NOTICE OF COMMENTS RECEIVED
Following Completion of the Public Review Period

The Regional Municipality of Niagara filed the 2016 Water and Wastewater Master Servicing Plan Update report for the 45-day public review period from **Thursday June 15, 2017** to **Monday July 31, 2017**.

All comments received were tracked in the attached summary table and responses were issued where required. A copy of all comments and responses are attached in Volume 5. Revisions to the 2016 Water and Wastewater Master Servicing Plan Update include the following:

Volume 1

- **Figure 1.15** to reflect decommissioning/ownership of the Grassy Brook Sewage Pumping Station

Volume 3

- Capital Project **W-P-001** and **W-P-002** Municipality ownership revised from Welland to Pelham
- Capital Project **W-P-003** Municipality ownership revised from Lincoln to Grimsby
- Modifications to *2041 Collection Schematics* including **Figure 3.A.19**, **Figure 3.B.20**, **Figure 3.C.17**, **Figure 3.D.18**, **Figure 3.E.18**, and **Figure 3.F.19** to reflect the updated water system schematics

Volume 4

- Table of Contents – Spelling correction
- Tables: 1,7,8,9,10,11,12,13 in all parts
- Existing serviced population and employment numbers in introductions for all parts
- Example calculations for peak dry weather flow and peak wet weather flow for all parts
- Capital Project **WW-FM-003** Municipality ownership revised from Welland to Pelham
- Capital Project **WW-SPS-037** Municipality ownership revised from Pelham to Thorold
- Capital Project **WW-SS-003** and **WW-SS-004** Municipality ownership revised from West Lincoln to Grimsby
- Capital Project **WW-II-006**, **WW-II-007** Municipality ownership revised from West Lincoln to Lincoln
- Modifications to **Figure 4.F.1**, **Figure 4.F.2**, **Figure 4.F.4**, **Figure 4.F.5**, **Figure 4.F.6**, **Figure 4.F.7** to reflect decommissioning/ownership of the Grassy Brook Sewage Pumping Station
- Modifications to *2041 Collection Schematics* including **Figure 4.A.13**, **Figure 4.C.8**, **Figure 4.E.6**, **Figure 4.F.8**, **Figure 4.K.8** to reflect the updated wastewater system schematics
- Part F – *Niagara Falls Wastewater System*, **F.6.2 Pumping Stations** text change to reflect decommissioning of Grassy Brook Pumping Sewage Pumping Station.

#	From	To	Date Received	Type	Comment	Action	Status
1	Nancy Bozzato (Town of Pelham)	Natasha Devos (Regional Municipality of Niagara)	6/6/2017	E-mail	• Attached letter from Town of Pelham relating to the Fenwick Supply - Regional Water/Wastewater Master Plan • Includes a report considered by Pelham Council (June 5, 2017). Pelham Council reviewed this together with the 2016 Water and Wastewater Regional Master Servicing Plan Update information	• Request that steps be taken to ensure Regional Council is aware of this correspondence • No further action required	Complete
2	Andrea Clemencio (Town of Pelham)	Phill Lambert (Regional Municipality of Niagara)	6/6/2017	E-mail	• Council requested to see if other capital solutions for security concerns can be considered • To verify if an additional main or twinned main can serve as a return, rather than a feed to integrate and loop Fenwick into the system as a whole, rather than at the end of the Feeder main had been considered	• Phill Lambert provided response and forwarded email to GM BluePlan, Mayor of Pelham, Ron Tripp, & Regional contacts • Following 45-day review period, GM BluePlan will instigate and provide an additional response	Follow-up will be provided to Council
3	Dave Augustyn (Mayor - Town of Pelham)	Phill Lambert (Regional Municipality of Niagara)	6/6/2017	E-mail	• Highlighted that the "Security of Supply" project is currently in the Region's 2012 bylaw • Expressed interest to continue with Security of Supply project and will be informing Council	• Mayor to inform Council • No further action required	Complete
4	Tikvah Mindorff (Niagara Sustainability Initiative)	Natasha Devos (Regional Municipality of Niagara)	6/9/2017	E-mail	• Shared formal letter from Board of Directors - Niagara Sustainability Initiative "Comments on Niagara 2041" • Includes summary of How We Grow - Municipal Comprehensive Review, How We Go - Transportation Master Plan, and How We Flow - Water and Wastewater Master Servicing Plan (MSP)	• Region forwarded presentation to Ron Tripp (Niagara Region) to confirm in Council Agenda • Recommended action: Refer to consideration of PWC - Formal letter response provided to Niagara Sustainability Initiative from Niagara 2041 team and signed by Ron Tripp	Complete
5	Phill Lambert (Regional Municipality of Niagara)	Julien Bell, Chris Hamel (GM BluePlan)	6/12/2017	E-mail	• Recap of Regional Council meeting held June 8, 2017 • Mayor of Pelham spoke about Town's concerns for security of supply to Fenwick • Mayor Dave and Pelham Council believes this should be in the new DC bylaw	• To be discussed and evaluated following the 45-day review period	Follow-up will be provided to Council
6	[redacted] (Resident)	Phill Lambert (Regional Municipality of Niagara)	6/22/2017	E-mail	• Would like to know when the Region plans to decommission the Sewage Lagoon servicing Stevensville and Douglastown/Black Creek	• Phill responded with a brief summary of the Water and Wastewater MSP Stevensville/Douglastown Lagoons • Provided link with direction to Volume 4- Part G Stevensville-Douglastown Wastewater System for additional information	Complete
7	Carmela Dipardo (City of Thorold)	Phill Lambert (Regional Municipality of Niagara)	6/23/2017	E-mail	• Confirmed receipt of 2016 Water and Wastewater MSP Update on June 20, 2017 at Thorold City Council meeting	• No further action required	Complete
8	[redacted] (Resident)	Phill Lambert (Regional Municipality of Niagara)	6/26/2017	E-mail	• Attached correspondence regarding the decommissioning of the Stevensville/Douglastown Sewage Waste Lagoon • To clarify why criteria for closure was different than closure of Port Robinson and Niagara-on-the-Lake	• Phill responded with a brief summary of the Water and Wastewater MSP Stevensville/Douglastown Lagoons • Provided link with direction to the Volume 4- Part G Stevensville-Douglastown Wastewater System for additional information	Complete
9	Phill Lambert (Regional Municipality of Niagara)	Lindsay Bowman (GM BluePlan)	6/29/2017	E-mail	• Provided recap of meeting with Richard Epp held at Regional Headquarters • Discussed analysis of Volume 4 in great detail to provide a good system understanding	• Resident may provide formal written comments to MOECC regarding the 1982 OMB decision in that the Lagoon should be decommissioned	Complete
10	Kelly M. Walsh (Town of Fort Erie)	Phill Lambert (Regional Municipality of Niagara)	7/6/2017	E-mail	• Would like clarification on two items: - The need for Region to provide a new main on Gilmore from Petit to Concession - The security of supply to Ridgeway/Crystal Beach • Provided attachment which includes a suggested alternative for the new main	• Detailed review was completed based on Fort Erie submission by GM BluePlan and Regional Staff • Response memo provided to Town of Fort Erie • No further action required	Complete
11	Suzanne McInnes (Niagara Peninsula Conservation Authority)	Phill Lambert (Regional Municipality of Niagara)	7/7/2017	E-mail	• NPCA comments are focused on the proposed inlet channel upgrades at the Decew Water Treatment Plant scheduled for 2017-2021 • Would like more information about channel upgrades because it may require some work for NPCA to update modelling for the intake protection zone within the work plan • Provided link to a workshop held in June regarding the Source Protection Plan work plan	• Regional W&WW staff met with NPCA staff to review	Complete
12	Nicole Coffer (Regional Municipality of Niagara)	Tikvah Mindorff (Niagara Sustainability Initiative)	7/6/2017	E-mail	• Attached letter from Ron Tripp that includes commentary and response to Niagara 2041- How We Grow, How We Flow, and How We Go • Copy was shared with Regional Council through email distribution	• Phill forwarded email to GM BluePlan • No further action required	Complete
13	[redacted] (Resident)	Phill Lambert (Regional Municipality of Niagara)	7/10/2017	E-mail	• Expressed concerns for the omission of the Sewage Lagoon closure • Requested response promptly to clarify omission	• Phill forwarded email to GM BluePlan • Phill responded to concerned resident with further context of the Study on June 26, 2017	Complete
14	[redacted] (Resident)	Phill Lambert (Regional Municipality of Niagara)	7/17/2017	E-mail	• Provided context on the area of Provincially Significant Wetlands (PSWs) noted within the Niagara MSP • Request that revisions be made to reflect PSW's in Figure 2.16 of the MSP	• Phill responded to email - Figure 2.16 was intended to provide an approximate location of potential future development in the Urban Area Boundary • Natural existing conditions are listed within Section 9 of the report • Provided opportunity to continue conversation	Complete
15	Tammy Cheyne (Regional Municipality of Niagara)	Phill Lambert (Regional Municipality of Niagara)	7/17/2017	E-mail	• [redacted] (Resident) provided written letter expressing concerns for the omission of the Sewage Lagoon closure • [redacted] (Resident) attached a Health and Safety letter with newspaper articles and additional information for Stevensville/Douglastown Lagoons	• Phill responded to concerned resident with further context of the W&WW MSP Study which focused on accomodating growth to 2041 on June 26, 2017 • Lagoon is operating in accordance with MOECC ECA	Complete
16	Phill Lambert (Regional Municipality of Niagara)	Lindsay Bowman (GM BluePlan)	7/26/2017	E-mail	• Would like clarification for Stevensville Lagoon's rated capacity values (Regional vs. ECA data)	• Rated capacity will be revised based on MOECC ECA values • No further action required	Complete
17	Garry Hunter (Hunter and Associates)	Phill Lambert (Regional Municipality of Niagara)	7/31/2017	E-mail	• Would like information on determination of the capacity of the Kalar Pumping Station in the City of Niagara Falls • Enclosed previous hydrographs of Wet Well Water Levels and Dry Weather Flows prepared from pumping station data supplied by the Region	• Phill responded following consultation with GM BluePlan • Provided additional context and references to areas of the report in which the capacity was calculated	Complete
18	[redacted] (Resident)	Phill Lambert (Regional Municipality of Niagara)	8/1/2017	E-mail	• To consider green infrastructure and reductions before overloaded stormwater systems • Advocate for conservation and restoration of Niagara's natural lands	• Phill forwarded email to GM BluePlan	Complete
19	Garry Hunter (Hunter and Associates)	Phill Lambert (Regional Municipality of Niagara)	8/3/2017	E-mail/Phone	• Provided summary and follow-up to previous phone conversation • Enclosed prior explanatory letter to Region for the Hydrographs • Believes the Kalar Road SPS Projected Peak Weather Flows by Catchment are significantly underestimated based on existing conditions and monitoring history	• Phone conversation with Mr. Hunter took place • Phill discussed content with GM BluePlan	Complete
20	Phill Lambert (Regional Municipality of Niagara)	Lindsay Bowman (GM BluePlan)	8/15/2017	E-mail	• Reviewed Secondary Plan in Niagara Falls for Grassy Brook SPS and Volume 4 MSP • Area was flagged for SPS capacity and FM upgrades, but projects were not carried forward • To revise for final version of MSP	• Would like verification on Grassy Brook Sewage Pumping Station ownership • Information forwarded to Greg Epp (Regional Municipality of Niagara)	Complete
21	Greg Epp (Regional Municipality of Niagara)	Phill Lambert (Regional Municipality of Niagara)	8/15/2017	E-mail	• Confirmed that Niagara Region has ownership of Grassy Brook Sewage Pumping Station • To include new information within the final Master Servicing Plan document	• Region provided information to GM BluePlan • GM BluePlan suggested decommissioning the station and convey flows via gravity to the new South Niagara Falls Wastewater Treatment Plant • GM BluePlan updated MSP Volume 4 respective text, figures, and project sheet for further clarification	Complete

