**. The design criteria for loading growth is summarized as follows:

- Residential per capita: 75 g/cap/d
- Employment per capita: 37.5 g/emp/d
- High User *annual* increase: 500 kg/d

Based on the criteria above and the population and employment projections to 2041, the loading projections for each plant's natural catchment area are shown in Figure 5 and Figure 6.

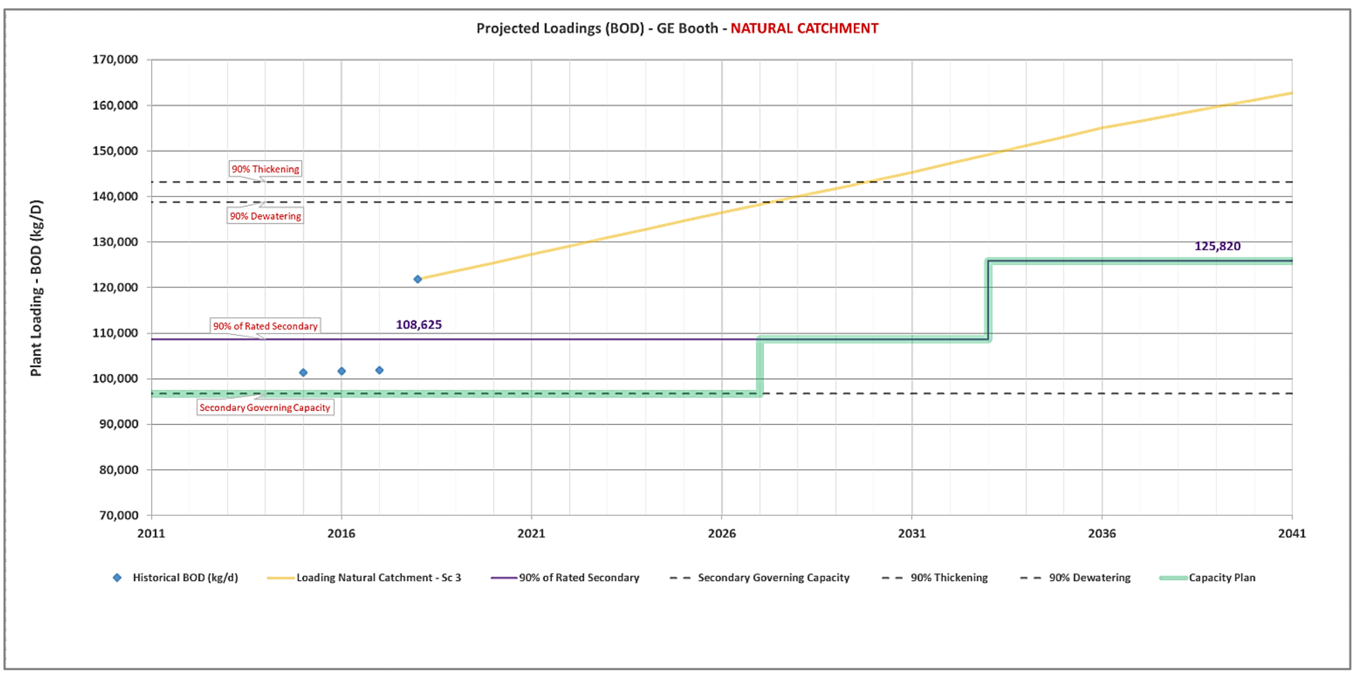


Figure 5 – Clarkson WWTP Loading Projection – Natural Catchment

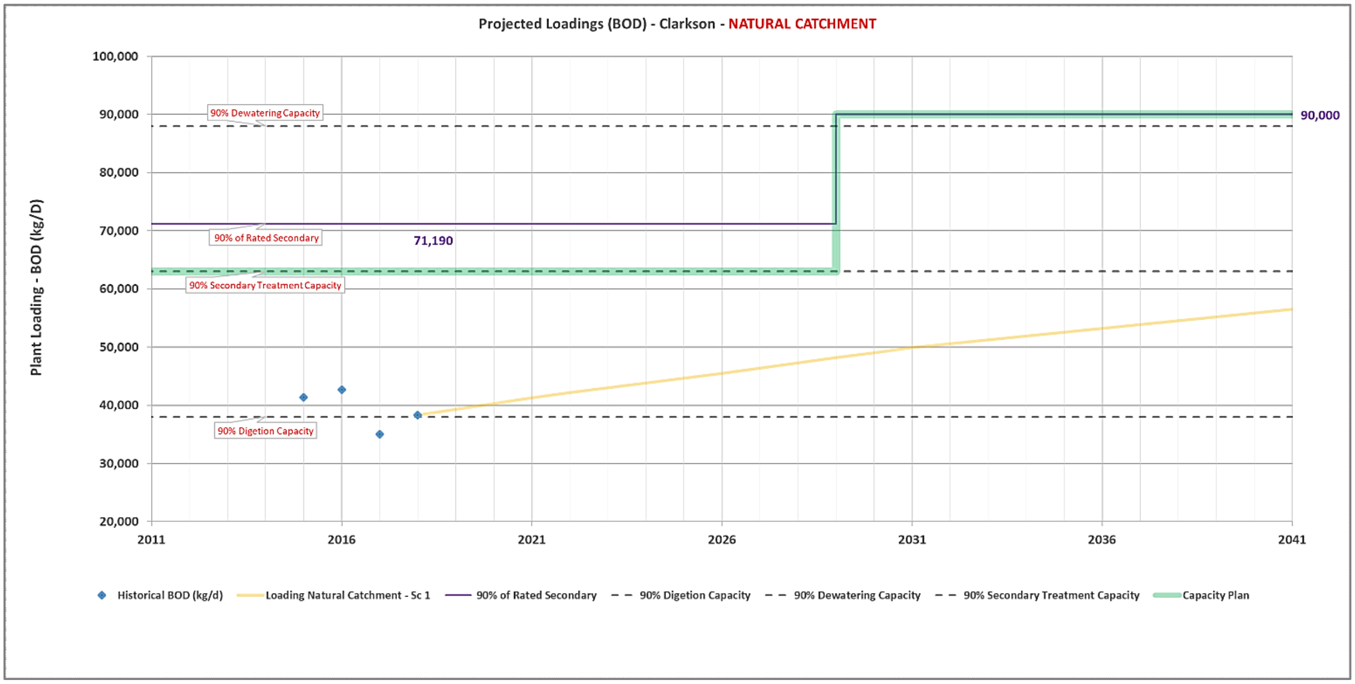


Figure 6 – G.E. Booth WWTP Loading Projections – Natural Catchment

4. Diversion Strategy – Hydraulics and Loadings

In order to optimize hydraulic and loading capacity at both WWTPs, a diversion strategy was developed. This assumes that flow is diverted through the new East-West Trunk Diversion located along Derry Rd.

As shown in Figure 4 there is relatively even distribution of high strength users north and south of the diversion; the total high strength sewage is 4.2M kg/year north of diversion and 5.8M kg/year south of diversion.

The preliminary proposed diversion strategy with hydraulic and loading projections is shown in Figure 7 and Figure 8 and the total average daily flow to be diverted is shown in Figure 9.

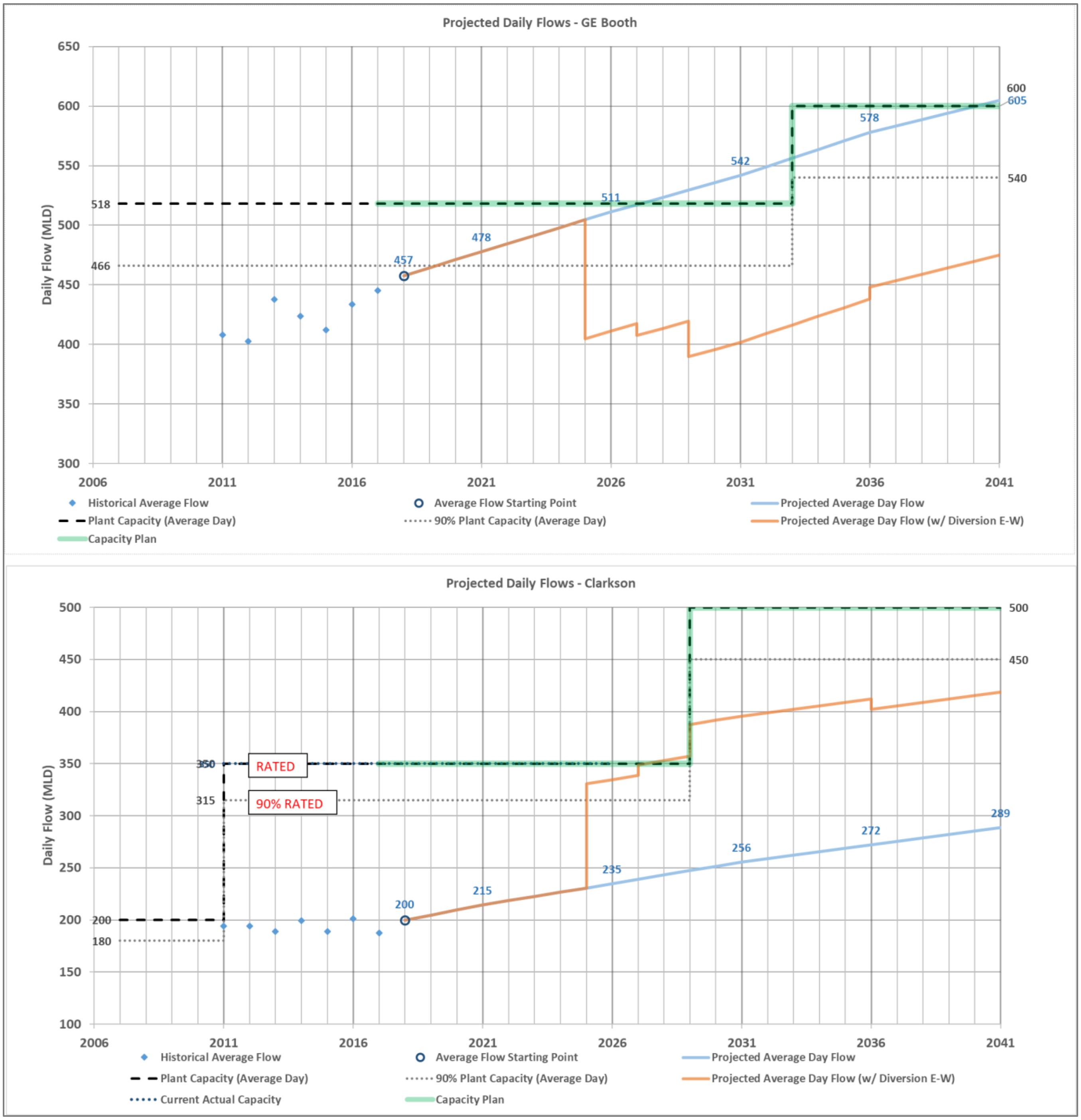
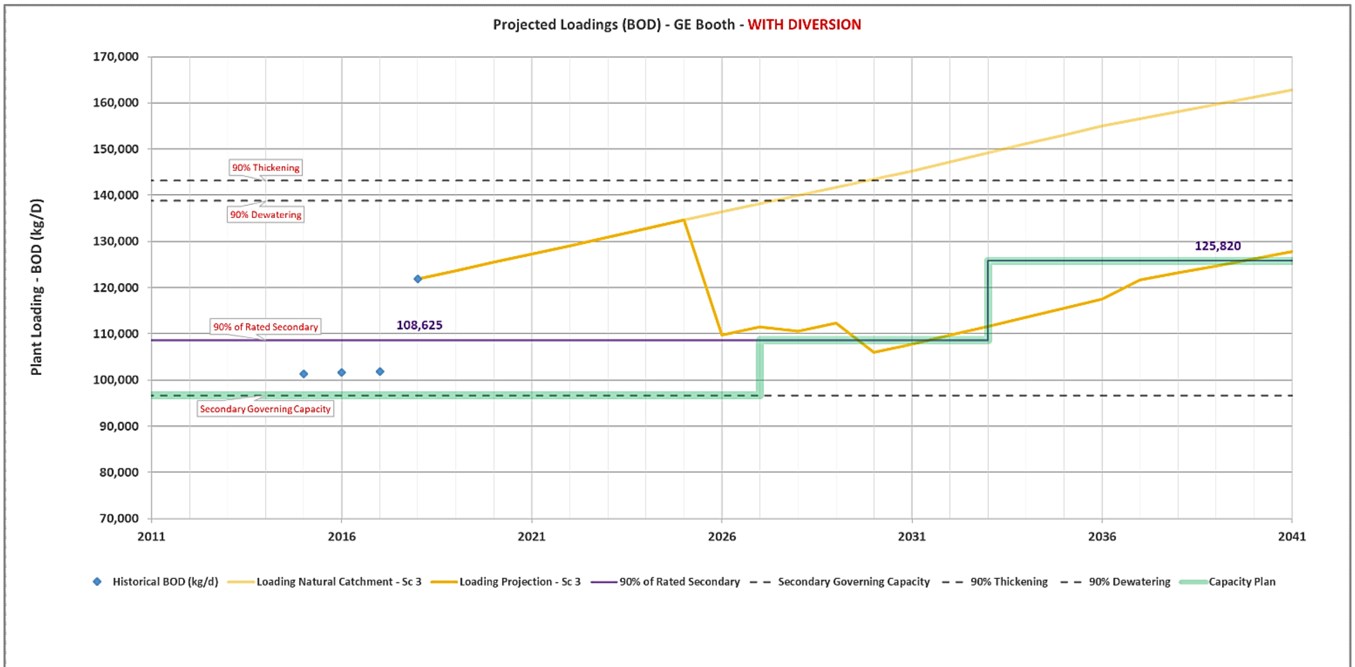


Figure 7 – Clarkson and G.E. Booth Flow Projections – With Preliminary Diversion Strategy



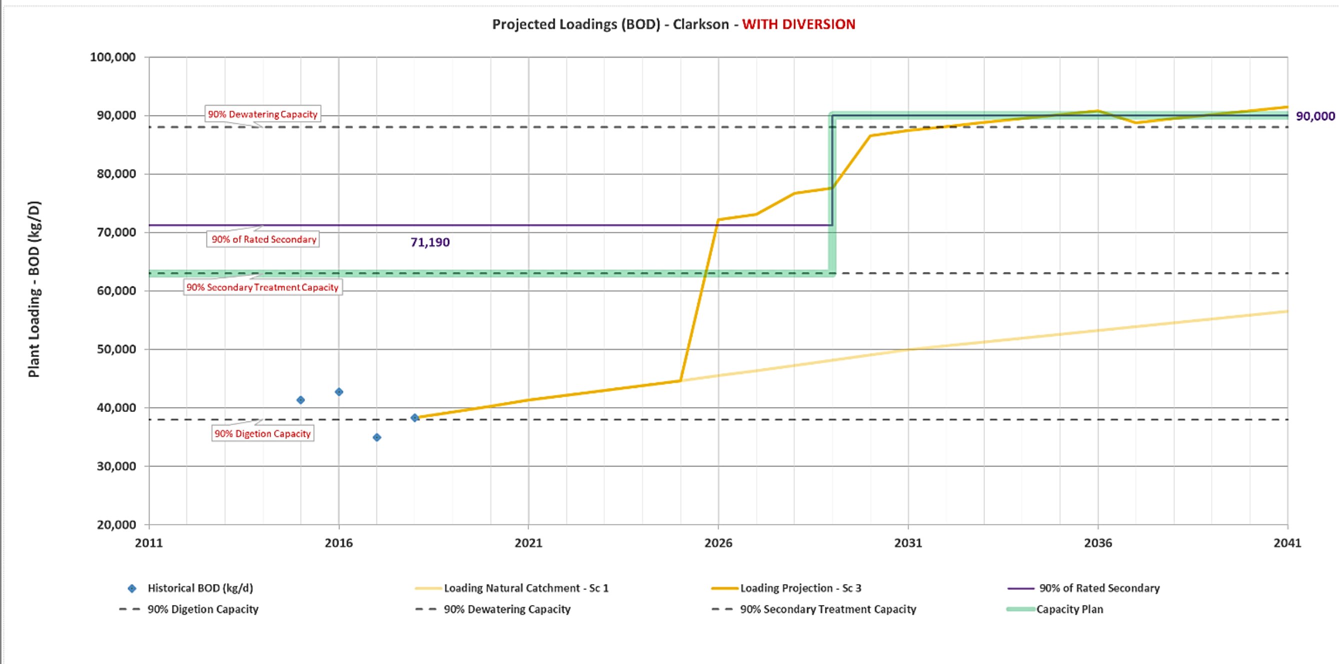


Figure 8 – Clarkson and G.E. Booth Loading Projections – With Preliminary Diversion Strategy

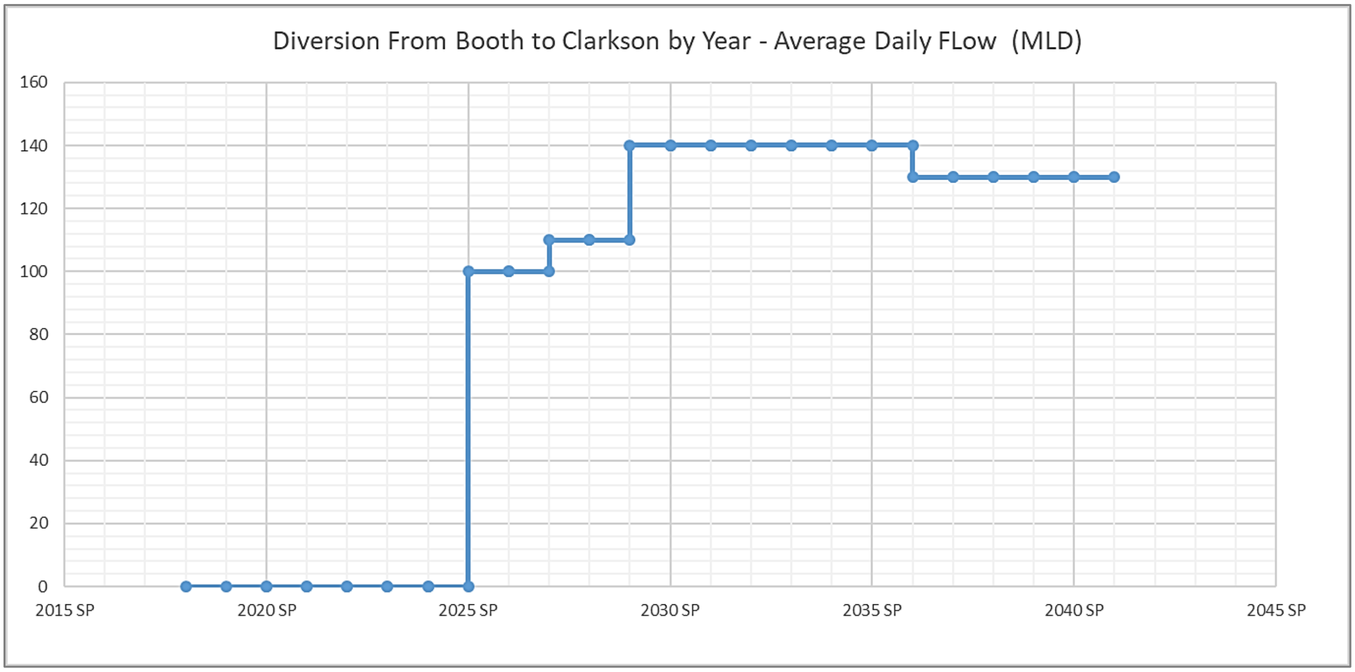


Figure 9 – Average Daily Flow Diversion by Year – Preliminary Diversion Strategy

5. Recommendations / Conclusions

- Both flow and loadings must be managed between treatment plants to optimize conveyance capacity, treatment capacity, ongoing plant upgrades and day to day operations.
- The G.E. Booth WWTP catchment has significantly more high strength users and subsequently higher concentration of BOD in sewage.
- Projections of flow and loading by treatment plant have been made out to 2041
- A preliminary flow diversion strategy has been developed, which set out the amount of flow diverted from year to year from Booth to Clarkson.
- This diversion strategy will require continuous monitoring and adjustments at the flow diversion points in order to optimize plant capacity and operations.

REGIONAL MUNICIPALITY OF PEEL

G.E. BOOTH WASTEWATER TREATMENT LIQUIDS CAPACITY ASSESSMENT

June 20, 2019

T000496B

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Revision History

Version	Date	Prepared by (Deliverable Lead)	QC Reviewer	Project Manager Sign-off
1.0	November 30, 2018	Stacey Romas, P.Eng	Troy Briggs, M.Eng, P.Eng	Troy Briggs
2.0	January 29, 2019	Stacey Romas, P.Eng	Troy Briggs, M.Eng, P.Eng	Troy Briggs
3.0	April 17, 2019	Stacey Romas, P.Eng.	Troy Briggs, M.Eng, P.Eng	Troy Briggs
4.0	May 22, 2019	Stacey Romas, P.Eng.	Troy Briggs, M.Eng, P.Eng	Troy Briggs
5.0	May 30, 2019	Stacey Romas, P.Eng.	Troy Briggs, M.Eng., P.Eng	Troy Briggs
6.0	June 20, 2019	Stacey Romas, P.Eng.	Troy Briggs, M.Eng., P.Eng	Troy Briggs

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1. Introduction

1.1 Background

The G.E. Booth Wastewater Treatment Plant (WWTP), located in the Region of Peel and operated by the Ontario Clean Water Agency (OCWA), is a conventional activated sludge plant with a rated capacity of 518 ML/d. The plant was expanded most recently in two phases; to 447 ML/d day in 2003-2004 and then to 518 ML/d in 2007-2008.

The plant was originally designed based on the Ministry of the Environment Conservation and Parks (MECP) Design Guidelines available at the time (1984 Guidelines), flow and loading characteristics experienced at the time and MECP approved effluent limits, which allowed for elevated ammonia levels during colder winter months.

Since the completion of the last expansion, a number of factors have changed that impact the capacity of unit processes a the G.E. Booth WWTP including:

- MECP Design Guidelines were updated in 2008 providing more stringent unit process loading criteria for primary and secondary clarifiers.
- Peak flows have been more extreme due to the climate change
- Lower per capital water usage has resulted in increased raw wastewater concentrations

CIMA+ has prepared this memorandum to provide a detailed liquids treatment unit process review to quantify impacts of the above changes together with suggested phasing to restore capacity and plan for future growth.

2. Existing Plant Description

2.1 Facility Overview

The G.E. Booth WWTP is a conventional activated sludge plant with chemical phosphorus precipitation. Wastewater flows by gravity to the WWTP through one 2,400 mm diameter sewer and two 2,140 mm sewers. The WWTP is comprised of three secondary treatment plants (Plant 1, Plant 2 and Plant 3) served by common headworks, disinfection and solids handling facilities. The plant currently has an ECA rated average daily flow capacity of 518 ML/d.

The existing treatment processes include screening, grit removal, primary clarification, aeration, secondary clarification and chlorine disinfection and dechlorination prior to discharge to Lake Ontario through a 3.65 m diameter, 1,400 m long outfall. Waste activated sludge (WAS) and raw sludge are incinerated in Fluidized Bed Incinerators with ash storage in on-site lagoons. The incineration facility also receives dewatered biosolids from the Clarkson WWTP.

The ECA effluent requirements are summarized in Table 1 for the existing G.E. Booth WWTP.

Table 1 G.E. Booth WWTP Effluent Objectives and Limits ECA No. 5461-AWWQUL, 2018)

Parameter	Effluent Objectives	Non-Compliance Limits	
	Concentration (mg/L)	Concentration (mg/L)	Loading (kg/d)[3]
Carbanaceous Biological Demand ($CBOD_5$)[1]	15.0	25.0	-
Total Suspended Solids (TSS)[2]	15.0	25.0	-
Total Phosphorus (TP)	0.7	0.8[2]	394
Total Ammonia Nitrogen[3]	<0.8 (May 1 to Oct 31) 17.0 (Nov 1 to Apr 30)	16.0 (May 1 to Jun 15) 8.0 (Jun 16 to Sep 15) 16.0 (Sep 16 to Oct 31) 34.0 (Nov 1 to Apr 30)	
Total Chlorine Residual[4]	0	0.01	-
pH of the effluent[5]		6.0-9.5	-

Notes:
1. Based on annual average concentration values
2. Based on monthly average concentration values
3. Based on the annual average daily loading
4. Single sample result
5. At all times

2.2 Historical Flow

A summary of the historical average day flow (ADF), peak day flow (PDF), peak hourly flow (PHF) and peak instantaneous flow (PIF) for the G.E. Booth WWTP over the historic review period (2013-2015) is presented in Table 2. Also highlighted are the historic peak factors and PDF, PHF and PIF as applied for the capacity assessment of different process units.

The peak factors were calculated using the combined data from the three inlet channels to minimize the effects of dampening as the wastewater travels through the plant.

Table 2 Historic Flow to the G.E. Booth WWTP (2013-2015)

Parameters	Influent Flow	Historic Peak Factor
Average Day Flow (m^3/d)	447,184 (86% of rated)	-
99.7 percentile PDF (m^3/d)	849,650	1.6
99.7 Percentile Peak Hourly Flow (PHF) (m^3/d) for Secondary Treatment	939,086	2.1
99.95 Percentile PHF for Chlorination	1,252,115	2.8
99.95 Percentile PHF for Headworks	1,252,115	2.8
Headworks and Outfall PHF Hydraulic Design	1,430,989	3.2

2.3 G.E. Booth WWTP Plant 1 Upgrades

A multi-discipline condition assessment was completed for Plant 1, which is now almost 60 years old. Appendix 1 provides additional information on the Plant 1 Condition Assessment. Two alternatives were considered for rehabilitation/replacement upgrades to Plant 1 to maintain long-term treatment capacity. The first alternative would see the complete refurbishment and/or replacement, on a like for like basis, of the existing Plant 1. All process equipment would be replaced, electrical and HVAC equipment would be upgraded to meet current code requirements and all structures would be refurbished as necessary. For this option, most of the concrete structures would be re-surfaced for continued use. The second alternative considered a complete replacement of Plant 1 to optimize site utilization. For this alternative, the existing digesters and associated tunnels would be demolished along with other Plant 1 infrastructure, freeing up plant footprint and allowing for construction of new process units.

The complete replacement of Plant 1 at the G.E. Booth WWTP was identified as the preferred alternative due to the significantly smaller plant footprint and the ability to expand modularly to 600 ML/d in the future. The Plant 1 Upgrades project would include demolishing existing digesters and their associated tunnels along with the Plant 1 and 2 inlet conduit, waste activated sludge thickening facility, grit facility and the storage, maintenance, heating and administration buildings. New maintenance and storage facilities would be constructed as the plant modularly expands in the future.

This upgrade provides an optimized approach to site utilization and allocates the land required for future expansion beyond 518 ML/d. The upgraded unit processes also decrease complexity as operation will be a similar configuration across Plants 1 and 2.

The new Plant 1 would also address hydraulic restrictions into Plant 1 and 2 by providing a new inlet conduit from the headworks. Although the replacement of Plant 1 has a higher capital cost associated with it, the reduced footprint and simplified process configuration offer significant long-term value to the Region.

3. Key Changes Since the Last Expansion

G.E. Booth WWTP has undergone two major expansions in the 2000's. The first was in 2003-2004 which increased plant capacity to 447 ML/d and the second in 2007-2008 to expand the capacity to the current rated capacity of 518 ML/d. Since this last expansion, there have been a number of changes influencing the design and capacity of the facility:

- Climate change – more extreme peak wet weather flows
- Higher raw wastewater concentrations
- MECP Design Guidelines which were changed in 2008 following the design of the latest expansion

3.1 Raw Wastewater Flow and Loadings

Raw wastewater flows are measured using non-contact radar style flow meters. Effluent flows from each plant are measured by Parshall Flumes. The effluent flow measurements are considered the most accurate and have been used for most of the assessment below. These readings more accurately reflect average daily, maximum day flows and peak hour flows to secondary treatment. However, they will underestimate peak hour flows at the headworks of the plant due to dampening impacts through each unit process. For the headworks peak hour flow, a 25% safety factor was added to the secondary treatment PHF to account for dampening through the unit processes.

Table 3 compares the original design basis from the 2007 expansion to 518 ML/d to recent historic data from 2013 to 2015. Consistent with current MECP policy to virtually eliminate secondary bypasses, 99.7 percentile peak flows have been presented (i.e., equivalent to one bypass event per year at design flow). Overall, peak daily and peak hourly flows are higher than the original design basis. As the facility moves forward with the design of future upgrades and expansion, the design basis should be verified based on the most recent plant data.

Table 4 summarizes the historic raw wastewater concentrations from 2015 to 2017 as compared to the original design basis. There has been a significant increase in TSS concentrations at 46%.

Table 3 Comparison of Historic Flows to the Original Design Basis

Parameter	2013-2015	Original Design Basis
Average Day Flow	447 ML/d	518 ML/d
Peak Day Flow (PDF) Factor – 99.7 Percentile	1.6	1.6
Peak Hour Flow (PHF) Secondary Treatment – 99.7 Percentile	2.1	2.0
Peak Hour Flow (PHF) Headworks	2.8	2.8
Peak Hydraulic[1] (Outfall, etc.)	3.2	2.9
Notes: 1. Selected to closely match inlet sewer capacity (2000 ML/d) for a 600 ML/d expanded plant		

Table 4 Comparison of Historic Raw Wastewater Concentrations (To Original Design Basis)

Parameter	2015-2017	Original Design Basis	% Increase
cBOD	233	232	-
TSS	322	220	+46%

3.2 Effluent Quality

Effluent criteria for the existing facility is expected to remain at the current limits up to the rated capacity of 518 ML/d. Due to the high ammonia limits during winter months in the current ECA, the existing plant was originally designed based on a 6-day solids retention time (SRT).

For any expansion beyond 518 ML/d, lower ammonia concentrations limits are anticipated; and, specifically during the more critical winter months. This is consistent with limits from other recently expanded plants discharging to Lake Ontario. In order to plan for lower winter ammonia limits, a slightly higher design SRT of 7-days is suggested for planning purposes. This change impacts the capacity of secondary treatment.

Future phosphorus limits are unknown at this time. For the purposes of this memo, it has been assumed that future phosphorus limits will be within the capabilities of a well operated secondary treatment facility without tertiary treatment. The Region is working on a parallel study to better understand the impacts of alternative phosphorus limits on the plant.

3.3 MECP Design Guidelines

In 2008, the MECP updated the Sewage Treatment Design Guidelines. Prior to 2008, most plants used the 1984 Design Guidelines. MECP Design Guidelines establish a suggested design basis to be used for determining unit process capacity. Deviation from the Guidelines is allowed, if extensive site-specific field verification data can demonstrate performance at higher than typical loading rates.

Key changes to the MECP design guidelines are summarized in Table 5 for primary clarifiers and secondary clarifiers. In general, the allowable loadings changed and the design basis (Peak Hour vs. Peak Daily) was better defined in the 2008 Design Guidelines.

Table 5 Changes in Recommended Loading Rates in MECP Design Guidelines

Parameter	MECP 1984 Design Guidelines	MECP 2008 Design Guidelines
Primary Clarifier Peak Surface Overflow Rate (separate WAS thickening)	80 – 120 $m^3/m^2.d$ (Flow Basis not defined. Peak Daily Flow Assumed for G.E. Booth)	<80 $m^3/m^2.d$ (Flow Basis defined as Peak Daily Flow)
Secondary Clarifier Peak Surface Overflow Rate	<29 $m^3/m^2.d$ (nitrifying) <35.6 $m^3/m^2.d$ (non-nitrifying) (Flow Basis not defined. Peak Daily Flow Assumed for G.E. Booth)	<40 $m^3/m^2/d$ (Flow Basis Defined as Peak Hour Flow)
Secondary Clarifier Solids Loading Rate	< 120 $kg/m^2.d$ (Nitrifying) <240 $kg/m^2.d$ (Non-nitrifying) (Flow Basis not defined. Peak Daily Flow Assumed for G.E. Booth)	< 170 kg/m^2-d[1] (Flow Basis defined as Peak Daily Flow)
Notes: 1. 2007 Plant Expansion to 518 ML/d was designed for a secondary clarifier SLR of 170 kg/m^2-d so the 1984 Design Guidelines are not applicable in this case.		

4. Unit Process Capacity Impacts

4.1 Existing Processes

All of the unit processes were designed for a rated capacity of 518 ML/d based on the original 1984 MECP Guidelines, flows and loadings at the time of design. Recent changes to these parameters have reduced the capacity for some unit processes to below 518 ML/d and more tankage may be required to restore this rated capacity.

Table 6 summarizes key design parameters for the major unit processes at the G.E. Booth WWTP.

Table 6 G.E. Booth WWTP Major Unit Design Parameters

Process		Description	Value
Headworks	Mechanical Screens	Number	6 (5 duty, 1 standby)
		Capacity (each)	290,000 m^3/d
	Vortex Type Grit Tanks	Number	4
		Capacity (each)	367,000 m^3/d
Primary Clarifiers	Plant 1A	Number	2
		Surface Area (total)	519 m^2
		SWD	3.7 m
	Plant 1B	Number	2
		Surface Area (total)	779 m^2
		SWD	3.7 m
	Plant 2	Number	2
		Surface Area (total)	2,582 m^2
		SWD	3.7 m
	Plant 3	Number	5
		Surface Area (total)	6,564 m^2
		SWD	3.7 m
Aeration Tanks	Plant 1	Number	4
		Volume (total)	13,792 m^3
		SWD	4.2 m
	Plant 2	Number	4
		Volume (total)	27,841 m^3
		SWD	4.3 m
	Plant 3	Number	12
		Volume (total)	144,623 m^3
		SWD	4.6 m
Blowers	Plant 1 and 2	Number	3 (2 duty, 1 standby)

		Capacity total	112,000 m^3/hr of air
	Plant 3	Number	5 (4 duty, 1 standby)
		Capacity total	274,000 m^3/hr of air
Secondary Clarifiers	Plant 1	Number	6
		Surface Area (total)	2,064 m^2
		SWD	3.7 m
	Plant 2	Number	4
		Surface Area (total)	1.025 m^2
		SWD	3.7 m
	Plant 3 (3.7 m deep)	Number	4
		Surface Area (total)	10,021 m^2
		SWD	3.7 m
	Plant 3 (4.0m deep)	Number	2
		Surface Area (total)	2,704 m^2
		SWD	4.0 m
Disinfection	Chlorination		
	Chemical Storage	Number of Sodium Hypochlorite Tanks	2
		Capacity, each	138 m^3
	Contact Volume Provided in Outfall	Diameter	3.65 m
		Length	1,400 m
		Volume	14,641 m^3
Dechlorination	Chemical Storage	Number of Sodium Bisulphite Tanks	2
		Capacity, each	18 m^3
Phosphorus Removal System	Chemical Storage	Number of Chemical Tanks	8
		Capacity, each	46 m^3
Sludge Thickening	Centrifuges (1)	Number	5 (4 duty, 1 standby)
		Rated Capacity, each	60 L/s
Sludge Dewatering	Centrifuges (1)	Number	6 (5 duty, 1 standby)
		Rated Capacity, each	2 dryT/hr
Sludge Incineration	Fluidized Bed Incinerators	Number	4
		Capacity, each	100 dryT/d[2]

Notes:

1. Centrifuges capacity estimation is based on operating 24 hr/day, 7 days a week
2. The rated capacity and in-situ capacity are currently under review in a separate study

4.2 Basis for Capacity Calculations and Redundancy

The basis for the capacity calculations and the redundancy provided for each unit process at the G.E. Booth WWTP are summarized in Table 7. For the purposes of this report, firm capacity refers to the available capacity with one unit offline and total capacity refers to the available capacity with all units online.

Table 7 Basis for Capacity Calculations and Unit Process Redundancy

Unit Process	Parameters for Capacity	Firm Capacity Measures
Inlet Sewer	Peak Hourly Flow	All sewers online
Screens	Peak Hourly Flow	One Screen offline
Grit Tanks	Peak Hourly Flow	All grit tanks online
Primary Clarifiers	Peak Day Flow	One primary clarifier out of service
Aeration Tanks	Average Day Flow	All aeration tanks online
Oxygenation System	Peak Loading	One blower offline per plant
Secondary Clarifiers	Peak Hourly Flow, Peak Loading	All secondary clarifiers online
Disinfection (Contact Time)	Peak Hourly Flow	N/A (Provided in Outfall)
Outfall	Peak Hourly Flow	N/A
Thickening	Peak Month Loading	One Centrifuge offline
Dewatering	Peak Month Loading	One Centrifuge offline
Incineration	Peak Month Loading	One Incinerator offline

4.3 Impacts of Changes on G.E. Booth Capacity

Figure 1 summarizes the impacts of the flow, loading and MECP Design Guideline changes on the capacity of each unit process at the G.E. Booth WWTP. The length of each bar shows the theoretical equivalent average day flow (ADF) capacity based on the recent flow factors, loadings and 2008 MECP design guidelines. The vertical orange lines show the average current operating conditions (2013-2015) and the ECA approved rated capacity of the WWTP. In summary, the following unit processes were impacted:

- Primary clarifier capacity was reduced due to higher peak flows and lower allowable loadings in the 2008 MECP Design Guidelines
- It is important to note that the Plant 3 aeration tanks were oversized in the last expansion based on available land area and to provide a high level of nitrification , however, this capacity cannot be fully utilized due to limitations in the secondary clarifiers
- Secondary clarifier capacity was reduced due to higher flows and the change in MECP Guidelines for loading rates
- Outfall capacity was reduced due to higher peak flows and lower more stringent discharge limits set by the ECA

Calculations are provided in Appendix B.

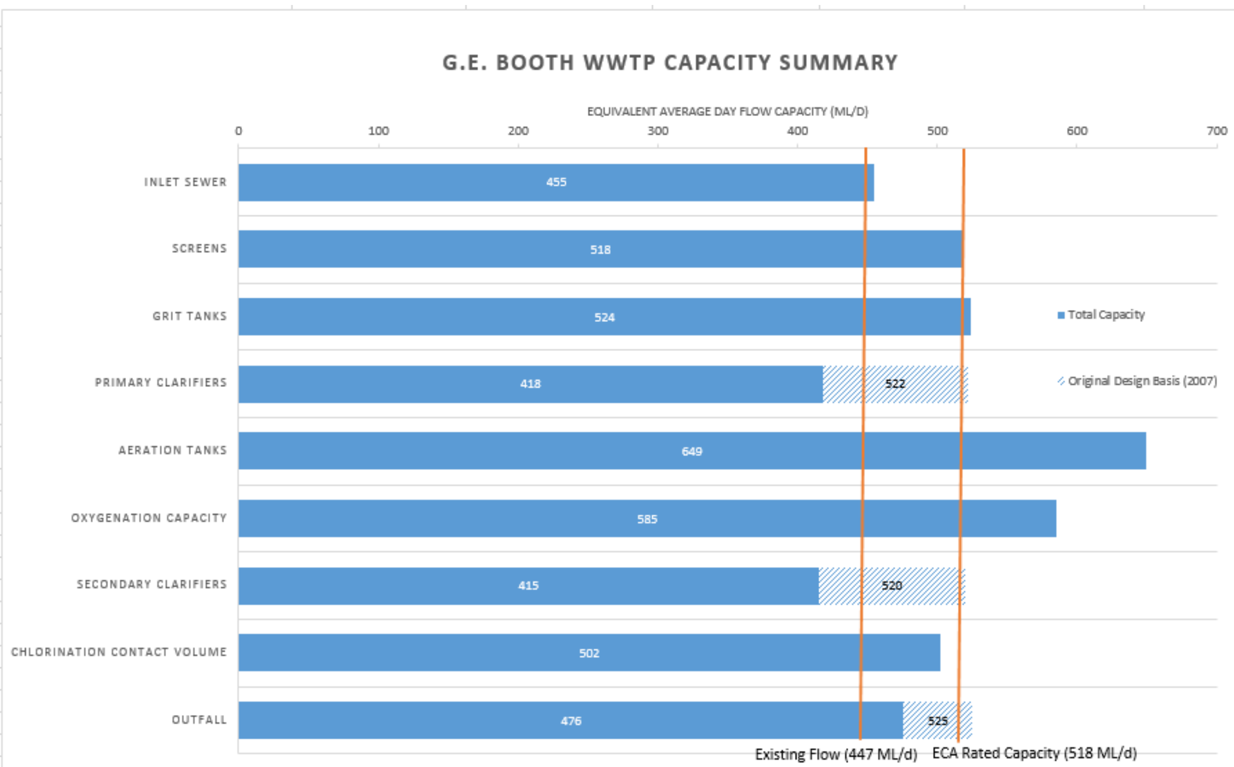

Figure 1 Performance Potential Graph for G.E. Booth WWTP

5. Capital Phasing Plan to Recover Capacity to 518 ML/d

A phasing approach was developed to complete upgrades to the plant in a series of phased projects. At the planning level, the approach for developing these phased projects relies on maintaining the same unit process technology at the existing plant. As part of each project, the Region should review alternative approaches and technologies to maximize the value to stakeholders in terms of both capital and life cycle costs.