2016 Water and Wastewater Master Servicing Plan Update

HOW WE **FLOW**

Volume IV - Wastewater Master Servicing Plan Update

Final Report

June, 2017

Table of Contents

PART F	**NIAGARA FALLS WASTEWATER SYSTEM**
PART G	**STEVENSVILLE-DOUGLASTOWN WASTEWATER SYSTEM**
PART H	**ANGER WASTEWATER SYSTEM**
PART I	**CRYSTAL BEACH WASTEWATER SYSTEM**
PART J	**SEAWAY WASTEWATER SYSTEM**
PART K	**WELLAND WASTEWATER SYSTEM**

1. INTRODUCTION

1.1 Background

Niagara Region currently services the urban area of the municipalities of Grimsby, West Lincoln, Lincoln, St. Catharines, Thorold, Welland, Pelham, Port Colborne, Niagara-on-the-Lake, Niagara Falls, and Fort Erie. Water and wastewater servicing is operated under a two-tier system. Niagara Region is responsible for water treatment, transmission mains, storage facilities and major booster pumping stations; as well as wastewater treatment, trunk sewers and sewage pumping stations. The area municipalities are responsible for local water distribution networks and local sewer collection systems.

Niagara Region is part of the Greater Golden Horseshoe (GGH) area situated around the western and southern end of Lake Ontario that continues to be one of the fastest growing regions in North America. The Government of Ontario's legislative growth plan, *Places to Grow Act 2005* and recent amendments, identifies substantial population and employment growth for the GGH to year 2041.

Readily available and accessible public infrastructure is essential to the viability of existing and growing communities. Infrastructure planning, land use planning and infrastructure investment require close integration to ensure efficient, safe and economically achievable solutions to provide the required water and wastewater infrastructure. To balance the needs of growth with the protection and preservation of natural, environmental and heritage resources, Niagara Region initiated an integrated process under the umbrella "Niagara 2041" to complete a Municipal Comprehensive Review, a new Transportation Master Plan, and a Water and Wastewater Master Servicing Plan Update.

The 2016 Master Servicing Plan Update provides a review, evaluation and development of water and wastewater servicing strategies for all servicing within the urban areas of the Region. The 2016 Master Servicing Plan Update uses updated population and employment growth forecasts based on a 2041 planning horizon.

The Study Area for the Master Servicing Plan Update covers primarily the urban areas of the local municipalities in Niagara Region serviced by the lake-based systems. The Township of Wainfleet is not included in the scope of this Master Servicing Plan Update.

Figure 4.1 Study Area

The 2016 Master Servicing Plan Update builds on previous work undertaken as part of the 2011 Master Servicing Plan and previous long term infrastructure planning studies. The 2016 Master Servicing Plan Update is a critical component in the Region's planning for growth and will provide the framework and vision for the water and wastewater servicing needs for the lake-based service areas of the Region to year 2041.

1.2 Integrated Planning Process

Niagara, as a whole, must proactively plan for and facilitate growth in order to conform with Provincial land use plans (*Places to Grow*). The Region is currently planning the best way to accommodate anticipated and targeted population and employment growth over the next 25 years. Under the umbrella "Niagara 2041" the Region will be establishing a growth strategy that will be urban in nature.

The establishment of the growth strategy involves completing (3) three projects:

1) Municipal Comprehensive Review (MCR) – ***How We Grow***

   Look at the land available across Niagara, ensure there is enough land to sustain the expected growth to year 2041 and examine how the land is distributed throughout Niagara

2) Transportation Master Plan (TMP) – ***How We Go***

   Look at current travel methods across Niagara and look to improve transportation systems including options for walking, cycling and public transit to better serve Niagara's future needs

3) Water and Wastewater Master Servicing Plan (MSP) – ***How We Flow***

   Ensure Niagara has the infrastructure to provide critical water and wastewater services to the growing Region in a sustainable and financially responsible way

These three projects are inter-connected and collectively form the foundation to support and foster Niagara's growth and input into the Niagara Region Development Charge Study. The Master Plans will identify the preferred servicing solution and associated infrastructure needs to support projected growth as set out in the Municipal Comprehensive Review.

1.3 Master Servicing Plan Update Report Objectives

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

The Master Servicing Plan Update evaluates the ability of existing and planned water and wastewater infrastructure in Niagara Region to efficiently and effectively service the Region's existing users, service anticipated growth, and to evaluate and develop recommended servicing strategies.

The key objectives of the 2016 Master Servicing Plan Update are as follows:

- Review planning forecasts to 2041 and determine the impacts on servicing needs for the Region's lake-based water and wastewater infrastructure;
- Evaluate the ability of existing and planned water and wastewater infrastructure to efficiently and effectively service the Region's existing users and anticipated growth;

- Undertake a comprehensive review and analysis for both water and wastewater servicing requirements;
- Address key servicing considerations as part of the development and evaluation of water and wastewater servicing strategies including:
  - Level of service to existing users and approved growth
  - Operational flexibility and system security and reliability
  - Mitigation of impacts to natural, social and economic environments
  - Opportunity to meet policy, policy statements, regulations and technical criteria
  - Opportunity to optimize existing infrastructure and servicing strategies
  - Ensuring the strategies are cost effective
- Consider and develop sustainable servicing solutions with lifecycle considerations;
- Update the capital program cost estimating methodology and utilize updated industry trends and more detailed information from relevant Region studies and projects to provide appropriate capital cost estimates;
- Utilize the updated water and wastewater hydraulic models for the analysis of servicing alternatives;
- Establish a complete and implementable water and wastewater capital program;
- Provide extensive consultation with the public and stakeholders; and
- Complete the Master Servicing Plan Update in accordance with the MEA Class EA process for Master Plans.

1.4 Master Servicing Plan Class EA Report Outline

The 2016 Water and Wastewater Master Servicing Plan Update Report, including all supporting volumes, is the documentation placed on public record for the prescribed review period. The documentation, in its entirety, describes all required phases of the planning process and incorporates the procedure considered essential for compliance with the *Environmental Assessment Act*.

The 2016 Master Servicing Plan Update documentation is organized into five volumes as illustrated in the following Figure and as described below:

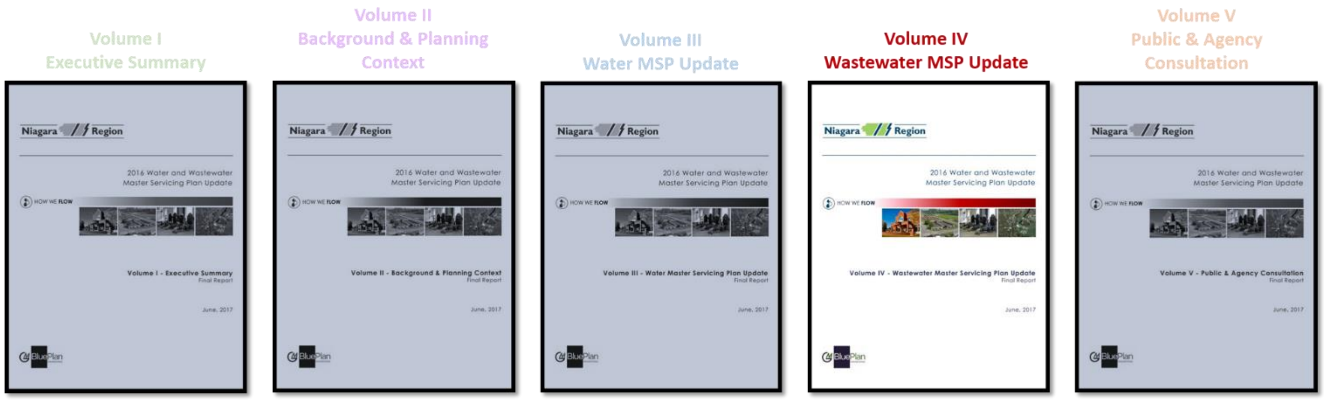

Figure 4.2 Master Servicing Plan Document Layout

Volume I – Executive Summary

Volume I provides a brief overview of the 2016 Master Servicing Plan Update. It summarizes the information contained in Volumes II, III, IV and V, including problem statement, purpose of the study, significant planning, policy and technical considerations, and description of the preferred water and wastewater servicing strategies including depiction of the projects and documentation of the capital programs.

Volume II – Background and Planning Context

Volume II details the master planning process including the Master Plan Class EA process, related studies, 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 III – Water Master Servicing Plan Update and Project File

Volume III is the principle document summarizing the study objectives, approach, methodologies, technical analyses, evaluation and selection of the preferred water servicing strategy for each of the water systems. 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 IV – Wastewater Master Servicing Plan Update and Project File

Volume IV is the principle document summarizing the study objectives, approach, methodologies, technical analyses, evaluation and selection of the preferred wastewater servicing strategy for each of the wastewater systems. 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 V – Public and Agency Consultation

Volume V 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. Other presentation material and discussion information from workshops held with relevant agencies, approval bodies and other stakeholders are also included.

1.5 Master Servicing Plan Report Volume IV

The current volume provides the overall approach, methodologies, technical analyses, evaluation and selection of the preferred water servicing strategy for each of the wastewater systems.

This main section of Volume IV has been organized into four sections as described below, outlining the general approach, methodologies, and technical analysis used to develop the preferred wastewater servicing strategy.

This volume's Introduction has been organized in 4 sections as described below:

1. Introduction
2. Analysis Methodology
3. Evaluation Methodology
4. Wastewater Capital Program

Further to the volume's Introduction, individual Sub-Parts A to K – one for each wastewater system – is also included to summarize the technical analyses and evaluation of the preferred water servicing strategy for each system.

Each volume Sub-Part A to K has been organized in 8 sections as described below:

1. Existing System Overview
2. Growth Projections
3. Assessment of Wastewater Infrastructure
4. System Opportunities and Constraints
5. Assessment of Alternatives
6. Preferred Servicing Strategy
7. Capital Program
8. Project Files (If Applicable)

Volume IV is one of five volumes that make up the complete Master Servicing Plan Class EA Study Report and should be read in conjunction with the other volumes.

2. ANALYSIS METHODOLOGY

The current analysis calculates the following:

- Total equivalent population fed by each wastewater treatment plant at the following time horizon: 2021, 2026, 2031, 2036, 2041.
- Total equivalent population fed by each pumping station at each time horizon.
- Peak Dry Weather Flow and Peak Wet Weather Flow for each pumping station at each time horizon.

The results of the analyses are used as input for this Master Servicing Plan, which identifies the problem and opportunity and develops alternative solutions to address system deficiencies.

2.1 Project Assumptions

The following key assumptions have been made as part of the analysis:

- Niagara Municipal Comprehensive Review 2041 growth projections were used:
  - To estimate growth related flows within the wastewater system.
  - To spatially allocate growth flow within the individual water system.
- Institutional, industrial, and commercial growth flows were estimated using equivalent employment projections.
- The following growth related wet weather flows assumptions were applied:
  - Intensification growth (growth located within the existing sewer service catchment) will not contribute additional wet weather flows to the system
  - Greenfield growth (growth located outside the existing sewer service catchment) will contribute additional wet weather flows to the system, in line with the design criteria provided in Section 2.4)
- Pumping station firm capacity is the firm capacity given in the latest Environmental Certificate of Approval (ECA) for each station. System capacity analysis was completed using the lesser of the ECA firm capacity or actual operational capacity as provided by Regional operational staff (where provided).
  - Where this value is not provided, for the purpose of this master plan, the firm capacity is taken as the sum of individual pump capacities with the largest pump out of service.