The approach includes the following 5 phases:

1. New Plant 1 Site Preparation
2. Plant 3 Primary Clarifier Capacity Recovery
3. Plant 1 Replacement
4. Plant Rated Capacity Recovery
5. Expansion to 600 ML/d

5.1 New Plant 1 Site Preparation

In advance of the construction project to replace Plant 1, the Region has undertaken site key projects to prepare the site for the new plant. Key work included:

- Relocating existing equipment/processes outside New Plant 1 area
- New Inlet Sewer
- Demolition of the Digesters within the new Plant 1 area

These works do not impact available plant capacity.

5.2 Plant 3 Primary Clarifier Capacity Recovery

The construction phase for the Plant 3 primary clarifier capacity recovery is currently underway (commenced in 2018) and includes the addition of two new Primary Clarifiers and replacement of the existing Effluent Water Pumping Station (PS). Construction is expected to end in 2020. In consideration of the number of primary clarifiers at G.E. Booth (11 currently; 13 with expansion), together with the maintenance downtime which sees one clarifier down for service at all times, the Region has adopted a firm capacity approach for Primary Clarification capacity (i.e. allow one clarifier offline for service). It is assumed that one unit is down at a time for maintenance. The available unit process capacities prior to Plant 3 primary clarifier expansion are summarized in Figure 2.

The impact of the expansion of the Plant 3 primary clarifiers on the rated capacity is summarized in Figure 3 below. The total capacity (all units online) is anticipated to be increased from 417 ML/d to 523 ML/d. Firm capacity (one unit offline) consistent with rated capacity will be provided following the Conventional Treatment Rated Capacity Recovery Phase (see Section 5.4 for more details).

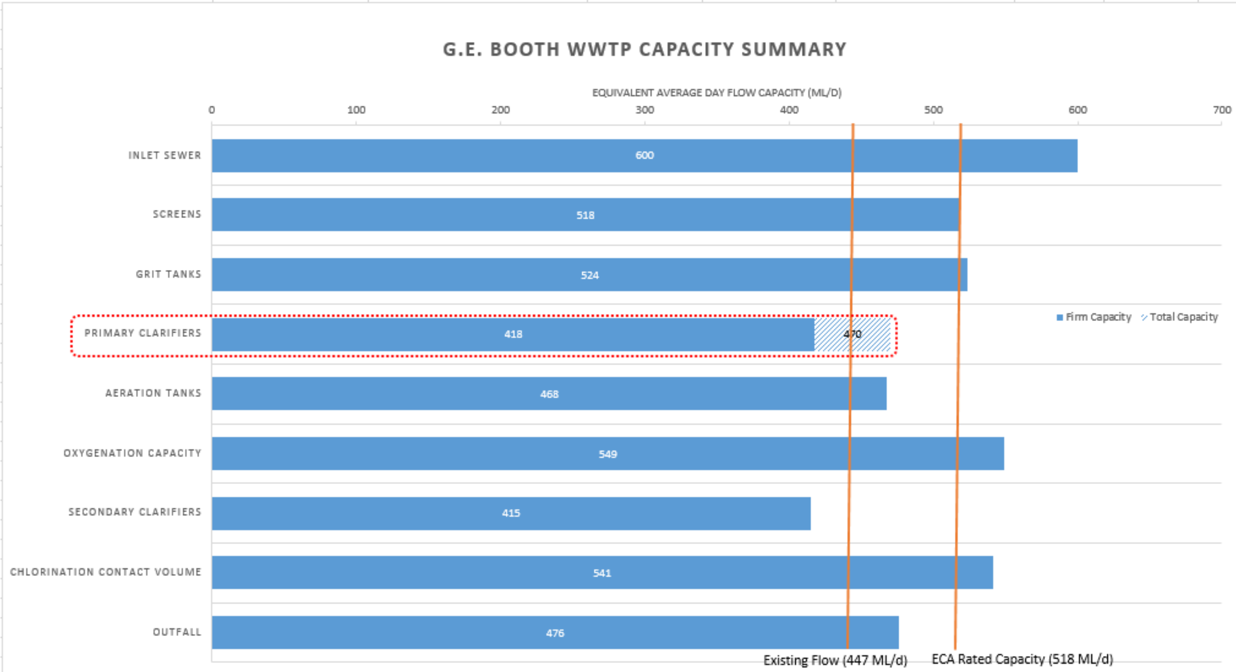

Figure 2 Existing Available Capacity Before Plant 3 Primary Clarifier Capacity Recovery

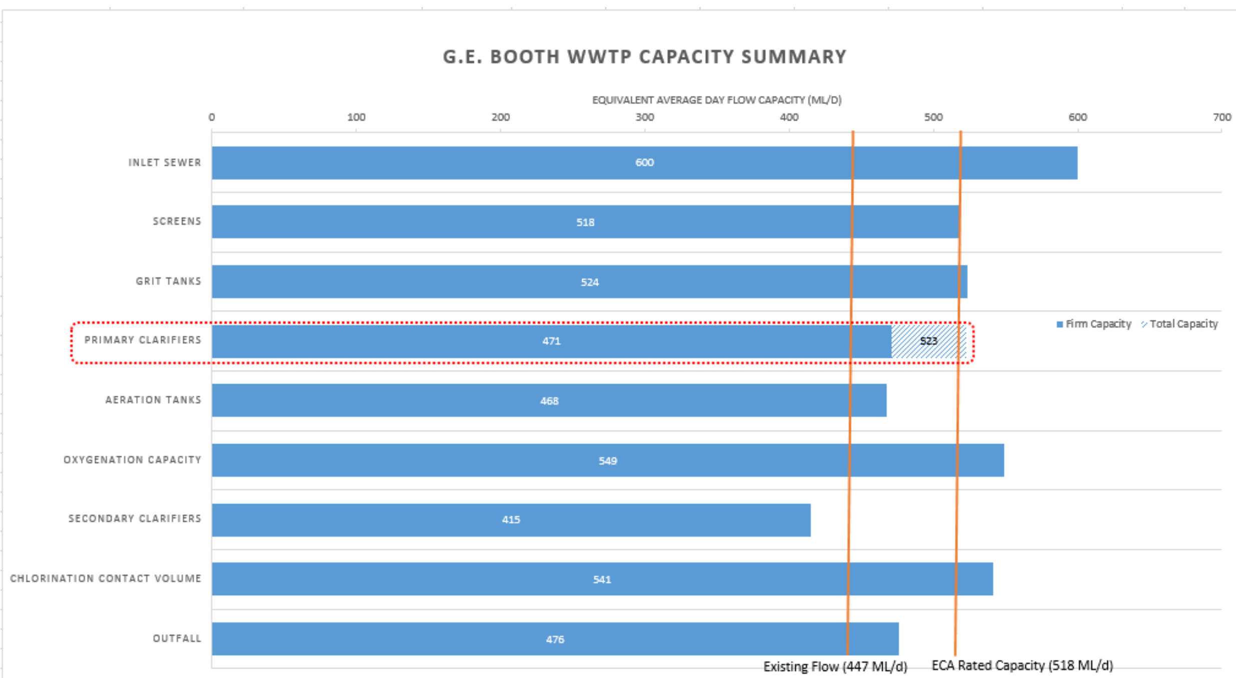

Figure 3 Capacity Following Plant 3 Primary Clarifier Capacity Recovery

The proposed site plan for these upgrades can be seen in Figure 4.

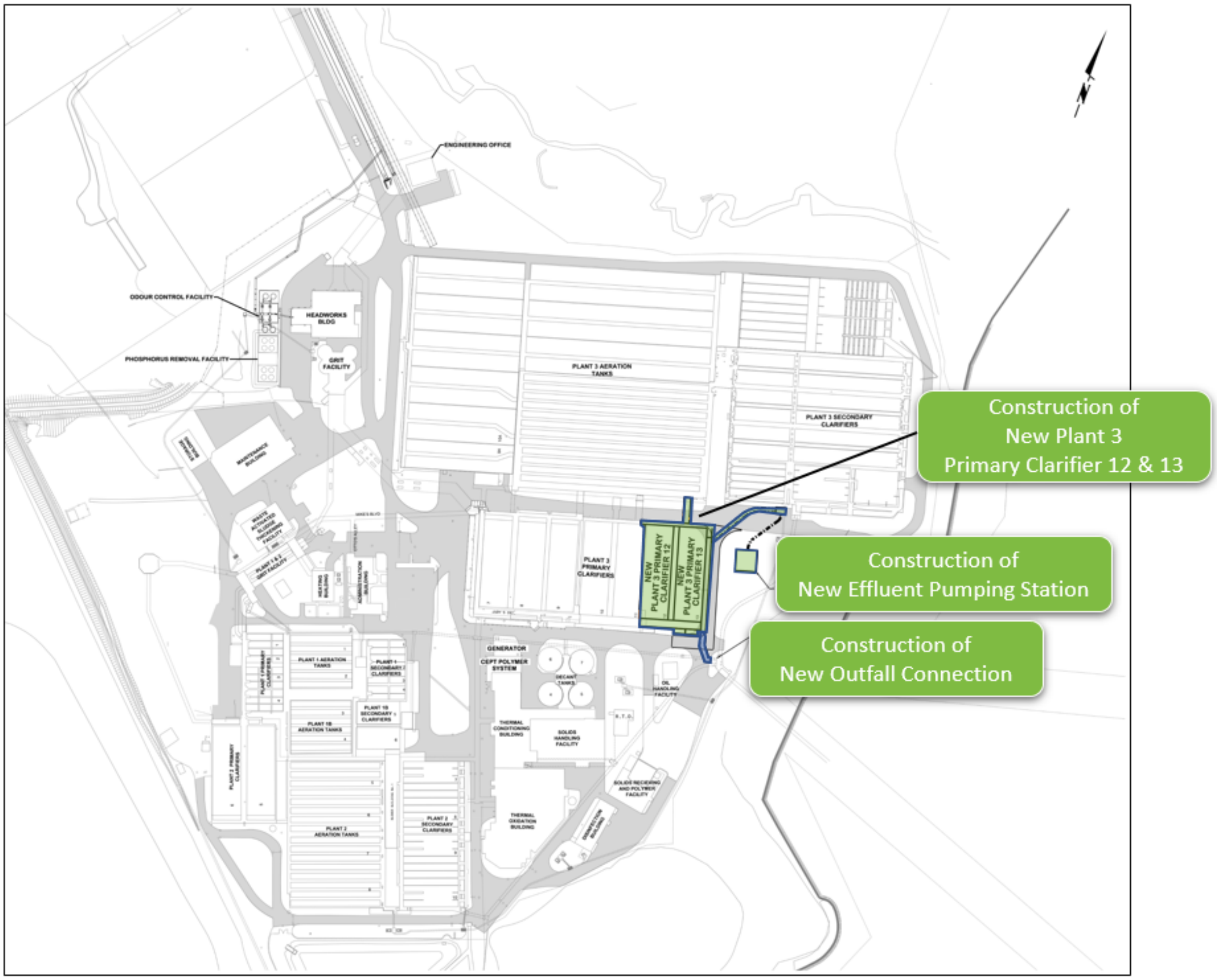

Figure 4 Plant 3 Primary Clarifier Capacity Recovery Site Plan

5.3 Plant 1 Replacement

The design phase for the Replacement of Plant 1 is currently underway. This project includes the complete replacement of Plant 1 with the same 40 ML/d capacity. The design optimizes space utilization on-site and plans for future extensions. There is no net impact to the current available capacity with the replacement of Plant 1. New construction includes an inlet channel, aeration tank, secondary clarifier, RAS/WAS gallery and blower building and ring road. The inlet channel is oversized to accommodate the future build-out of Plant 1 to 200 ML/d. The existing available capacity and design basis prior to Plant 1 upgrades is summarized in Figure 5.

The impacts of these improvements to the G.E. Booth rated capacity are summarized in Figure 6. The capacity of the aeration tanks and secondary clarifiers is slightly increased with this phase.

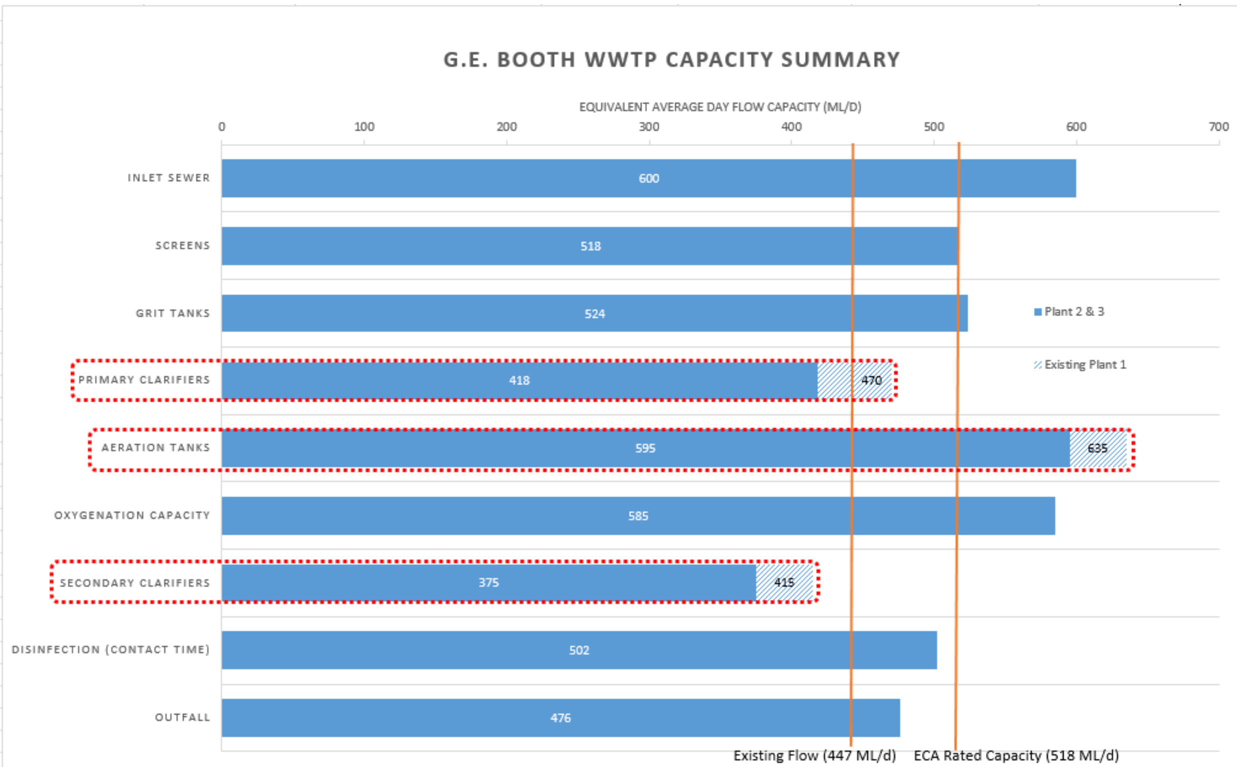

Figure 5 Existing Available Capacity and Design Basis Before Plant 1 Replacement

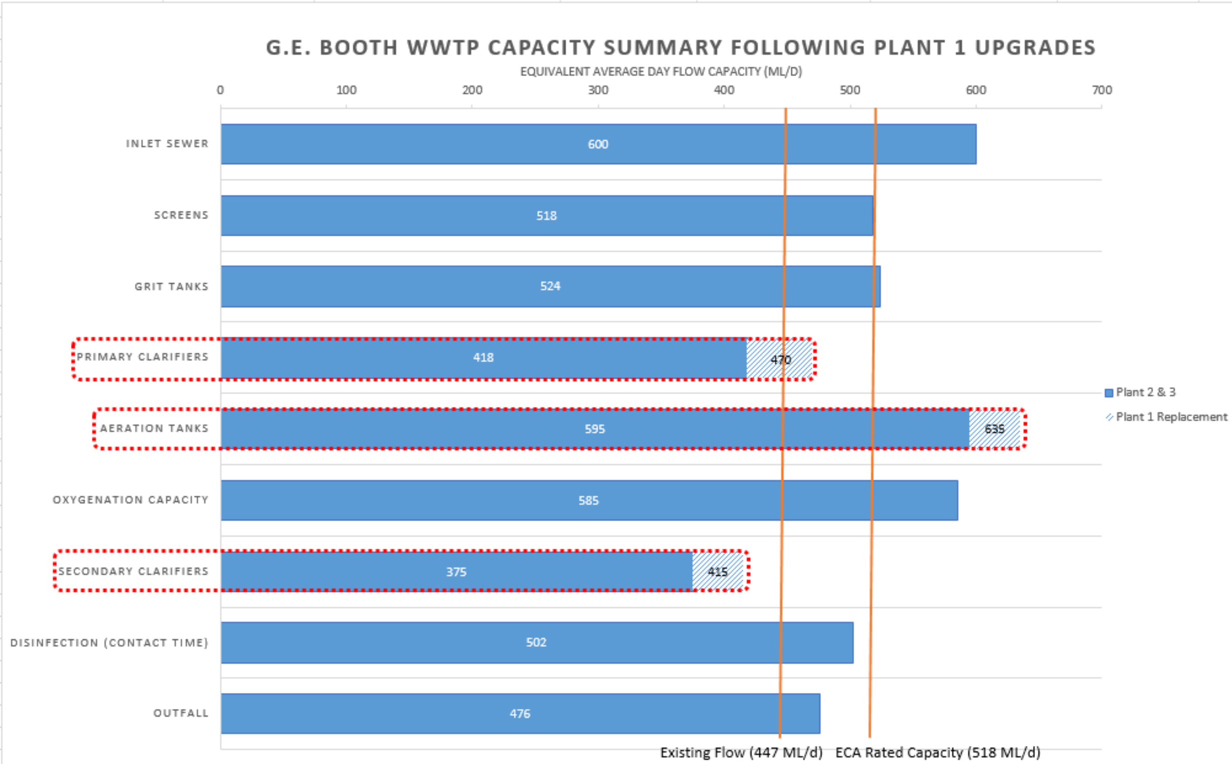

Figure 6 G.E. Booth WWTP Unit Process Capacities Following Plant 1 Replacement

The proposed site plan for the New Plant 1 at G.E. Booth WWTP can be seen in Figure 5. To accommodate the new Plant 1, a number of existing buildings will be demolished including the existing Administration Building.   Since the existing administration building serves as a hub for plant-wide communications, all of these services will be relocated as part of the Plant 1 replacement project.

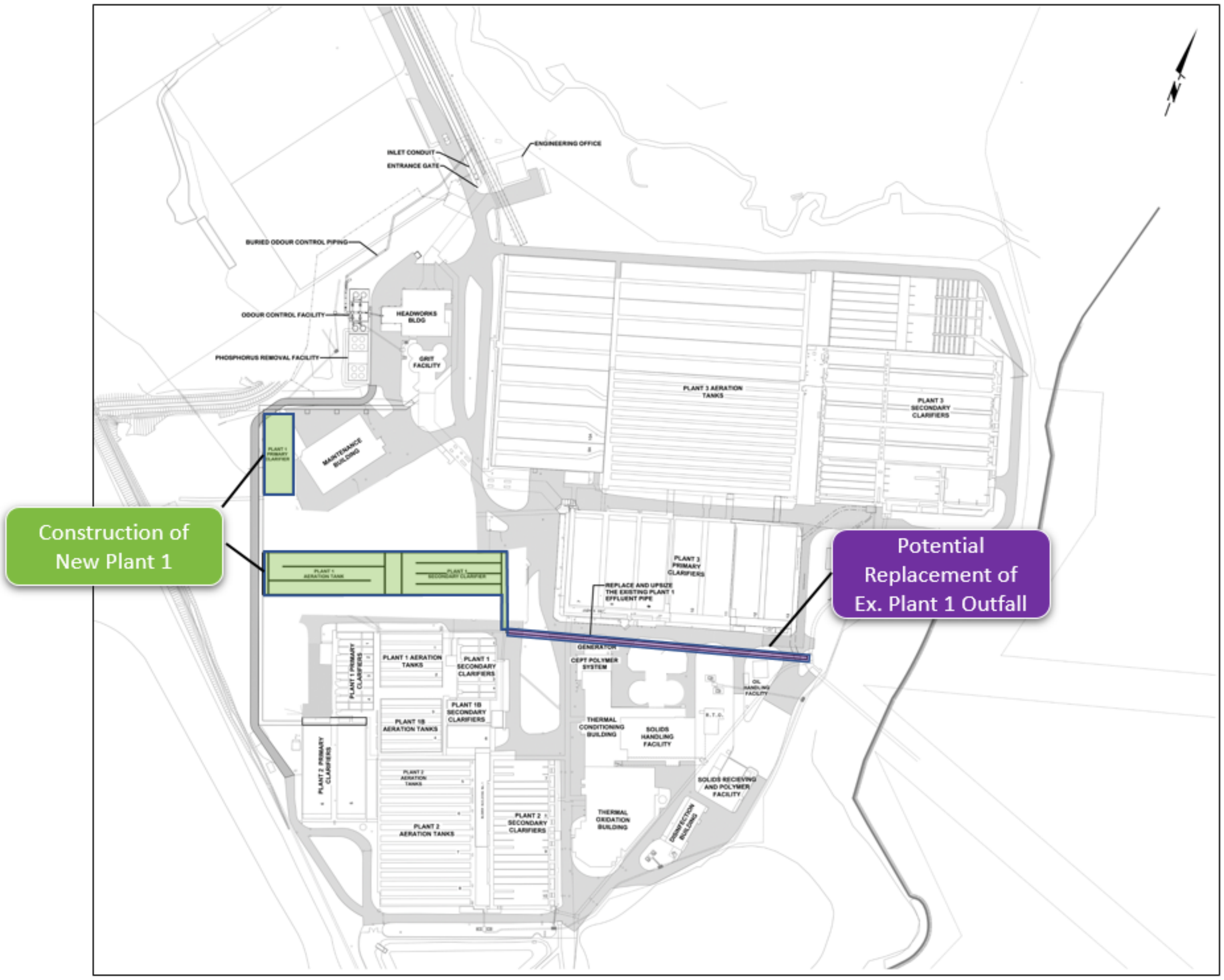

Figure 7 **New Plant 1 Site Plan**

5.4 Conventional Treatment Rated Capacity Recovery

This phase would see the restoration to a minimum of 90% of the existing rated capacity. This phase would include an extension of the Plant 3 Secondary Clarifier 11 and a second treatment train in Plant 1. The capacity is limited by the secondary clarifiers and outfall hydraulics to 90% of the rated plant capacity. Figure 8 presents the impact of this phase on the G.E. Booth WWTP capacity. The aeration tanks and secondary clarifiers will provide a capacity increase of 675 ML/d and 523 ML/d respectively following these upgrades. The original unit process capacities and design basis is summarized in Figure 8 and the unit process capacities following restoration of the rated plant capacity can be found summarized in Figure 9.

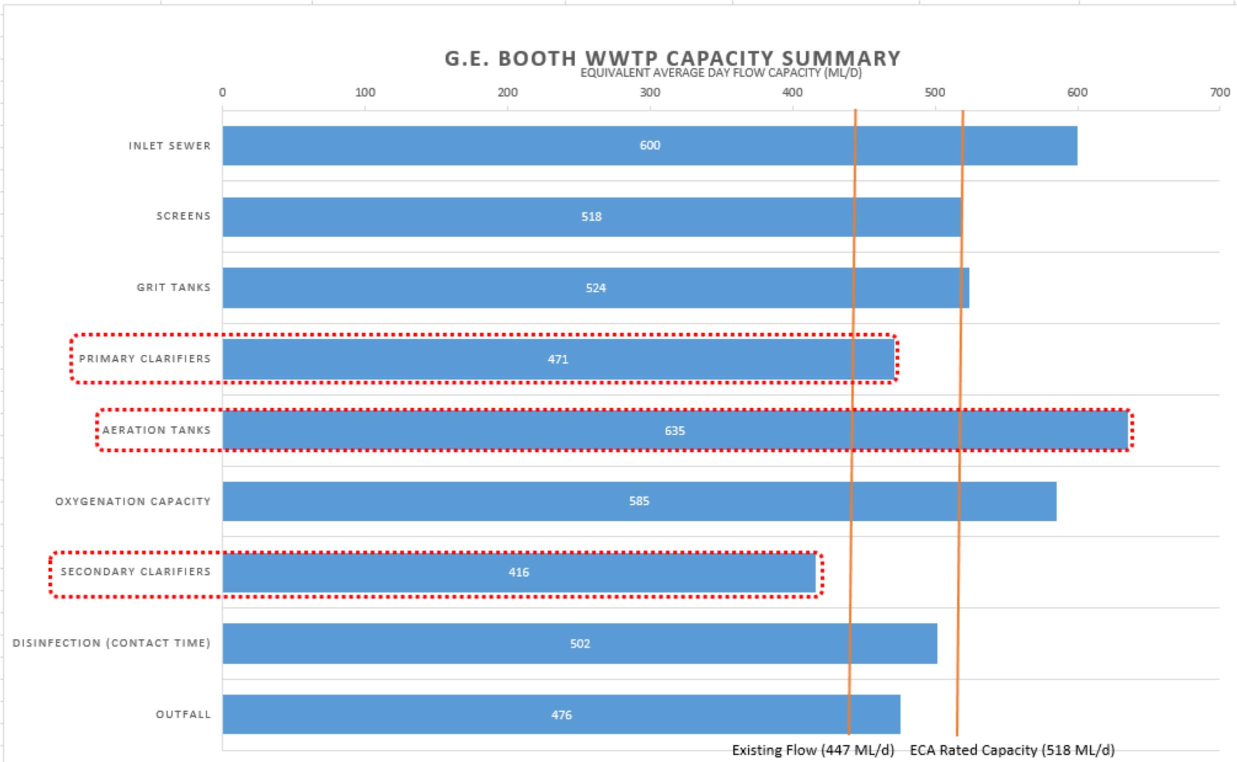

Figure 8 Existing Available Capacity Before Plant Capacity Recovery

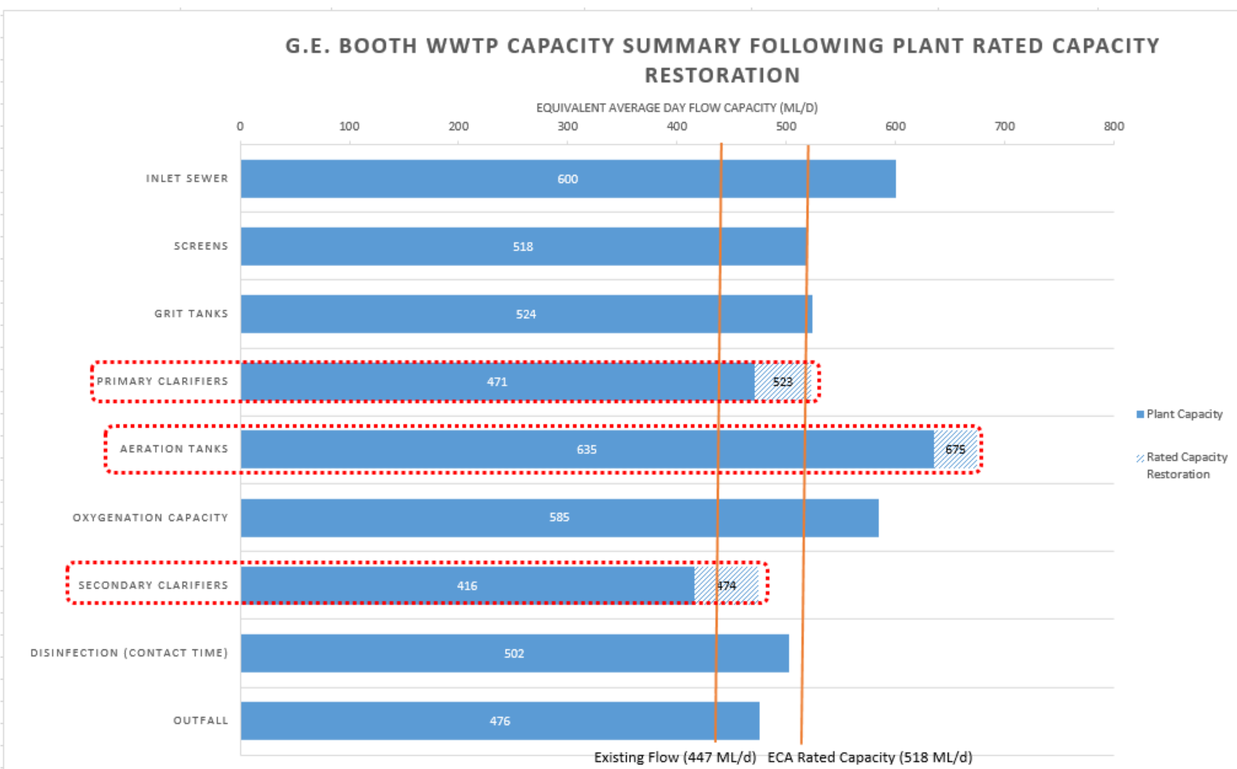

Figure 9 G.E. Booth WWTP Unit Process Capacities Following Plant Rated Capacity Recovery

The figure below outlines the proposed site plan for the upgrades to the rated capacity phase.

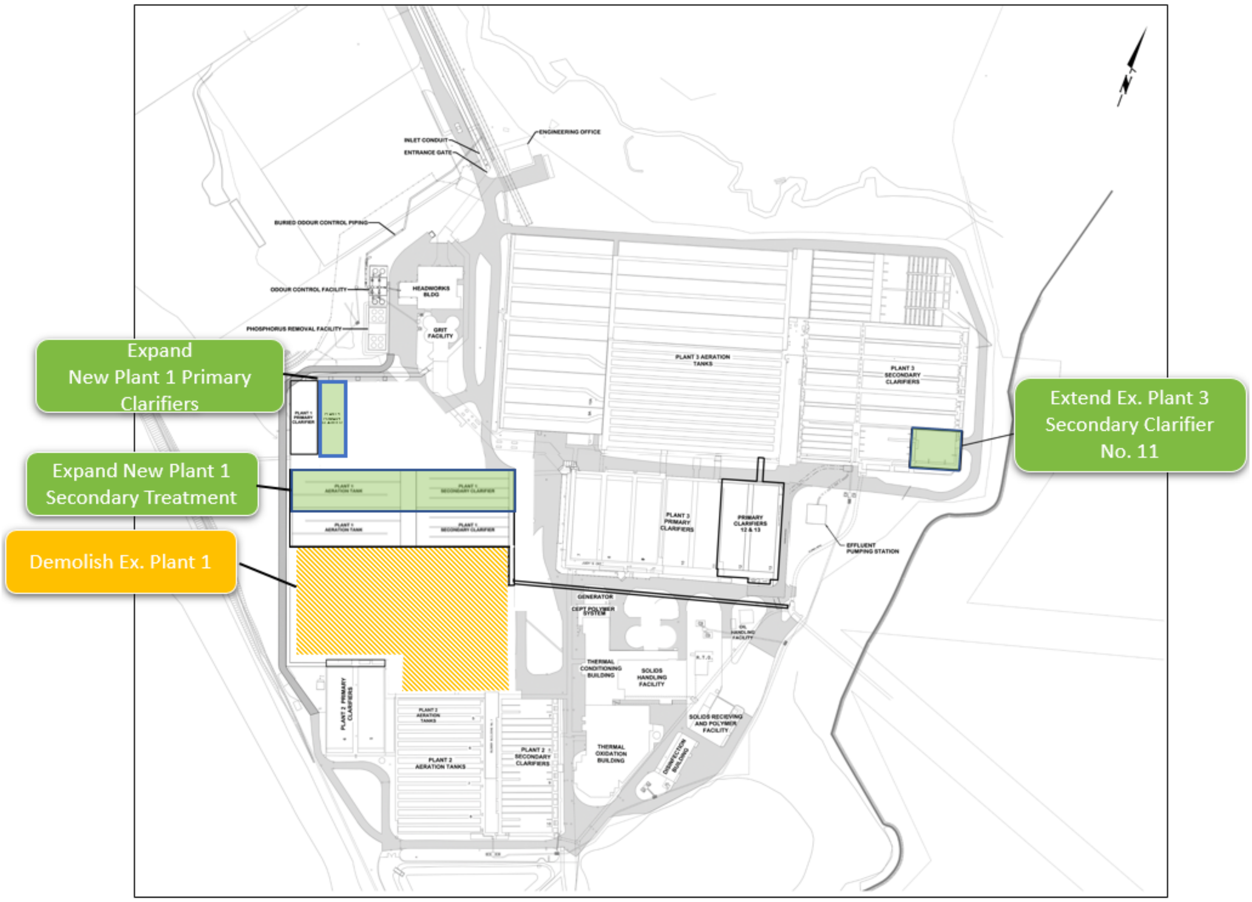

Figure 10 **Site Plan for Plant Capacity Recovery Upgrades**

5.5 Expansion to 600 ML/d

This phase includes the expansion of the G.E. Booth WWTP to a rated capacity of 600 ML/d. To achieve this new rated capacity, capacity upgrades are required for several unit processes including screens, grit tanks, primary clarifiers, aeration tanks, oxygenation system, secondary clarifiers, disinfection and the outfall. For the purposes of this capacity assessment, it is important to note that the same technologies as existing were utilized for budgeting and land use impacts only. The unit process capacities for the plant prior to expansion are summarized in Figure 11.

The impacts of the expansion to the G.E. Booth WWTP rated capacity are summarized in Figure 12.

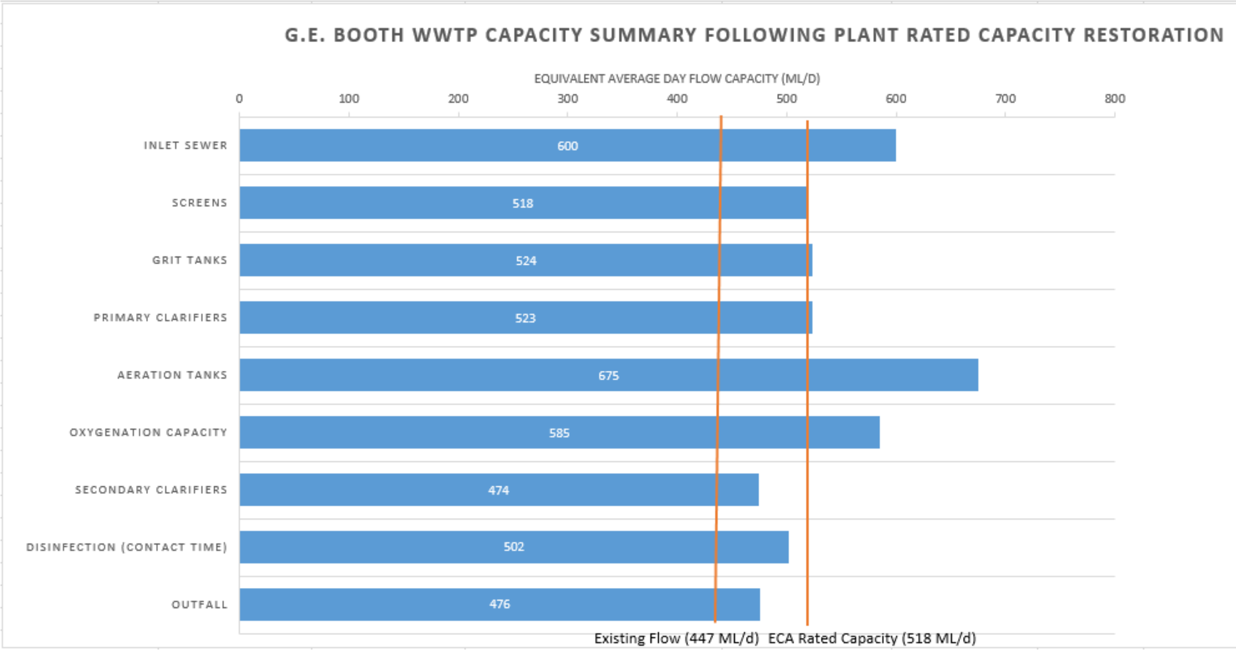

Figure 11 Existing G.E. Booth WWTP Unit Process Capacities Before Expansion to 600 ML/d

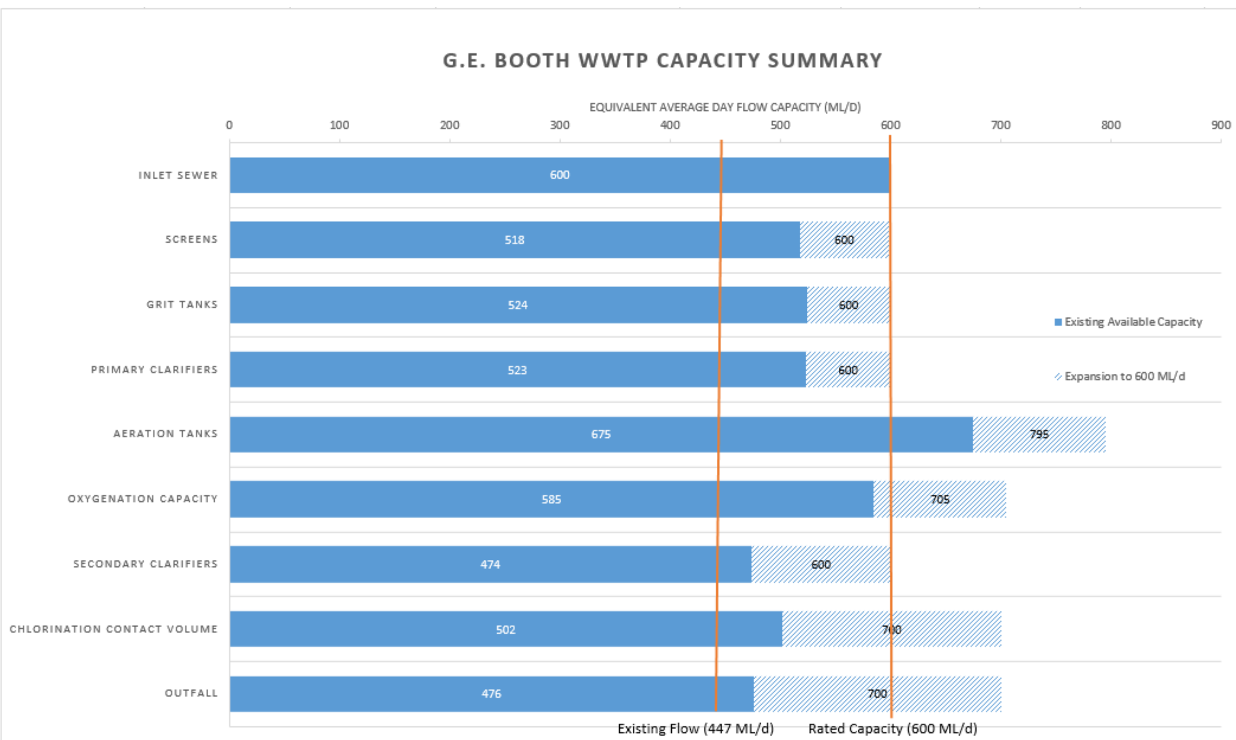

Figure 12 G.E. Booth WWTP Unit Process Capacities Following Expansion to 600 ML/d

During design for the expansion to a rated capacity of 600 ML/d, a criticality review of each of the unit processes listed in the figure above is recommended to be completed to assess the criticality to plant operations. This will dictate some over capacity per unit such as increasing design capacity of the screens to a capacity of 650 ML/d to provide maintenance flexibility while still maintaining peak flows.

The siting for this phase can be found in Figure 13.

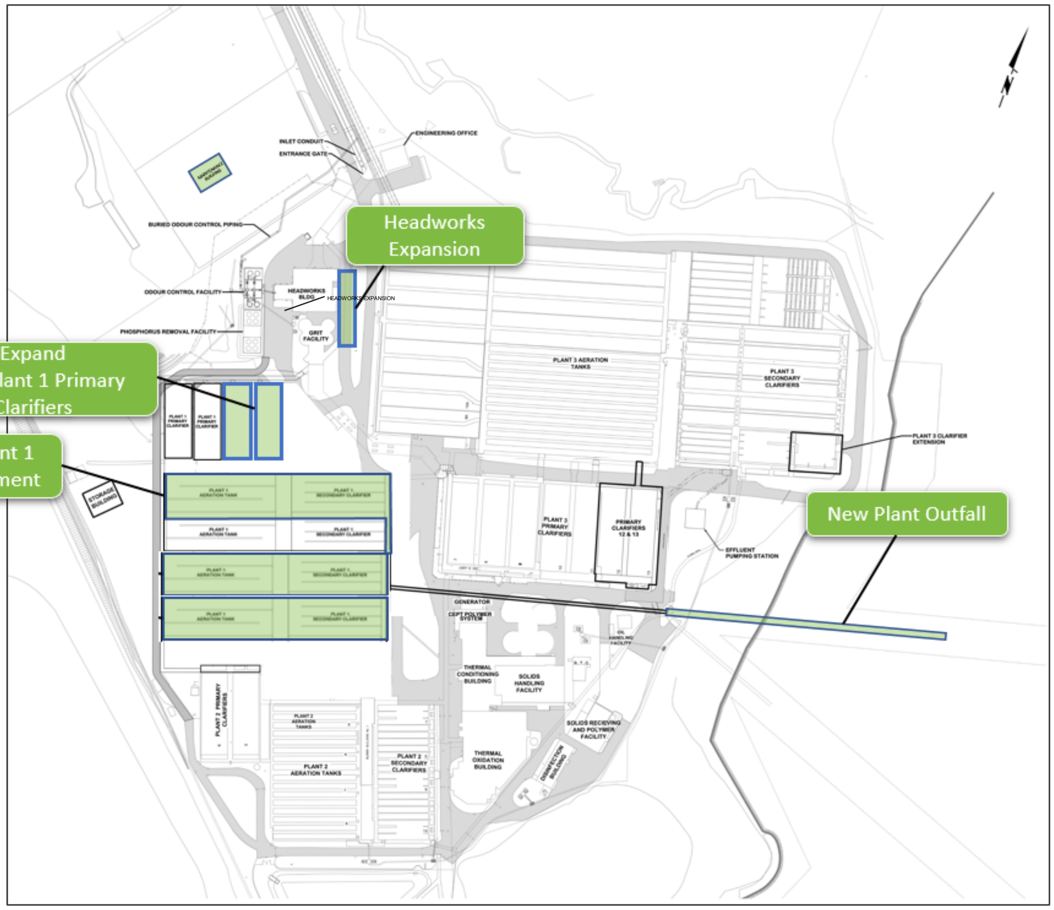

Figure 13 Site Plan for Expansion to Rated Capacity of 600 ML/d

6. Summary

The estimated capital cost for each upgrade phase is summarized in Table 8. Due to the conceptual nature of this memorandum, an estimating allowance of 15% is included for each phase. Appendix C provides additional details on the cost estimates.

Table 8 Summary of Capital Costs

Phase	Estimated Capital Cost
New Plant 1 Site Preparation	**$ 30,000,000 +/- 15%**
Plant 3 Primary Clarifier Capacity Recovery (excludes Effluent Pumping Station)	$ 33,000,000 +/- 15%
Plant 1 Replacement	$ 145,000,000 +/- 15%
Conventional Treatment Plant Rated Capacity Recovery	$ 104,000,000 +/- 15%
Expansion to 600 ML/d	$ 271,000,000 +/- 15%

A

Appendix A

Plant 1 Condition Assessment

Region of Peel

G.E. BOOTH WWTP ODOUR CONTROL AND PLANT 1 ASSESSMENT

PLANT 1 CONDITION ASSESSMENT

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Mississauga, Ontario
L4T 1V2 Canada
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Partners in excellence

January 11, 2016

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Appendix

1. INTRODUCTION

1.1 BACKGROUND

The G.E. Booth (Lakeview) Wastewater Treatment Plant (WWTP) is located at 1300 Lakeshore Road East in the City of Mississauga and currently services central and eastern areas of the Regional Municipality of Peel (the Region) and western portions of York Region. The plant is operated by the Ontario Clean Water Agency (OCWA) and consists of three (3) separate liquids treatment trains (Plant 1, Plant 2 and Plant 3), with a total combined rated capacity of 518 ML/day.

A number of areas of concern have been identified in the plant in recent years including the age and condition of Plant 1. Plant 1 is over 50 years old and has recently experienced failures of various process equipment and piping. Plant 1 was constructed in two phases: the original plant (Plant 1A) was constructed in 1962 and expanded (Plant 1B) in 1965. The aeration blowers are shared with Plant 2 and located in a blower building constructed during the Plant 2 expansion in 1973.

A detailed and comprehensive multidisciplinary condition assessment of Plant 1 structures, process, mechanical, electrical and instrumentation and control/SCADA components has been completed as the first step in identifying the best approach to upgrade or replace Plant 1 capacity.

1.2 PURPOSE OF TECHNICAL MEMORANDUM NO. 3

The purpose of Technical Memorandum No. 3 (TM-3) is to describe and document the detailed condition assessment of Plant 1, which includes a review of available documentation and comprehensive on-site inspection by experienced senior discipline leads to complete condition logs for individual equipment/process areas with photos.

TM-3 documents the findings of the Plant 1 condition assessment, including discussion of key findings and identification of critical repair and replacement recommendations.

2. CONDITION ASSESSMENT SCOPE

The Condition Assessment scope includes all dedicated Plant 1 process areas as well as the blower building and general electrical service infrastructure:

- Primary Treatment
  - Four (4) Primary Clarifiers
  - Raw Sludge Pumping Station (PS) 1, Raw Sludge PS 2 and interconnecting gallery
- Secondary Treatment
  - Four (4) Aeration Tanks
  - Six (6) Secondary Clarifiers
  - Return Sludge PS 1
  - Return Sludge PS 2 and adjoining galleries
  - Blower Building (shared with Plant 2)
- Additional Plant 1 Electrical Infrastructure

The main process areas visited during the condition assessment are depicted in Figure 1.

Figure 1 G.E Booth Plant 1 Process Areas Site Plan

3. APPROACH AND METHODOLOGY

3.1 BACKGROUND INFORMATION

Previous drawings were reviewed to become familiarized with construction and equipment details ahead of the site visit and to gather information that could not be determined through non-destructive visual inspection. A summary of the drawings reviewed is presented in Table 1.

Table 1 Background Drawing Information

Contract Name	Job No.	Consultant	Version	Date
Lakeview Sewage Scheme	59-S-43	Gore and Storrie Limited	Revised as Constructed	February 1962
Lakeview Water Pollution Control Plant Extension No. 1	63-S-160	Gore and Storrie Limited	Revised as Constructed	August 1965
Lakeview Water Pollution Control Plant Extension No. 2 Contract 2 Settling and Aeration Works	1-0053-66-01	Gore and Storrie Limited	Revised as Constructed	February 1973
Lakeview Wastewater Treatment Plant Contract No. 7 Primary and Secondary Treatment	02-2935	KMK and B&V		January 2004

Additional background information sources included:

- Ministry of Environment Environmental Compliance Approval (ECA) No. 1043-7QNR8L issued on April 14, 2009
- Shop drawings
- 2014 Asbestos Reassessment Survey (CGI Group, 2015)

3.2 DATA COLLECTION AND INSPECTION/ASSESSMENT

Site inspections were undertaken on November 3 and 4, 2015. CIMA developed site specific forms for field data collection and notes; completed forms (transcribed and with photos of key areas added) are provided in Appendix A. The team members included:

- Process mechanical – Marina Khinich-Kreynin, P.Eng. and Kimberley Thomas, P.Eng., M.A.Sc.
- Structural and Architectural – Rebecca Pringlemeir, P.Eng. and Emily Keyes, EIT
- Electrical, Instrumentation and Controls, and Building Mechanical – Brian Sudic, P.Eng. and Michael Liu, P.Eng.

3.3 CONDITION ASSESSMENT APPROACH

Based on visual, non-invasive site inspections, the condition of existing equipment and facilities were assigned one of three (3) physical condition grades, ranging from Good (3) to Poor (1). The definitions of the physical condition grading terms are presented in Table 2.

Table 2 Physical Condition Grading System

Condition	Description
3 – Good	Acceptable physical condition – no or minor wear and tear, minimum risk of physical failure. No immediate repair work required, or only minor work required (if any).
2 – Fair	Acceptable physical condition – moderate wear and tear, moderate risk of physical failure. Minor work may be required, but asset is still serviceable.
1 – Poor	Poor physical condition – heavy wear and tear, failure is likely in short term. Substantial work required in short term, asset barely serviceable.
0	Asset exists, but was not able to be inspected.

Excluded from this report are all areas that were not accessible, such as in-service tanks, sumps, confined spaces, roofs, and elements hidden by tiles, false ceilings, cladding, panels or other coverings. Disassembly or operational checks of equipment (e.g., exercising sluice gates, valves, and pumps) were not performed during these investigations.

4. CONDITION ASSESSMENT FINDINGS

4.1 CONDITION ASSESSMENT OVERVIEW

All areas of Plant 1 were visually assessed by process area and design discipline. Completed Physical Condition Assessment Forms, including photographs, are provided in Appendix A, and an overview of key findings, including summaries of short term (high priority and to be completed in 5 years) repairs and equipment replacement recommendations, with budget cost estimates, are presented in this section.

4.2 PRIMARY TREATMENT – PRIMARY CLARIFIERS

4.2.1 General Overview

Plant 1 contains a total of four (4) rectangular primary clarifiers (PCs) equipped with chain & flight sludge mechanisms. PC No. 1 and 2 were constructed in 1962 and are two-pass tanks, with overall dimensions of 27.28 m long by 10.78 m wide per tank and 3.7 m side water depth (SWD). PCs No. 2 and 4 were constructed in 1968 and are three-pass tanks, with overall dimensions of 26.50 m long by 16.50 m wide per tank and 3.7 m SWD.

During the site visit, PC No. 3 was offline, empty, and undergoing refurbishment, including new chain & flight sludge mechanisms including motors. Based on the condition of the other motors, it appears that PC No. 3 is the only recently refurbished PC.

4.2.2 Process

The PCs have manual inlet slide gates that distribute flow to the PCs from the influent channel. PCs No. 1 and 2 each have four (4) influent gates: 1 gate and 2 gates are closed in PC No. 1 and 2 respectively, and are grown over with vegetation. PC No. 3 and 4 each have six (6) influent gates; all PC No. 3 gates are closed (the tank is offline) with minor leakage and all Primary No. 4 gates are open. All open gates are supported either by rope tied to a handrail or using wood pieces or bricks.

The longitudinal and cross collector motor and drives for PC No. 1, 2 and 4 all appear to be original and are discussed further in Section 4.2.4. Although in fair condition, all equipment is approaching end of service life. These three (3) tanks were in operation at the time of the visit and it was not possible to inspect the chain & flight components. The longitudinal and cross collectors for PC No. 3 are new.

All scum troughs appear to be operational and are in fair condition, with some clogging apparent.

The PC No. 1, 2 and 4 weir plates are in poor condition, with rusty, jagged, irregular edges and heavy algae growth. Based on the record drawings, the original weir plates had a straight edge. The weir plate on PC No. 3 was not in place at the time of inspection.

4.2.3 Structural and Architectural

The PCs are cast in place concrete tanks with multiple concrete bridges as access points that run from the east to west side of the tank as well as walkways on the walls between the clarifiers running north to south. The cement matrix on all exposed concrete is deteriorating with small aggregate visible throughout. The aluminum handrail height on PC No. 1 and 2 does not meet the current Ontario Building Code. The handrail was connected using multiple methods, including embedment into the concrete. Spalling has occurred around the connections that include a socket style connection to the concrete slab and tops of walls. Repairs to some handrail connections have been completed at one time, although in some locations the repair product has dried out and cracked. Checkered plate covers have been used over the channels on the west side of the tanks and are in fair condition.

PC No. 3 was offline and empty and the majority of the interior structure was visible from above. The walls appeared to be in fair condition, with staining visible and multiple locations where rusting and spalling has occurred at previous equipment connections. Multiple joint locations have sealant missing and vegetation growth. Leakage has occurred in one joint location in the interior of the tank, between two cells, where leakage is generally not considered as critical.

To maintain the PCs in long term operation, the concrete will need to be resurfaced, and all expansion joint sealants replaced. All handrails that do not meet code will have to be replaced, all spalled concrete at the handrail bases will need to be repaired; however, review of the handrail around the checkered plate covers may reveal that they can be eliminated in some locations.

4.2.4 Electrical

The PC chain & flight motors and gear boxes are in poor condition. Equipment is outdoor type, exposed to wet conditions with signs of corrosion. Custom fitted stainless steel covers used for mechanical protection are also showing signs of corrosion. Each motor is equipped with explosion-proof local disconnect switches, junction boxes, fittings, rigid metal conduits and TECK90 type conductors for power distribution. The equipment appears to part of the original installation of the clarifiers and has reached their end of service life. It is recommended that original equipment be replaced to maintain equipment classification (NFPA 820) and ensure equipment reliability.

Lighting in this process area is pole-mounted High Pressure Sodium (HPS) lighting fixtures that were installed during the original Plant 1 construction. The lights have exceeded their typical 20 year service life and should be replaced.

4.2.5 Repair and Replacement Recommendations

A summary of critical, short term (i.e., within the next 5 years) repair and replacement recommendations is presented in Table 3.

Table 3 Summary of Short Term Repair and Replacement Recommendations

Discipline	Asset Description	Recommendation	Budget Cost Estimate
Process	Clarifier mechanisms	Replace in 3 primary clarifiers	$1,409,000
Process	Weirs	Replace in 3 primary clarifiers	$51,000
Structural	Handrail	Replace all handrail on PC No. 1 and 2	$84,000
Structural	Concrete	Repair spalls at handrail	$280,000
Structural	Concrete	Seal all joints	$560,000
Electrical	Chain & Flight Motors and Actuators	Replace original motors and actuators, along with distribution and disconnect switches.	$175,000
Electrical	Lighting	Replace original lighting with high efficiency LED flood lights	$140,000

4.3 PRIMARY TREATMENT – RAW SLUDGE PS 1 AND PS2 AND GALLERY

4.3.1 General Overview

The Plant 1 PCs are equipped with a total of two (2) raw sludge pumps, each rated at approximately 15.7 L/s at 21 TDH and one (1) scum pump rated at approximately 9 L/s at 13.7 TDH. One (1) raw sludge pump is dedicated to each pair of clarifiers, with Raw Sludge Pump No. 1 serving PCs No. 1 and 2 and Raw Sludge Pump No. 2 serving PCs No. 2 and 3; there is no redundancy. The pumps and piping (including raw sludge, scum, and unwatering piping) are contained in the basements of and connecting gallery between Raw Sludge PS 1 and 2. The gallery is also connected to the digester access tunnel.

4.3.2 Process

Raw Sludge Pump No. 1 is in poor condition, with rust on the pump body and motor. The piping is heavily rusted and there is leakage at the connection to the pump discharge. Raw Sludge Pump No. 2 is in fair condition and appears to have been replaced at some time. The piping and valves are in poor condition, with heavy rust.

Primary Scum Pump No. 1 is in poor to fair condition, with rust on the pump body and motor. Associated piping is in poor condition with heavy rusting, although the discharge piping and valve is in fair condition, having been replaced in the mid-1980s.

Piping is generally not labeled. Most piping and valving is in poor condition and requires replacement.

4.3.3 Structural and Architectural

Raw Sludge PS 1

The Raw Sludge PS 1 substructure consists of cast in place concrete walls and base slab. Localized cracking and spalling has started on the basement roof slab and the “ships ladder” to the Raw Sludge Gallery has corroded.

The Raw Sludge PS 1 superstructure is divided into multiple storage rooms and is a combination of loadbearing triple brick, cast in place concrete and block walls. The roof structure consists of a steel deck supported on open web steel joists, with the exception of one room, where a cast in place concrete slab was used.

The interior superstructure walls and roof structure were painted at one time and the paint has failed in localized areas throughout the building. The open web steel joists and steel deck have started to corrode and are in poor condition. A plaster ceiling is used in one room, concealing the open web steel joists and steel deck, whose condition is unknown. The roof and roofing will need replacement in this building.

Shrinkage cracking has formed in the floor slab perpendicular to the walls and radially at the floor drains. At the time of the inspection, water covered the entire floor in the north-west room, making it difficult to assess the condition. The source of the water was not evident; however it is suspected that the roof penetrations may be leaking.

The exterior brick is in fair condition, with the exception of spalling on the north-east and south-east corners. These areas should be repaired and all brick repointed. Painted steel doors are used throughout the building and have localized paint failure and inoperable door hardware on multiple doors. The equipment door is in poor condition, with missing door hardware and paint failure. In all cases, door frames have started to corrode. All the doors will need replacement in the medium term. Aluminum and steel windows appear to be in fair condition, but will require replacement in the medium term.

Raw Sludge PS 2

The Raw Sludge PS 2 substructure consists of cast in place walls and base slab. The superstructure is loadbearing triple brick walls with a cast in place concrete roof slab.

The substructure roof slab is in poor condition with spalling around a light fixture, exposing rusted rebar. Paint has failed in localized areas on the walls and columns.

The superstructure is in fair condition. The concrete topping on the floor slab has chips and cracks, specifically at the brick starter wall. Condensation appears to be causing paint to fail around pipe penetrations in the roof slab.

Painted steel doors are used throughout the building and have localized paint failure and inoperable door hardware on one door. Door frames have started to corrode and will need replacement. Aluminum windows have concrete sills and steel lintels and one window appears to have impact damage on the sill and light corrosion has started on all frames and lintels. Windows will need replacement in the medium term.

The roof was not accessed and therefore not inspected, although, from a distance, vegetation growth was visible, suggesting it may be approaching the end of its service life and will require replacement in the medium term.

Raw Sludge Gallery

The gallery is constructed of cast in place concrete. The original construction of the gallery, located at the north end, was built as a crawl space, and is very difficult to maneuver. In some areas the structure was not visible due to the large quantity of pipes lining the wall and roof slabs.

Cracking is visible throughout the gallery with some containing efflorescence. Leaking is not apparent, with the exception of one location on the shared wall between the gallery and the PCs. Spalling has occurred around expansion joints and joint filler material is falling out of place in one location. Pipe penetrations through concrete walls have not been properly sealed in multiple locations and many steel pipe supports have fully corroded.

A steel door was located at the north end of the gallery and was not operable.

4.3.4 Electrical

Raw Sludge PS 1

The main electrical equipment in Raw Sludge PS 1 is MCC 01-2 (600V, 3ph). 600V, 3 phase power for MCC 01-2 is sourced from MCC-01 in the Administration Building. The MCC also includes a 600V 3 phase feeder breaker to provide power to MCC 01-21 in the Raw Sludge PS 2. The 600V MCC lineup shows signs of extensive corrosion and has been in service for over 30 years. The existing MCC is based on a discontinued product that is no longer available and more difficult to maintain. The MCC 01-2 is recommended for immediate replacement with new, to minimize risk of equipment failure.

Electrical distribution equipment at the station is based on original distribution conduits and cables (wall-mounted Teck cables, rigid metal conduits and PVC conduits) that have exceeded typical service life. Extensive corrosion is apparent on exterior and some interior rigid metal conduits. PVC conduits are not rated for classified areas and should be replaced with rigid metal conduits suited for Class 1 Div 2 environments. Wall-mounted explosion-proof switches, disconnects and receptacles are all original. Corroded conduits and any original distribution equipment is in poor condition and requires replacement.

Lighting systems are also original and at the end of their service life. Some interior lighting fixtures have failed and are not functional. Exterior lighting (wall packs and flood lights), HPS (in storage and electrical room) and fluorescent T8 tube lighting (in staircase to gallery) are all original and require replacement. Existing light switches are not rated for classified environments and need to be replaced with switches in gasketted enclosures.

Raw Sludge PS 2

The main electrical equipment in Raw Sludge PS 2 is MCC 01-21 (600V, 3ph, General Electric), supplied with 600V 3 phase power from MCC 01-2 in the electrical room of Raw Sludge PS 1. The MCC does not include a feeder breaker to supply to MCC 01-211 in the Storage Room, as indicated on the single line diagrams (SLD) located in the facility. The MCC 01-211 does not exist and the SLD needs to be verified and updated accordingly. The MCC 01-21 is original and has been in service for over 30 years; it is at the end of its service life and is based on a discontinued MCC product that is no longer not available. MCC 01-21 is in poor condition and is recommended for immediate replacement.

The electrical distribution equipment including lighting panels, transformers, conduits and cables are original and have been in service for more than 30 years. The distribution system consists of wall-mounted Teck cables, rigid metal, aluminum conduits and PVC conduits. Signs of corrosion are apparent on some interior rigid metal conduits and in the below grade gallery. The wall-mounted switches, disconnects, pull-boxes and enclosures are at their end of life and not rated for classified environments.

Lights and switches in the Raw Sludge PS 2 are original, more than 30 years old and have reached their end of life. There are missing lights for ceiling and wall-mounted fixtures. Some interior lighting fixtures have failed and require replacement. Exterior lighting (wall packs and flood lights) are original and have broken lenses. Ceiling-mounted incandescent light fixtures in the electrical room have missing lighting units. Existing light switches are not rated for classified environments and need to be replaced with switches in gasketted enclosures.

Raw Sludge Gallery

Electrical distribution in the Raw Sludge PS Gallery is wall-mounted, with no embedded distribution except for transitional wall penetrations. The distribution consists of aluminum and rigid metal conduits, Teck cables and some PVC conduits. The majority of the conduits and Teck cables are in fair condition, with some metal conduits showing signs of corrosion. PVC conduits are not suited for hazardous environments and need to be replaced with rigid metal, rated for Class 1 Div 2 environments.

Most of the switches and disconnects are for small motor loads and pumps (<1 HP) and are in wall-mounted explosion-proof style enclosures. All switches are original and at end of life and should be replaced with equipment rated for the hazardous environments.

There are wall-mounted caged lighting fixtures (explosion proof) in the galleries with some failed fixtures that need to be replaced. Pendant style lighting is currently installed in gallery access areas, which should be replaced with Class 1 Div 2 rated lighting fixtures. Some light switches and the motion sensors in the galleries are not rated for classified environments.

4.3.1 Instrumentation and Controls

Raw Sludge PS 1

The electrical room contains the Raw Sludge Pump No. 1 and 2 Control Interface Panels, and the wall-mounted Variable Speed Drive (VSD) are all in fair condition. The VSDs were installed in the last 5 to 10 years based on the model and condition of the equipment. The pump control equipment may not be rated for classified environments; therefore, ventilation upgrades to provide unclassified space for existing equipment should be considered.

There are original panels and cabinets that have been abandoned or out of service, which should be removed from site.

Raw Sludge PS 2

The existing gas detection system consists of a lower explosive limit (LEL) detection and has analog meter displays for concentration readings. The detection unit is based on technology that has been discontinued. The detection unit is at the end of its service life and should be replaced with a sensor and transmitter that comes with a digital display.

4.3.2 Mechanical

Raw Sludge PS 1

Heating in the PS is provided by one (1) electric unit heater in the electrical room (fair condition), two (2) hydronic heaters in the storage rooms (poor condition), and baseboard water heaters in the storage rooms (poor condition) and the hot water piping shows signs of heavy corrosion. The heating units function could not be verified, but are in poor condition and should be replaced.

Raw Sludge PS 1 has poor ventilation with no forced air flow. Existing exhaust fans are original and no longer functional. Original intake louvers are in poor condition and ceiling openings to atmosphere allow ingress of precipitation and foreign objects. It was noted that the storage room may have been exposed to flooding.

Raw Sludge PS 2

Heating is provided by one (1) electric unit heater (fair condition) in electrical room and hot water radiators for stairs and other parts of the PS. The heating units are original and functions of the units could not be verified.

Ventilation in the Raw Sludge PS 2 is poor, with no forced air flow. The existing fans are original and no longer functional. The original louvers and openings are also in poor condition.

Raw Sludge Gallery

There is currently no HVAC system to provide forced air ventilation through the galleries. The gallery is accessible through open stair cases in Raw Sludge PS 1 and 2. Heating is provided via hot water radiators, that are original and at their end of service life. The galleries and access ways are exposed to humid conditions that will reduce the life of typical heating equipment. To allow this interconnecting space to be considered as unclassified, NFPA820 requires 6 ACH.

4.3.3 Repair and Replacement Recommendations

A summary of critical, short term (i.e., within the next 5 years) repair and replacement recommendations is presented in Table 4.

Table 4 Summary of Short Term Repair and Replacement Recommendations

Discipline	Asset Description	Recommendation	Budget Cost Estimate
Process	Raw Sludge Pump No. 1 and 2	Replace	$70,000
Process	Raw Sludge and Scum Piping/Valves	Replace	$175,000
Process	Spools	replace	$320,000
Process	Primary Scum Pump No. 1	Replace	$20,000
Process	Sump pumps	Replace	$29,000
Structural	Steel roof structure-PS1	Coat steel deck and OWSJ	$30,000
Structural	Concrete-PS1	Repair spalls and cracks	$28,000
Structural	Concrete-PS1	Seal pipe penetrations	$28,000
Structural	Concrete-PS1	Repair expansion joints	$35,000
Structural	Concrete-PS2	Repair spalls and cracks	$28,000
Structural	Concrete-PS2	Seal pipe penetrations	$14,000
Structural	Concrete-PS2	Repair expansion joints	$35,000
Electrical	Raw Sludge PS1 MCC 01-2	Replace MCC 01-2 (3 sections)	$126,000
Electrical	Raw Sludge PS1 Distribution	Remove and replace PVC conduits with rigid metal conduits.	$35,000
		Replace all corroded conduits and any original distribution equipment and switches at the end of their service life.	$91,000
Electrical	Raw Sludge PS1 Lighting	Replace lighting fixtures (interior & exterior) and light switches with properly rated equipment	$63,000
I&C	Raw Sludge PS1 Pump Controls & Panels	Replace existing control systems.	$105,000
		Remove any abandoned and out of service electrical panels and cabinets.	$14,000
Mechanical	Raw Sludge PS1 HVAC system	Replace existing heaters and related equipment and services that are original or in poor condition.	$28,000
		Remove all existing fans and ventilation openings.	$16,800
		Replace HVAC system to provide 6 ACH.	$49,000
Electrical	Raw Sludge PS2 MCC 01-21	MCC 01-21 (2 sections) is recommended for immediate replacement to minimize the risk of equipment failure.	$84,000
Electrical	Raw Sludge PS2 Distribution	Replace PVC conduits with rigid metal conduits suited for Class 1 Div 2 environments.	$42,000
		Replace all corroded conduits and original distribution in poor condition or at the end of their service.	$91,000
		Replace switches, disconnects, pull boxes and enclosures that have reached their end of life and equipment that are not rated for classified environments.	$42,000
Electrical	Raw Sludge PS2 Lighting	Replace light fixtures, switches and sensors that are not appropriately rated for Class 1 Div 2 environments or are broken, failed or have reached end of life.	$70,000
I&C	Raw Sludge PS2 Gas Detection system	Replace gas detection system (LEL).	$11,000

Mechanical	Raw Sludge PS2 HVAC system	Replace hot water radiator. Remove all existing fans and ventilation openings. Replace HVAC system to provide 6 ACH.	$75,000
Electrical	Raw Sludge PS1 & PS2 Gallery Distribution	Replace all PVC and corroded conduits with rigid metal conduits.	$30,000
		Replace original switches and disconnects, which are at their end of life, to ensure classification ratings.	$65,000
Electrical	Raw Sludge PS1 & PS2 Gallery Lighting	Replace original lighting fixtures that are at the end of their service life.	$40,000
		Replace all light fixtures that are not appropriately rated for Class 1 Div 2 environments.	$60,000
Mechanical	Raw Sludge PS1 & PS2 Gallery HVAC	Replace hot water radiators with unit heaters. Replace HVAC system to provide 6 ACH for Class 1 Div 2 galleries and access spaces.	$189,000

4.4 SECONDARY TREATMENT – AERATION TANKS

4.4.1 General Overview

Plant 1 contains a total of four (4) three-pass rectangular Aeration Tanks (ATs) equipped with fine bubble aeration systems. ATs No. 1 and 2 were constructed in 1962 and Aeration Tanks No. 3 and 4 were constructed in 1968. All Plant 1 aeration tanks are 43.9 m long by 18.7 m wide with 4.2 m SWD. Manual aeration distribution is used between the tanks; the aeration blower system is described in Section 4.8.

4.4.2 Process

A heavily rusted motorized sluice gate in very poor condition with heavy corrosion is located on the influent conduit. This gate is appears to be abandoned.

Each AT is equipped with one (1) inlet gate. The inlet gates for all ATs are in poor condition. The gates and frames are rusted (in some cases heavily) and the seals are peeling. AT No. 4 is the only motorized gate; the actuator is in fair condition.

All ATs were in operation and the condition of diffusers and associated frames and piping could not be observed. The following observations were made of the tank liquid surface condition during the site visit, which suggest potential air distribution problems (e.g., due to clogged or broken diffusers and/or associated piping):

- AT No. 2: first half of Pass 2 was stagnant and exhibited heavy algae growth
- AT No. 3: first quarter of Pass 1 was stagnant
- AT No. 4: Half of Pass 1 and Pass 2 exhibits turbulent areas indicative of broken diffusers. Half of Pass 1 has a still surface with no evidence of aeration.

The unbalanced distribution of air has negative implications on energy efficiency and performance.

Air piping headers and drop legs are in poor condition with heavy rusting. Air piping headers run in channels between tanks; vegetation and rust was observed through the grating.

A mixer located on a bridge in the middle of Aeration Tank No. 3 Pass 1 is heavily rusted and does not appear to be operational.

AT No. 4 was previously used in an integrated fixed film activated sludge (IFAS) pilot study. IFAS media continues to be apparent in Pass 3 and some of the IFAS equipment (e.g., screens, walkways) remain in place). The IFAS related equipment is generally in poor condition and should be removed.

Sanitaire analyzers are located at the end of aeration tank passes, as follows:

- AT No. 1: electrical box at end of pass 1 and 3; sensor not observed and no display
- AT No. 2: electrical box at end of pass 1; sensor not observed and no display
- AT No. 3: electrical box at end of pass 1, 2, and 3; sensor not observed and no display
- AT No. 4: electrical box at end of pass 1, 2, and 3; sensor not observed and displays did not appear to be functional

The aeration system is controlled manually, therefore the data is used for monitoring and manual distribution adjustment only. No functioning indicators were observed and the purpose of the analyzers were not labeled.

A single actuated valve and flow meter are used to adjust total air flow to Plant 1 via the Plant 2 Blower MCP. Upgrade to automatic controls is a recommended medium term upgrade. Automatic air control is good practice for performance and energy efficiency.

4.4.3 Structural and Architectural

Aeration tanks are cast in place concrete tanks with multiple concrete channels covered with aluminum grating. The cement matrix on the concrete channels is deteriorating with small aggregate visible throughout. In the medium term resurfacing of the concrete will be required.

The grating is warped and uneven in some locations and has been replaced with temporary steel grating over channels between the Aeration Tanks and Secondary Clarifiers that are loose and corroding. Grating over this connection channel needs replacement. The aluminum handrail height is not built to the current Ontario Building Code and is connected with a socket style connection and spalling has occurred. Repairs to the concrete at some handrail connections have been completed and these have also started to fail. Multiple joint locations have sealant missing and loose joint filler. Vegetation growth is visible in multiple joint locations and through channel grating. Checkered plate covers have been used over the channels on the west side of the tanks and are in good condition.

The tanks are below grade and were in operation at the time of the inspection and therefore, only the visible portions of the tank were reviewed. Typically, concrete below the waterline is in similar or better condition than above the waterline.

4.4.4 Electrical

Some existing electrical distribution is aging and should be replaced. .

Lighting in this process area is original pole-mounted HPS lighting fixtures, which have reached the end of their service life and should be replaced.

4.4.5 Instrumentation and Controls

Field equipment and control enclosures show signs of extensive corrosion and are in poor condition. The control switches and enclosures require replacement with explosion-proof equipment rated for Class 1 Div 2 environments.

4.4.6 Repair and Replacement Recommendations

A summary of critical, short term (i.e., within the next 5 years) repair and replacement recommendations is presented in Table 5.

Table 5 Summary of Short Term Repair and Replacement Recommendations

Discipline	Asset Description	Recommendation	Budget Cost Estimate
Process	Inlet Gates	Replace all aeration tank inlet gates	$100,000
Process	Fine Bubble Diffusers and Associated Piping	Replace in all aeration tanks	$1,575,000
Process	Sensors and indicators	Replace as required	$64,000
Structural	Handrail	Replace all handrail on tanks 1 and 2	$280,000
Structural	Grating	Replace grating between Aeration Tanks and SC	$10,000
Structural	Concrete	Repair spalls at handrails	$420,000
Structural	Concrete	Crack injection	$112,000
Structural	Concrete	Replace joint sealant	$392,000
Electrical	Distribution Equipment	Replace with new	$210,000
Electrical	Lighting	Replace original lighting with high efficiency LED flood lights	$294,000
I&C	Control panels and enclosures	Replace with explosion-proof equivalents	$119,000

4.5 SECONDARY TREATMENT – SECONDARY CLARIFIERS

4.5.1 General Overview

Plant 1 contains a total of six (6) two-pass rectangular Secondary Clarifiers (SCs) equipped with chain & flight sludge mechanisms and sludge collectors. SCs No. 1 to 4 were constructed in 1962 and are each 26.5 m long by 10.2 m wide with 3.7 m SWD. SCs No. 5 and 6 were constructed in 1968 and each have overall dimensions of 31.7 m long by 17.2 m wide with 3.7 m SWD.

4.5.2 Process

A parshall flume is located between the two (2) passes of SC No. 2. No level sensor is in place and this flume no longer appears to be used as a flow measurement device. Secondary effluent flow meters located in the secondary effluent channel between SC No. 5 and 6 are in poor condition and should be replaced.

All longitudinal and cross collector motors and gear drives are in poor condition, with heavy rusting. SCs No. 1 and 6 appear to have all original components, the other tanks have combinations of original and replacement components; all are approaching the end of the service life. This equipment is discussed further in Section 4.5.4

Effluent weirs for SCs No. 1 to 3 are in fair condition, with minor corrosion. SC No. 4 is in very poor condition, with heavily corroded weir plates and deteriorated concrete; flow is uneven along the weir plate and flow leaking through bolt holes and under the weir plate. The weir plates of SCs No. 5 and 6 are in poor to fair condition, with some uneven flow caused by uneven weir plates.

SCs No. 1 to 4 are equipped with scum troughs, which are in poor to fair condition with some clogging apparent. The SC No. 3 and 4 scum troughs have broken arms. SCs No. 5 and 6 have scum collection mechanisms with heavily rusted chains motor and drives that appear to be original. The mechanisms were not observed in operation.

4.5.3 Structural and Architectural

The SCs are cast in place concrete tanks with multiple concrete bridges and channels covered with aluminum grating.

The cement matrix on the concrete bridges is deteriorating with small aggregate visible throughout. The aluminum handrail height is not built to the current Ontario Building Code and appears to have been embedded into the concrete bridges with a socket style connection. Spalling and cracking has occurred, with visible rusted rebar in multiple locations. Repairs to the sockets at some handrail connections have been completed at one time, although the repair product has dried out and cracked.

Multiple expansion joint locations have sealant missing and loose joint filler. Some joints have a significant separation and vegetation growth. Checkered plate covers have been used over the channels on the west side of the tanks and are in good condition.

The tanks are below grade and were in operation at the time of the inspection and therefore, only the visible portions of the tank were reviewed.

4.5.4 Electrical

The SC chain and flight motors and actuators are in poor condition, with signs of corrosion. Custom fitted stainless steel covers used for mechanical protection are also showing signs of corrosion. Each motor and actuator are equipped with explosion-proof local disconnect switches, junction boxes and rigid metal conduits and Teck cables for power distribution. The majority of the electrical equipment is original and is at the end of its service life and is recommended for replacement.

Lighting in this process area is pole-mounted HPS lighting fixtures that were erected from the original Plant 1 construction. They have been in service for more than 20 years and should be replaced.

4.5.5 Repair and Replacement Recommendations

A summary of critical, short term (i.e., within the next 5 years) repair and replacement recommendations is presented in Table 6.

Table 6 Summary of Short Term Repair and Replacement Recommendations

Discipline	Asset Description	Recommendation	Budget Cost Estimate
Process	Sludge collection mechanisms and scum troughs – SC 1 - 4	Replace in all secondary clarifiers	$3,176,000
Process	Weirs	Replace in all secondary clarifiers	$118,000
Process	Scum Troughs/mechanisms	Replace in all secondary clarifiers	$175,000
Structural	Handrail	Replace all handrail on SC No. 1 to 4	$112,000
Structural	Concrete	Repair spalls at handrail	$280,000
Structural	Concrete	Crack injection	$112,000
Structural	Concrete	Replace joint sealants	$252,000
Electrical	Chain & Flight Motors and Actuators	Replace original motors and actuators, along with distribution and disconnect switches.	$140,000
Electrical	Lighting	Replace original lighting with high efficiency LED flood lights	$126,000

4.6 SECONDARY TREATMENT – RETURN SLUDGE PS 1

4.6.1 General Overview

Return Sludge PS 1 is a single story building with basement. The ground level contains a laboratory and electrical equipment and the basement contains the sludge and scum pumps associated with Secondary Clarifiers No. 1 to 4:

- Four (4) return activated sludge (RAS) pumps (one standby), each rated at approx. 45.4 L/s at 8.5 m TDH
- One (1) waste activated sludge (WAS) pump, rated at approx. 17.4 L/s at 4.3 m TDH
- One (1) scum pump, rated at approximately 3.8 L/s at 10 m TDH

4.6.2 Process

All pumps and piping in the Return Sludge PS 1 are painted and appear to be in good condition. However, name plates were painted over therefore details on the pumps are not known. No significant rust or corrosion was observed.

4.6.3 Structural and Architectural

The Return Sludge PS 1 substructure is composed of cast in place walls and slab, housing pipes, pumps and other equipment. The superstructure is loadbearing triple brick and the roof structure is a cast in place roof slab supported on concrete beams. The interior concrete throughout the building appears to be recently painted.