2.2 Flow Projections and Allocations

The study area consists of the existing service area as well as residential and industrial land supply within the existing urban boundary. The MCR population and employment projects were provided in five year increments on a traffic survey zone basis.

Tributary population employment numbers to each pressure zone and treatment facility were calculated using the following process:

- A baseline growth area shapefile was provided by the Region. The growth area included all existing available vacant land supply, as well as known growth nodes and corridors.
- Traffic survey zones were overlaid with the growth area shapefile. The total traffic survey zone growth was assigned to the growth areas proportionally based on area-weighted basis.
- For traffic survey zone with no corresponding growth area shapes, all growth was assumed to be proportionally applied to existing area within the urban boundary.
- For traffic survey zones partially in the urban boundary, all growth was assumed to occur within the urban boundary with no growth outside the urban boundary.
- For traffic survey zones entirely outside the urban boundary, growth was only applied to existing service areas proportionally based on area-weighted basis or total service area within the traffic survey zone.
- The total population growth serviced by wastewater out to 2041 will be less than the total growth presented in Table 4.1 and Table 4.2 as this includes unserviced areas outside the urban area boundary.
- The growth shapes were overlaid with the existing sewershed areas to assign growth to individual sewersheds.
- For unassigned growth shapes, a manual review of existing service network, topographic, and existing natural and physical features was reviewed and growth was assigned to individual sewersheds based on likely service connection.
- The following growth related wet weather flow assumptions were applied:
  - Intensification growth (growth located within the existing sewer service catchment) will not contribute additional wet weather flows to the system
  - Greenfield growth (growth located outside the existing sewer service catchment) will contribute additional wet weather flows to the system, in line with the design criteria provided in Section 2.4)
- For allocation to the InfoSWMM model, the growth area shapes were then allocated to the closest existing node within the growth shapes' previously assigned sewershed.

Figure 4.3 provides an example of the process used to allocate system demands.

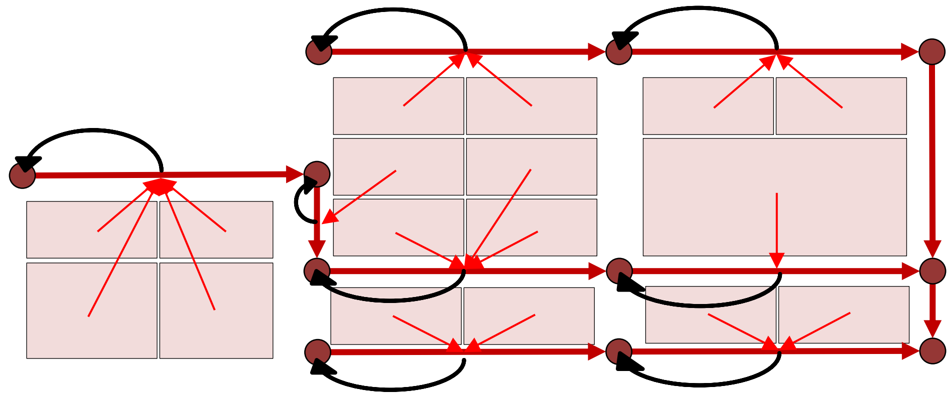

Figure 4.3 Process for Allocating System Demands

2.3 Study Area Population and Employment

Table 4.1 and Table 4.2 present the MCR projected population and employment by municipality.

Table 4.1 MCR Population Growth by Municipality

MCR Strategic Growth Option Forecast Total Population by Local Municipality								
Municipality	**Total Population Including Net Undercoverage**							
	2011	**2014 ***	**2016**	**2021**	**2026**	**2031**	**2036**	**2041**
Fort Erie	30,760	31,216	31,520	32,310	34,720	37,780	41,220	43,940
Grimsby	26,000	27,224	28,040	29,430	31,400	33,200	35,140	37,150
Lincoln	23,080	23,884	24,420	24,990	26,230	28,060	30,030	31,590
Niagara Falls	85,200	88,326	90,410	92,830	99,990	108,770	117,670	124,580
Niagara-on-the-Lake	15,810	17,112	17,980	19,750	21,420	22,850	24,700	26,580
Pelham	17,040	17,352	17,560	17,900	19,410	21,560	23,720	25,260
Port Colborne	18,910	18,838	18,790	18,600	19,210	20,080	21,050	21,820
St. Catharines	134,890	135,940	136,640	136,930	142,560	150,590	160,040	167,480
Thorold	18,410	18,944	19,300	19,680	21,500	23,850	26,470	28,470
Wainfleet	6,520	6,532	6,540	6,590	6,760	6,990	7,260	7,480
Welland	51,980	53,000	53,680	54,130	56,540	59,600	63,160	66,180
West Lincoln	14,200	14,608	14,880	16,170	18,930	22,630	26,530	29,460
Niagara Region	**442,800**	**452,976**	**459,760**	**469,310**	**498,670**	**535,960**	**576,990**	**609,990**

* Note: The Master Servicing Plan Update has an established baseline condition of year 2014. 2014 represents the best available system information and system calibration data for the water and wastewater models at the time of study initiation. The Master Servicing Plan Update has projected growth from year 2014 to establish the 2041 infrastructure needs.

Table 4.2 MCR Employment Growth by Municipality

MCR Strategic Growth Option Forecast Employment by Local Municipality								
Municipality	**Total Place of Work Employment**							
	2011	**2014 ***	**2016**	**2021**	**2026**	**2031**	**2036**	**2041**
Fort Erie	11,290	11,992	12,460	13,270	13,960	14,920	15,940	17,240
Grimsby	7,720	9,010	9,870	10,780	11,440	12,380	13,310	14,630
Lincoln	9,740	10,664	11,280	11,870	12,300	13,040	13,710	14,600
Niagara Falls	41,030	43,628	45,360	47,790	49,630	52,060	54,570	57,720
Niagara-on-the-Lake	10,650	12,066	13,010	13,720	14,150	14,660	15,230	16,030
Pelham	4,090	4,360	4,540	4,880	5,220	5,750	6,280	6,930
Port Colborne	5,860	5,806	5,770	5,900	6,080	6,350	6,640	7,000
St. Catharines	60,180	61,668	62,660	65,530	67,820	71,480	75,240	80,240
Thorold	7,360	7,786	8,070	8,480	8,870	9,390	9,960	10,660
Wainfleet	1,160	1,244	1,300	1,350	1,400	1,470	1,550	1,650
Welland	22,090	22,990	23,590	24,490	25,170	26,220	27,300	28,760
West Lincoln	4,280	4,802	5,150	5,770	6,370	7,270	8,280	9,560
Niagara Region	**185,450**	**196,016**	**203,060**	**213,830**	**222,410**	**234,990**	**248,010**	**265,020**

* Note: The Master Servicing Plan Update has an established baseline condition of year 2014. 2014 represents the best available system information and system calibration data for the water and wastewater models at the time of study initiation. The Master Servicing Plan Update has projected growth from year 2014 to establish the 2041 infrastructure needs.

2.4 Design Criteria

The Master Servicing Plan Update has used the following design criteria to project wastewater flows, determine capacity requirements and establish the wastewater infrastructure program:

- Residential Average Day Demand: 275 Lpcd
- Employment Average Day Demand: 275 Lped
- Peak Factor based on Harmon formula with values between 2 and 4 with consideration to the catchment area performance.
- Utilize an extraneous flow rate of 0.286 L/ha/s as the wet weather level of service for triggering and sizing Regional wastewater infrastructure.

2.5 Flow Projection

2.5.1 Starting Point Methodology

Niagara Region provided daily flows at each plant for 2011 – 2015. Using this data, an average daily flow was calculated for each year. The five year rolling average of average day flows was used to establish baseline (2014*) system average day flows.

2.5.2 Growth Flow Projections

Future average daily system flows at wastewater treatment plant facilities were developed using a starting point methodology. Expected flow due to growth were added to the starting point flows to establish future flows. An example for the Welland system is provided below.

44.8 MLD = 35.6 MLD + (129,679 – 96,106) * 275 Lpcd
2041 ADD = Baseline ADD + (2041 total equ.pop. – 2014 total equ.pop) * 275 Lpcd

Table 4.3 Wastewater Flow Projections

Wastewater System	2014 – 2041 Growth *			2014	2041
	Growth Population	Growth Employment	Total Equivalent Growth	Average Daily Flow (MLD)	Average Daily Flow (MLD)
Baker Road Wastewater Treatment Plant (WWTP)	31,428	12,229	43,656	20.5	32.5
Port Dalhousie WWTP	24,252	14,761	39,012	34.7	45.4
Port Weller WWTP	17,601	8,531	26,995	36.0	43.4
Niagara-on-the-Lake WWTP	5,140	1,735	6,874	4.4	6.3
Niagara Falls WWTP	38,321	13,626	51,949	41.5	55.8
Stevensville and Douglastown Lagoons	1,544	522	2,068	1.3	1.9
Anger Avenue WWTP	7,666	3,456	11,119	13.1	16.2
Crystal Beach WWTP	3,495	256	3,752	5.5	6.5
Seaway WWTP	3,014	1,202	4,216	12.1	13.3
Welland WWTP	25,065	8,508	33,571	35.6	44.8

* Note: The Master Servicing Plan Update has an established baseline condition of year 2014. 2014 represents the best available system information and system calibration data for the water and wastewater models at the time of study initiation. The Master Servicing Plan Update has projected wastewater flows from year 2014 to establish the 2041 infrastructure needs.

2.6 Wastewater Infrastructure Capacity

2.6.1 Sizing of Treatment Plant

Treatment plants are designed to treat the average daily flows. The following criteria were used to assess when water treatment facilities require expansion, as agreed upon with the Region.

- When flows reach 80% of plant capacity, the planning process for plant expansion will be flagged.
- When 90% of plant capacity has been reached, expansion should be completed.

2.6.2 Sizing of Pumping Station

Pumping stations are sized to provide peak wet weather flows, using the extraneous flow rate of 0.286 L/ha/s.

The following criterion is used to assess when a pumping station requires expansion:

- Capacity expansion will be triggered once the peak wet weather flow reaches the station's firm capacity.

Once capacity expansion has been triggered, site capacity will be evaluated to determine if a new or expanded site is required. When proposing a new site for a pumping station, an allowance in building facility and equipment will be considered to account for future expansion and staging of works.

The following presents an example calculation of projected peak dry weather flow.

2041 Peak Dry Weather Flow for Douglastown Sewage Pumping Station:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (2.66 L/s × 2.0) + (2,818 – 1,523 people) × 275 L/cap/day × 1 day/86400 s × 3.465
= 19.6 L/s

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for Douglastown Sewage Pumping Station:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 19.6 L/s + (97.9 ha × 0.286 L/s/ha)
= 47.6 L/s

2.6.3 Sizing of Forcemains

Forcemain capacity is sized based on the firm capacity of the pumping station.

The following criterion is used to assess when a forcemain for a pumping station requires expansion:

- Capacity expansion will be triggered once the forcemain design velocity exceeds 2.5 m/s.

Sizing of new forcemains will target the following criteria:

- Design velocity exceeds 0.8 m/s with an ideal target of 1.0 m/s
- Where presently feasible, capacity requirements will be achieved by twinning of existing forcemain with same size as existing.

2.6.4 Sizing of Sewermains

Sewer capacities are sized to provide peak wet weather flows, using the extraneous flow rate of 0.286 L/ha/s (2.6.2).

The following criterion is used to assess when a sewermain requires expansion:

- Capacity expansion will be triggered once the sewermains peak hydraulic grade line exceeds the pipe obvert.

Sizing of new sewermains will have the following criterion:

- Target 2041 peak wet weather flows hydraulic grade line less than 70% of pipe obvert.

3. WASTEWATER SERVICING STRATEGY

3.1 Servicing Principles and Policies

Through the course of the Master Servicing Plan Update, priority policy areas were brought forward including:

- Health and safety;
- System reliability and security;
- Reserve capacity for operational flexibility and level of service;
- Impacts of climate change;
- Considerations to energy use and efficiency;
- Recognition of impacts from water efficiency and conservation;
- Addressing issues related to the full lifecycle of water and wastewater services.

A comprehensive list of general wastewater policies were established. As a result from the priority policy areas, key principle and policy statements were developed as highlighted below:

- Niagara Region will endeavor to maintain sufficient reserve capacity in its water and wastewater infrastructure and facilities to provide operational flexibility and meet potential changes in servicing conditions
- Niagara Region shall endeavor to provide reliability, redundancy and security in its water and wastewater systems with attention to high risk and critical areas
- Niagara Region shall be aware of and consider the potential impact of climate change on the planning and sizing of infrastructure
- Niagara region shall design wastewater facilities with consideration to energy use
- Niagara Region will review a combination of servicing strategies including infrastructure and non-infrastructure (e.g. i/i reduction) solutions to meet wet weather level of service and provide sufficient wastewater capacity
- Niagara Region will approach Guidelines F-5-5 and F-5-1 such that new development will not put the Region out of compliance with regulations and the Region will consider opportunities to not increase wet weather overflows beyond current conditions

3.2 Evaluation Methodology

The process for developing, evaluating and selecting the preferred wastewater servicing strategy followed these key steps:

- Review of baseline conditions across each wastewater system;
- Identify opportunities and constraints for each system;

- Develop high level servicing concepts;
- Review each concept with respect to environmental, social, legal, technical and financial factors. Develop advantages and disadvantages for each;
- Provide additional detail for the preferred concept ensuring alignment, siting, capacity, timing and other technical factors are identified; and
- Develop a conceptual cost estimate for each project.

Each alternative was evaluated through the reasoned argument approach which provided a clear and thorough rationale of the trade-offs among the various options based on the anticipated impacts caused by various evaluation criteria and factors. The basis of this approach is to qualitatively evaluate the relative advantages, disadvantages, and impacts of each alternative against the established criteria. This process was intended to highlight why the preferred alternative was chosen through evaluation of technical, environmental, social/cultural, financial, and legal/jurisdictional criteria.

3.3 Alternative Strategies

The wastewater systems across the Region are impacted not only by growth but through wet weather responses in the systems compromising infrastructure capacity.

When reviewing wastewater system servicing alternatives, 3 typical strategies were considered for all systems:

1. Capacity Upgrades: Wastewater Treatment Plant (WWTP), Pumping (SPS), Trunk Sewer
2. Upstream Management: Storage, Peak Shaving, Diversion
3. Peak Flow Management: Flow Reduction, Rainfall Derived Inflow and Infiltration (RDII) Removal

In the review and evaluation of the 3 strategies it was found that hybrid approach should be used consisting of:

- Providing capacity within Regional SPS and trunk sewer to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Provide upstream flow management and peak flow management address peak flows in systems where peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in basement flooding and overflow risks.