The substructure appears to be in fair condition. Concrete pipe supports have cracking and localized spalling. The cast in place stairs have some spalling on the nosing, possibly from impact damage. The superstructure is also in fair condition, with minor paint wear in localized areas.

The brick exterior has started to spall at the north-east corner, but is otherwise in fair condition. Repointing will be required in the medium term. Shrinkage cracks were visible on the soffit. Steel doors also appear to be recently painted and the aluminum windows are in fair condition.

4.6.4 Electrical

The Electrical equipment of the Return Sludge PS 1 is located on the main floor of the building. The primary distribution equipment servicing the pumping station is MCC 01-1 (2 sections, 600V, 3ph), which is fed from MCC-01 in the Administration Building's electrical room. The MCC provides a 600V 3 phase feeder breaker supply to MCC 01-11, located in the Return Sludge PS 2. MCC 01-1 is based on a discontinued product that has reached end of service life and requires replacement.

Distribution equipment (e.g., distribution and lighting panels, transformers, receptacles, conduits and cables) in the Return Sludge PS 2 are original and more than 30 years old. The interior wall-mounted Teck cables and rigid metal conduits are in fair condition. Signs of corrosion were noticed on the original rigid metal conduits on the exterior of the station.

The lights and switches in the station are original and at the end of service life. Some interior lighting fixtures have failed. Exterior lighting (wall packs and flood lights) are original and are at end of service life, and require replacement. Original ceiling mounted lighting fixture and fluorescent tube lighting on the main floor are in poor condition. Fluorescent tube lighting in the basement (pumps and valves room) are in fair condition. The lighting fixtures, switches and related equipment are not rated for classified environments.

4.6.5 Instrumentation and Controls

The RAS PS has four (4) wall mounted VSDs that service the respective pumps. VSD's were installed after the original construction of the pumping station. There are also pump Control Panels and instruments, which are all in fair condition.

4.6.6 Mechanical

The PS is heated by two (2) electric unit heaters and one (1) hydronic heater on the main floor are in fair condition.

RAS PS 1 has poor ventilation with no forced air flow. HVAC should be upgraded to comply with NFPA820 and provide a fully unclassified space.

4.6.7 Repair and Replacement Recommendations

A summary of critical, short term (i.e., within the next 5 years) repair and replacement recommendations is presented in Table 7.

Table 7 Summary of Short Term Repair and Replacement Recommendations

Discipline	Asset Description	Recommendation	Budget Cost Estimate
Electrical	MCC 01-1	Replace MCC (2 sections).	$140,000
Electrical	Distribution	Replace all corroded conduits and original distribution equipment at the end of their service life.	$63,000
Electrical	Lighting	Replace original lighting and any fixtures that are in poor condition and/or fixtures that are not rated for the classified environment.	$42,000
I&C	Pump Drives and Control Panels	Panels and control units are not rated for Class 1 Div 2 environments. Space needs to be declassified.	$84,000
Mechanical	RAS PS 1 HVAC	Replace HVAC system to comply with NFPA820.	$70,000

4.7 SECONDARY TREATMENT – RETURN SLUDGE PS 2 AND GALLERIES

4.7.1 General Overview

Return Sludge PS 2 contains the sludge and scum pumps associated with SCs No. 5 and 6.

- Three (3) RAS pumps, each rated at approximately 83.3 L/s at 6.4 m TDH
- One (1) WAS pump, rated at approximately 14.4 L/s at 4.8 m TDH
- One (1) scum pump, rated at approximately 3.8 L/s at 12 m TDH

The Return Sludge PS 2 contains an abandoned washroom that is no longer in service; renovation to the washroom are required if it is to be placed back into service. The storage room at the south end of the Return Sludge PS 2 on the ground floor was locked, and therefore not assessed.

Galleries between SCs No. 5 and 6 and between Aeration Tank No. 3 and 4 and SCs No. 5 and 6 contain piping and instrumentation related to sludge and scum pumping.

4.7.2 Process

All pumps, piping, and valves in the Return Sludge PS 2 building are in good condition. The pumps are not original, having been replaced in the late 1980s. Based on name plate information, it appears that the pumps were serviced (or possibly rebuilt) in 2000.

The foam control pump, sump pump, scum pump, and low pressure effluent water strainer (all located in the adjoining gallery) are in fair to good condition, with minor rusting. WAS piping is heavily rusted.

4.7.3 Structural and Architectural

Return Sludge PS 2

The Return Sludge PS 2 substructure consists of a cast in place concrete. The superstructure is divided into multiple rooms including an electrical room and washroom. The superstructure consists of concrete block walls and a steel deck roof, supported on open web steel joists.

The substructure is in fair condition, with only minor spalling on equipment pads and pipe supports.

The superstructure block walls had cracking and paint failure. The roof structure was generally hidden with ceiling drop panels, but was exposed in the washroom. The steel deck appeared to be delaminating and the open web steel joists have significant rust and therefore, the entire roof structure will need replacement. The floor slab was concealed with terrazzo flooring throughout the ground floor and was cracked and appeared to be damp in the electrical room.

The washroom had been abandoned with the toilet, sinks, shower and urinal all inoperable. The finishes in the washroom all have failed as they were placed over glazed block.

The doors were constructed of painted steel, prefinished metal or aluminum. The steel door had damaged hardware and its frame was starting to corrode. The windows are either aluminum or steel construction and were in fair condition. In the medium term all doors and windows and interior coatings will need replacement.

Return Sludge Gallery

Access to the gallery is through a small building constructed of double brick walls and a cast in place concrete roof structure. The staircase and walls leading to the below grade gallery consist of cast in place concrete. The access house has paint failure and the soffit above the stairs is spalling, exposing electrical conduit and rusted rebar.

The gallery is constructed of cast in place concrete. In some areas the structure was not visible due to the large quantity of pipes lining the wall and roof slabs. Paneling was used on the ceiling, concealing the roof slab.

Cracking is visible on the walls and floor slab, with some containing efflorescence. Leaking was not evident, with the exception of one location at the access stair. One expansion joint was open and had visible signs of past leakage. The gallery was taped off at the Return Sludge PS 2 basement entrance, where the sump had caused flooding. Moisture staining is visible on the ceiling around the skylights. The exterior of the skylights are located on the concrete walkways on the west side of the SCs, which have been covered with elevated grating, except at one location.

4.7.4 Electrical

The RAS PS 2 electrical equipment is located on the main floor of the facility. The primary electrical distribution equipment includes MCC 01-11 (3 sections, 600V, 3ph), which is fed from MCC 01-1 in

RAS PS 1. The MCC lineup is more than 30 years old and is in fair condition. The existing MCC is based on a Canadian General Electric that has been discontinued. MCC 01-11 has reached its end of service life and should be replaced to minimize risk of equipment failure.

The distribution equipment in the PS (e.g., wall-mounted Teck cables, rigid metal and PVC conduits) is mostly original and at the end of service life. Newer distribution equipment is in fair condition. Signs of corrosion were noted on some rigid metal conduits and disconnect switches. Some of the original transformers and panels in the station are out of service or completely abandoned and should be removed.

Lighting equipment primarily consists of fluorescent tube (T8) lighting in all areas of the PS with some non-functional fixtures. Fluorescent lights are in fair condition, and they are ceiling-mounted on the main floor and in the basement (pumps and valves room). Exterior lighting (wall packs and flood lights) are original and are at their end of life and should be replaced.

4.7.5 Instrumentation and Controls

The three (3) RAS pumps are equipped with dedicated VSDs, wall mounted enclosures. The pump VSDs are equipped with analog displays and discontinued hardware. The VSDs should be upgraded to modern equipment with digital displays.

The #3 WAS Pump Panel, located in the basement of the PS, is in good condition. Instruments (including flow and turbidity meters) are in fair condition.

There are some control panels and terminal boxes that have been abandoned and out of service. It is recommended that all abandoned equipment are removed from the PS.

4.7.6 Mechanical

Heating within the PS is provided by a mix of original and newer hydronic radiators on the main floor and in the basement. Cooling is provided by a wall-mounted air-conditioning unit, which is in poor condition and out of service.

The RAS PS 2 has poor ventilation with low air flow. The existing fans do not provide adequate ventilation for the pumping facility. The exhaust fans are original and in poor condition. The existing ventilation system requires replacement and should provide ventilation rates sufficient to provide an unclassified space in accordance with NFPA820.

4.7.7 Repair and Replacement Recommendations

A summary of critical, short term (i.e., within the next 5 years) repair and replacement recommendations is presented in Table 8.

Table 8 Summary of Short Term Repair and Replacement Recommendations

Discipline	Asset Description	Recommendation	Budget Cost Estimate
Structural	Concrete	Repair cracks and spalls	$84,000
Structural	Concrete	Expansion joint repair	$28,000
Structural	Steel roof structure	Expose and coat steel deck and OWSJ	$42,000
Structural	Skylight	Add grating over skylight exterior	$7,000
Structural	Bathroom	Demolish and replace all bathroom fixtures	$42,000
Electrical	MCC 01-11	MCC 01-11 (3 sections) is recommended for replacement with the upgrade of RAS PS 2.	$160,000
Electrical	Distribution	Replace PVC conduits with rigid metal conduits suited for Class 1 Div 2 environments and corroded and end of life distribution equipment.	$56,000
		Remove abandoned equipment.	$21,000
Electrical	Lighting	Replace original and non-functional lighting fixtures with new.	$35,000
I&C	Pump VSD, Instruments, Control Panels	Replace and upgrade the 3 VSDs for the RAS.	$112,000
		Remove all abandoned and out of service panels.	$14,000
Mechanical	HVAC	Replace heaters and provide new HVAC system is required for the RAS PS 1 to provide ventilation in accordance with NFPA820	$126,000

4.8 SECONDARY TREATMENT – BLOWER BUILDING

4.8.1 General Overview

Three (3) aeration blowers, each having an approximate capacity of 56,000 m^3/h, serve Plant 1 and 2. The blowers are contained in a dedicated blower building that has several rooms: loading bay, control room, blower room, and washroom. The building was constructed in 1973, with the Plant 2 expansion.

At the time of the site visit, one (1) blower was offline for refurbishment.

4.8.2 Process

The blowers are in fair condition. The building year indicated on the nameplate is 1970. Although the blowers are 45 years old, with ongoing maintenance, the blowers can remain in operation well into the future. An ongoing maintenance program of rebuilding each blower every 15 to 20 years is recommended. At the time of the site visit, one blower was being rebuilt. All LCPs are newer and are in good condition. All observed air piping was is in fair condition. The Air Filter unit appears to be original and in poor condition, but could not be inspected closely due to access restrictions. The air filter is at the end of its service life and will need to be replaced.

4.8.3 Structural and Architectural

The Blower Building was reviewed only in the areas where services for the Plant 1 systems are located on the main floor of the building. The remainder of the building was not inspected and not in the scope, and much of the substructure assets were not accessible.

The Blower Building superstructure consists of multiple rooms. The Loading Bay, Control Room, Blower Room and Washroom were inspected. The superstructure was constructed of a cast in place concrete floor slab finished with tile, structural glazed tile walls and a concrete roof supported on steel beams, columns and bracing.

The Loading Bay floor slab has minor damage, possibly due to wheel loads or impact. The Loading Bay ceiling consists of removable concrete panels and multiple panels are out of place. The washroom roof slab appears to have impact damage, possibly due to impact damage from the monorail above. The washroom ceiling is finished with drop panels and has moisture damage at the entrance. Floor tile is missing and cracked in localized areas, but is otherwise in good condition.

4.8.4 Electrical

Switchgear and Step-down Transformers

The Blower Building contains the main switchgear 04 SWGR 02 & 04 SWGR 03. The switchgear is rated 4160V, 600A, Main Tie Main secondary selective configuration with fused interrupter switches. The switchgear is fed from XMR T2 & T3 and supplies power to the 3 blowers, step-down transformers, feed to Blower Building No. 2, and MCC 02-1 & MCC 03-1. The 4160V switchgear is original and has been in service for more than 30 years and is in fair condition. The 4160V blower motor starters are based on full voltage, non-reversing type. The motor starters are based on equipment that is discontinued and at the end of its service life. The Blower motor starters should be replaced with solid state, reduced voltage type.

XFMR T2-1 and T3-1 are the step-down transformers (4160V-600V/347V) that are connected to MCC 02-1 and MCC 03-1. The two (2) transformers were installed as part of the original 4160V installation and have been in service for over 30 years. XFMR T3-2 (4160V-600V/347V) and interrupter switch provides power to DP-03-2 and is less than 10 years old, and in good condition.

4.8.5 Repair and Replacement Recommendations

A summary of critical, short term (i.e., within the next 5 years) repair and replacement recommendations is presented in Table 9.

Table 9 Summary of Short Term Repair and Replacement Recommendations

Discipline	Asset Description	Recommendation	Budget Cost Estimate
Electrical	Switchgear Blower Motor Starters, and step down transformers	Replace main 4160V switchgear, 4160V blower motor starters and interrupter switches recommended for replacement	$2,240,000

4.9 ADDITIONAL PLANT 1 ELECTRICAL INFRASTRUCTURE

4.9.1 General Overview

Major general Plant 1 electrical infrastructure includes upstream transformers, switchgear and MCCs, and downstream MCCs and related facilities. Plant 1 process and facilities loads are powered by MCCs and step-down transformers of the Administration Building (MCC 01 & MCC 04). This section provides the assessment results of these MCCs and other connected facility loads to MCC 01, which is directly connected to provide power to Plant 1. The Heating Building and the Service Building were also assessed, as they are also connected to MCC 01. Instrumentation and Controls, and Heating/Ventilation systems were assessed, where applicable.

4.9.2 Administration Building

MCC-01 and MCC-04 are located in the Administration Building electrical room. MCC-01 and MCC-04 provide 600V power distribution to other electrical loads and MCCs located in Plant 1. MCC-01 and MCC-04 are fed by transformers T1 and T4, which are located outside, adjacent to the Administration Building. The transformers have been in service for approximately 10 years and are in good condition.

MCC-01 has been in service for 10 years and is in fair condition. It should be considered for replacement with the rest of the end-of-life equipment in the electrical room. MCC-04 has been in service for more than 30 years and is in poor condition; it is a discontinued product that is beyond its end-of-life and should be replaced.

The lighting transformers and lighting panels are original and have been in service for more than 30 years. Dry-type transformers, distribution and lighting have been in service for more than 15 years. The equipment are in fair condition but should be considered for an upgrade with the replacement of the MCCs.

Electrical room ventilation is provided through a central Administration Building HVAC system. Forced-air is provided to the electrical room via a small air duct, which allows adequate cooling and ventilation of the space.

4.9.3 Repair and Replacement Recommendations

A summary of critical, short term (i.e., within the next 5 years) repair and replacement recommendations is presented in Table 10.

Table 10 Summary of Short Term Repair and Replacement Recommendations

Discipline	Asset Description	Recommendation	Budget Cost Estimate
Electrical	Admin Building MCC-04	Replace MCC-04 (3 sections) with modern MC lineup.	$126,000

5. SUMMARY AND FINANCIAL FORECAST

A cash flow forecast for Plant 1 has been developed to estimate the costs required (including replacement and repair) to maintain Plant 1 in operation for 25 years. Appendix B presents a summary of all plant assets, recommended works to maintain the asset in operation for 25 years, a recommended upgrade timeline (i.e., short or medium term) and a budget cost estimate for the recommended work. A summary of the cash flow is presented in Figure 2. In general, considering the overlap of work areas and the close proximity of timelines, a single coordinated project would be recommended for the Plant 1 refurbishment. The total cost fo this refurbishment project is estimated at $ 30,056,400.

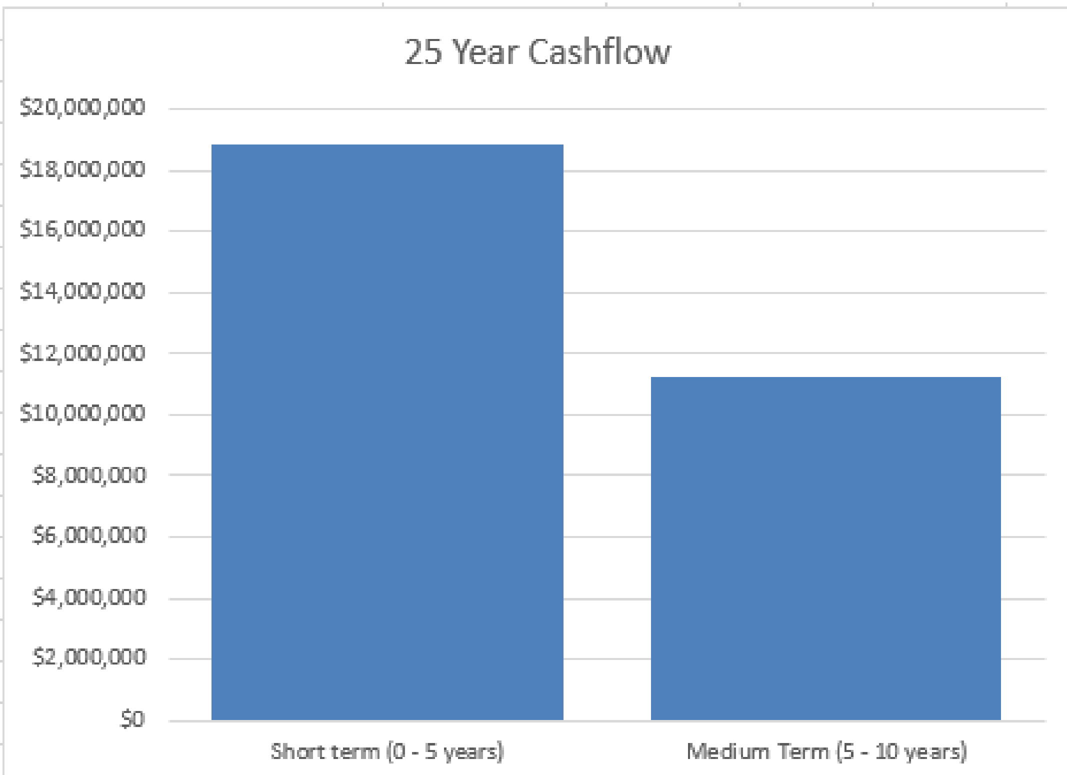


Figure 2 25 Year Cash Flow Summary

Appendix A Completed Condition Assessment Forms

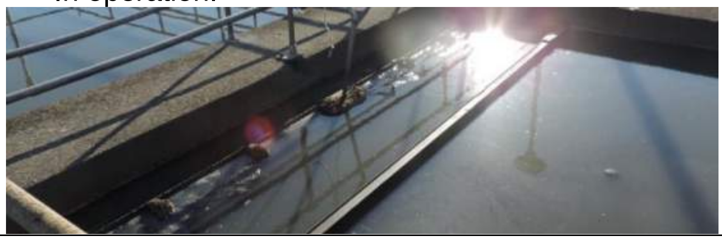
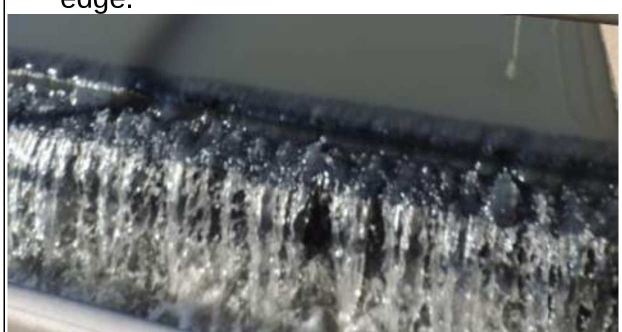
G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area:	Primary Treatment
Process:	Primary Clarifier No. 1
Year of Installation: 1962	**Current Age:** 53 years

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Inlet Gates	Manual distribution gates (4); connect inlet channel to primary clarifier	2	• Not shown on P&IDs • Wood/bricks used to hold position • One is closed and grown over. Three are open. 
Valve	Mud valve? Near inlet channel	1	• Handwheel rusty • Covered with checkerplate, not observable. 
Longitudinal Collector	Motor, drive: Sew Eurodrive; 0.37 kW	2	• Partially enclosed with metal cover • Minor rust on body 

	Chain and Flight x2 (1 per pass)	0	• Tank in surface, only upper surface visible. • In operation. 
Cross Collector	Motor, drive: Sew Eurodrive; 0.37 kW	2	• Partially enclosed with metal cover • Minor rust on body 
Weir Plate		1	• Rusty and covered with algae. Appears to have jagged edge. 
Scum Trough		2	• Appears operational. Little scum observed on tank surface 

Additional Notes:

- Inlet gates indicated on P&IDs not found
- Inlet channel covered with checkerplate, chekerplate and air piping all in fair to good condition.

G.E. Booth WWTP Condition Assessment

<u>Process Mechanical</u>

Date: November 2, 2015

Process Area:	Primary Treatment
Process:	Primary Clarifier No. 2
Year of Installation: 1962	**Current Age: 53 years**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Inlet Gates	Manual distribution gates (4); connect inlet channel to primary clarifier	2	• Not shown on P&IDs • Two are closed and grown over • Two are held open; one by a brick and one by rope  
Longitudinal Collector	Motor, drive: Sew Eurodrive; 0.37 kW	2	• Partially enclosed with metal cover • Minor rust on body
	Chain and Flight x2 (1 per pass)	0	• Tank in surface, only upper surface visible. • In operation.
Cross Collector	Motor, drive: Sew Eurodrive; 0.37 kW	2	• Partially enclosed with metal cover • Minor rust on body
Weir Plate		1	• Rusty and covered with algae. Appears to have jagged edge.
Scum Trough		2	• Appears operational. Little scum observed on tank surface

Additional Notes:

- Inlet gates indicated on P&IDs not found
- Inlet channel covered with checkerplate, chekerplate and air piping all in fair to good condition.

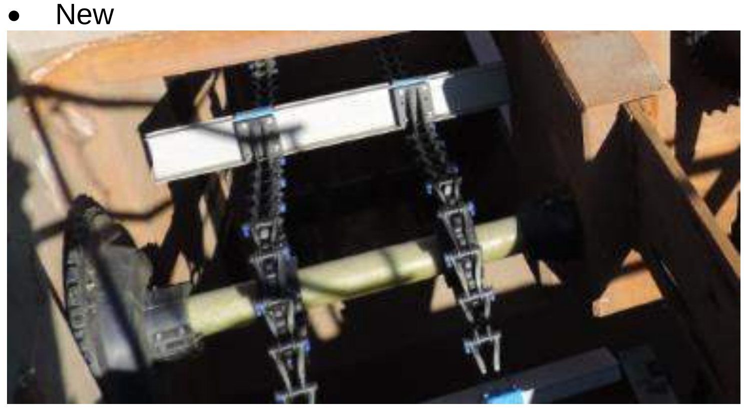
G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area:	Primary Treatment
Process:	Primary Clarifier No. 3
Year of Installation: 1968	**Current Age:** 47 years

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Inlet Gates	Manual distribution gates (6); connect inlet channel to primary clarifier	2	• Not shown on P&IDs • All operational • Closed to isolate tank, some minor leakage observed on concrete below
Longitudinal Collector	Motor, drive: Sew Eurodrive; 0.37 kW	3	• New 
	Chain and Flight x2 (1 per pass)	3	• New • Plastic chains, fibreglass stem • No supplier/manufacturer name available 

Cross Collector	Motor, drive: Sew Eurodrive; 0.37 kW	3	• New 
	Chain and Flight x1	3	• New 
Weir Plate		N/A	• Removed
Scum Trough		2	• All appear operational • 3rd pass scum trough filled with material 
Wooden Baffle		2	

Additional Notes:

- Inlet gates indicated on P&IDs not found
- Inlet channel covered with checkerplate, chekerplate and air piping all in fair to good condition.
- 3 pass tank

G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area: Primary Treatment

Process: Primary Clarifier No. 4

Year of Installation: **1968** **Current Age:** **47 years**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Inlet Gates	Manual distribution gates (6); connect inlet channel to primary clarifier	2	• Not shown on P&IDs • All held open by rope tied to handrail
Longitudinal Collector	Motor, drive: Sew Eurodrive; 0.37 kW	2	• Partially enclosed with metal cover • Minor rust on body
	Chain and Flight x2 (1 per pass)	0	• Tank in surface, only upper surface visible. • In operation.
Cross Collector	Motor, drive: Sew Eurodrive; 0.37 kW	2	• Partially enclosed with metal cover • Minor rust on body
Weir Plate		1	• Rusty and covered with algae. Appears to have jagged edge.
Scum Trough		2	• Appears operational. Little scum observed on tank surface

Additional Notes:
- Inlet gates indicated on P&IDs not found
- Inlet channel covered with checkerplate, chekerplate and air piping all in fair to good condition.
- 3 pass tank

G.E. Booth WWTP Condition Assessment

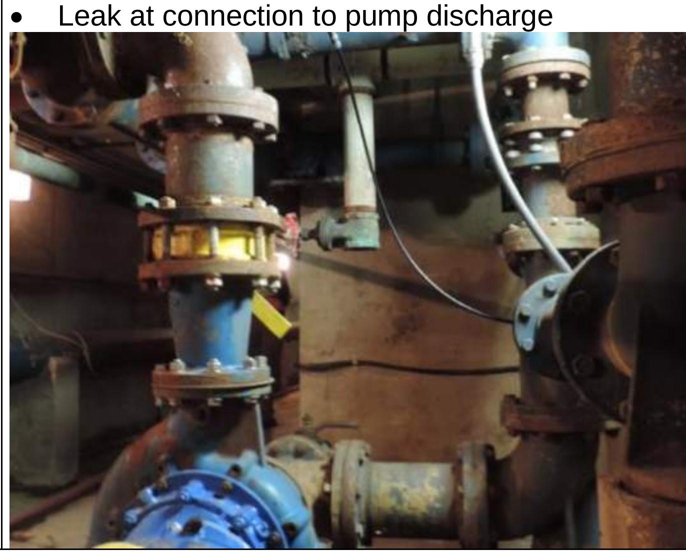
Process Mechanical

Date: November 2, 2015

Process Area: Primary Treatment

Process: Raw Sludge Pumping Station 1 and 2 and Connecting Gallery

Year of Installation: **1962/1968** **Current Age:**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies**
Raw Sludge Pump No. 1	Pump Wemco Hidrostal 20 HP	1	• Serves 2 primary clarifiers, no redundancy • 1 actuated valve per primary clarifier • Flush connection line connected • Flange leaky • Pump body rusted 
	Piping	1	• Extensive rusting • Leak at connection to pump discharge 

	Actuated Valves	2	• Actuator looks relatively new
	Motor Optim Tefc Westinghouse 15kW	1	• Body rusty
	Sump Pump	0	• Could not be observed • Rusty discharge piping
Primary Scum Pump 1	Pump Vaughan	1-2	• Pressure gauge unreadable • Body rusty • Flush water connection 
	Motor Westinghouse 10 HP	1-2	• Body rusty 

	Piping	1	• Rusty 
	Discharge piping and valve	2	• Replaced in 1985
Raw Sludge Pump No. 2	Pump Wemco Hidrostal	2	• Pump looks not original • Flush water connection 
	Piping	1	Very Rusted 

	Actuated Valves	1	• Valves generally rusty • Pneumatic actuators on inlet valves look relatively new 
	Motor Optim Tefc Westinghouse 15kW	2	
Flow Meter and Indicator	Bally Fisher Porter	3	• Looks relatively new • Indicator labeled as being for 1-4 pump rate • Stainless steel
Sump Pump	Gorman Rupp pump, dry pit. Westinghouse motor; 3 HP	1	

Additional Notes:

- Appears that sludge pumps might not be original; may be able to refurbish.
- Piping generally not labeled
- No scum hopper found
- No HVAC equipment observed – empty pipe capped with mesh, and HW return piping observed on upper level
- All piping requires replacement
- A sludge flow FIT observed on upper level of the tunnel; may be abandoned? Could not identify purpose.

G.E. Booth WWTP Condition Assessment

Process Mechanical

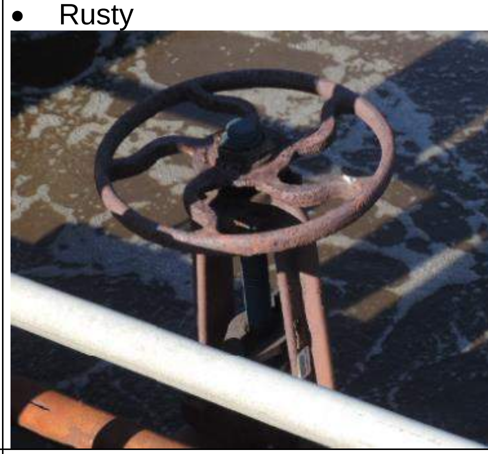
Date: November 2, 2015

Process Area: Secondary Treatment

Process: Aeration Tank No. 1

Year of Installation: **1962** **Current Age:** **53 years**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Inlet Gate(?)	Motorized Sluice Gate	1	• Not shown on P&ID, Abandoned? • Painted, heavy rusting • Stainless steel stem 
Inlet Gate	Manual	1	• Rusty • Seal peeling • Stainless steel stem 

Diffusers		0	• Tank in use therefore diffusers could not be assessed • Surface of tank observed: • Surface does not show obvious signs of broken or clogged diffusers 
Air Drop Leg Valves		1	• Rusty 
Air Piping	Header run in channel under grating	1	• Rusty, foliage growing in channel between leg 2 and 3
Drain Valves?	5 valves in pass 2, from middle channel. Purpose unknown.	1	• Rusty 
Sanitaire Sensor	End of pass 1 and pass 3	0	• Sensor could not be observed • No indicator

Additional Notes:

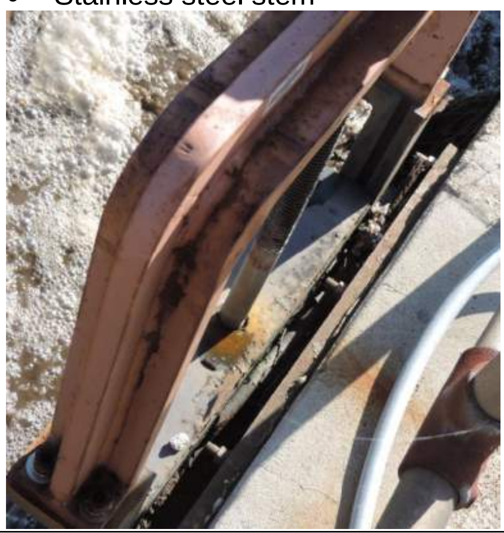
- Foam suppression line

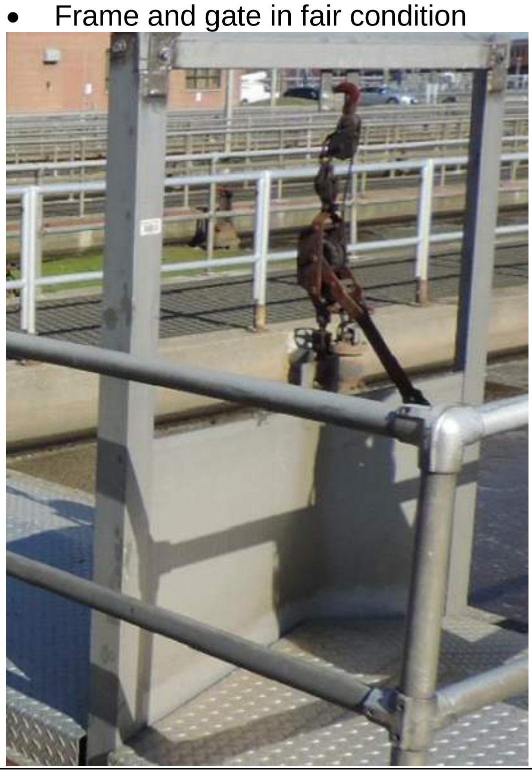
G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	Aeration Tank No. 2
Year of Installation: 1962	**Current Age:** 53 years

Description (including location details)		Condition Grade (1-3)	Comments/Deficiencies
Inlet Gate	Manual	1	• Rusty, seal peeling • Stainless steel stem 
Diffusers		0	• Tank in use therefore diffusers could not be assessed • Surface of tank observed: • Pass 1, 3 – surface ok • Pass 2 – first ½ stagnant; excessive algae growth 

Air Drop Leg Valves		1	• Rusty
Air Piping	Header run in channel under grating	1	• Rusty, vegetation in channel 
Drain Valves?	5 valves in pass 2, from middle channel. Purpose unknown.	1	• Rusty
Sanitaire Sensor	End of pass 1	0	• Sensor could not be observed • No indicator
Gate	Manual gate between Aeration Tank 1&2 and 3&4	1	• Winch used to raise/lower gate rusy • Frame and gate in fair condition 

Additional Notes:
- Inlet channels covered. Odour control piping rusty.

G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area: Secondary Treatment

Process: Aeration Tank No. 3

Year of Installation: **1968** **Current Age:** **47 years**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Inlet Gate	Manual	1	• Very rusty • Seal peeling • Stainless steel stem 

Diffusers		0	• Tank in use therefore diffusers could not be assessed
			• Surface of tank observed:
			  • Pass 2, 3 – surface ok
			  • Pass 1 – first ¼ stagnant
			

Air Drop Leg Valves		1	• Rusty
Air Piping	Header run in channel under grating	1	• Rusty • Vegetation in air header channel

Slide Plate		2	• On drawing, but not P&ID • Connects pass 3 to channel
Mixer	Middle of pass 1	1	• Very rusty; does not appear to be operational. Bridge is missing portion of grating. 
Sanitaire Sensor	End of pass 1, 2, and 3	0	• Sensor could not be observed • No indicator
Gate	Located at start of pass 3	1	• Purpose unknown 
Valve	Mud valve? End of pass 1.	1	Rusty hand wheel 

Additional Notes:
- RAS added by open discharge above water surface
- Foam spray piping rusting but solid

G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	Aeration Tank No. 4
Year of Installation: **1968**	**Current Age:** **47 years**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Inlet Gate	Gate	1	• Very rusty • Seal peeling • Stainless steel stem 
	Actuator AUMA	2	• Labeled "IFAS inlet actuator" 

Diffusers		1	• Tank in use therefore diffusers could not be assessed
			• Surface of tank observed:
			  • Pass 1
			    ○ First half: Turbulent areas indicative of broken diffusers
			
			    ○ Second half: Still surface, no aeration apparent
			
			  • Pass 2 –Turbulent areas in 2nd half
			

Air Drop Leg Valves		1	• Rusty

G.E. Booth WWTP Condition Assessment

<table>
<tr><td>Air Piping</td><td>Header run in channel under grating</td><td>1</td><td>• Rusty
• Vegetation in air header channel
• Drop leg pipes in fair condition
</td></tr>
<tr><td>Sanitaire Sensor</td><td>End of pass 1, 2, and 3</td><td>0</td><td>• Sensor could not be observed
• No indicator
• Indicators at end of pass 1, 2 do not appear to work</td></tr>
<tr><td>Mud valve?</td><td>End of pass 1</td><td>1</td><td>• Rusty handwheel
</td></tr>
<tr><td>Gate</td><td>End of Pass 3</td><td>1</td><td>•</td></tr>
<tr><td colspan="4">Additional Notes:
• RAS added by open discharge above water surface
• Some IFAS screens remain in place
• IFAS media apparent in Pass 3
• Foam spray piping rusting but solid</td></tr>
</table>

G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	Aeration Blowers
Year of Installation: 1973	**Current Age:** 42 years

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies**
Blower No. 1	Blower Brown Boveri Sulzer 30,000 cfm In 14.4 psi; end 7.5 psi 3565 rpm	2	
	LCP Turblex	3	• Indicates 26,956.8 hours • Panels relatively new 

	Motor Westinghouse 1120 kW With multiple dust type capacitor	2	
Blower No. 2	Blower Brown Boveri Sulzer 30,000 cfm In 14.4 psi; end 7.5 psi 3565 rpm	2	
	LCP Turblex	3	• Indicates 48,567.4 hours • Panels relatively new
	Motor Westinghouse 1120 kW With multiple dust type capacitor	2	
Blower No. 3	Blower Brown Boveri Sulzer 30,000 cfm In 14.4 psi; end 7.5 psi 3565 rpm	2	
	LCP Turblex	3	• Indicates 41,363.4 hours • Panels relatively new
	Motor Westinghouse 1120 kW With multiple dust type capacitor	2	

G.E. Booth WWTP Condition Assessment

Lube Oil Units	Located in basement	2	
Air piping	Air piping	2	
Air filter unit	Main floor	1	• Appears to be original 
Additional Notes: Unit heater in basement			

G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	Secondary Clarifier No. 1

Year of Installation: **1962** **Current Age:** **53 years**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Longitudinal Collector	Falk gear drive Killark starter	1	• Dated 8/60 (original) • Paint peeling, some rust 
	Chain and Flight x2 (1 per pass)	1.5	• Tank full, cannot be inspected • Operational • Excess algae growth on observed surface 

Cross Collector	Winsmith speed reducer	1	• Paint peeling, some rust 
Effluent weirs		2	• Some corrosion • Heavy algae growth • Last section of tank filled with duckweed 
Final Effluent Flow Meter	Parshall Flume Located between secondary clarifier 2 tank passes.	0	• Level sensor support is rusty and not connected • Abandoned? 
Scum Trough		2	
Additional Notes:			

G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	Secondary Clarifier No. 2
Year of Installation: 1962	**Current Age:** 53 years

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Longitudinal Collector	Falk gear drive Killark starter	1	• Dated 8/60 (original) • Paint peeling, some rust
	Chain and Flight x2 (1 per pass)	1.5	• Tank full, cannot be inspected • Operational • Excess algae growth on observed surface
Cross Collector	Brook Hanson Motor Winsmith speed reducer	1	• Paint peeling, some rust • Different than secondary clarifier 1 • Combination of new and old; newer components in fair condition • Starter original
Effluent weirs		2	• Heavy algae growth 
Scum Trough		2	
Additional Notes:			

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G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area: Secondary Treatment

Process: Secondary Clarifier No. 3

Year of Installation: **1962** **Current Age:** **53 years**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies**
Longitudinal Collector	Falk gear drive	1	• Paint peeling, some rust
	Chain and Flight	1.5	• Tank full, cannot be inspected • Operational • Excess algae growth on observed surface
Cross Collector	Winsmith	1	• Original starter, rest appears to have been replaced
Effluent Weirs		2	
Scum Collector Mechanism		1	• Arm Broken off

Additional Notes:

G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	Secondary Clarifier No. 4
Year of Installation: 1962	**Current Age:** 53 years

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Longitudinal Collector	Falk gear drive	1	• Paint peeling, some rust • Loud
	Chain and Flight	1.5	• Tank full, cannot be inspected • Operational • Excess algae growth on observed surface
Cross Collector	Winsmith	1	• Original starter, rest appears to have been replaced
Scum Collector Mechanism		1	• Arm Broken off

Effluent Weirs		1	• Some uneven flow • Damaged in places • Flow through cracks in concerte • Concrete deteriorated, water flowing through bolt holes • Preferential flow through this clarifier due to leaks • Very poor condition   

Additional Notes:

G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area: Secondary Treatment

Process: Secondary Clarifier No. 5

Year of Installation: 1968 **Current Age:** 53 years

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Longitudinal Collector	Brook Compton motor	1	• Original; motor looks like replacement 
	Chain and Flights	1.5	• Tank full, cannot be inspected • Operational • Excess algae growth on observed surface, corrosion 
Cross Collector	Falk	1	• Original; starter has been replaced 

Scum Collector Mechanism	Chain and flights	1.5	• Chains rusted (not observed in operation, may be intermittent) 
	Motor – brook Compton Drive – Falk	1	• Original 
Effluent Weirs		1.5	• Some uneven flow and breakthrough 
Flow meter		1	• Appears to measure flow in effluent channels. Or turbidity? No readout.
Additional Notes:			

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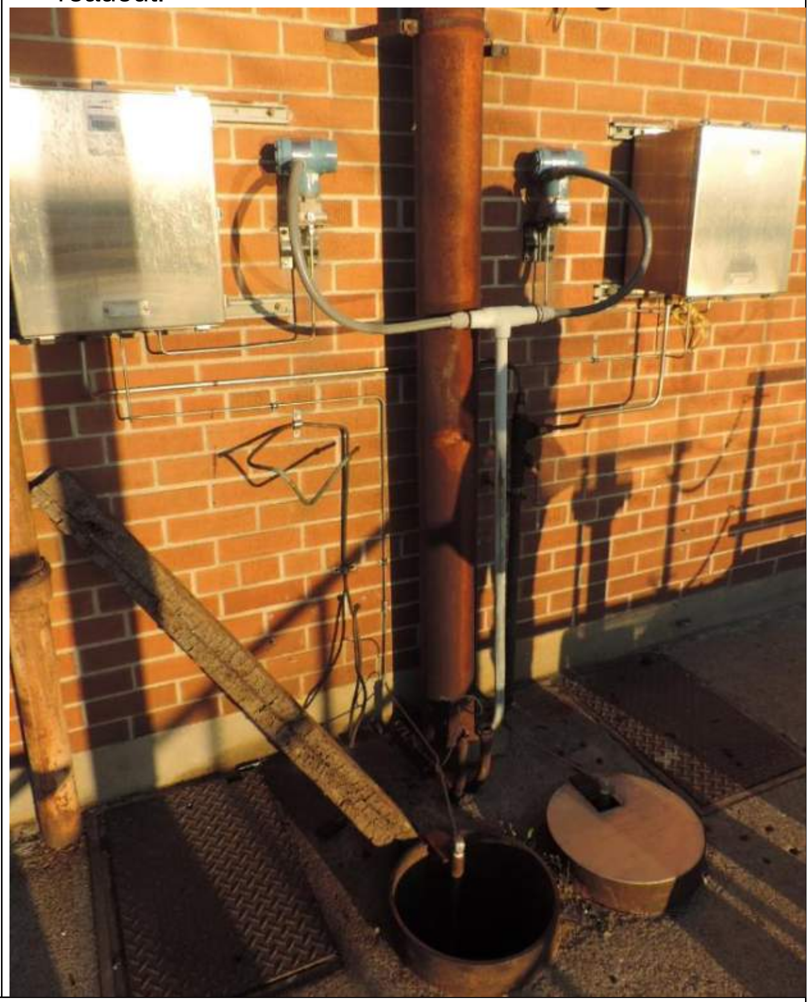
G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area:	Secondary Treatment		
Process:	Secondary Clarifier No. 6		
Year of Installation:	**1968**	**Current Age:**	**53 years**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Longitudinal Collector	Brook Compton motor Falk Drive	1	• Original
	Chain and Flight	1.5	• Tank full, cannot be inspected • Operational • Excess algae growth on observed surface
Cross Collector	Falk	1	• Original; starter has been replaced
Scum Collector Mechanism	Chain and flights	1.5	• Chains rusted (not observed in operation, may be intermittent)
	Motor – brook Compton Drive – Falk	1	• Original
Effluent Weirs		1.5	• Some uneven flow and breakthrough

Flow meter		1	• Appears to measure flow in effluent channels. No readout. 