Under this strategy:

- The existing regional infrastructure configuration would remain as is, with capacity upgrades to existing facilities as needed.
- The best strategy for upstream flow management and peak flow management would de identified through next step area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, and others.
- Upstream flow management and peak flow management projects would be primarily lead by local municipalities with support from the Region.
- Wet weather management projects would prioritize growth areas with existing wet weather flow issues.

Further to the overall hybrid approach, area-specific alternatives were reviewed where warranted.

4. CAPITAL PROGRAM

4.1 Wastewater System Recommendations Overview

A summary of the key aspects of the wastewater servicing strategy are in Table 4.4.

Table 4.4 Wastewater Servicing Strategy

System	Special Project Implementation and Considerations
Baker Road	• Based on the level of growth in the system, the Baker Road Wastewater Treatment Plant (WWTP) will require additional wastewater treatment capacity. • The projected growth and wet weather flow needs across much of the service area has triggered sewage pumping station (SPS) upgrades across many of the facilities. • The SPS upgrades and potential trunk sewer capacity constraints will be mitigated by implementing wet weather management programs in West Grimsby, Beamsville and Vineland. • There is significant growth projected in Smithville in relation to existing infrastructure capacity. A new trunk sewer in the community plus an expansion of the SPS will be required for the growth flows. The additional SPS capacity will require forcemain twinning and trunk sewer capacity upgrades downstream of the new forcemain.
Port Dalhousie	• While infrastructure capacity upgrades were considered, the recommended solution for the Port Dalhousie WWTP system is to provide wet weather management across the system. This will require Regional solutions as well as local municipal solutions. • An upgrade to the Beaverdams SPS has been identified to support growth in the area. • With implementation of the wet weather program, the Port Dalhousie WWTP will have sufficient capacity to meet growth to year 2041.

System	Special Project Implementation and Considerations
Port Weller	• While infrastructure capacity upgrades were considered, the recommended solution for the Port Weller WWTP wastewater system is to provide wet weather management across the system. This will require Regional solutions as well as local municipal solutions. • In addition to the wet weather program, there is opportunity to re-direct the Thorold South wastewater flows to the new South Niagara Falls system. • The preferred strategy includes upgrades to the Peel Street SPS and forcemain to pump south and upgrades to the Black Horse SPS and forcemain to pump to the new South Niagara Falls wastewater system. • The preferred strategy will remove flows from Thorold South on the Port Weller system alleviating some existing capacity impacts. • With implementation of the wet weather program and redirecting the Thorold South flows, the Port Weller WWTP will have sufficient capacity to meet growth to year 2041.
Niagara-On-The-Lake	• The pockets of urban areas in Niagara-On-The-Lake ultimately convey flows to the Niagara-On-The-Lake WWTP. There is some growth projected for these areas. • The Niagara-On-The-Lake WWTP is a newly constructed facility. The WWTP has sufficient capacity to support growth to year 2041. • The wastewater strategy is comprised of only a few sewage pumping station capacity upgrades to address additional growth flows. • Wet weather management is recommended for the system.
Queenston	• The Queenston WWTP system is a small system in Niagara-On-The-Lake. There is minimal growth projected and the system has capacity to support its needs. However, from a lifecycle perspective, it can be inefficient to operate small independent systems. • The South Niagara Falls wastewater strategy presents opportunities for adjacent systems. On this basis, it is recommended to redirect the Queenston flows with a new sewage pumping station to Niagara Falls and decommission the Queenston WWTP.

System	Special Project Implementation and Considerations
Niagara Falls	• Based on the level of growth in the system, the Niagara Falls WWTP is approaching capacity within the 2041 planning horizon. The plant is aging and requires sustainability upgrades to maintain level of service. • Conveying growth flows to the Niagara Falls WWTP will require significant infrastructure upgrades across the system and within the built boundary of the City. • Given the level of impact on the existing system based on current system conveyance, a broader evaluation process was undertaken to develop Niagara Falls servicing alternatives. A South Niagara Falls wastewater strategy was developed. • The South Niagara Falls wastewater strategy resulted in the recommendation for a new South Niagara Falls WWTP. • The Niagara Falls service area south of Lundy's Lane will convey flows to the new plant. The remaining service areas will continue to convey flows to the existing plant. • Capacity upgrades in the St. David's area are required to support growth. This area, as well as the Queenston service area, will direct flows to the existing plant. • The Thorold South service area will be directed to the new South Niagara Falls WWTP. • The South Side High Lift pumping station will be directed south to the new plant. • Isolated pumping stations will require capacity upgrades to support the project growth. • In order to minimize infrastructure upgrades, wet weather management will be required across the Niagara Falls system.
Stevensville and Douglastown	• The treatment plant will have sufficient capacity to support growth to 2041. • The Stevensville SPS will require additional capacity. • Wet weather management is recommended for the system.

System	Special Project Implementation and Considerations
Anger Avenue	• The Anger Avenue WWTP has sufficient capacity to support growth to year 2041. • The projected growth will require expansions at Alliston SPS, Lakeshore Road SPS, and Catherine Street SPS and forcemain. • Additional wet weather management is recommended to minimize impact to existing infrastructure and support the growth to year 2041
Crystal Beach	• The Crystal Beach WWTP has sufficient capacity to support growth to year 2041. • The growth flows will require additional capacity at the Nigh Road SPS and Shirley Road SPS. • Additional wet weather management in the core of the service area is recommended to minimize impact to existing infrastructure and support growth to year 2041.
Seaway	• The Seaway WWTP has sufficient capacity to support growth to year 2041. • The projected growth will require pumping station expansions at Oxford Road SPS, Steele Street SPS and Rosemount South SPS. • Additional wet weather management, particularly on the east side of the canal is recommended to minimize impact to existing infrastructure and support growth to year 2041.
Welland	• The Welland WWTP has sufficient capacity to support growth to year 2041. • Due to the projected growth in the Fenwick area, additional pumping station and forcemain capacity is required. • Additional capacity is required at the Hurricane Road SPS and Towpath SPS. • Additional conveyance capacity across Highway 406 at the Towpath SPS is required to support growth. • The wet weather management program within the core areas of Welland and within the combined sewer systems is required to support growth and minimize infrastructure costs within the built boundary.

4.2 Wet Weather Management Strategy

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program.

The Niagara Region wastewater systems are a mix of separated and combined sewer systems. Each system experiences varying levels of impact during wet weather conditions. Climate change continues to create changing weather conditions and the wastewater systems experience high peak flows under rainfall events in most cases. Providing infrastructure capacity for the peak flow events would require upgrades not only for local sewers, but also trunk sewers, pumping stations and ultimately the treatment plants. The infrastructure capacity approach can prove costly.

The wet weather management program has been developed to identify targeted amounts of inflow and infiltration reduction. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts.

4.3 South Niagara Falls Servicing Strategy

The South Niagara Falls servicing strategy has been highlighted based on the significant change in servicing strategy from previous Master Plans.

The Niagara 2041 planning exercise resulted in significant growth in South Niagara Falls, partly based on the extension of the planning horizon from 2031 to 2041. It is noted that 64% of the growth in Niagara Falls is projected south of Lundy's Lane and 22.5% of the growth is projected south of the Welland River. This growth in combination with wet weather issues in South Niagara Falls as well as servicing constraints in adjacent wastewater systems including Thorold South and St. Catharines, prompted a broader review of wastewater servicing strategies for the area.