Additional Notes:

G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	RAS WAS PS1 and Gallery
Year of Installation: 1962	**Current Age:** 53 years

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Horizontal Pumps	4 Horizontal Pumps	3	• 2 WAS, 2 scum? Only one is labeled (scum pump) • Name plates are painted over 
Vertical Pumps	4 Vertical Pumps Cornell pump Brook Compton Motor – 10HP	3	• RAS pumps • Painted 

	Piping and valves	3	
Indicators	• BTG • Fisher porter	3	• Final tank 5 RAS density, final tank sludge density and solenoid valves • 1B and 1C total waste, plus 2 others (labeled 6R, 5R)
WAS density meter	0-1000 ppm range	2	
Sludge Flow Meter	Baily Fisher Porter 2 flow meters	2	

Additional Notes:

G.E. Booth WWTP Condition Assessment

Process Mechanical

Date: November 2, 2015

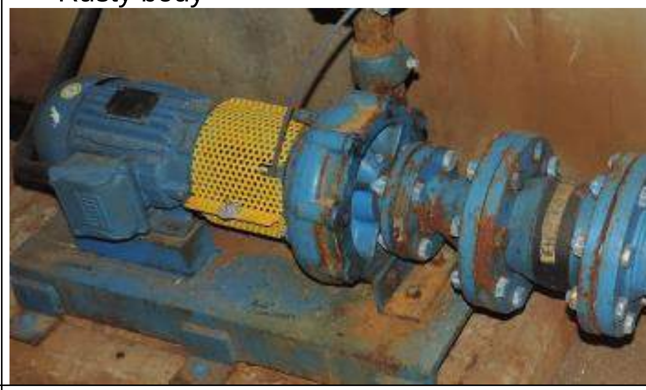
Process Area:	Secondary Treatment
Process:	RAS WAS PS2
Year of Installation: 1968	**Current Age:** 53 years

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
RAS Pumps	Motors Located upstairs Brook Compton Motor – 25HP	2	
	RAS Pumps No. 1 – 3 Fairbanks Morse Name plate data: originally 1988, rebuilt 2000.	2-3	• 2 in good condition, 1 in fair condition 

WAS Pumps		3	• Labeled WAS pump 2 and WAS pump 3 
Piping and Valves		3	
Turbimeter No. 1, 2	No. 1 - Final Tank 5 No. 2 - Final tank 8	2	

G.E. Booth WWTP Condition Assessment

Foam Control Pump	2 pumps Marlow pump Centrum motor	2	
LPEW Strainer		1.5	• Rust on body 
AT 1&2 Air Flow Indicator		2	

Sump Pump No. 1	Weg Motor	2	• Rusty body 
	Piping and valves	2	• Flange connections rusty
Scum Pump No. 2	Fairbanks Morse pumps ASL rotor motor	2	
	Piping and valves	2	
WAS Piping		1.5	• Heavy corrosion 
Indicators	• BTG • Fisher porter	3	

Additional Notes:
1 other pump – unknown use. Possible effluent water? Painted. Self Priming Centrifugal.
All pumps and piping have been painted and corrosion is minimal
Water leaking into the floor of the adjacent gallery, which is located between Secondary Clarifiers No. 5 and 6. Piping in gallery in poor condition.

G.E. Booth WWTP Condition Assessment

Structural/Architectural

Date: November 3, 2015

Process Area:	Raw Sludge Pumping Station 1 (Plant 1A)
Structure:	
Year of Installation: **1962**	**Current Age:** **53 years**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Ex. Walls and Cladding	Triple brick  	2	- Brick spalling at north east and south east corners 
Doors	Painted steel doors	2	- Some with paint failure - Frames corroding - Inoperable hardware and some doors do not close
	Painted steel and wood equipment door	1	- Paint failure, frame is corroding 

Windows	Two types: Aluminum, single pane and steel, double pane	2	- Some windows are operable - Sealant is pliable - Paint has failed on steel lintels - Concrete sill in fair condition - Condensation between double panes  
Roofing	Gravel roofing	0	- Roof was not accessed and only inspected from a distance
Roof Structure	Concrete topping on steel deck, with open web steel joists (OWSJ)	1	- OWSJs hidden with plaster in some areas - Where OWSJs and steel deck are visible, coatings have failed and corrosion has started 
	Cast in place concrete, painted	2	- Appears to be in fair condition - Paint has started to fail in corners and other localized areas 
Int. Walls and Finishes	Cast in place concrete, painted	2	- Paint failure at corners - Cracking
	Block wall, painted	3	- Minor paint failure

	Brick, triple and single, painted	2	- Paint failure - Where visible, brick appears to be in fair condition 
Floor Slab and Finishes	Cast in place concrete	2	- ¼" water on floor in north west room - Equipment bases have been removed, leaving concrete rough, cracks formed from corners - Some cracking at walls and floor drain 
Structural Steel and Coatings	See 'Roof Structure' above		
Grating	None		
Handrails	Stainless steel on stair to basement level	3	
Ladders	Exterior aluminum ladder	3	
Stairs	Cast in place stairs with abrasive tile	3	

Special Rooms	Basement level access to gallery	2	- Ships ladder to gallery has corroded - Rust staining on the walls - Cracking and spalling starting on roof slab	  

Additional Notes:

Structural/Architectural

Date: November 3, 2015

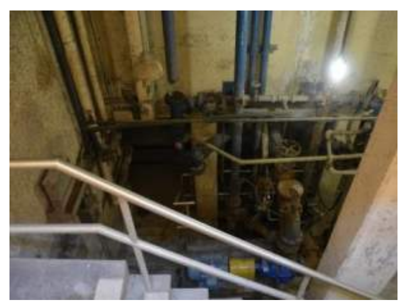
Process Area: Raw Sludge Pumping Station 2 (Plant 1B)

Structure:

Year of Installation: **1968** **Current Age:** **47 years**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies**
Ex. Walls and Cladding	Triple brick	3	- Appears to be in fair condition  
Doors	Painted steel doors	2	- Some paint failing with failing hardware - Glass pane broken above one door - Door frames are corroding  

Windows	Aluminum, single pane	2	- Operable - Sealant is pliable - Windows intact, with light corrosion starting on frames and lintels - Concrete window sill, one with impact damage at the corner 
Roofing	Built-up roofing	0	- Roof was not accessed and only inspected from a distance - Vegetation growing on roof - Flashing is wearing 
Roof Structure	Cast in place concrete, painted	2	- Condensation appears to be present - Paint failure 
Int. Walls and Finishes	Double brick	2	- Some damage at the bottom of the wall, where concrete starter wall meets brick
Floor Slab and Finishes	Cast in place concrete	2	- Concrete topping chipped and cracked - Equipment pads have been removed, leaving concrete rough 
	Checkered plate floor hatch	3	

Structural Steel and Coatings	None		
Grating	None		
Handrails	Aluminum handrail on stair	3	
Ladders	None		
Stairs	Cast in place with abrasive tile	3	
Special Rooms	Basement level access to gallery	1 2	- Spall on concrete roof slab at light fixture, approx. 5' long, rebar exposed in both directions - Staining around pipes - Coating on concrete walls failing   

Additional Notes:

Structural/Architectural

Date: November 3, 2015

Process Area: Raw Sludge PS1 and 2 Interconnecting Gallery

Structure: Gallery

Year of Installation: **1962/1968** **Current Age:** **47 - 53 years**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies**
Floor Slabs and Coatings	Cast in place concrete	2	- Three cracks visible
Roof Slabs and Coatings	Cast in place concrete	2	- Minor cracking - Some spalling around expansion joints - Expansion joint material falling out of place - Some locations appear to have been repaired with cement product  

Walls and Coatings	Cast in place concrete  	1	- Approx. 15 visible vertical cracks, some with efflorescence - Wall shared with primary settling tank is leaking in one location - Pipes not sealed in wall openings in some locations    
Handrail	None		
Ladders	None		
Stairs	Cast in place concrete with abrasive tile 	2	- Nosing has broken at stair to Raw Sludge PS Plant 1B 

Structural Steel and Coatings	Steel pipe supports	1	- Fully corroded 
Grating	Aluminum grating	3	- Generally in fair condition - Openings where pipes may have been 

Additional Notes:

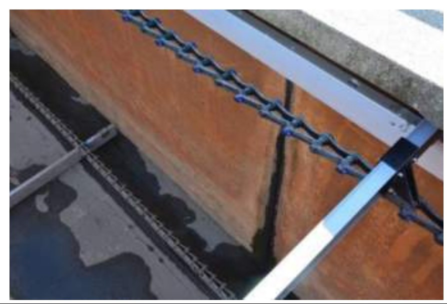
Plant 1A construction (1962) of gallery width and height is small, making it very difficult to maneuver.
Door at the end of Plant 1A construction (north end) has rusted shut.

Structural/Architectural

Date: November 3, 2015

Process Area:	Primary Clarifiers 1-4
Structure:	
Year of Installation: 1962/1968	**Current Age:** 47 - 53 years

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Slabs and Coatings	Cast in place concrete walkways 	2	- Cement matrix deteriorating with small aggregate visible - Approximately 50% of handrail connections appear to have caused spalled concrete   

Walls and Coatings	Cast in place concrete	2	- Only approx. 300mm of wall visible on Plant 1A tanks - Plant 1B tanks were emptied for maintenance - Staining - One expansion joint has filler falling out - Sealant was not used in joints in multiple locations - Appears to be leaking between cells in one location - Spalling around locations where it appears equipment was once bolted to the concrete - Repairs appear to be completed at multiple locations on the walls, approximately 900x900mm.    
Handrail	Aluminum handrail 	1	- Plant 1A tank handrail height is not built to the Ontario Building Code - Some appear to have been embedded into the concrete, causing major spalling on concrete walkway - Repairs have been completed in localized areas with either a repair product or baseplate 

Ladders	None		
Stairs	None		
Structural Steel and Coatings	None		
Grating / Checkered Plate	Checkered plate covers	3	- Covers over channels on west side appear to be in fair condition 

Additional Notes:

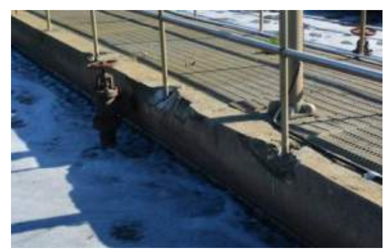
Structural/Architectural

Date: November 3, 2015

Process Area: Aeration Tanks 1-4

Structure:

Year of Installation: **1962/1968** **Current Age:** **47 - 53 years**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Slabs and Coatings	Cast in place concrete walkways	2	- Surface has degraded, with small aggregate visible - One channel full of water - 50% of handrail connections have caused spalling on concrete around connection, some repairs have been completed - Equipment pads removed from concrete slab south of tanks has left the concrete rough   
Walls and Coatings	Cast in place concrete	2	- Only top 300mm visible - Expansion joints do not appear to have sealant and filler is loose

Handrail	Aluminum handrail  	1	- Height of handrail at Plant 1A tanks have not been built to current Ontario Building Code - Repair product used on some connections 
Ladders	Access ladder inside tank	1	- Only top rung visible - Build-up of tank contents on rungs and corrosion has started 
Stairs	None		
Structural Steel and Coatings	None		

Grating / Checkered Plate	Aluminum grating 	2	- Grating spanning channels - Some locations grating is warped and uneven - Grating over channels east of tanks leading to final settling tanks, appears to be installed in the wrong direction and has deflected, replaced in some locations with temporary steel grating which is rusting   
	Aluminum checkered plate covers	3	- Covers at west end of tanks appear to be in good condition.

Additional Notes:

Abandoned agitator and bridges in multiple locations have rusted and handrail is not to code.
Vegetation is growing through grating on concrete walkways.
Troughs full of plastic pieces.

Structural/Architectural

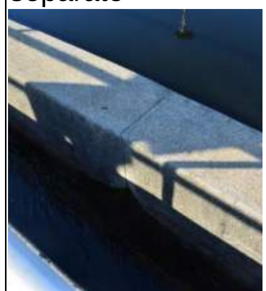
Date: November 3, 2015

Process Area: Secondary Clarifiers 1-6

Structure:

Year of Installation: **1962/1968** **Current Age:** **47 - 53 years**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Slabs and Coatings	Cast in place concrete  	2	- Surface degradation with small aggregate visible - Cracking and spalling around handrails, visible rusted rebar in some locations - Openings in slab, possibly where previous equipment had been placed   

Walls and Coatings	Cast in place concrete	2	- Top 300mm of wall visible - Vertical cracking at 3' c/c - Appears to have some leaking at construction joints - Expansion joints appear to not have any joint filler - Appears vegetation growth in some areas has forced the slabs to separate  
Handrail	Aluminum handrail	1	 - Height of handrail at Plant 1A tanks have not been built to current Ontario Building Code - Original construction of handrails appear to have been embedded, appears that some have been repaired with a grout product - Impact damage in some locations 

Ladders	None visible		
Stairs	None		
Structural Steel and Coatings			
Grating / Checkered Plate	Aluminum grating	2	- Vegetation growth  
	Checkered plate hatch covers	2	- Appear to be in fair condition

Additional Notes:

It is expected there is damage to 3 troughs due to visible flooding.

Structural/Architectural

Date: November 3, 2015

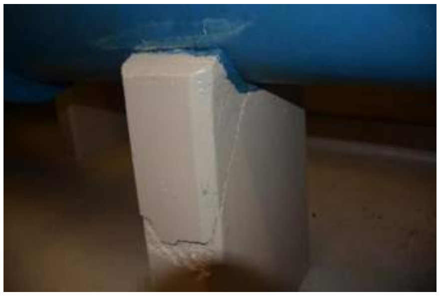
Process Area: Return Sludge Pumping Station 1 (Plant 1A)

Structure:

Year of Installation: **1962** **Current Age:** **53 years**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies**
Ex. Walls and Cladding	Triple brick 	2	- Brick spalling a north east corner - Knockout panel on south face  
	Concrete starter wall	2	- Diagonal crack, propagating from south east corner 
Doors	Painted steel doors	3	- Appear to be recently painted

Windows	Aluminum, single pane 	2	- Fair condition - Sealant is pliable - Concrete sill and steel lintel
Roofing	Was not accessed	0	
Roof Structure	Cast in place concrete slab and beams	3	- Shrinkage cracking visible at soffit on the exterior of the building, approx. 5' c/c - Painted on the interior - No visible damage from the interior of the building 
Floor Slab and Finishes	Cast in place concrete, painted	2	- Appears to be recently painted - Paint worn in some locations - Equipment pads removed in 2 locations and have left concrete rough, although has been painted\ - Water leaking onto floor from sink drain 
Structural Steel and Coatings	None		
Grating / Checkered Plate	Checkered plate hatch	3	

Handrails	Aluminum handrail	3	
Ladders			
Stairs	Cast in place concrete stairs with abrasive tile	2	- Some spalling on nosing and corners, possibly from impact damage  
Special Rooms	Basement	2	- Cast in place concrete, painted - Appears to be recently painted - Concrete pipe supports, some with cracking and spalling - Spalling around floor drain - Water from ground floor leaking through hatch and into basement 
Additional Notes:			

Structural/Architectural

Date: November 3, 2015

Process Area: Return Sludge Pumping Station 2 (Plant 1B)

Structure:

Year of Installation: **1968** **Current Age:** **47 years**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies**
Ex. Walls and Cladding	Triple brick 	2	- Some efflorescence 
Doors	Prefinished metal door	2	- Generally in fair condition - Steel lintel has deflected
	Steel painted doors	2	- One door has damaged hardware - Door frame starting to corrode
Windows	Aluminum, single pane	2	- Sealant is pliable - Operable - Concrete sill and steel lintel
	Steel, double pane	2	- Windows are frosted - Sealant is pliable - Rusted vent in spandrel
Roofing	Not accessed	0	

Roof Structure and Finishes	Concrete slab on steel deck, supported with OWSJs	1	- Drop ceiling panels used, and therefore roof structure not visible, although panels removed in bathroom - Steel deck is delaminating - Rust is evident on OWSJs  
Int. Walls and Finishes	CMU	2	- Cracking in block on east wall at north corner  
Floor Slab and Finishes	Terrazzo flooring	2	- Used throughout ground floor - Cracked at pump in electrical room and appears to be damp 

Structural Steel and Coatings	None		
Grating	None		
Handrails	Aluminum handrail	1	
Ladders	None		
Stairs	Cast in place concrete stairs, with abrasive tiles	2	- Crack across riser at mid height of staircase 
Special Rooms	Washroom	1	- Toilet, shower, sinks, urinal not operable - Block is glazed, and is peeling - Terrazzo flooring is painted 
	Basement	2	- Painted concrete floor, walls, ceiling, columns, equipment pads and pipe supports - Spalling on some equipment pads

Additional Notes:

One door locked at south end of ground floor, and therefore room not accessed.
Access to gallery in basement, although taped off because of flooding.

Structural/Architectural

Date: November 3, 2015

Process Area: Access House to Return Sludge Gallery

Structure:

Year of Installation: 1968 **Current Age:** 47 years

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Ex. Walls and Cladding	Double brick	3	 
Doors	Painted steel door	2	- Paint is chalking - Frame is starting to corrode 
Windows	Aluminum single pane	2	- Sealants have cracked and are rigid
Roofing	Not accessed	0	
Roof Structure	Cast in place concrete, painted	1	- Spall above stairs, electrical conduit and rebar exposed - Paint failure 
Int. Walls and Finishes	Brick above grade	3	

	Stair shaft walls cast in place concrete, painted	1	- Paint has failed - 3 vertical cracks with signs of leakage at one time 
Floor Slab and Finishes	Cast in place concrete	2	
Structural Steel and Coatings	None		
Grating	None		
Handrails	Aluminum handrail	2	
Ladders	None		
Stairs	Cast in place concrete	3	
Special Rooms	None		

Additional Notes:

Structural/Architectural

Date: November 3, 2015

Process Area:	Return Sludge Gallery
Structure:	Gallery
Year of Installation: 1968	**Current Age:** 47 years

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Slabs and Coatings	Cast in place concrete floor slab	2	- Some cracking at slab edges at approx. 16” c/c
	Cast in place roof slab	2	- Moisture staining and efflorescence - Some cracking with efflorescence - Concrete roof slab not visible in some locations, covered with paneling and pipes - Moisture staining on panels appears to be around skylight opening   

Walls and Coatings	Cast in place concrete	2	- Cracking with efflorescence at approx. 2' c/c in gallery to Return Sludge PS 1B - Major leak near access stair - Expansion joint open with signs of leaking in two locations   
Handrail	Aluminum handrail	3	
Ladders	Stainless steel ladder rungs	3	
Stairs	Cast in place concrete with abrasive tiles	3	
Structural Steel and Coatings	Pipe supports	2	- Some corrosion

Grating	None		

Additional Notes:

- Gallery skylights have been covered with elevated grating on the exterior, except for one location. - Skylight frame is partially missing in one location.
- Small aggregate is exposed around skylights in some locations
- Entrance at basement of Return Sludge PS 2 taped off because of flooding from sump

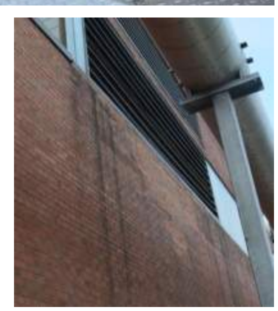
Structural/Architectural

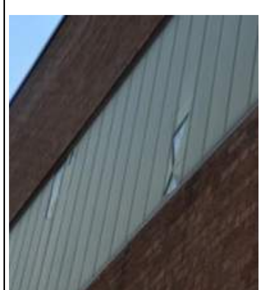
Date: November 4, 2015

Process Area: Blower Building

Structure:

Year of Installation: **1973** **Current Age:** **42 years**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies**
Ex. Walls and Cladding	Brick   	2	- West side of the building has peaked checkered plate covers over channels that have been built right up to the brick and therefore, blocking the brick drains. - The covers are sloping towards the brick - Vegetation growth at cover and brick intersection - The brick is showing signs of frost and water damage in this location with spalling - Expansion joint sealant has debonded - Staining on brick beneath louvre on east wall - Louvre without a frame on west wall     

	Concrete starter wall		- Crazing on east side of building - Crack on east side
Doors	Painted steel doors	1	- One door has hardware missing and is rusted - Interior doors in fair condition 
	Prefinished metal doors	2	- Some hardware damaged
	Sectional overhead door	2	- Frame has started to corrode - Door was not closed and therefore not assessed
	Equipment door in Loading Bay	2	
Windows	Steel, double pane	3	
	Structural glazing	2	- Panes are broken in two locations  
Roofing	Not accessed	0	
Roof Structure	Concrete panels supported by steel beams and bracing	3	- No visible signs of corrosion, leakage or distress

	Removable concrete panels over loading bay	1	- Some are not in place causing fall hazard  
Int. Walls and Finishes	Tile	3	
Floor Slab and Finishes	Concrete with tile	2	- 2 removable concrete panels are missing tile around the perimeter causing a tripping hazard - Tiles cracked in some locations - Concrete floor slab in loading bay has some damage, possibly from wheel loads or impact  

Structural Steel and Coatings	Monorail	3	- Appears to be in fair condition  
Grating	None		
Handrails	Aluminum handrail	3	
Ladders	None		
Stairs	Cast in place concrete with tile	3	

Special Rooms	Washroom	2	- Drop ceiling has visible moisture damage - Appears to have impact damage on top slab	 

Additional Notes:

A thorough structural inspection was not completed in the Blower Building. The roof, Water Filter Room and Pipe Gallery in the basement were not accessed. A more in-depth structural inspection will be required in the future.

G.E. Booth WWTP Condition Assessment

Electrical

Date: November 2, 2015

Process Area:	Primary and Secondary Treatment
Process:	Primary Clarifiers, Aeration Tanks and Secondary Clarifiers

Year of Installation: **Life Expectancy:** **Current Age:**

<table>
<tr><th colspan="2">Description
(including location details)</th><th>Condition Grade (1-3)</th><th>Comments/Deficiencies/Photos</th></tr>
<tr><td>Primary Clarifiers</td><td>- Chain and Flight Motors and Actuators next to Primary Clarifier Tanks
• Motors and Actuators are in poor condition, with minor signs of corrosion
• Custom fitted S.S. covers used for mechanical protection showing signs of corrosion
• Explosion-proof local disconnect switches are original and at the end of service life
• Rigid metal conduits and Teck cables for power distribution
• Junction boxes showing signs of corrosion</td><td>1</td><td>

- Chain and Flight motors and actuators are in poor condition with original explosion proof disconnect switches that are at the end of life. Replacement of the corroded distribution equipment and the original motor disconnect switches is recommended to maintain equipment classification in accordance with NFPA 70.</td></tr>
</table>

Secondary Clarifiers	- Chain and Flight Motors and Actuators next to Secondary Clarifier Tanks • Motors and Actuators are original and in poor condition, with clear signs of corrosion • Custom fitted S.S. covers used for mechanical protection showing signs of corrosion • Some explosion-proof local disconnect switches are original • Rigid metal conduits for power distribution • Junction boxes showing signs of corrosion	1	  - Chain and Flight motors and actuators are original and at the end of their service life. The applicable motor, actuator, electrical disconnects and related distribution is recommended for replacement to maintain equipment classification (NFPA 70) and to ensure equipment reliability.

Aeration Tanks	- Field Equipment • Control switches and command buttons • Terminal boxes • Rigid metal conduits • All equipment show signs of heavy corrosion • Immediate replacement recommended - Control Panels • Pump and Instrumentation Control • PVC conduits and junction boxes • Equipment not rated for Class 1 Div 2 environments • Consider replacement of panels, junctions and conduits that are not appropriately rated	1	 - Field equipment and control enclosures show signs of heavy corrosion, in poor condition. The equipment are at the end of their service life. The control switches and enclosures need to be replaced with like that are explosion-proof and rated for Class 1 Div 1 environments.  

Lighting and Distribution	- Lighting • Pole-mounted High Pressure Sodium (HPS) lighting • Showing signs of corrosion - Distribution • Teck cables and rigid metal conduits for field devices and junction boxes • Some junctions and terminal boxes are rated for classified environments • Mounted to handrails of tanks and clarifiers • General distribution that are not corroded are in fair condition	1 / 2	 - Lighting equipment for the Aeration tanks and the Clarifiers (Primary and Secondary) for Plant 1 are original and have been in service for more than 20 years. Replacement is recommended. 

Additional Notes:
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.

G.E. Booth WWTP Condition Assessment

Electrical

Date: November 2, 2015

Process Area: Primary Treatment

Process: Raw Sludge Pumping Station No.1

Year of Installation: **Life Expectancy:** **Current Age:**

<table>
<tr><th colspan="2">Description
(including location details)</th><th>Condition Grade (1-3)</th><th>Comments/Deficiencies/Photos</th></tr>
<tr><td>MCC</td><td>- MCC 01-2
• 3 sections, 600V, 3ph
• Fed from MCC 01 in the Administration Building
• Provides feeder breaker to MCC 01-21 in the Raw Sludge Pumping Station #2
• Showing signs of heavy corrosion
• >30 years old
• Discontinued MCC product not available
• MCC 01-2 is recommended for immediate replacement with new, to minimize the risk of equipment failure</td><td>1</td><td>





</td></tr>
</table>

Electrical Distribution	- Distribution equipment • Original (>30 years) distribution conduits and cables • Wall-mounted Teck cables, rigid metal conduits and PVC • Signs of heavy corrosion on exterior and some interior rigid metal conduits • Wall-mounted explosion-proof switches, disconnects and receptacles	1	    - PVC conduits need to be removed and replaced with rigid metal conduits suited for Class 1 Div 2 environments. - All corroded conduits and any original distribution equipment at the end of their service life need to be replaced with new.

Lighting	- Lights and switches • >30 years old, original and at the end of service life • Some interior lighting fixtures have failed as not all light fixtures are functional • Exterior lighting (wall packs and flood lights) are original • HPS (in storage and electrical room) and fluorescent T8 tube lighting (in staircase to tunnels) • Lighting fixtures are ceiling and wall-mounted • Light switches are not rated for classified environments	1	     - Lighting fixtures (interior & exterior) have reached the end of their service life and requires replacement. - Light switches are not Class 1 Div 2 rated and require immediate replacement.

Instrumentation and Controls	- Pump Controls • Raw Sludge Pumps 1 & 2 Control Interface Panels are in fair condition • VSD in fair condition • Equipment not rated for classified environments - Panels • Terminal Cabinet #1 is in fair condition • Original panels and cabinets have been out of service and should be removed	2	     - The Raw Sludge Pumping Station #1 contains cabinets, panels and control units that are not rated for Class 1 Div 2 environments. Unclassified space is required for existing equipment without replacements with explosion-proof varieties. - Any abandoned and out of service electrical panels and cabinets should be removed.

Heating and Ventilation	- Heating • 1 electric unit heater in electrical room in fair condition • 2 hydronic heaters in storage rooms in poor condition • Baseboard water heaters in storage room in poor condition • Water piping show signs of heavy corrosion • Heating units' function could not be verified. They are in poor condition and should be replaced - Ventilation • Raw Sludge Pumping Station #1 has poor ventilation with no forced air flow • Exhaust fans are original and no longer functional • Original intake louvers in poor condition • Ceiling opening to atmosphere allow ingress of precipitation and foreign objects • Storage room is flooded from moisture ingress	1	       - New HVAC system required for the Raw Sludge Pumping Station #1 to provide 6ACH.

Additional Notes:

The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC**.**

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G.E. Booth WWTP Condition Assessment

Electrical

Date: November 2, 2015

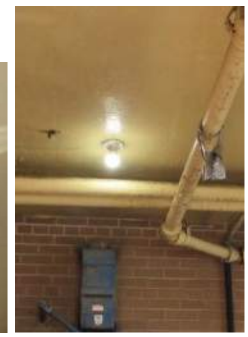
Process Area: Secondary Treatment

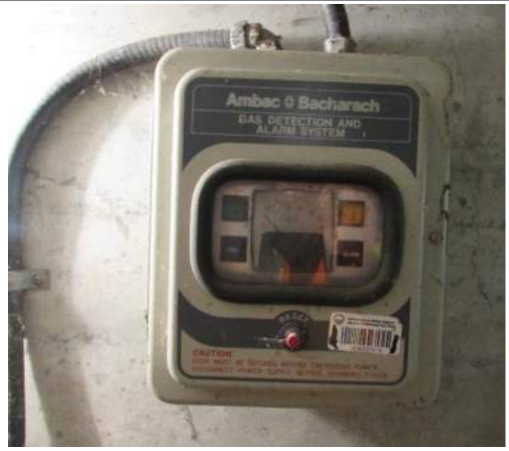
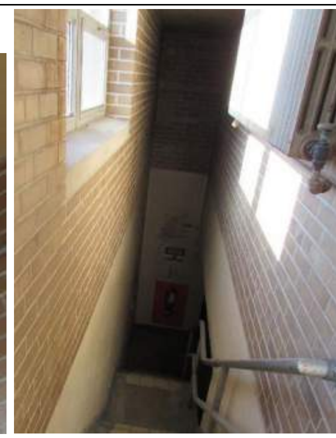
Process: Return Sludge Pumping Station No.2

Year of Installation: **Life Expectancy:** **Current Age:**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
MCC	- MCC 01-21 • 3 sections, 600V, 3ph (General Electric) • Fed from MCC 01-2 in the electrical room of Raw Sludge Pumping Station #1 • Feeder to MCC 01-211 in Storage Room does not exist (SLD requires update) • >30 years old and at the end of service life • Discontinued MCC product not available • MCC 01-21 is recommended for immediate replacement with new MCC to minimize the risk of equipment failure	1	   

Electrical Distribution	- Distribution equipment • Original (>30 years) distribution lighting panels, transformers, conduits and cables • Wall-mounted Teck cables, rigid metal, aluminium and PVC conduits • Signs of corrosion on some interior rigid metal conduits and the tunnel access areas • Majority of distribution equipment found in the basement of the Raw Sludge Pumping Station #2, connected to the tunnels • Wall-mounted switches, disconnects, pull boxes and enclosures are at their end of life and not rated for classified environments	1	      - PVC conduits need to be removed and replaced with rigid metal conduits suited for Class 1 Div 2 environments. - All corroded conduits and any original and poor condition distribution equipment at the end of their service life need to be replaced with new.

Lighting	- Lights and switches • >30 years old, original and are at the end of service life • Lighting fixtures are ceiling and wall-mounted • Some interior lighting fixtures are missing and/or have failed • Exterior lighting (wall packs and flood lights) are original and have broken lenses • Ceiling-mounted incandescent light fixtures in the electrical room • Wall-mounted caged lighting fixtures (explosion proof) in tunnels with some failed fixtures • Pendant style lighting in tunnel access areas • Light switches and motion sensors are not rated for classified environments	1	        - Lights and switches in the Raw Sludge Pumping Station #2 are at the end of life and/or in poor condition. - Replace existing light fixtures as they are not appropriately rated for Class 1 Div 2 environments.

Instrumentation and Controls	- Gas detection system • LEL% gas detection • Ambac Bacharach • Analog display of concentration levels • Flexible conduits for power and signals at end of life • Detection system at its end of life and should be replaced	1	
Heating and Ventilation	- Heating • 1 electric unit heater in electrical room in fair condition • Hot water radiators for stairs and other parts of the pumping station are original • Heating units' function could not be verified - Ventilation • Raw Sludge Pumping Station #2 has poor ventilation with no forced air flow • Ventilation fans are original and no longer functional • Original louvers and openings are in poor condition	1	    - New HVAC system required for the Raw Sludge Pumping Station #2 to provide 6ACH.

Additional Notes:
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.

G.E. Booth WWTP Condition Assessment

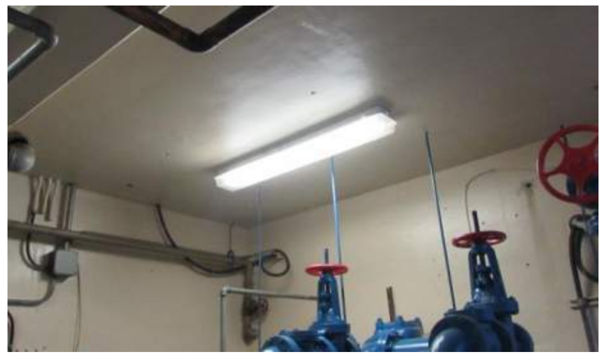
Electrical

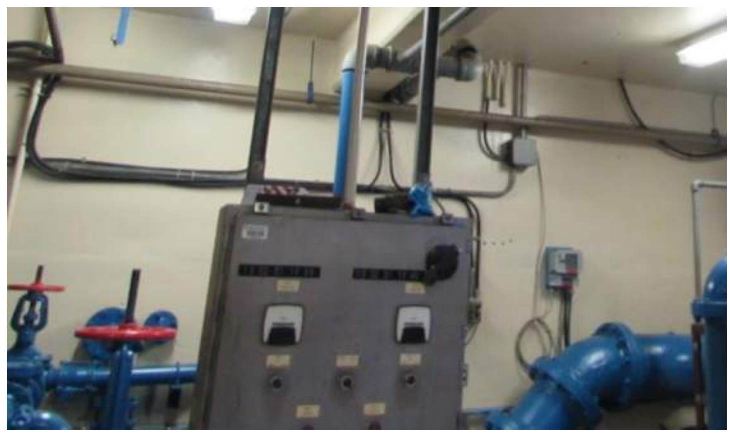
Date: November 2, 2015

Process Area:	Return Sludge Pumping Station No.1 and Tunnel	
Process:	**Pumping Station**	
Year of Installation:	**Life Expectancy:**	**Current Age:**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
MCC	- MCC 01-1 • 2 sections, 600V, 3ph • Fed from MCC 01 in the Administration Building's electrical room • Provides feeder breaker to MCC 01-11 in the Return Sludge Pumping Station #2 • >30 years old discontinued MCC product not available • MCC 01-1 is recommended for immediate replacement with new MCC to minimize the risk of equipment failure	1	   

Electrical Distribution	- Distribution equipment • Original (>30 years) distribution lighting panels, transformers, conduits and cables • Wall-mounted Teck cables and rigid metal conduits in fair condition • Signs of corrosion on original rigid metal conduits on the exterior of the station • Wall-mounted explosion-proof receptacle	1 / 2	   - All corroded conduits and any original distribution equipment at the end of their service life need to be replaced with new.

Lighting	- Lights and switches • >30 years old, original and at the end of service life • Some interior lighting fixtures have failed as not all light fixtures are functional • Exterior lighting (wall packs and flood lights) are original and are at their end of life • Original ceiling mounted lighting fixture and fluorescent tube lighting on main floor and in poor condition • Fluorescent tube lighting in the basement (pumps and valves room) in fair condition • Lighting fixtures, switches and related equipment are not rated for classified environments • Replace original lighting and any fixtures that are in poor condition	1 / 2	   

Instrumentation and Controls	- Pump Drives • Return Sludge Pumps 1, 2, 3 & 4 VSD and interfaces are in fair condition • Equipment not rated for classified environments - Pump Control Panels • Control panels for pumps and instruments are in fair condition • Control panel for pumps in basement is in fair condition • All panels are not rated for classified environments	2	   - The Return Sludge Pumping Station #1 contains panels and control units that are not rated for Class 1 Div 2 environments. Unclassified space is required for existing equipment without replacements with explosion-proof varieties.

Heating and Ventilation	- Heating • 2 electric unit heaters and 1 hydronic heater on the main floor are in fair condition - Ventilation • Return Sludge Pumping Station #1 has poor ventilation with no forced air flow • Operator requires the two doors of the station to be open while working inside the building • Basement and main floor of the pumping station are connected via an open staircase • The entire space (main floor and basement) is classified as Class 1 Div 2	2	   - New HVAC system required for the Return Sludge Pumping Station #1 to provide 6ACH.

Electrical Distribution and Equipment	- Distribution • Wall-mounted, with no embedded distribution except for transitional wall penetrations • Aluminium and rigid metal conduits, Teck cables and some PVC conduits • Majority of the conduits and Teck cables are in fair condition. Some metal conduits show signs of corrosion. • All electrical distribution conduits need to be in rigid metal conduits, rated for Class 1 Div 2 environments. - Switches and Disconnects • Disconnects for small motor loads and pumps (<1hp) • Switches are in wall-mounted explosion-proof style enclosures • Switches are original and at end of life. Replacement is recommended to ensure equipment classification ratings.	1 / 2	  

Lighting	- Outdoor Lighting • HPS wall-pack, original lighting (2) - Stairs Lighting • Wall and ceiling-mounted T8 florescent tubing (2) - Tunnel Lighting • Wall-mounted caged lighting fixtures (explosion proof) • Some parts of the tunnel have fluorescent tube lighting • Some lighting fixtures need maintenance replacement (1)	1 / 2	   - Lighting fixtures are original and most likely at the end of their service life (>20 years). - Recommendation for replacement of lights that are not appropriately rated for Class 1 Div 2 environments.
Ventilation	• No forced air ventilation • Tunnels accessible through open stair cases in Raw and Return Sludge Pumping Stations • Heating provided through hot water radiators (end of life) • Noticeable excess moisture in the tunnels and access ways	1	- No visible ventilation equipment in the tunnels and access stairs. Ventilation is through natural convection. - A new HVAC system is recommended to provide 6 ACH for the Class 1 Div 2 tunnels and access spaces.

Additional Notes:

The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC**.**

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G.E. Booth WWTP Condition Assessment

Electrical

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	Return Sludge Pumping Station No.2

Year of Installation: **Life Expectancy:** **Current Age:**

<table>
<tr><th colspan="2">Description
(including location details)</th><th>Condition Grade (1-3)</th><th>Comments/Deficiencies/Photos</th></tr>
<tr><td>MCC</td><td>- MCC 01-11
3 sections, 600V, 3ph
Fed from MCC 01-1 in Return Sludge Pumping Station #1
>30 years old and it is at end of service life
Discontinued MCC product by Canadian General Electric no longer available
MCC 01-11 is still in fair condition but has reached its end of service life
Risk of MCC failure will increase as the lineup remain in service</td><td>2</td><td>

- MCC 01-11 is recommended for replacement with the upgrade of Return Sludge Pumping Station #2.</td></tr>
</table>

Electrical Distribution	- Distribution equipment • Original distribution is >30 years old • Newer distribution equipment are still in fair condition • Wall-mounted Teck cables, rigid metal and PVC conduits • Signs of corrosion on some rigid metal conduits and disconnect switches • Some original transformers and panels are out of service or completely abandoned • Lighting panels are not rated for classified environments	1 / 2	      - PVC conduits need to be removed and replaced with rigid metal conduits suited for Class 1 Div 2 environments. - Corroded and end of life distribution equipment need to be replaced. - Equipment that are abandoned and of service should be removed.

Lighting and Facility Spaces	- Lighting equipment • Fluorescent tube (T8) lighting in all areas of the pumping station with some non-functional fixtures • Exterior lighting (wall packs and flood lights) are original and are at their end of life • Fluorescent lights are in fair condition, and they are ceiling-mounted on the main floor and in the basement (pumps and valves room) • Lighting fixtures are not rated for classified environments - Facility spaces • Return Sludge Pumping Station #2 contains an abandoned washroom that is no longer in service • The storage room was locked and could not be assessed	1 / 2	    - Replace original and non-functional lighting fixtures with new. - Renovation of the abandoned washroom is required if it is to be placed into service.

Instrumentation and Controls	- Pump Drives • 3 Return Sludge Pump VSD and enclosures are in fair condition, but they are at the end of their service life • Pump VSDs are equipped with analog displays and discontinued hardware • Upgrade the VSD to modern equipment is recommended - Pump Control Panels • #3 WAS Pump panel in good condition - Instruments • Flow meter and turbidity meter in fair condition - Control panels • Some control panels and terminal boxes have been abandoned and out of service • Remove all abandoned equipment and from the pumping station	2	    

Heating and Ventilation	- Heating and Cooling • Hydronic radiators on the main floor and in the basement pumps and valves room • Wall-mounted air-conditioning unit in poor condition and out of service - Ventilation • Return Sludge Pumping Station #2 has poor ventilation with low air flow • Not enough ventilation is provided by the existing fans. • Exhaust fans are original and in poor condition • Basement and main floor of the pumping station are connected via an open staircase • The entire space pumping station (main and basement) is classified as a Class 1 Div 2 environment	1	     - New HVAC system required for the Return Sludge Pumping Station #1 to provide 6ACH.

<u>Additional Notes:</u>
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC**.**

G.E. Booth WWTP Condition Assessment

Electrical

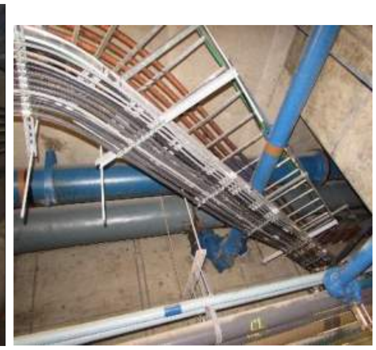
Date: November 2, 2015

Process Area:	Secondary Treatment		
Process:	Aeration Blowers		
Year of Installation:	**Life Expectancy:**	**Current Age:**	

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
Switchgear and Step-down Transformers	- 04 SWGR 02 & SWGR 03 (Original) • 4160V, 600A, M-T-M configuration with S&C Alduti type interrupter switches • Fed from XMR T2 & T3 located southwest of the blower building • >30 years old switchgear equipment in fair condition • Blowers 1-3, Transformers and feed to Blower Building No. 2 - Transformers • XFMR T2-1 and T3-1 installed within the last 15 years and are in fair condition • XFMR T3-2 and interrupter switch is <10 years old and in good condition - Original main switchgear and interrupter switches recommended for replacement with the next capital upgrades project	2 / 3	    

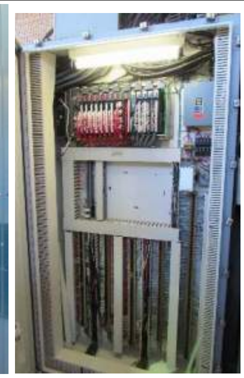
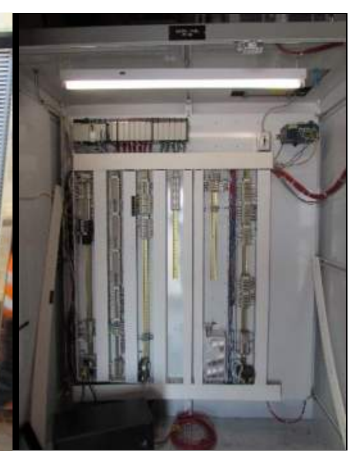
MCCs	- MCC 02-1 & MCC 03-1 • 22 sections, 600V, 600A, 3ph, M-T-M, Canadian GE • Fed from T3-1 & T2-1 • Provide feeder breakers to MCC 02-12, MCC 03-12 and miscellaneous loads • >30 years old discontinued MCC product - MCC 02-12 & MCC 03-12 • 9 section total, 600V, 600A, 3ph, M-T-M, Square D in fair condition • Fed from MCC 02-1 & 03-1 respectively • WAS pumps 4 & 5 VFDs (Square D) are in fair condition • RAS pumps 1-3 VFDs (Allen-Bradley) are in good condition • Lighting transformers and LPs in good condition - DP-03-2 • 600V, 1000A, 65kA • Supernatant pumps1-3 feeder breakers • Main breaker, DP and T3-2 are all in good condition	1-3	      - MCC 02-1 & MCC 03-1 are recommended for replacement with the next capital upgrades project.

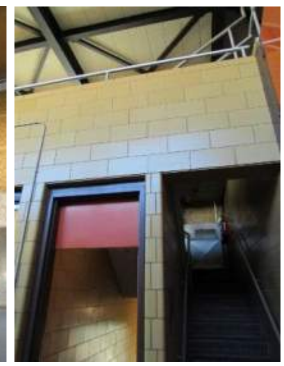
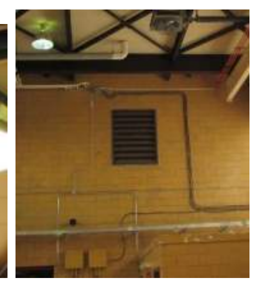
Electrical Distribution (Main Floor)	- Distribution equipment • Mix of original (>30 years) and newer (<15 years) distribution equipment • Wall-mounted Teck cables, rigid metal and PVC conduits, and cable trays (newer) are in fair to good condition • Signs of corrosion on some original rigid metal conduits, switches and junctions • Newer dry-type transformers, DPs and LPs are in fair and good condition • Original dry-type transformers, DPs and LPs are in poor condition and are beyond end of life - All corroded and original distribution equipment at the end of their service life should be replaced with new with the next capital upgrades project.	1–3	        

<table>
<tr>
<td>Electrical Distribution (Basement)</td>
<td>- Distribution
Mix of original (>30 years) and newer (<15 years) distribution equipment
Wall-mounted Teck cables and rigid metal conduits with no embedded distribution (original)
Cable trays anchored on basement ceilings and walls (newer)
All distribution conductors are either in fair or good condition</td>
<td>2 / 3</td>
<td>   </td>
</tr>
<tr>
<td>Electrical Distribution (Main Transformers)</td>
<td>- XMR T2 & T3
27.6kV - 4160V, 2500/2800kVA, ONAN, Carte
NGR (IPC), 2400V, 12Ω, 200A
Transformers and NGRs were installed within the last 15 years and in fair condition
Regular scheduled maintenance is recommended</td>
<td>2</td>
<td> 


</td>
</tr>
</table>

Lighting	- Lighting equipment • Mixtures of original (>30 years) and newer (<15 years) lighting fixtures • Metal halide ceiling-mount high bay fixtures for the blower gallery and low bay fixtures for access stair wells, with many non-functional units • Fluorescent tube (T8 and T12) lighting in all areas of the blower building and basement, both ceiling and wall mounted • Wallpack lighting over doorways and sparsely located in basement, not all units are functional - Original lighting and related equipment are in poor condition and requires replacement. - Newer lighting fixtures are in fair condition and should be considered for upgrade with the next capital upgrades project.	1 / 2	      

Instrumentation and Controls	- Control Room • Displays & equipment are in poor condition and out of service • Migrate remaining functional controls and monitoring circuits to a local ICP • Abandon and remove all the control room interfaces and displays - Control Panels • 3 blower ICPs (Turblex): ICP-222-01, ICP-222-02 & ICP-222-03 • Master Turblex panel (MCP) with proprietary HMI and software • Communication panel (ICP-16) with F.O. & Ethernet connections • Turblex MCP, Turblex ICPs and ICP-16 all contain PLC based on A.B. ControlLogix, and enclosed in S.S. (NEMA 4X) • ICP-18 is based on A.B. PLC 5 product (discontinued) • ICP-25 is PAIDS compliant and is in good condition • Replace ICP-18 with PAID compliant panel, including A.B. ControlLogix PLC	1-3	       

Heating and Ventilation	- Hydronic heating • 4 operational heaters mounted on ceilings of the blower gallery and the MCC room • 1 unit in the gallery is original and in poor condition, rest are fair - Ventilation • Louvers, motorized dampers and exhaust fans are original and in poor condition • AHU on the upper level above the control room provides forced air ventilation, in fair condition • Plenum air circulation in the blower gallery (original) • High ACH was noticed during the condition assessment • Ventilation in access areas connected to the blower building has poor ventilation with exhaust fans in poor condition • Replace original HVAC equipment on the next capital upgrades project to ensure adequate ventilation in all areas of the building	1 / 2	       

Additional Notes:
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.

G.E. Booth WWTP Condition Assessment

Electrical

Date: November 2, 2015

Process Area: Administration Building

Process: **Power Distribution for Plant 1 Facilities**

Year of Installation: **Life Expectancy:** **Current Age:**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
Building Exterior	- Transformers T1 & T4 • 27.6kV – 600/347V • 890 / 1000kVA • Delta-Wye • ONAN • Z = 5.6% • Carte International	2	 - Transformers T1 and T4 have been in service for ~10 years and are still in fair condition.

<table>
<tr>
<td>**Electrical Room MCCs**</td>
<td>- 2 x MCCs arrangement in Main-Tie-Main Kirk-Key Interlock configuration.

- Equipped with Cutler-Hammer / Westinghouse, EATON and Square-D Power Meters, Surge Protectors and Ground Fault Indicators.

- MCC-01 (Condition: 2)
• 5x508mm sections
• 600VAC, 1200A
• SC rating: 25kA
• Cutler-Hammer Westinghouse

- MCC-04 (Condition: 1)
• 3 sections
• 600VAC, 1000A
• 1 section: EATON, Cutler-Hammer
• 2 sections: Discontinued MCC product (~30 years)</td>
<td>1 / 2</td>
<td>
- MCC-01 (gray) in service for 18 years (1997) and is in fair condition. Considered for replacement with the rest of the end-of-life equipment in the electrical room.


- MCC-04 (green) consists of a product that is beyond its end of life (~30 years) and requires replacement.</td>
</tr>
</table>

Electrical Room Lighting, Distribution and Ventilation	- Transformers (Dry-type) • 17-15-16-1C-01 & 17-15-16-1C-02 • UPS and Battery Charger transformers (Polygon & Square D) - Lighting Panels • LP1 & LP2 (Federal Pioneer) - Distribution • Teck Cables, Rigid metal conduits, metal cable raceways • UPS and Battery Charger Switches (Square D) - Lighting • T12 ceiling-mount fluorescent tubes - Ventilation (2) • Forced-air ventilation through a small air duct within the Administration Building's HVAC system	2	      - Lighting transformers and lighting panels have been in service for ~30 years. Dry-type transformers, distribution, lighting and ventilation have been in service for more than 15 years. The equipment are in fair condition and should be considered for replacement with the capital upgrade works of the electrical room.

Additional Notes:
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.

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G.E. Booth WWTP Condition Assessment

Electrical

Date: November 2, 2015

Process Area:	Heating Building		
Process:	**Power and Building Services**		
Year of Installation:	**Life Expectancy:**	**Current Age:**	

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
MCC	- MCC 01-3/04-1 • 6 sections, 600V, 600A (Canadian General Electric) • 1 feeder breaker from each of the MCCs in the Administration Building's electrical room (MCC-01 and MCC-04) • Miscellaneous plant, pump and building loads on the MCC • 30+ years old	1	 - MCC is beyond its end of life and should be replaced with the next Heating Building's upgrade project.

Lighting and Distribution	- Lighting • Ceiling mounted high bay lighting (one needs replacement) • Pedant fluorescent T8 tubes • Wall-mounted perimeter fluorescent T8 tubes - General Distribution • Wall-mounted rigid metal conduits and Teck • Dry-type transformers and panels in fair condition • Original Lighting Panels and Transformers are in poor condition	2	 - Lighting equipment in fair condition. Maintenance and replacement of failed/broken light fixtures required by the maintenance staff.   - Original equipment are at the end of their service life and should be considered for replacement with the next upgrade works.

Instrumentation and Controls	- ICP 33 • Stand-alone PLC panel • c/w AB Panelview 1400 mounted on door • PLC based on Allen-Bradley's PLC 5 system • No field terminations in the panel • No power to the panel and is out of service	2	  - ICP 33 seems to be out of service and not used by the Region. The panel PLC hardware is based on a PLC system that is not PAIDS compliant. The panel should be replaced with PAIDS compliant HMI and AB Control Logix PLC if the panel is to be recommissioned.

Ventilation and Heating	- Intake and Exhaust • Intake and exhaust fans used for emergency power generator (no longer exists in the building) • Exhaust stack piping remain intact through the ceiling structure • Intake louvers and motorized dampers still in fair condition (no longer in service) • Exhaust fans are original and in poor condition - Heating • 3 electric unit heaters in fair condition	1 / 2	     

Additional Notes:
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.

G.E. Booth WWTP Condition Assessment

Electrical

Date: November 2, 2015

Process Area: Service Building

Process: **Maintenance**

Year of Installation: **Life Expectancy:** **Current Age:**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
MCC	- MCC 01-4 • 5 sections, 600V, 200A, (Square D) • MCC feeder breaker from MCC-01 in the Administration Building's electrical room • Service building equipment and miscellaneous loads on MCC 01-4 • 30+ years old	1	 - MCC 01-4 is beyond its end of life and should be replaced with the next Service Building's upgrade project.

Lighting and Distribution	- Lighting • High bay type • Fluorescent pendant T8 tubes and wall-mounted - Distribution • Lighting Panels and Transformers are in fair condition • Rigid metal wall-mounted conduits • Electrical distribution is generally in good condition within the service building facility	2	  
Heating and Ventilation	- Ventilation • Forced air ventilation system with ceiling-mounted ducts and diffusers • Roof-top air handling unit was not accessible - Heating • Hydronic heating units	2	- The heating and ventilation systems for the Service Building are fully functional and in fair condition. No actions necessary.

Additional Notes:
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC**.**

G.E. Booth WWTP Condition Assessment

Instrumentation & Controls

Date: November 2, 2015

Process Area:	Primary Treatment
Process:	Raw Sludge Pumping Station No.1
Year of Installation:	**Life Expectancy:** **Current Age:**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
Instrumentation and Controls	- Pump Controls • Raw Sludge Pumps 1 & 2 Control Interface Panels are in fair condition • VSD in fair condition • Equipment not rated for classified environments - Panels • Terminal Cabinet #1 is in fair condition • Original panels and cabinets have been out of service and should be removed - The Raw Sludge Pumping Station #1 contains cabinets, panels and control units that are not rated for Class 1 Div 2 environments. Unclassified space is required for existing equipment without replacements with explosion-proof varieties. - Any abandoned and out of service electrical panels and cabinets should be removed.	2	    

Additional Notes:
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC**.**

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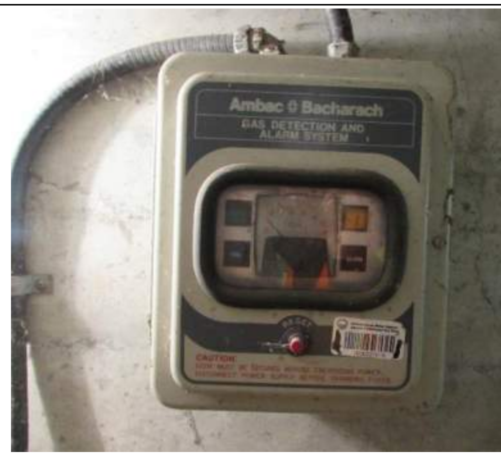
G.E. Booth WWTP Condition Assessment

Instrumentation & Controls

Date: November 2, 2015

Process Area:	Primary Treatment
Process:	Raw Sludge Pumping Station No.2

Year of Installation: **Life Expectancy:** **Current Age:**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
Instrumentation and Controls	- Gas detection system • LEL% gas detection • Ambac Bacharach • Analog display of concentration levels • Flexible conduits for power and signals at end of life • Detection system at its end of life and should be replaced	1	

Additional Notes:

The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC**.**

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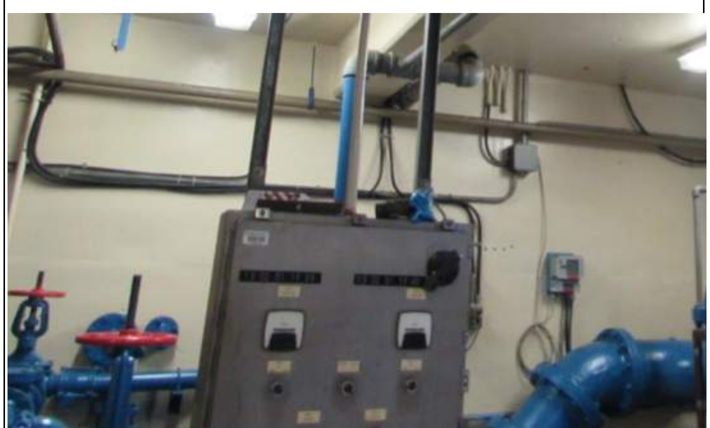
G.E. Booth WWTP Condition Assessment

Instrumentation & Controls

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	Return Sludge Pumping Station No.1
Year of Installation:	**Life Expectancy:** **Current Age:**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
Instrumentation and Controls	- Pump Drives • Return Sludge Pumps 1, 2, 3 & 4 VSD and interfaces are in fair condition • Equipment not rated for classified environments - Pump Control Panels • Control panels for pumps and instruments are in fair condition • Control panel for pumps in basement is in fair condition • All panels are not rated for classified environments - The Return Sludge Pumping Station #1 contains panels and control units that are not rated for Class 1 Div 2 environments. - Unclassified space is required for existing equipment without replacements with explosion-proof varieties.	2	  

Additional Notes:

The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC**.**

G.E. Booth WWTP Condition Assessment

Instrumentation & Controls

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	Return Sludge Pumping Station No.2
Year of Installation: **Life Expectancy:** **Current Age:**	

<table>
<tr><th colspan="2">Description
(including location details)</th><th>Condition Grade (1-3)</th><th>Comments/Deficiencies/Photos</th></tr>
<tr><td>Instrumentation and Controls</td><td>- Pump Drives
• 3 Return Sludge Pump VSD and enclosures are in fair condition, but they are at the end of their service life
• Pump VSDs are equipped with analog displays and discontinued hardware
• Upgrade the VSD to modern equipment is recommended

- Pump Control Panels
• #3 WAS Pump panel in good condition

- Instruments
• Flow meter and turbidity meter in fair condition

- Control panels
• Some control panels and terminal boxes have been abandoned and out of service
• Remove all abandoned equipment and from the pumping station</td><td>2</td><td>

</td></tr>
<tr><td colspan="4"><u>Additional Notes:</u>
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.</td></tr>
</table>

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G.E. Booth WWTP Condition Assessment

Instrumentation & Controls

Date: November 2, 2015

Process Area:	Blower Building	
Process:	**Aeration**	
Year of Installation:	**Life Expectancy:**	**Current Age:**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
	- Control Room • Displays & equipment are in poor condition and out of service • Migrate remaining functional controls and monitoring circuits to a local ICP • Abandon and remove all the control room interfaces and displays -		

Instrumentation and Controls	- Control Panels • 3 blower ICPs (Turblex): ICP-222-01, ICP-222-02 & ICP-222-03 • Master Turblex panel (MCP) with proprietary HMI and software • Communication panel (ICP-16) with F.O. & Ethernet connections • Turblex MCP, Turblex ICPs and ICP-16 all contain PLC based on A.B. ControlLogix, and enclosed in S.S. (NEMA 4X) • ICP-18 is based on A.B. PLC 5 product (discontinued) • ICP-25 is PAIDS compliant and is in good condition • Replace ICP-18 with PAID compliant panel, including A.B. ControlLogix PLC	1-3	

Additional Notes:
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.

G.E. Booth WWTP Condition Assessment

Instrumentation & Controls

Date: November 2, 2015

Process Area:	Heating Building	
Process:	Power and Building Services	
Year of Installation:	**Life Expectancy:**	**Current Age:**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
Instrumentation and Controls	- ICP 33 • Stand-alone PLC panel • c/w AB Panelview 1400 mounted on door • PLC based on Allen-Bradley's PLC 5 system • No field terminations in the panel • No power to the panel and is out of service	2	  - ICP 33 seems to be out of service and not used by the Region. The panel PLC hardware is based on a PLC system that is not PAIDS compliant. The panel should be replaced with PAIDS compliant HMI and AB Control Logix PLC if the panel is to be recommissioned.

Additional Notes:

The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.

G.E. Booth WWTP Condition Assessment

Mechanical

Date: November 2, 2015

Process Area: Secondary Treatment

Process: Raw Sludge Pumping Station No.1

Year of Installation: **Life Expectancy:** **Current Age:**

Description *(including location details)*		Condition Grade (1-3)	Comments/Deficiencies/Photos
Heating and Ventilation	- Ventilation • Raw Sludge Pumping Station #1 has poor ventilation with no forced air flow • Exhaust fans are original and no longer functional • Original intake louvers in poor condition • Ceiling opening to atmosphere allow ingress of precipitation and foreign objects	1	 

	- Heating • 1 electric unit heater in electrical room in fair condition • 2 hydronic heater in storage rooms in poor condition • Baseboard water heaters in storage room in poor condition • Water piping show signs of heavy corrosion • Heating units' function could not be verified. They are in poor condition and should be replaced		    - New HVAC system required for the Raw Sludge Pumping Station #1 to provide 6ACH.
	- Storage room is flooded from moisture ingress		

<u>Additional Notes:</u>
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC**.**

G.E. Booth WWTP Condition Assessment

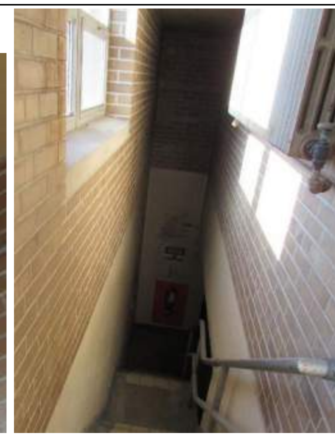
Mechanical

Date: November 2, 2015

Process Area: Raw Sludge Pumping Station No.2

Process: **Pumping Station**

Year of Installation: **Life Expectancy:** **Current Age:**

Description *(including location details)*		Condition Grade (1-3)	Comments/Deficiencies/Photos
Heating and Ventilation	- Heating • 1 electric unit heater in electrical room in fair condition • Hot water radiators for stairs and other parts of the pumping station are original • Heating units' function could not be verified - Ventilation • Raw Sludge Pumping Station #2 has poor ventilation with no forced air flow • Ventilation fans are original and no longer functional • Original louvers and openings are in poor condition	1	    - New HVAC system required for the Raw Sludge Pumping Station #2 to provide 6ACH.

Additional Notes:
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.

Partners in excellence

G.E. Booth WWTP Condition Assessment

Mechanical

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	Return Sludge Pumping Station No.1

Year of Installation: **Life Expectancy:** **Current Age:**

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
Heating and Ventilation	- Heating • 2 electric unit heaters and 1 hydronic heater on the main floor are in fair condition - Ventilation • Return Sludge Pumping Station #1 has poor ventilation with no forced air flow • Operator requires the two doors of the station to be open while working inside the building • Basement and main floor of the pumping station are connected via an open staircase • Under current conditions the entire space (main and basement) is classified as Class 1 Div 2	2	   - New HVAC system required for the Return Sludge Pumping Station #1 to provide 6ACH.

Additional Notes:
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC**.**

G.E. Booth WWTP Condition Assessment

Mechanical

Date: November 2, 2015

Process Area:	Secondary Treatment
Process:	Return Sludge Pumping Station No.2

Year of Installation: **Life Expectancy:** **Current Age:**

<table>
<tr><th colspan="2">Description
(including location details)</th><th>Condition Grade (1-3)</th><th>Comments/Deficiencies/Photos</th></tr>
<tr><td>Heating and Ventilation</td><td>- Heating and Cooling
• Hydronic radiators on the main floor and in the basement pumps and valves room
• Wall-mounted air-conditioning unit in poor condition and out of service

- Ventilation
• Return Sludge Pumping Station #2 has poor ventilation with low air flow
• Not enough ventilation is provided by the existing fans.
• Exhaust fans are original and in poor condition
• Basement and main floor of the pumping station are connected via an open staircase
• The entire space pumping station (main and basement) is classified as a Class 1 Div 2 environment</td><td>1</td><td>
- New HVAC system required for the Return Sludge Pumping Station #1 to provide 6ACH.</td></tr>
<tr><td colspan="4">**Additional Notes:**
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.</td></tr>
</table>

CIMA Partners in excellence

G.E. Booth WWTP Condition Assessment

Mechanical

Date: November 2, 2015

Process Area:	Tunnels and Access		
Process:	**Services and Distribution**		
Year of Installation:	**Life Expectancy:**	**Current Age:**	

	Description *(including location details)*	**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
Ventilation	• No forced air ventilation • Tunnels accessible through open stair cases in Raw and Return Sludge Pumping Stations • Heating provided through hot water radiators (end of life) • Noticeable excess moisture in the tunnels and access ways	1	- No visible ventilation equipment in the tunnels and access stairs. Ventilation is through natural convection. - A new HVAC system is recommended to provide 6 ACH for the Class 1 Div 2 tunnels and access spaces.

Additional Notes:
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.

G.E. Booth WWTP Condition Assessment

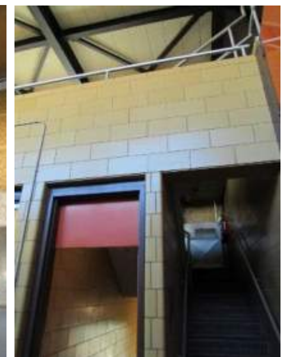
Mechanical

Date: November 2, 2015

Process Area:	Blower Building
Process:	**Aration**

Year of Installation: **Life Expectancy:** **Current Age:**

	Description *(including location details)*	Condition Grade (1-3)	Comments/Deficiencies/Photos
	- Hydronic heating • 4 operational heaters mounted on ceilings of the blower gallery and the MCC room • 1 unit in the gallery is original and in poor condition, rest are fair -		 

<table>
<tr>
<td>Heating and Ventilation</td>
<td>- Ventilation
Louvers, motorized dampers and exhaust fans are original and in poor condition
AHU on the upper level above the control room provides forced air ventilation, in fair condition
Plenum air circulation in the blower gallery (original)
High ACH was noticed during the condition assessment
Ventilation in access areas connected to the blower building has poor ventilation with exhaust fans in poor condition
Replace original HVAC equipment on the next capital upgrades project</td>
<td>1 / 2</td>
<td>     </td>
</tr>
<tr>
<td colspan="4"><u>Additional Notes:</u>
The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC.</td>
</tr>
</table>

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G.E. Booth WWTP Condition Assessment

Mechanical

Date: November 2, 2015

Process Area:	Heating Building
Process:	**Power and Building Services**
Year of Installation:	**Life Expectancy:** **Current Age:**

Description *(including location details)*		**Condition Grade (1-3)**	**Comments/Deficiencies/Photos**
Ventilation and Heating	- Intake and Exhaust • Intake and exhaust fans used for emergency power generator (no longer exists in the building) • Exhaust stack piping remain intact through the ceiling structure • Intake louvers and motorized dampers still in fair condition (no longer in service) • Exhaust fans are original and in poor condition	1 / 2	  

	- Heating • 3 electric unit heaters in fair condition	1 / 2	
Additional Notes: The following were assessed for each Process Area (where applicable): Service Entrance, MCC & Switchgear, Electrical Power and Distribution, Emergency Power, Lighting and HVAC**.**			

Appendix B Condition Assessment 25 Year Cash Forecast

G.E. Booth (Lakeview) WWTP Plant 1 Condition Assessment
Region of Peel

Condition Assessment Cash Forecast

Date: 11-Jan-16

Discipline	Asset	Condition Rating	Period[1]	Budget Cost Estimate[2]
PRIMARY CLARIFIERS				
Process	Replace 20 influent gates	2	Medium	$500,000
Process	Replace 2 Plant 1A Mechanisms	2	Short	$937,000
Process	Replace 2 Plant 1A Weirs	1	Short	$21,000
Process	Replace 2 Plant 1A Scum Troughs	2	Medium	$48,000
Process	Replace 1 Plant 1B Mechanism	2	Short	$472,000
Process	Replace 1 Plant 1B Weirs	1	Short	$30,000
Process	Replace 1 Plant 1B Scum Troughs	2	Medium	$55,000
Structural and Architectural	Handrail - Replace on PC No. 1 and 2	1	Short	$84,000
Structural and Architectural	Concrete - Repair spalls at handrail	2	Short	$280,000
Structural and Architectural	Concrete - Seal all joints	2	Short	$560,000
Structural and Architectural	Concrete - Resurface inside and out	2	Medium	$840,000
Electrical	Electrical Power Distribution - Replace Chain & Flight and Actuators	1	Short	$175,000
Electrical	Replace Outdoor Lighting	1	Short	$140,000
I&C	Automation Allowance		Medium	$250,000
RAW SLUDGE PS 1 AND PS2 AND GALLERY				
Process	Replace 2 Raw Sludge Pumps	1	Short	$70,000
Process	Replace Raw Sludge and Scum Piping and valves	1	Short	$175,000
Process	Replace 16 spools	1	Short	$320,000
Process	Replace 1 Scum Pump	1.5	Short	$20,000
Process	Replace 2 Sump Pump	1	Medium	$29,000
Structural and Architectural	Steel roof structure - Coat steel deck and OWSJ (PS 1)	1	Short	$30,000
Structural and Architectural	Steel roof structure - Replace roof structure with precast panels (PS 1)	1	Medium	$40,000
Structural and Architectural	Roofing- Replace (PS 1)	0	Medium	$21,000
Structural and Architectural	Steel man doors - Replace all doors (PS 1)	2	Medium	$7,000
Structural and Architectural	Equipment door - Replace (PS 1)	1	Medium	$7,000
Structural and Architectural	Windows - Replace all windows (PS 1)	2	Medium	$19,600
Structural and Architectural	Concrete - Repair spalls and cracks (PS 1)	2	Short	$28,000
Structural and Architectural	Concrete - Seal pipe penetrations (PS 1)	2	Short	$28,000
Structural and Architectural	Concrete - Repair expansion joints (PS 1)	2	Short	$35,000
Structural and Architectural	Brick - Repaired and repointed (PS 1)	2	Medium	$35,000
Structural and Architectural	Paint - General painting (PS 1)	2	Medium	$21,000
Structural and Architectural	Roofing- replace (PS 2)	0	medium	$21,000
Structural and Architectural	Steel man doors - Replace all doors (PS 2)	2	Medium	$2,800
Structural and Architectural	Windows - Replace all windows (PS 2)	2	medium	$8,400
Structural and Architectural	Concrete - Repair spalls and cracks (PS 2)	2	Short	$28,000
Structural and Architectural	Concrete - Seal pipe penetrations (PS 2)	2	Short	$14,000
Structural and Architectural	Concrete - Repair expansion joints (PS 2)	2	Short	$35,000
Structural and Architectural	Brick - Repaired and repointed (PS 2)	2	Medium	$28,000
Structural and Architectural	Paint - General painting (PS 2)	2	Medium	$21,000
Electrical	Replace MCC 01-2 (3 sections) (PS 1)	1	Short	$126,000
Electrical	Remove and replace PVC conduits with rigid metal conduits. (PS 1)	1	Short	$35,000
Electrical	Replace all corroded conduits and any original distribution equipment and switches at the end of their service life. (PS 1)	1	Short	$91,000
Electrical	Replace lighting fixtures (interior & exterior) and light switches with properly rated equipment (PS 1)	1	Short	$63,000
Electrical	Replace MCC 01-21 (2 sections) (PS 2)	1	Short	$84,000
Electrical	Replace PVC conduits with rigid metal conduits suited for Class 1 Div 2 environments. (PS 2)	1	Short	$42,000
Electrical	Replace all corroded conduits and original distribution in poor condition or at the end of their service. (PS 2)	1	Short	$91,000
Electrical	Replace switches, disconnects, pull boxes and enclosures that have reached their end of life and equipment that are not rated for classified environments. (PS 2)	1	Short	$42,000
Electrical	Replace light fixtures, switches and sensors that are not appropriately rated for Class 1 Div 2 environments or are broken, failed or have reached end of life. (PS 2)	1	Short	$70,000
Electrical	Replace all PVC and corroded conduits with rigid metal conduits. (PS1/2 and Gallery)	1	Short	$42,000
Electrical	Replace original switches and disconnects, which are at their end of life, to ensure classification ratings. (PS1/2 and Gallery)	1	Short	$91,000
Electrical	Replace original lighting fixtures that are at the end of their service life. (PS1/2 and Gallery)	1	Short	$56,000
Electrical	Replace all light fixtures that are not appropriately rated for Class 1 Div 2 environments. (PS1/2 and Gallery)	1	Short	$84,000
I&C	Replace existing control systems. (PS 1)	1	Short	$105,000
I&C	Remove any abandoned and out of service electrical panels and cabinets. (PS 1)	1	Short	$14,000

G.E. Booth (Lakeview) WWTP Plant 1 Condition Assessment
Region of Peel

Condition Assessment Cash Forecast

Date: 11-Jan-16

Discipline	Asset	Condition Rating	Period[1]	Budget Cost Estimate[2]
I&C	Replace gas detection system (LEL). (PS 2)	1	Short	$11,200
Mechanical	Replace hot water radiator. Remove all existing fans and ventilation openings. Replace HVAC system to provide 6 ACH. (PS 2)	1	Medium	$105,000
Mechanical	Replace existing heaters and related equipment and services that are original or in poor condition. (PS 1)	1	Short	$28,000
Mechanical	Remove all existing fans and ventilation openings.(PS 1)	1	Short	$16,800
Mechanical	Replace HVAC system to provide 6 ACH.(PS 1)	1	Short	$49,000
Mechanical	Replace hot water radiators with unit heaters. Replace HVAC system to provide 6 ACH for Class 1 Div 2 galleries and access spaces. (Gallery)	1	Short	$189,000
AERATION TANKS				
Process	4 Inlet gates	1	Short	$100,000
Process	Fine bubble diffusers and associated in tank piping	0	Short	$1,575,000
Process	Air header and drop leg piping	1	Medium	$714,000
Process	Replace 42 Spools	1	medium	$840,000
Process	Replace 18 drain valves	1	Medium	$126,000
Process	Instrumentation	0	Short	$64,000
Structural and Architectural	Handrail - Replace on tanks 1 and 2	1	Short	$280,000
Structural and Architectural	Grating - Replace between aeration and secondary clarifier	1	Short	$10,000
Structural and Architectural	Concrete - spalls at handrail	2	Short	$420,000
Structural and Architectural	Concrete - Crack injection	2	Short	$112,000
Structural and Architectural	Concrete - Replace joint sealant	2	Short	$392,000
Structural and Architectural	Concrete - Resurfacing	2	Medium	$1,120,000
Electrical	Replace with new (rigid metal), rated for Class 1 Div 2 environments	1	Short	$210,000
Electrical	Replace original lighting with high efficiency LED flood lights	1	Short	$294,000
I&C	Replace with explosion-proof equivalents	1	Short	$119,000
I&C	Automation Allowance		Medium	$250,000
SECONDARY CLARIFIERS				
Process	Replace 4 Plant 1A Mechanisms	1	Short	$1,803,000
Process	Replace 4 Plant 1A Weirs	1-2	Short	$70,000
Process	Replace 4 Plant 1A Scum Troughs	1-2	Short	$35,000
Process	Replace 2 Plant 1B Mechanisms	1	Short	$1,373,000
Process	Replace 2 Plant 1A Weirs	1.5	Short	$48,000
Process	Replace 2 Plant 1A Scum Mechanisms	1	Short	$140,000
Process	Replace Flow meters	1	Medium	$14,000
Process	Replace 18 Spools	1	Medium	$360,000
Structural and Architectural	Handrail - Replace on SC No. 1 to 4	1	Short	$112,000
Structural and Architectural	Concrete - spalls at handrail	2	Short	$280,000
Structural and Architectural	Concrete - Crack injection	2	Short	$112,000
Structural and Architectural	Concrete - Replace joint sealant	2	Short	$252,000
Structural and Architectural	Concrete - Resurfacing	2	Medium	$840,000
Electrical	Replace original motors and actuators, including electrical distribution and disconnect switches.	1	Short	$140,000
Electrical	Replace original lighting with high efficiency LED flood lights	1	Short	$126,000
I&C	Automation Allowance		Medium	$500,000
RETURN SLUDGE PS 1				
Process	Replace 4 RAS Pumps (45.4 L/s at 8.5 m TDH)	3	Medium	$121,000
Process	Replace 2 WAS pumps (17.4 L/s at 4.3 m TDH)	3	Medium	$40,000
Process	Replace piping, fitting and valves	3	Medium	$300,000
Process	Replace 10 Spools	1	Medium	$200,000
Process	Replace 1 scum pump (3.8 L/s at 10 m TDH)	3	Medium	$40,000
Process	Replace Sludge Flow meter	2	Medium	$63,000
Process	Replace WAS density meter	2	Medium	$38,000
Structural and Architectural	Brick - Repair and repointing	3	Medium	$14,000
Structural and Architectural	Roofing - Replace	0	Medium	$21,000
Electrical	Replace MCC (2 sections).	1	Short	$140,000
Electrical	Replace all corroded conduits and original distribution equipment at the end of their service life.	1	Short	$63,000
Electrical	Replace original lighting and any fixtures that are in poor condition and/or fixtures that are not rated for the classified environment.	1	Short	$42,000
I&C	Panels and control units are not rated for Class 1 Div 2 environments. Space needs to be declassified.	1	Short	$84,000
Mechanical	HVAC system - replace to comply with NFPA820	1	Short	$70,000

G.E. Booth (Lakeview) WWTP Plant 1 Condition Assessment
Region of Peel

Partners in excellence

Condition Assessment Cash Forecast

Date: 11-Jan-16

Discipline	Asset	Condition Rating	Period[1]	Budget Cost Estimate[2]
RETURN SLUDGE PS 2 AND GALLERIES				
Process	Replace 3 RAS Pumps (88.3 L/s, 6.4 m TDH)	2	Medium	$158,000
Process	Replace 2 WAS pumps (14.4 L/s at 4.8 m TDH)	3	Medium	$105,000
Process	Replace Piping and fittings	3	Medium	$250,000
Process	Replace 1 spool	3	Medium	$20,000
Process	Replace Valves	2	Medium	$56,000
Process	Replace 1 scum pumps (3.8 L/s at 12 m TDH)	2	Medium	$40,000
Process	Replace 2 Turbimeters	3	Medium	$38,000
Process	Replace AT Air Flow Meter	3	Medium	$16,000
Process	Replace Sludge Flow meter	3	Medium	$63,000
Structural and Architectural	Concrete - Repair cracks and spalls	2	Short	$84,000
Structural and Architectural	Concrete - Repair expansion joint	2	Short	$28,000
Structural and Architectural	Steel roof structure - expose and coat steel deck and OWSJ	1	Short	$42,000
Structural and Architectural	Steel roof structure - Replace roof structure with precast panels	1	Medium	$46,200
Structural and Architectural	Roofing - Replace	0	Medium	$28,000
Structural and Architectural	Painting - General painting	3	Medium	$21,000
Structural and Architectural	Skylight - Add grating over skylight exterior	1	Short	$7,000
Structural and Architectural	Bathroom - Demolish and replace all fixtures	1	Short	$42,000
Electrical	Replace MCC 01-11 (3 sections)	1	Short	$160,000
Electrical	Replace PVC conduits with rigid metal conduits suited for Class 1 Div 2 environments and corroded and end of life distribution equipment.	1	Short	$56,000
Electrical	Remove abandoned equipment.	1	Short	$21,000
Electrical	Replace original and non-functional lighting fixtures with new.	1	Short	$35,000
I&C	Replace and upgrade the 3 VSDs for the RAS.	1	Short	$112,000
I&C	Remove all abandoned and out of service panels.	1	Short	$14,000
Mechanical	Replace heaters and provide new HVAC system is required for the RAS PS 1 to provide 6ACH.	1	Short	$126,000
BLOWER BUILDING				
Process	Rebuild 2 Blowers	2	Medium	$1,000,000
Process	Replace 2 Blower Lube Oil Units	2	Medium	$14,000
Process	Replace Air Filter	1	Medium	$250,000
Electrical	Replace main 4160V switchgear, 4160V blower motor starters and interrupter switches recommended for replacement with the next capital upgrades project.	1	Short	$2,240,000
ADDITIONAL PLANT 1 ELECTRICAL INFRASTRUCTURE				
Electrical- Admin Bld	Replace MCC-04 (3 sections) with modern MCC lineup.	1	Short	$126,000
General requirements and demolition (15% of short term subtotal)			Short	$2,455,650
General requirements and demolition (15% of medium term subtotal)			Medium	$1,464,750
General requirements and demolition (15% of long term subtotal)			Long	$0
Short Term Upgrades Subtotal				$18,826,650
Medium Term Upgrades Subtotal				$11,229,750
Long Term Upgrades Subtotal				$0
			TOTAL	**$30,056,400**

Notes:

1. Short Term: 0 - 5 years; Medium Term: 5 - 10 years and Long Term: 10 - 25 years

2. Includes 40% markup, inclusive of estimating allowance, contingency and engineering fees. All costs are based on 2016 dollars.