The analysis for the South Niagara Falls servicing strategy followed these principal steps:

- Review of system integration opportunities
- Hydraulic analysis of the systems
- Preliminary identification of infrastructure needs and alignments/sites

- Detailed cost benefit analysis considering capital, lifecycle and offsetting cost components
- Multiple bottom line evaluation process

The analysis developed and evaluated two options for the servicing of future growth:

1. Go North: Accommodate only the south Niagara Falls growth through the existing Niagara Falls Wastewater Treatment Plant (Go North) including all necessary upgrades / upsizing of existing infrastructure.
2. New Plant: Construct a new South Niagara Falls Wastewater Treatment Plant (New Plant), divide the Niagara Falls service area into two, provide additional capacity suitable for the servicing of Thorold South, introduce additional capacity in the Port Weller sewer shed area of St. Catharines, create the opportunity to service future growth in the St. David's area of Niagara-on-the-Lake, and introduce significant capacity in the north sewer shed area of Niagara Falls for intensification and growth.

Option 2 – New Plant was selected as the preferred South Niagara Falls servicing strategy. Overall comments related to the selection of the New Plant option are:

- Providing a new South Niagara Falls Wastewater Treatment Plant provides the greatest flexibility and support for long term servicing and benefit to the Niagara Falls and surrounding systems.
- A New Plant provides the greatest opportunity to mitigate risks including cost risks, implementation risks, and capacity risks.
- The New Plant option does have higher capital costs for 2041 program and higher annual lifecycle costs than the Go North option. However, the New Plant can provide more flexible and less expensive post 2041 costs.
- Based on the opportunity to implement green technologies and address wet weather issues, the New Plant provides opportunity for other funding sources similar to the Niagara-on-the-Lake plant.

Under either option, continued sustainability upgrades will be required for existing infrastructure including the existing Niagara Falls Wastewater Treatment Plant.

4.4 Capital Program

A summary of the wastewater servicing strategy capital program with details for each project is provided in Table 4.5.