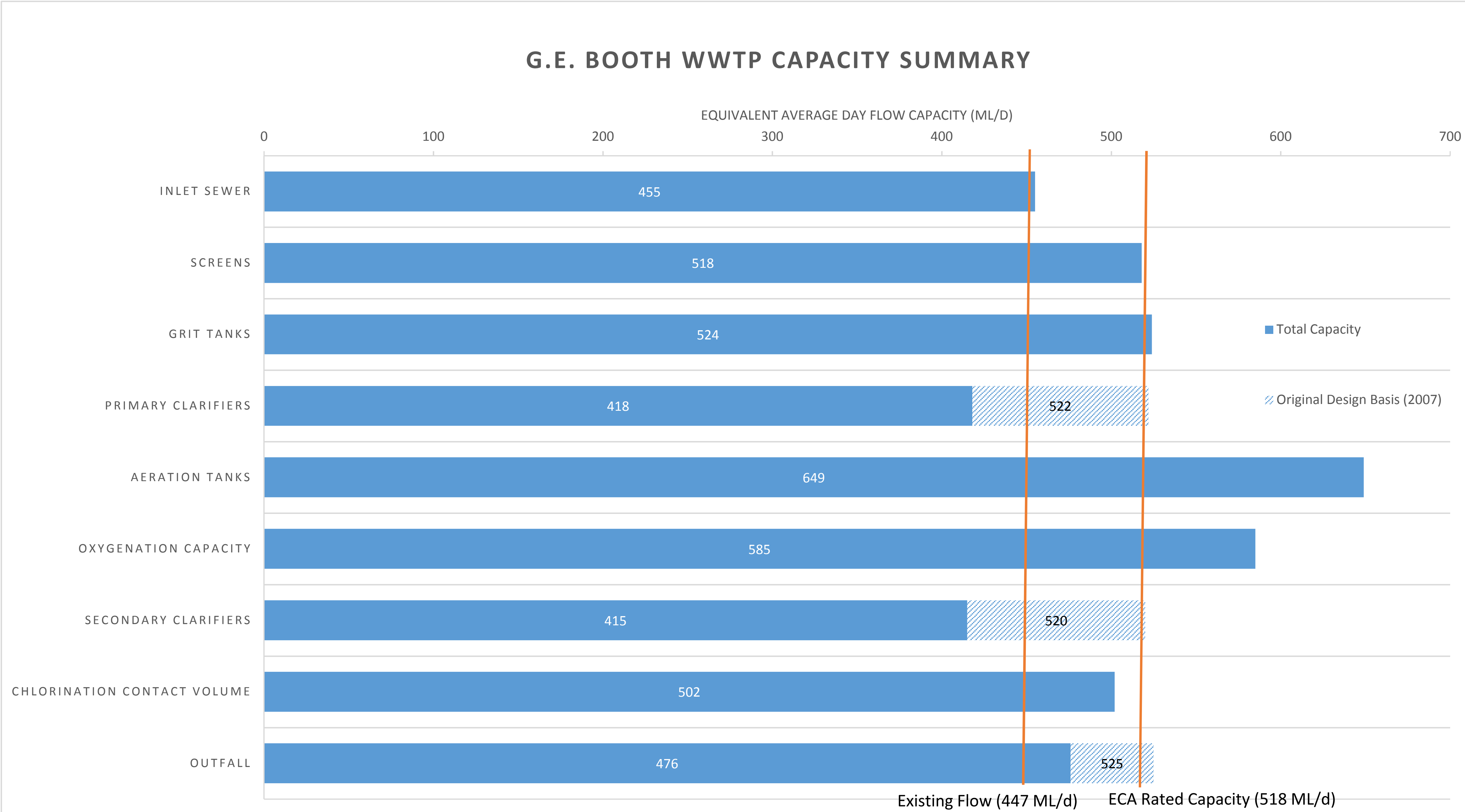
B

Appendix B

Capacity Calculations

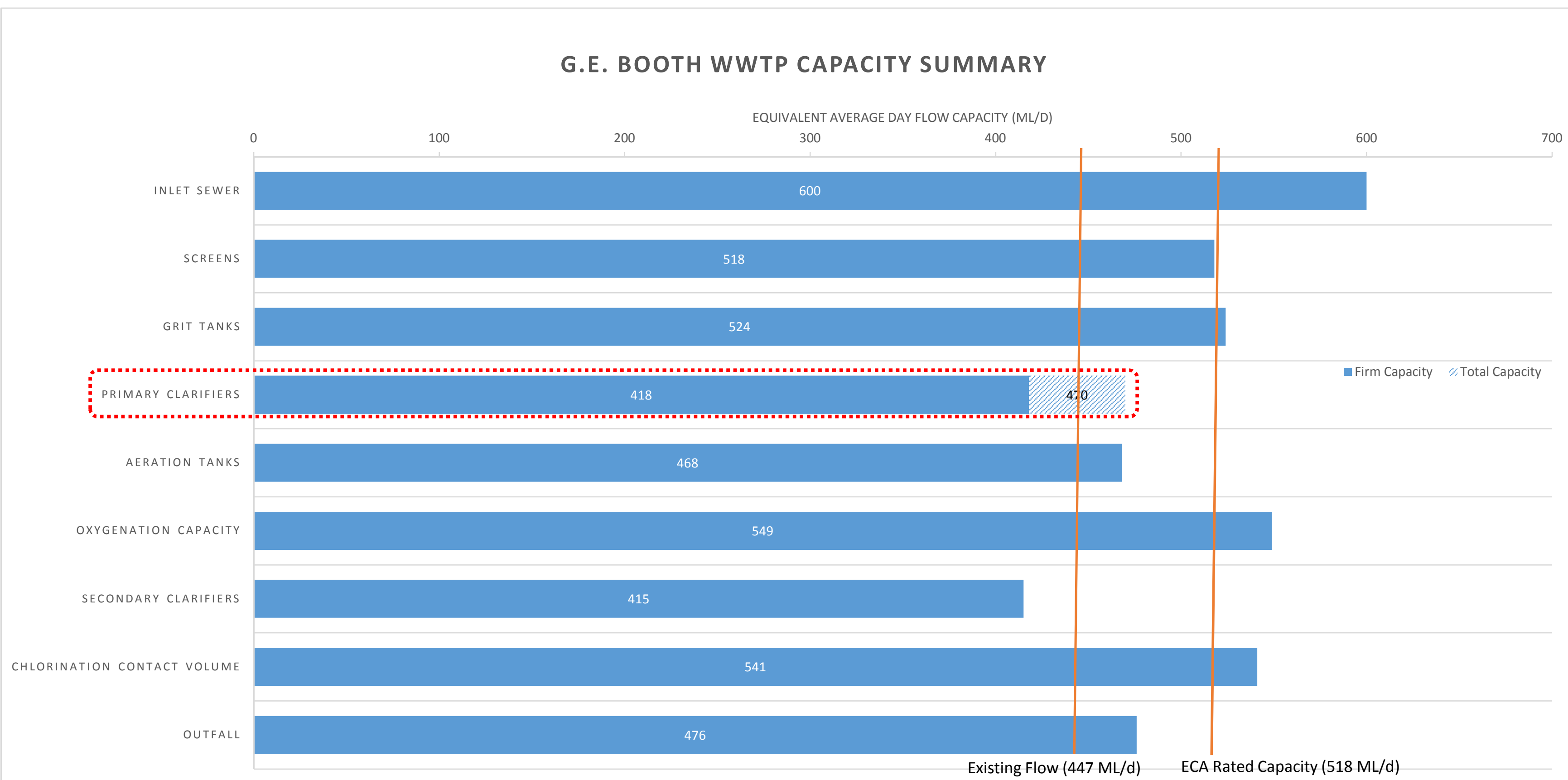
G.E. Booth WWTP
Expansion of Major Treatment Processes to Accommodate Growth

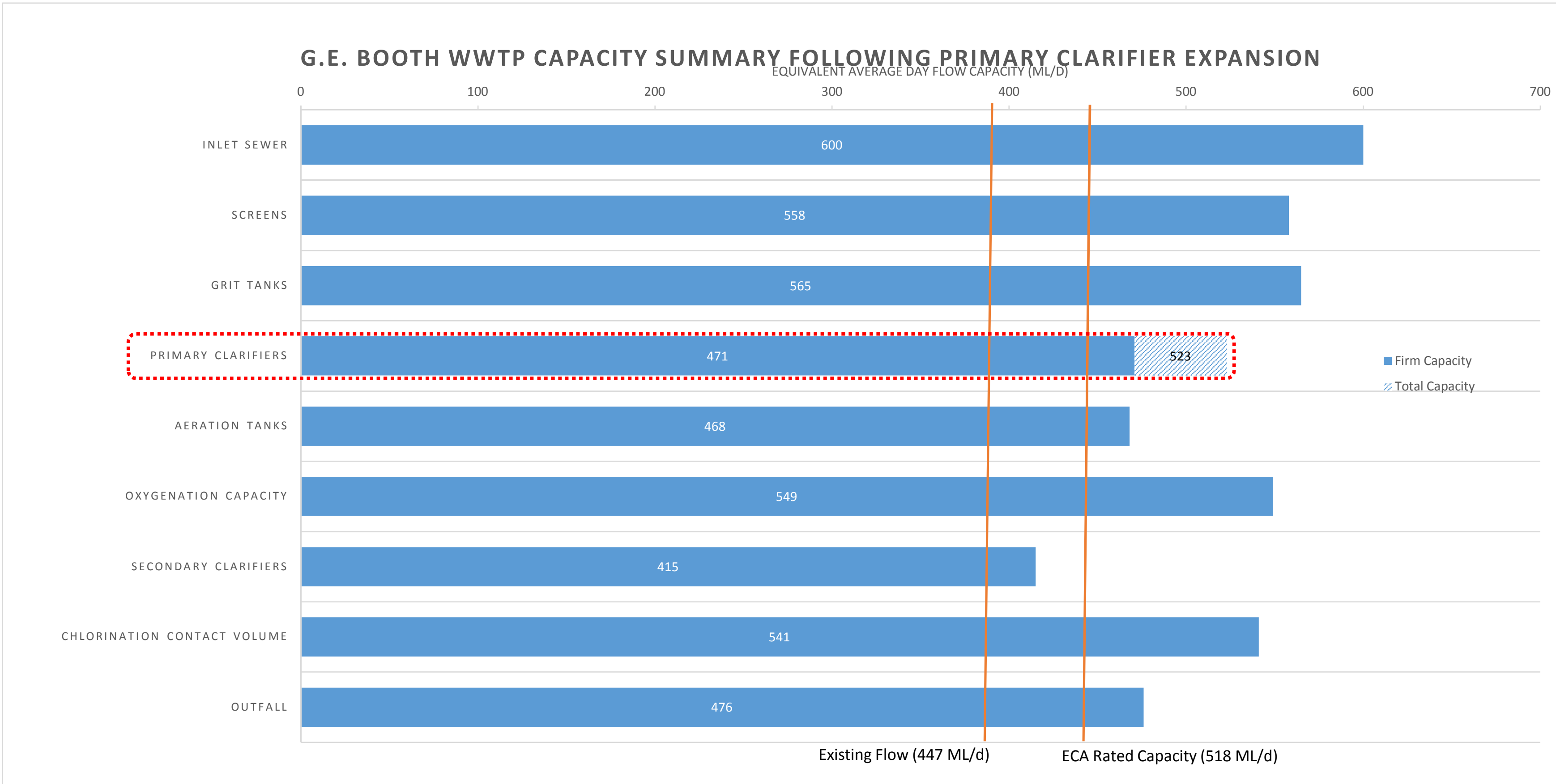
Unit Process	Original Design Basis	Existing Capacity (ML/d) Equiv. ADF	Ex. Total Number Units	Additional Units to Reach 518 ML/d	Additional Units to Reach 600 ML/d	Difference Between Original Design Basis and Existing Capacity (ML/d)	New Inlet Capacity (ML/d)	Difference Between New and Existing Clarifier Capacity (ML/d)
Inlet Sewer		**455**	**1**				600	145
Screens	518	518	6	0	2	0		
Grit Tanks	524	524	4	0	2	0		
Primary Clarifiers	522	418	11	3	4	104		
Aeration Tanks	536	649	14	5	8			
Oxygenation Capacity	585	585	8	3	5			
Secondary Clarifiers	520	415	16	5	8	105		
Chlorination Contact Volume	538	502	1	0	1	0		
Outfall	525	476	1	0	1	49		
Thickening Centrifuges	764	666	5	0	0	98		
Dewatering Centrifuges	811	683	6	0	0	128		
Incineration	782	479	4	1	2	303		


G.E. BOOTH WWTP CAPACITY SUMMARY
EQUIVALENT AVERAGE DAY FLOW CAPACITY (ML/D)
0
100
200
300
400
500
600
700
INLET SEWER
455
SCREENS
518
GRIT TANKS
524
PRIMARY CLARIFIERS
418
522
AERATION TANKS
649
OXYGENATION CAPACITY
585
SECONDARY CLARIFIERS
415
520
CHLORINATION CONTACT VOLUME
502
OUTFALL
476
525
Total Capacity
Original Design Basis (2007)
Existing Flow (447 ML/d)
ECA Rated Capacity (518 ML/d)

G.E. Booth WWTP
Plant 3 Primary Treatment Expansion

Unit Process	Original Design Basis	Existing Capacity (ML/d) Equiv. ADF	Ex. Total Number Units	Additional Units to Reach 518 ML/d	Additional Units to Reach 600 ML/d	Difference Between Original Design Basis and Existing Capacity (ML/d)	New Firm Clarifier Capacity (ML/d)	Firm Capacity After Expansion (ML/d)	New Total Capacity After Expansion	New Total Capacity After Expansion	Difference after Expansion	After Expansion Firm	After Expansion Total	Difference	Difference Between New and Existing Clarifier Capacity (ML/d)	Difference Between New and Existing after Expansion
Inlet Sewer		**600**					**600**	**600**				**600**				
Screens	518	518	6	0	2202000	0	558	558				558				
Grit Tanks	524	524	4	0	144	0	565	565				565				
Primary Clarifiers	522	418	11	8	8	0	523	575	575	575	0	471	523	52	52	52
Aeration Tanks	536	468	14	4	4	69	468	468				468				
Oxygenation Capacity	585	549	8	3	5	36	549	549				549				
Secondary Clarifiers	520	415	16	4	4	105	415	415				415				
Chlorination Contact Volume	538	541	1	0	14	0	541	541				541				
Outfall	525	476	1	0	14	49	476	476				476				
Thickening Centrifuges	764	666	5	0	0	98	666	666				666				
Dewatering Centrifuges	811	683	6	0	0	127	683	683				683				
Incineration	782	479	4	0	0	303	479	479				479				

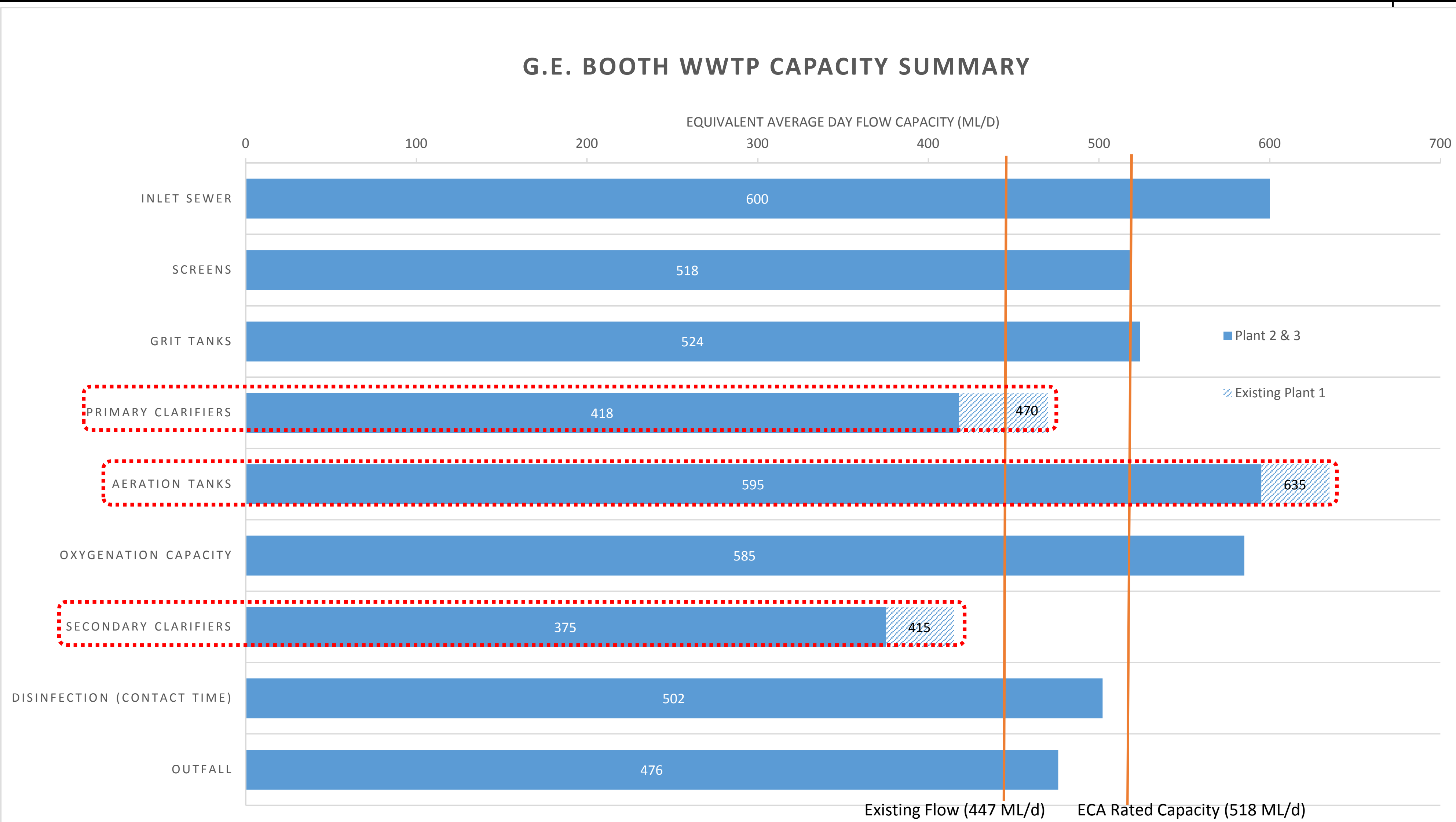


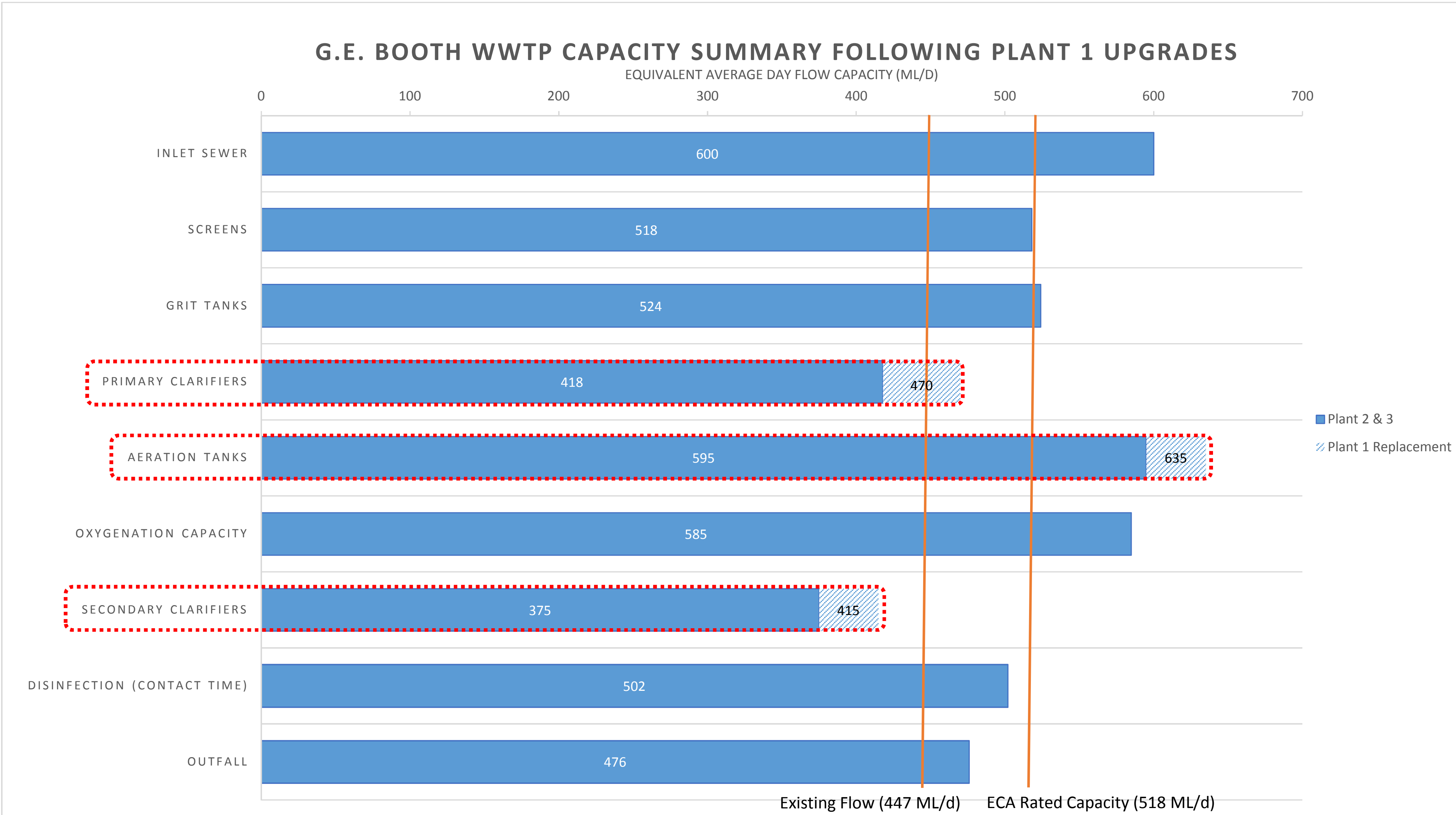


G.E. BOOTH WWTP CAPACITY SUMMARY FOLLOWING PRIMARY CLARIFIER EXPANSION
EQUIVALENT AVERAGE DAY FLOW CAPACITY (ML/D)
0
100
200
300
400
500
600
700
INLET SEWER
600
SCREENS
558
GRIT TANKS
565
PRIMARY CLARIFIERS
471
523
AERATION TANKS
468
OXYGENATION CAPACITY
549
SECONDARY CLARIFIERS
415
CHLORINATION CONTACT VOLUME
541
OUTFALL
476
Firm Capacity
Total Capacity
Existing Flow (447 ML/d)
ECA Rated Capacity (518 ML/d)

G.E. Booth WWTP
Plant 1 Replacement

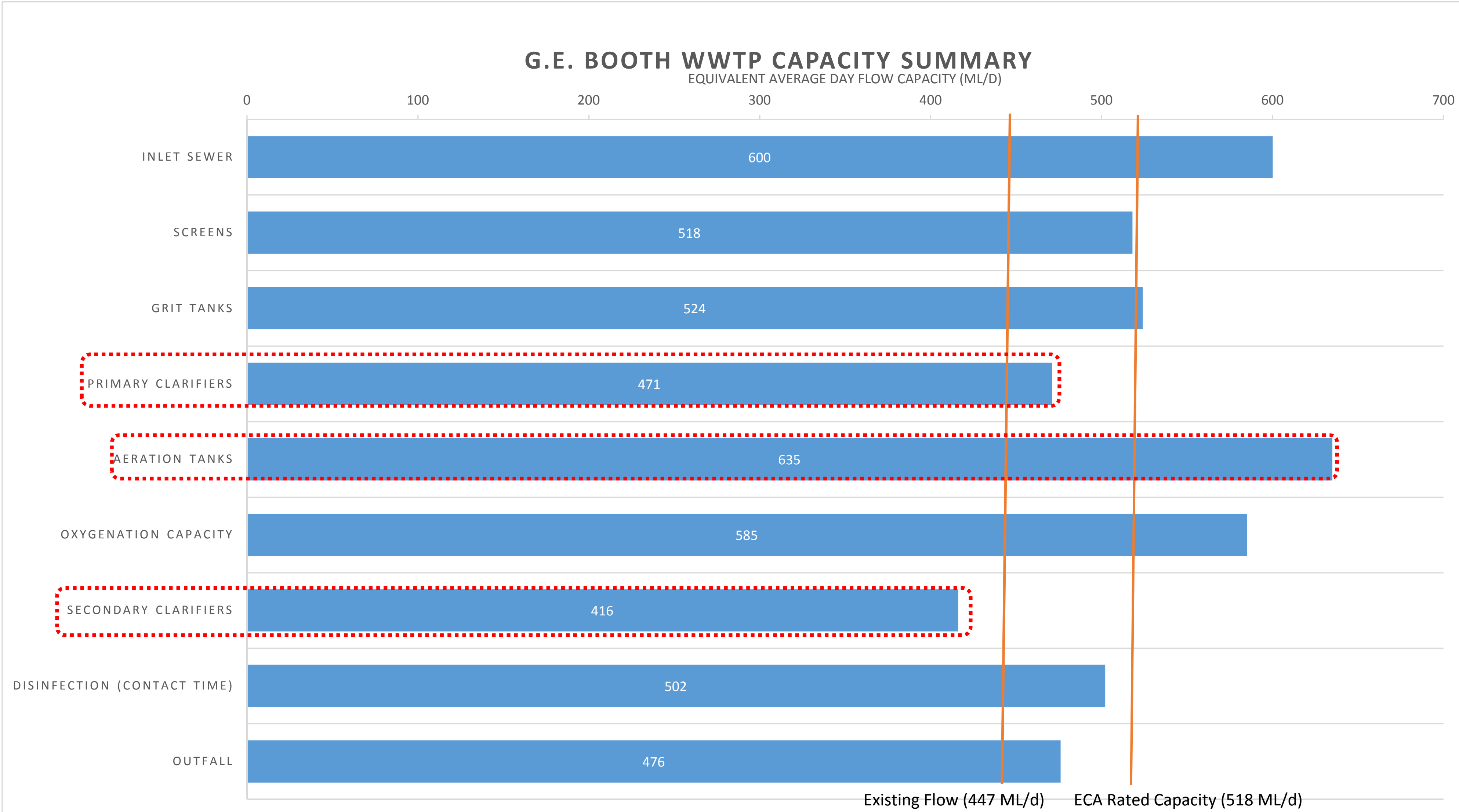
Unit Process	Original Design Basis	Existing Capacity (ML/d) Equiv. ADF	Ex. Total Number Units	Additional Units to Reach 518 ML/d	Additional Units to Reach 600 ML/d	Difference Between Original Design Basis and Existing Capacity (ML/d)	New Capacities (ML/d)	Difference Between New Capacities and Existing Capacities (ML/d)	Plant 1 Replacement Capacities (ML/d)	Difference Between Plant 1 Replacement Capacity and Existing Capacity (ML/d)	Plant 1 Upgrades	Differenc e
Inlet Sewer		**600**									600	
Screens	518	518	6	0	2202000		600				558	
Grit Tanks	524	524	4	0	144		558				565	
Primary Clarifiers	470	418	11	8	8	0	470			52	574	52
Aeration Tanks	536	595	14	4.3	4	105	522	108	468	40	468	40
Oxygenation Capacity	585	585	8	3	5	36	536		589		549	
Secondary Clarifiers	520	375	16	4.3	4	145	585	145	415	40	415	40
Disinfection (Contact Time)	538	502	1	0	14		520				541	
Outfall	525	476	1	0	14	49	541				476	
Thickening Centrifuges	764	666	5	0	0	98	525				666	
Dewatering Centrifuges	811	683	6	0	0	127	764				683	
Incineration	782	479	4	0	0	303	811				479	
							82					



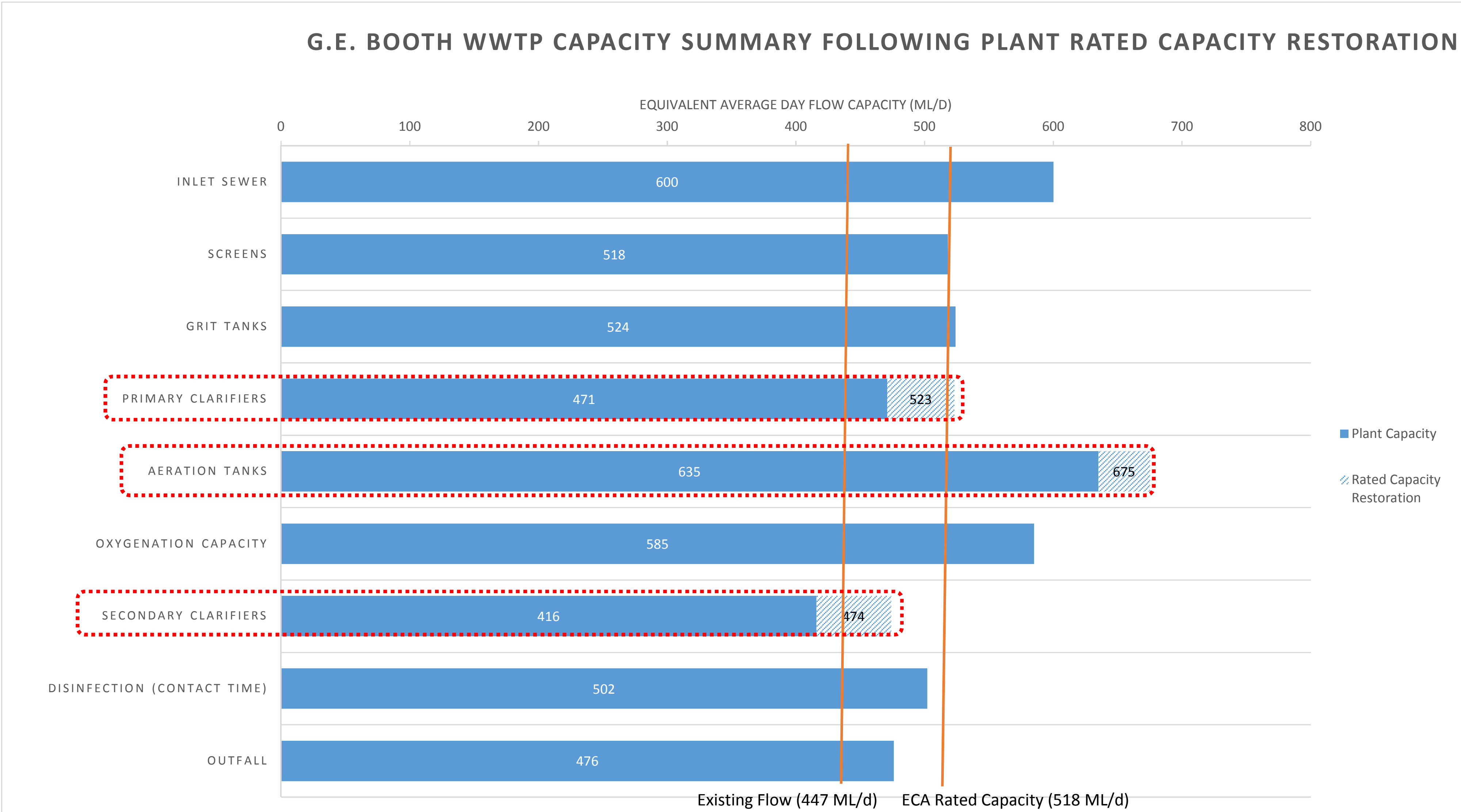

G.E. BOOTH WWTP CAPACITY SUMMARY FOLLOWING PLANT 1 UPGRADES
EQUIVALENT AVERAGE DAY FLOW CAPACITY (ML/D)
0
100
200
300
400
500
600
700
INLET SEWER
600
SCREENS
518
GRIT TANKS
524
PRIMARY CLARIFIERS
418
470
AERATION TANKS
595
635
OXYGENATION CAPACITY
585
SECONDARY CLARIFIERS
375
415
DISINFECTION (CONTACT TIME)
502
OUTFALL
476
Existing Flow (447 ML/d)
ECA Rated Capacity (518 ML/d)
Plant 2 & 3
Plant 1 Replacement

G.E. Booth WWTP
Restore Plant Rated Capacity

Unit Process	Original Design Basis	Existing Capacity (ML/d) Equiv. ADF	Ex. Total Number Units	Additional Units to Reach 518 ML/d	Additional Units to Reach 600 ML/d	Difference Between Original Design Basis and Existing Capacity (ML/d)	New Capacities (ML/d)	Difference Between New Capacities and Existing Capacities (ML/d)	Plant 1 Replacement Capacities (ML/d)	Difference Between Plant 1 Replacement Capacity and Existing Capacity (ML/d)	Plant 1 Upgrades	Difference
Inlet Sewer		**600**									600	
Screens	518	518	6	0	2202000		600				558	
Grit Tanks	524	524	4	0	144		558				565	
Primary Clarifiers	470	471	11	8	8	0	522	51		52	574	52
Aeration Tanks	536	635	14	4.3	4	105	468	-167	468	40	468	40
Oxygenation Capacity	585	585	8	3	5	36	536		589		549	
Secondary Clarifiers	520	416	16	4.3	4	145	416	0	474	58	415	40
Disinfection (Contact Time)	538	502	1	0	14		520				541	
Outfall	525	476	1	0	14	49	541				476	
Thickening Centrifuges	764	666	5	0	0	98	525				666	
Dewatering Centrifuges	811	683	6	0	0	127	764				683	
Incineration	782	479	4	0	0	303	811				479	



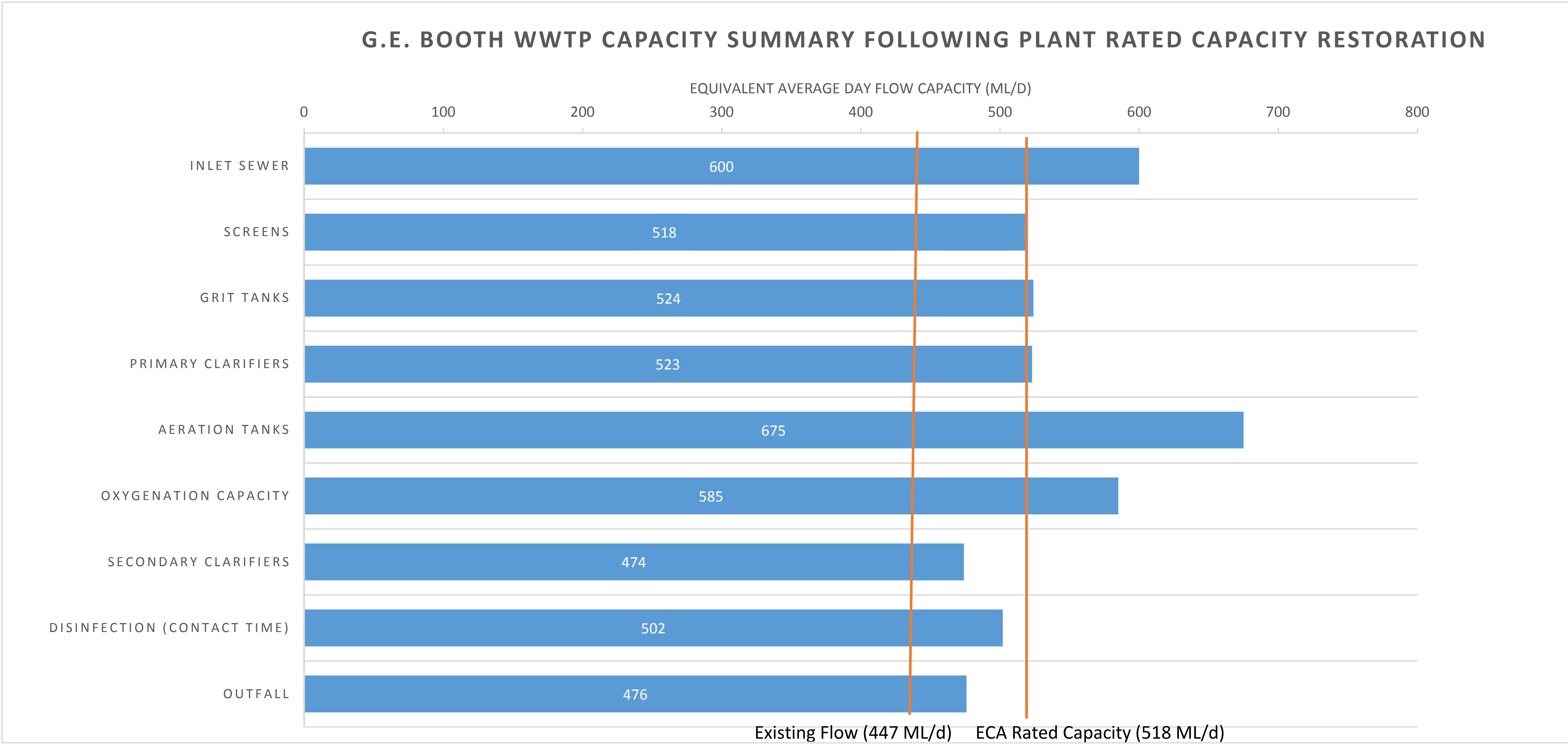
G.E. BOOTH WWTP CAPACITY SUMMARY
EQUIVALENT AVERAGE DAY FLOW CAPACITY (ML/D)
0
100
200
300
400
500
600
700
INLET SEWER
600
SCREENS
518
GRIT TANKS
524
PRIMARY CLARIFIERS
471
AERATION TANKS
635
OXYGENATION CAPACITY
585
SECONDARY CLARIFIERS
416
DISINFECTION (CONTACT TIME)
502
OUTFALL
476
Existing Flow (447 ML/d)
ECA Rated Capacity (518 ML/d)



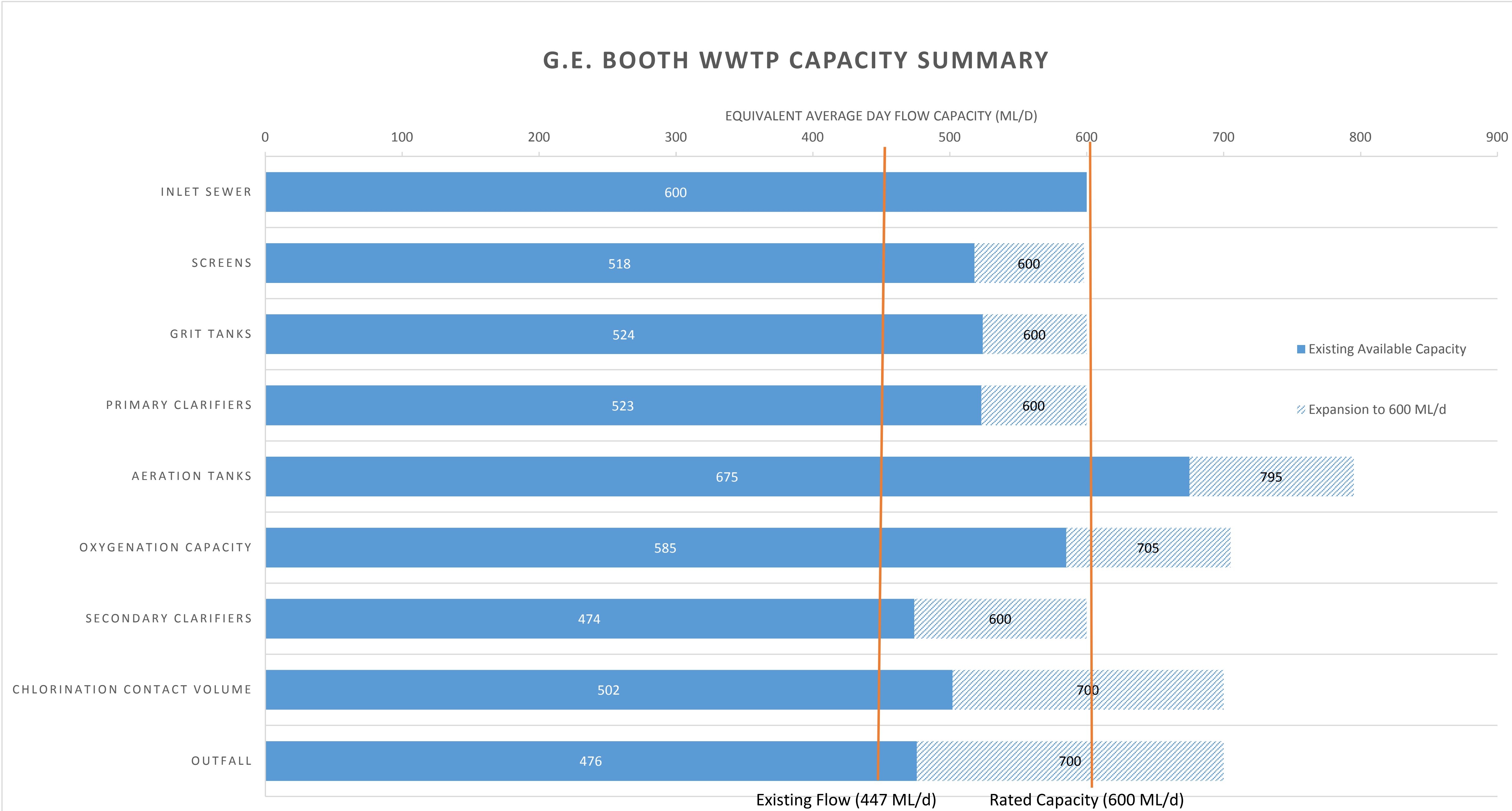
G.E. BOOTH WWTP CAPACITY SUMMARY FOLLOWING PLANT RATED CAPACITY RESTORATION
EQUIVALENT AVERAGE DAY FLOW CAPACITY (ML/D)
0
100
200
300
400
500
600
700
800
INLET SEWER
600
SCREENS
518
GRIT TANKS
524
PRIMARY CLARIFIERS
471
523
AERATION TANKS
635
675
OXYGENATION CAPACITY
585
SECONDARY CLARIFIERS
416
474
DISINFECTION (CONTACT TIME)
502
OUTFALL
476
Plant Capacity
Rated Capacity Restoration
Existing Flow (447 ML/d)
ECA Rated Capacity (518 ML/d)

G.E. Booth WWTP
Expansion to 600 ML/d

Unit Process	Original Design Basis	Capacity of Figure 9	Existing Capacity (ML/d) Equiv. ADF	Ex. Total Number Units	Additional Units to Reach 518 ML/d	Additional Units to Reach 600 ML/d	Difference Between Original Design Capacity and Existing Capacity (ML/d)	Expanded Capacities (ML/d)	Difference Between New Capacity and Existing Capacity (ML/d)
Inlet Sewer		**600**	600						
Screens	518	518	558	6	6	2202000		600	80
Grit Tanks	524	524	565	4	4	144		600	76
Primary Clarifiers	522	523	522	11	11	8		600	77
Aeration Tanks	536	675	508	14	14	4		795	120
Oxygenation Capacity	585	585	549	8	8	5	36	705	120
Secondary Clarifiers	520	474	515	16	16	4		600	126
Chlorination Contact Volume	538	502	541	1	1	14		700	198
Outfall	525	476	476	1	1	14	49	700	224
Thickening Centrifuges	764	666	666	5	5	0	98	666	0
Dewatering Centrifuges	811	683	683	6	6	0	127	683	
Incineration	782	479	479	4	4	0	121	600	121



G.E. BOOTH WWTP CAPACITY SUMMARY FOLLOWING PLANT RATED CAPACITY RESTORATION
EQUIVALENT AVERAGE DAY FLOW CAPACITY (ML/D)
0
100
200
300
400
500
600
700
800
INLET SEWER
600
SCREENS
518
GRIT TANKS
524
PRIMARY CLARIFIERS
523
AERATION TANKS
675
OXYGENATION CAPACITY
585
SECONDARY CLARIFIERS
474
DISINFECTION (CONTACT TIME)
502
OUTFALL
476
Existing Flow (447 ML/d)
ECA Rated Capacity (518 ML/d)



G.E. BOOTH WWTP CAPACITY SUMMARY
EQUIVALENT AVERAGE DAY FLOW CAPACITY (ML/D)
0
100
200
300
400
500
600
700
800
900
INLET SEWER
SCREENS
GRIT TANKS
PRIMARY CLARIFIERS
AERATION TANKS
OXYGENATION CAPACITY
SECONDARY CLARIFIERS
CHLORINATION CONTACT VOLUME
OUTFALL
600
518
600
524
600
523
600
675
795
585
705
474
600
502
700
476
700
Existing Available Capacity
Expansion to 600 ML/d
Existing Flow (447 ML/d)
Rated Capacity (600 ML/d)

C

Appendix C

Cost Estimate

Phasing Cost Estimate for G.E. Booth WWTP Expansion
Phase 1 Capacity Upgrades - 518 ML/d
Cost Estimate Summary

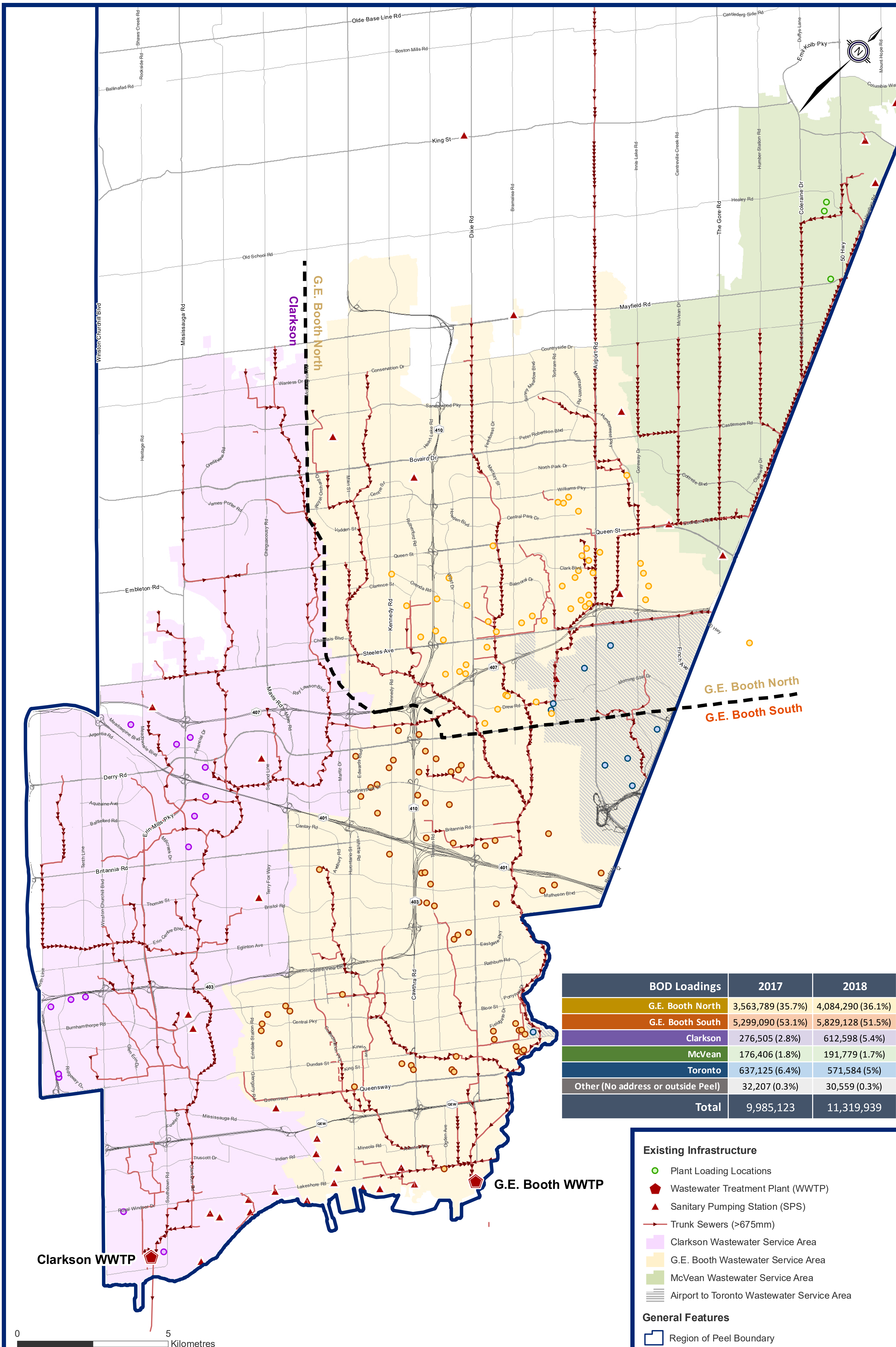
Phase	Process	Capacity Increase	Total Estimated Cost
New Plant 1 Site Preparation	Re-location of Existing Equipment/Processes outside New Plant 1 Area	0 MLD	$ 19,000,000.00
	New Inlet Sewer	0 MLD	
	Demolition of Digesters within New Plant 1 Area	0 MLD	$ 11,000,000.00
New Plant 1 Site Preparation - Subtotal			**$ 30,000,000.00**
Plant 3 Primary Clarifier Expansion	Design - Plant 3 Primary Clarifier (Underway)	Increases Primary Capacity from 418-522 MLD	$ 3,000,000.00
	Construction - Plant 3 Primary Clarifier (Imminent)		$ 30,000,000.00
Plant 3 Primary Clarifier Expansion - Subtotal			**$ 33,000,000.00**
New Plant 1 with same 40 MLD	Design - New Inlet Channel	0 MLD	$ 1,000,000.00
	Construction - New Inlet Channel		$ 30,000,000.00
	Design - Plant 1 Replacement		$ 11,000,000.00
	Demolition of Buildings with New Plant 1 Area		$ 14,000,000.00
	New Plant 1		$ 67,000,000.00
	Program Allowance and Internal Charges		$ 22,000,000.00
New Plant 1 with Same 40 MLD - Subtotal			**$ 145,000,000.00**
Restore Rated Plant Capacity	Plant 1 Demolition	Restore Rated Cpacity to 518 MLD	$ 12,000,000.00
	Plant 1 Extension		$ 80,000,000.00
	Secondary Clarifier No. 11		$ 12,000,000.00
Restoration of Rated Plant Capacity - Subtotal			**$ 104,000,000.00**
Expansion to 600 ML/d	Headworks Expansion	Increases Plant Capacity to 600 MLD	$ 25,000,000.00
	Plant 1 Extension		$ 133,000,000.00
	Admin/Maintenance Building		$ 21,000,000.00
	New Outfall		$ 92,000,000.00
Expansion to 600 ML/d			**$ 271,000,000.00**

4H

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 4H

Maps



BOD Loadings	2017	2018
G.E. Booth North	3,563,789 (35.7%)	4,084,290 (36.1%)
G.E. Booth South	5,299,090 (53.1%)	5,829,128 (51.5%)
Clarkson	276,505 (2.8%)	612,598 (5.4%)
McVean	176,406 (1.8%)	191,779 (1.7%)
Toronto	637,125 (6.4%)	571,584 (5%)
Other (No address or outside Peel)	32,207 (0.3%)	30,559 (0.3%)
Total	9,985,123	11,319,939

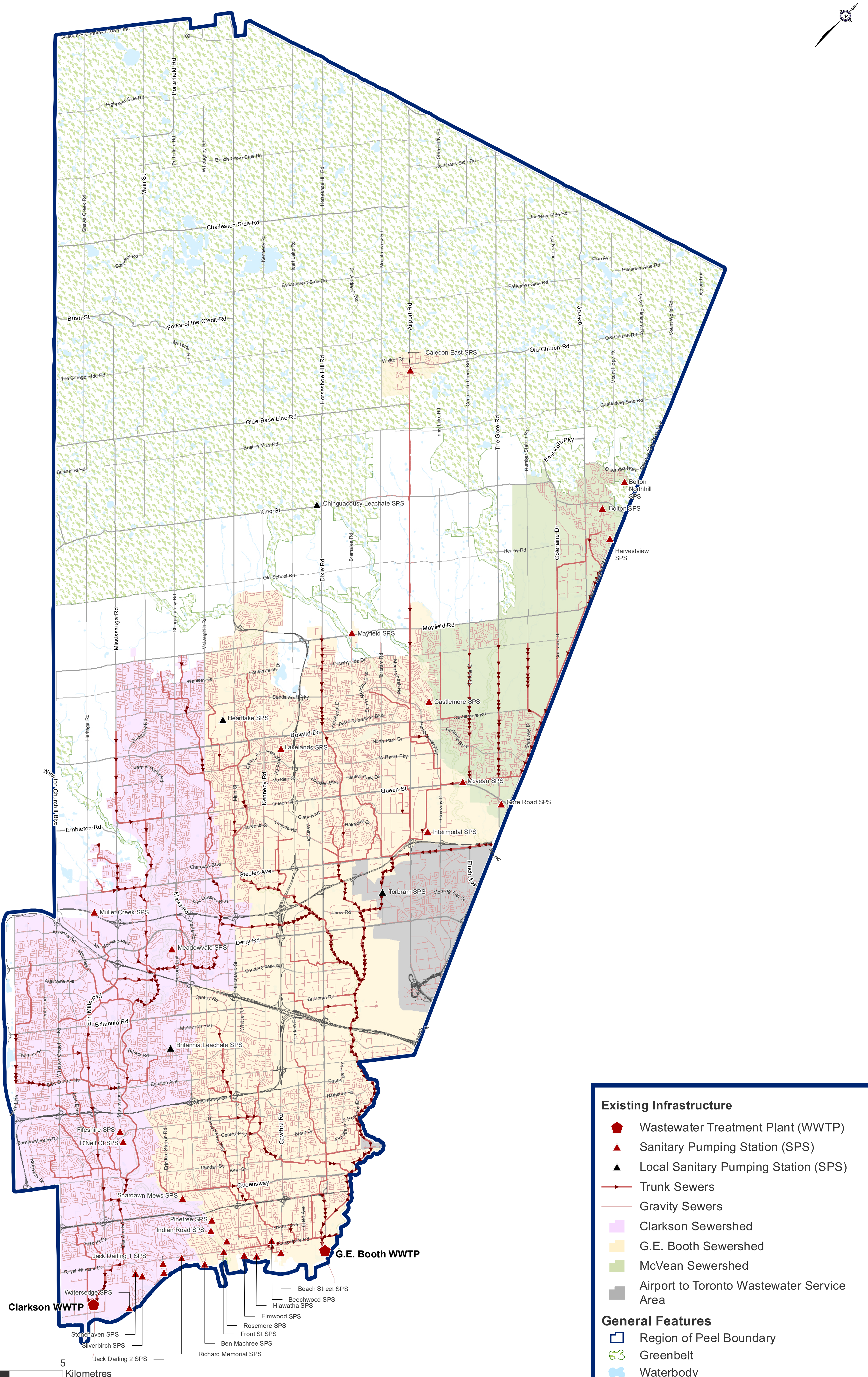
Region of Peel
working with you

2020 WATER AND WASTEWATER MASTER PLAN

High Strength Users Distribution

BluePlan ENGINEERING

June 2020
715022-155-WW
NAD 1983 UTM Zone 17N



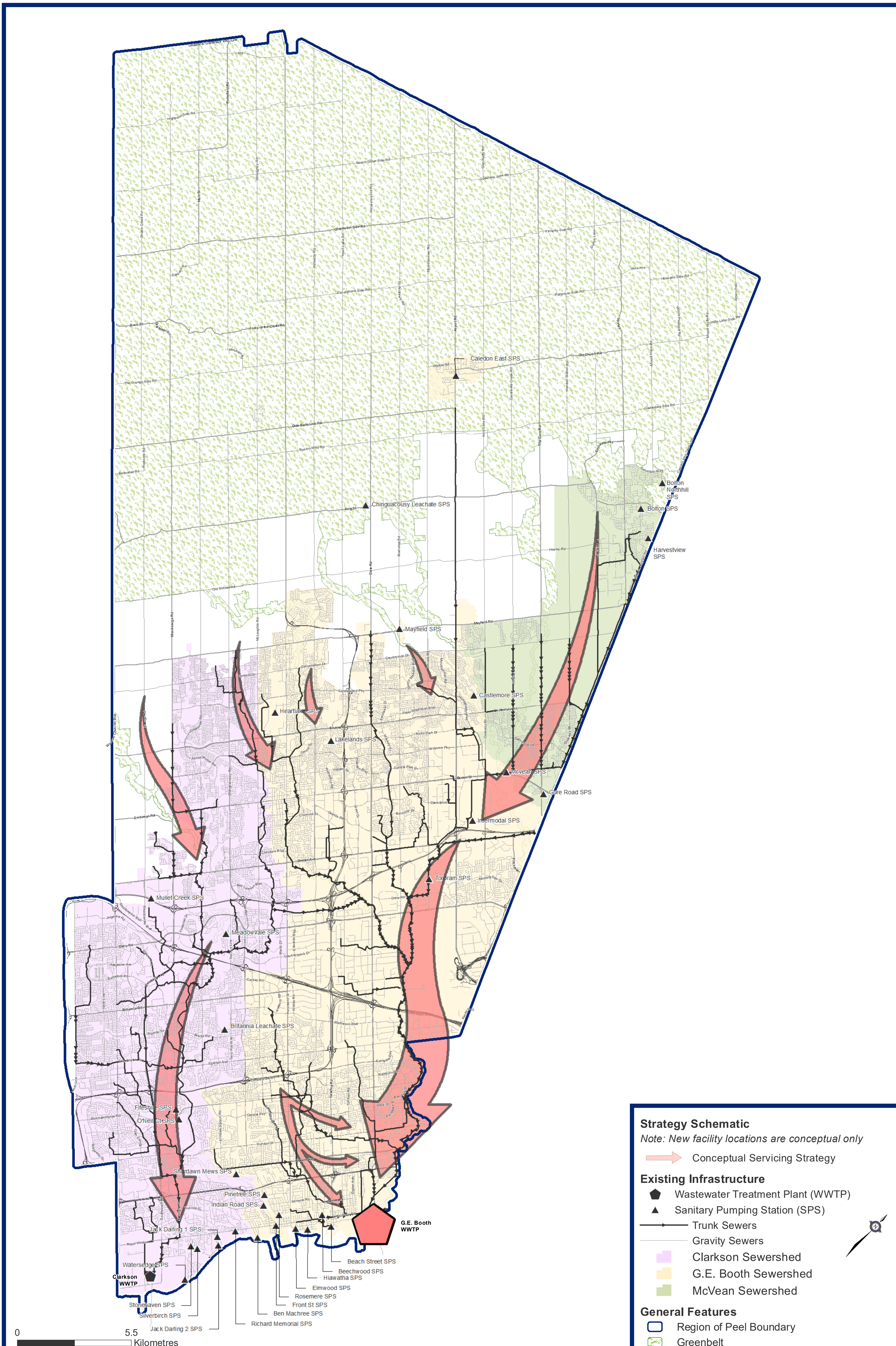
Region of Peel
working with you

2020 WATER AND WASTEWATER MASTER PLAN

Existing Lake-Based Wastewater System

BluePlan ENGINEERING

June 2020
715022-140-WW
NAD 1983 UTM Zone 17N



Region of Peel working with you

2020 WATER AND WASTEWATER MASTER PLAN

Alternative System Wide Servicing Strategy 1

BluePlan ENGINEERING

May 2020
715022-172-WW
NAD 1983 UTM Zone 17N

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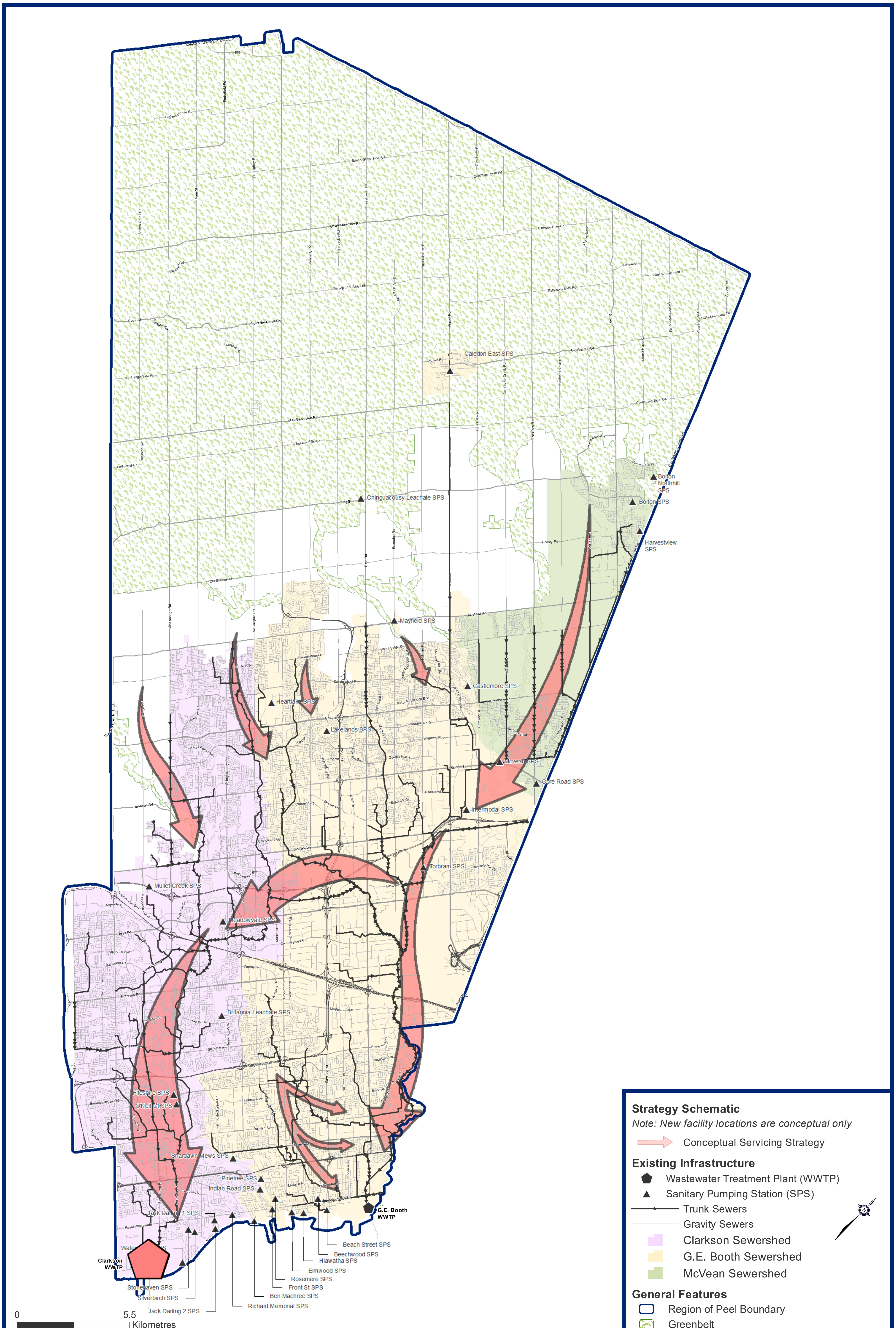

Region of Peel working with you

2020 WATER AND WASTEWATER MASTER PLAN

Alternative System Wide Servicing Strategy 2

BluePlan ENGINEERING

May 2020
715022-172-WW
NAD 1983 UTM Zone 17N

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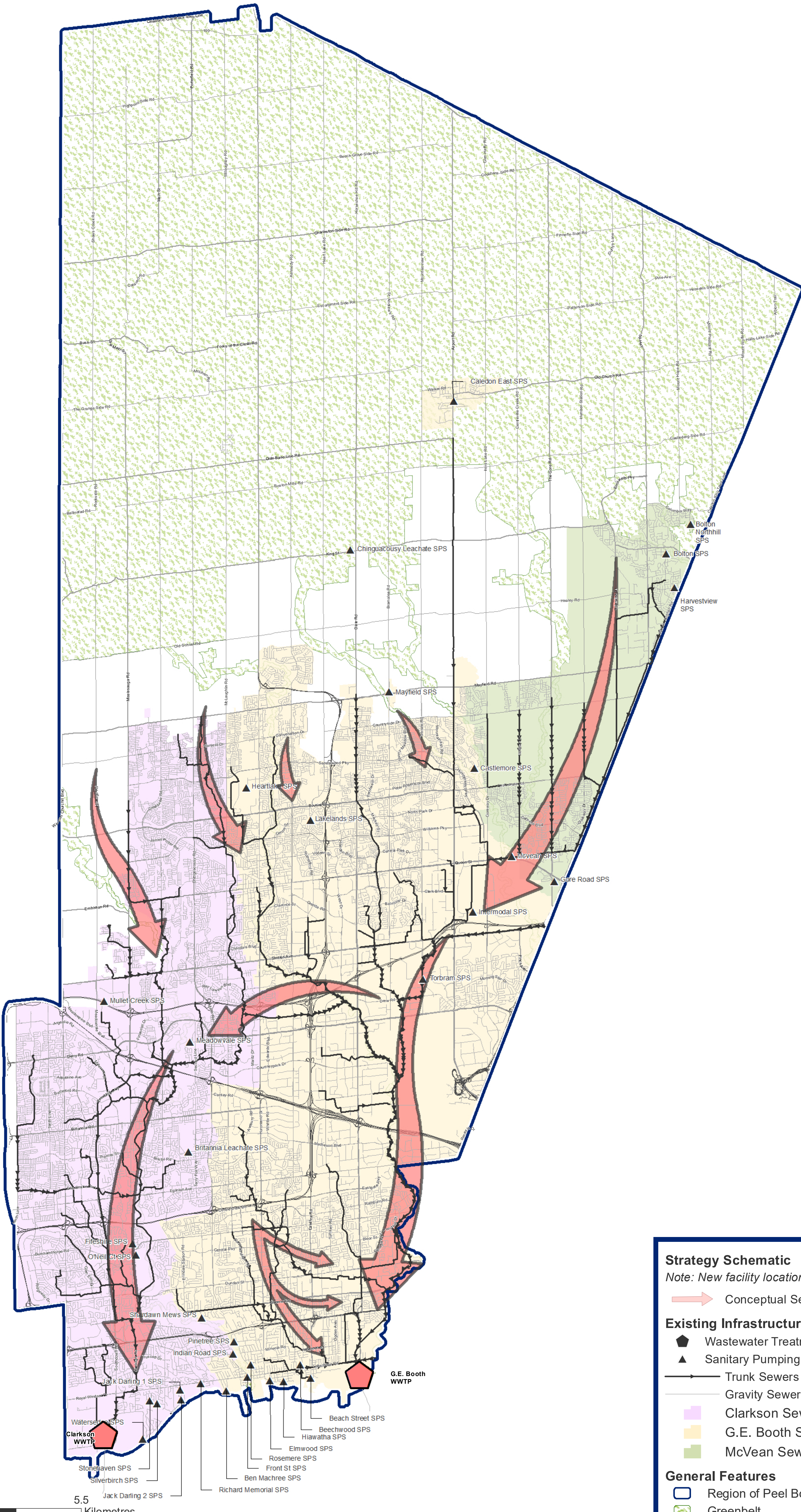


Strategy Schematic

Note: New facility locations are conceptual only

Conceptual Servicing Strategy

Existing Infrastructure

- Wastewater Treatment Plant (WWTP)
- Sanitary Pumping Station (SPS)
- Trunk Sewers
- Gravity Sewers
- Clarkson Sewershed
- G.E. Booth Sewershed
- McVean Sewershed

General Features

- Region of Peel Boundary
- Greenbelt

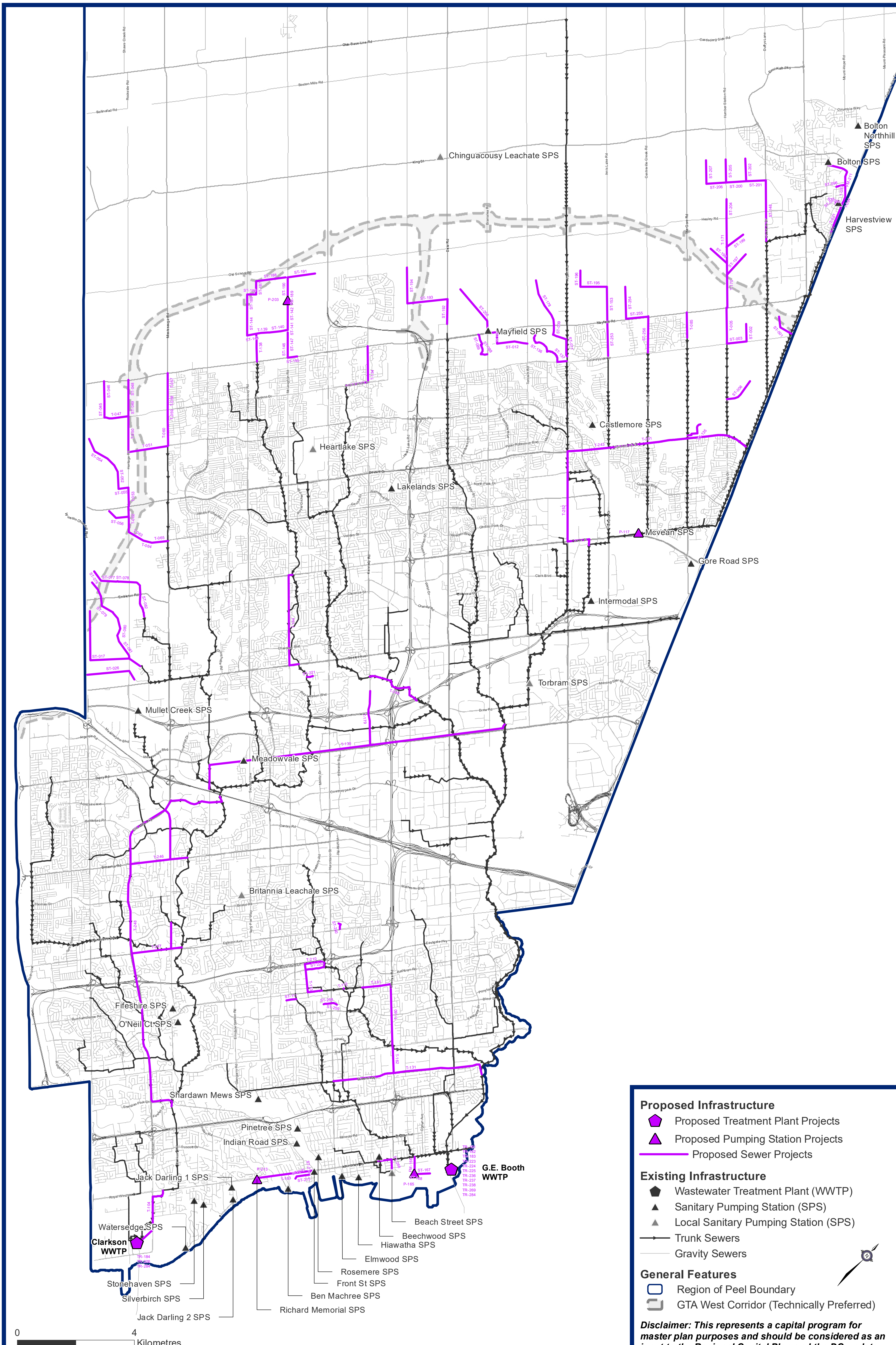
Region of Peel
working with you

2020 WATER AND WASTEWATER MASTER PLAN

Alternative System Wide Servicing Strategy 3

GM BluePlan ENGINEERING

May 2020
715022-172-WW
NAD 1983 UTM Zone 17N



Region of Peel
working with you

2020 WATER AND WASTEWATER MASTER PLAN

2041 Wastewater Capital Program

BluePlan ENGINEERING

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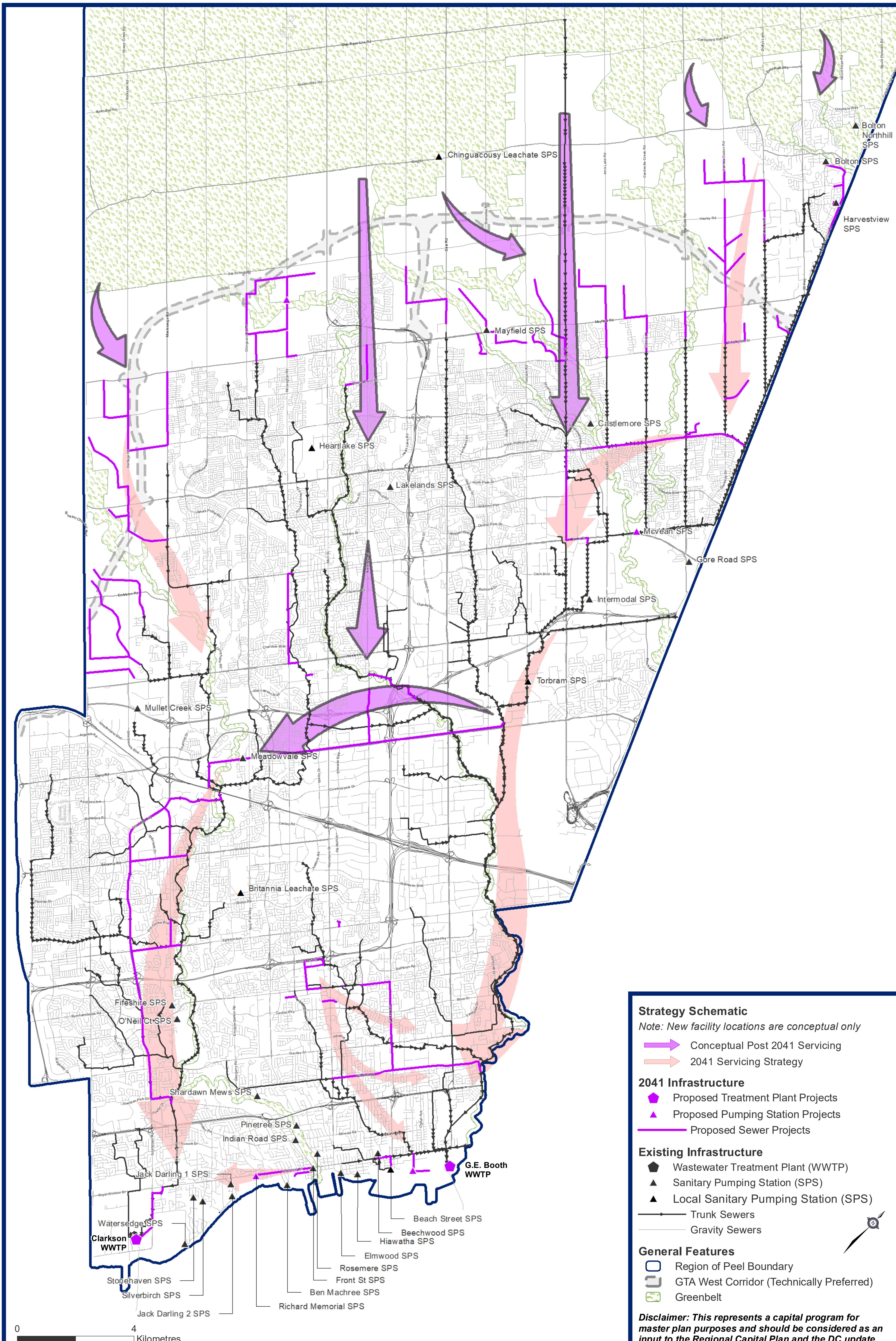

Region of Peel working with you

2020 WATER AND WASTEWATER MASTER PLAN

Post-2041 Wastewater Servicing Strategy

BluePlan ENGINEERING

June 2020
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NAD 1983 UTM Zone 17N