Table 4.5 Wastewater Servicing Strategy

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-D-001	Decommissioning of Queenston Wastewater Treatment Plant (WWTP)	Decommissioning of Queenston WWTP, to be replaced by new SPS and forcemain to St. David's #1	N/A	2022-2031	Niagara Falls	A+	To be Satisfied Under Consolidated Queenstown Schedule B EA - Separate Study	Treatment	$ 1,979,000
WW-FM-001	Upgrade Catherine Street Sewage Treatment Plant (SPS) Forcemain	Upgrade Catherine Street SPS Forcemain in Fort Erie	300 mm	2032-2041	Fort Erie	A+	Satisfied	Forcemain	$ 467,000
WW-FM-003	Upgrade Foss Road SPS Forcemain	Upgrade Foss Road SPS Forcemain in Welland	250 mm	2022-2031	Pelham	A+	Satisfied	Forcemain	$ 4,500,000
WW-FM-004	Laurie Avenue SPS Forcemain Upgrade	Laurie Avenue SPS Forcemain Upgrade in Lincoln	250 mm	2017-2021	Lincoln	A+	Satisfied	Forcemain	$ 2,981,000
WW-FM-005	New Peel Street SPS Forcemain	New Peel Street SPS Forcemain in Thorold from station to Black Horse SPS	400 mm	2022-2031	Thorold	A+	To be Satisfied Under Consolidated South NF Schedule C EA - Separate Study	Forcemain	$ 4,889,000
WW-FM-006	New Black Horse Forcemain to Niagara Falls	New Black Horse Forcemain to Niagara Falls	400 mm	2022-2031	Niagara Falls	A+	To be Satisfied Under Consolidated South NF Schedule C EA - Separate Study	Forcemain	$ 9,820,000
WW-FM-008	South Side High Lift conveyance	South Side High Lift to new South Niagara Falls WWTP	900 mm	2022-2031	Niagara Falls	A+	To be Satisfied Under Consolidated South NF Schedule C EA - Separate Study	Sewer	$ 38,039,000
WW-FM-009	Dorchester Forcemain twinning	Twin existing Dorchester Forcemain in Niagara Falls	300 mm	2022-2031	Niagara Falls	A+	Satisfied	Forcemain	$ 303,000
WW-FM-010	St. Davids #1 Forcemain twinning	Twin existing St. Davids #1 Forcemain in Niagara-on-the-Lake	300 mm	2022-2031	Niagara-on-the-Lake	A+	Dependent on outcome of wet weather flow study	Forcemain	$ 3,923,000
WW-FM-011	Smithville Forcemain twinning	Twin existing Smithville Forcemain	400 mm	2022-2031	West Lincoln	A+	Satisfied	Forcemain	$ 18,132,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-FM-012	New Queenston Forcemain	New Queenston Forcemain into Niagara Falls system	250 mm	2022-2031	Niagara-on-the-Lake	A+	To be Satisfied Under Consolidated Queenstown Schedule B EA - Separate Study	Forcemain	$ 11,136,000
WW-II-001	Wet weather reduction in East Fort Erie	Wet weather reduction in East Fort Erie	30 L/s reduction	2022-2031	Fort Erie	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 4,500,000
WW-II-002	Wet weather reduction in Crystal Beach	Wet weather reduction in Crystal Beach	30 L/s reduction	2022-2031	Fort Erie	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 4,500,000
WW-II-003	Wet weather reduction in Stevensville/Douglastown	Wet weather reduction in Stevensville/Douglastown	30 L/s reduction	2022-2031	Fort Erie	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 4,500,000
WW-II-004	Wet weather reduction in Central Welland	Wet weather reduction in Central Welland	200 L/s reduction	2022-2031	Welland	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 30,000,000
WW-II-005	Wet weather reduction in West Grimsby	Wet weather reduction in West Grimsby	50 L/s reduction	2022-2031	Grimsby	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 7,500,000
WW-II-006	Wet weather reduction in Beamsville	Wet weather reduction in Beamsville	20 L/s reduction	2022-2031	Lincoln	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 3,000,000
WW-II-007	Wet weather reduction in Jordan Valley	Wet weather reduction in Jordan Valley	10 L/s reduction	2022-2031	Lincoln	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 1,500,000
WW-II-008	Wet weather reduction in St. Catharines - Port Dalhousie	Wet weather reduction in St. Catharines - Port Dalhousie	200 L/s reduction	2022-2031	St. Catharines	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 30,000,000
WW-II-009	Wet weather reduction in North Thorold	Wet weather reduction in North Thorold	90 L/s reduction	2022-2031	Thorold	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 13,500,000
WW-II-010	Wet weather reduction in St. Catharines and Thorold - Port Weller	Wet weather reduction in St. Catharines and Thorold - Port Weller	134 L/s reduction	2017-2021	St. Catharines	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 20,100,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-II-011	Wet weather reduction in Central Port Colborne	Wet weather reduction in Central Port Colborne	20 L/s reduction	2022-2031	Port Colborne	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 3,000,000
WW-II-012	Wet weather reduction in Central Niagara Falls	Wet weather reduction in Central Niagara Falls	100 L/s reduction	2022-2031	Niagara Falls	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 15,000,000
WW-II-013	Wet weather reduction in South Side Niagara Falls	Wet weather reduction in South Side Niagara Falls	100 L/s reduction	2017-2021	Niagara Falls	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 15,000,000
WW-II-014	Wet weather reduction in Northeast Niagara-on-the-Lake	Wet weather reduction in Northeast Niagara-on-the-Lake	5 L/s reduction	2022-2031	Niagara-on-the-Lake	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 750,000
WW-II-015	Wet weather reduction in Virgil	Wet weather reduction in Virgil – Niagara-on-the-Lake	5 L/s reduction	2022-2031	Niagara-on-the-Lake	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 750,000
WW-SPS-001	Alliston SPS Pump Replacement - Anger Avenue	Increase station capacity from 43 L/s to 129 L/s.	129 L/s	2022-2031	Fort Erie	A+	Satisfied	Pumping	$ 989,000
WW-SPS-002	Catherine Street SPS Expansion - Anger Avenue	Increase station capacity from 117 L/s to 140 L/s	140 L/s	2032-2041	Fort Erie	A+	Satisfied	Pumping	$ 2,945,000
WW-SPS-003	Lakeshore SPS Upgrade - Anger Avenue	Increase station capacity from 63 L/s to 70 L/s	70 L/s	2022-2031	Fort Erie	A+	Satisfied	Pumping	$ 2,618,000
WW-SPS-004	Shirley SPS Upgrade - Crystal Beach	Increase station capacity from 29 L/s to 63 L/s; Also includes sustainability upgrades to the station	63 L/s	2032-2041	Fort Erie	A+	Satisfied	Pumping	$ 2,889,000
WW-SPS-005	Nigh Road SPS Pump Replacement - Crystal Beach	Increase station capacity from 29 L/s to 45 L/s Use implementation plan prior to upgrade: Flow monitoring, validate wet weather flows, re-evaluate required upgrades	45 L/s	2022-2031	Fort Erie	A+	Dependent on outcome of wet weather flow study	Pumping	$ 989,000
WW-SPS-006	Stevensville SPS Upgrade - Stevensville Douglastown	Increase station capacity from 42 L/s to 65 L/s	65 L/s	2022-2031	Fort Erie	A+	Satisfied	Pumping	$ 1,022,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-SPS-007	Rosemount South SPS Pump Replacement - Seaway	Increase station capacity from 9 L/s to 17 L/s	17 L/s	2017-2021	Port Colborne	A+	Satisfied	Pumping	$ 665,000
WW-SPS-008	Oxford SPS Pump Replacement - Seaway	Increase station capacity from 7 L/s to 10 L/s	10 L/s	2032-2041	Port Colborne	A+	Satisfied	Pumping	$ 665,000
WW-SPS-009	Steele SPS Pump Replacement - Seaway	Increase station capacity from 16 L/s to 40 L/s	40 L/s	2032-2041	Port Colborne	A+	Satisfied	Pumping	$ 989,000
WW-SPS-011	Foss Road SPS Upgrade - Welland	Increase station capacity from 27 L/s to 76 L/s	76 L/s	2022-2031	Pelham	B	Satisfied (Project File Included)	Pumping	$ 1,866,000
WW-SPS-012	Smithville SPS Expansion - Baker Road	Increase station capacity from 120 L/s to 375 L/s	375 L/s	2022-2031	West Lincoln	B	Satisfied (Project File Included)	Pumping	$ 8,241,000
WW-SPS-013	Campden SPS Pump Replacement - Baker Road	Increase station capacity from 11 L/s to 19 L/s pumps	19 L/s	2022-2031	Lincoln	A+	Satisfied	Pumping	$ 1,299,000
WW-SPS-014	Laurie Avenue SPS Expansion - Baker Road	Increase station capacity from 28 L/s to 48 L/s	48 L/s	2017-2021	Lincoln	B	Satisfied (Project File Included)	Pumping	$ 1,814,000
WW-SPS-015	Victoria Avenue SPS Upgrade - Baker Road	Increase station capacity from 120 L/s to 230 L/s	230 L/s	2017-2021	Lincoln	B	Satisfied (Project File Included)	Pumping	$ 4,051,000
WW-SPS-016	Bridgeport SPS Pump Replacement - Baker Road	Increase station capacity from 11 L/s to 24 L/s Use implementation plan prior to upgrade: Flow monitoring, validate wet weather flows, re-evaluate required upgrades	24 L/s	2022-2031	Lincoln	A+	Dependent on outcome of wet weather flow study	Pumping	$ 834,000
WW-SPS-017	Jordan Valley SPS Pump Replacement - Baker Road	Increase station capacity from 40 L/s to 74 L/s Use implementation plan prior to upgrade: Flow monitoring, validate wet weather flows, re-evaluate required upgrades	74 L/s	2022-2031	Lincoln	A+	Dependent on outcome of wet weather flow study	Pumping	$ 1,145,000
WW-SPS-018	Ontario Street SPS Upgrade - Baker Road	Increase station capacity from 420 L/s to 600 L/s	600 L/s	2032-2041	Lincoln	B	Satisfied (Project File Included)	Pumping	$ 3,755,000
WW-SPS-019	Biggar Lagoon Pump Replacement - Baker Road	Increase station capacity from 60 L/s to 105 L/s; Also includes SOGR project as per Niagara Region capital forecast	105 L/s	2017-2021	Grimsby	A+	Satisfied	Pumping	$ 3,902,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-SPS-020	Lake Street SPS Upgrade - Baker Road	Increase station capacity from 375 L/s to 495 L/s	495 L/s	2017-2021	Grimsby	B	Satisfied (Project File Included)	Pumping	$ 4,410,000
WW-SPS-021	Beaverdams SPS Pump Replacement - Port Dalhousie	Increase station capacity from 10 L/s to 20 L/s	20 L/s	2017-2021	Thorold	A+	Satisfied	Pumping	$ 665,000
WW-SPS-025	Garner Road SPS Pump Replacement - Niagara Falls	Increase station capacity from 81 L/s to 206 L/s. Addition of a third 103 L/s pump	206 L/s	2032-2041	Niagara Falls	B	Satisfied (Project File Included)	Pumping	$ 824,000
WW-SPS-026	Dorchester SPS Pump Replacement - Niagara Falls	Increase station capacity from 220 L/s to 270 L/s	270 L/s	2022-2031	Niagara Falls	A+	Satisfied	Pumping	$ 2,414,000
WW-SPS-028	Black Horse SPS Upgrade - South Niagara Falls	Increase station capacity from 21 L/s to 180 L/s	180 L/s	2022-2031	Thorold	C	To be Satisfied Under Consolidated South NF Schedule C EA - Separate Study	Pumping	$ 4,620,000
WW-SPS-031	St. Davids #2 SPS Expansion - Niagara Falls	Increase station capacity from 44 L/s to 104 L/s	104 L/s	2022-2031	Niagara-on-the-Lake	B	Dependent on outcome of wet weather flow study	Pumping	$ 3,836,000
WW-SPS-032	St. Davids #1 SPS Upgrade - Niagara Falls	Increase station capacity from 41 L/s to 88 L/s Use implementation plan prior to upgrade: Flow monitoring, validate wet weather flows, re-evaluate required upgrades	88 L/s	2022-2031	Niagara-on-the-Lake	B	Dependent on outcome of wet weather flow study	Pumping	$ 1,794,000
WW-SPS-033	Lakeshore Road SPS Pump Replacement - Niagara-on-the-Lake	Increase station capacity from 90 L/s to 142 L/s	142 L/s	2032-2041	Niagara-on-the-Lake	A+	Satisfied	Pumping	$ 1,512,000
WW-SPS-034	Niagara Stone Road SPS Pump Replacement - Niagara-on-the-Lake	Increase station capacity from 22 L/s to 27 L/s	27 L/s	2032-2041	Niagara-on-the-Lake	A+	Satisfied	Pumping	$ 834,000
WW-SPS-035	Line 2 SPS Pump Replacement – Niagara-on-the-Lake	Increase station capacity from 8 L/s to 17 L/s	17 L/s	2017-2021	Niagara-on-the-Lake	A+	Satisfied	Pumping	$ 665,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-SPS-036	Garrison Village SPS Pump Replacement - Niagara-on-the-Lake	Increase station capacity from 62 L/s to 68 L/s	68 L/s	2032-2041	Niagara-on-the-Lake	A+	Satisfied	Pumping	$ 1,250,000
WW-SPS-037	Towpath SPS Pump Replacement - Welland	Increase station capacity from 150 L/s to 300 L/s. Addition of a third 150 L/s pump.	300 L/s	2022-2031	Thorold	A+	Satisfied	Pumping	$ 834,000
WW-SPS-038	Huricane Road SPS Pump Replacement - Welland	Increase station capacity from 39 L/s to 52 L/s	52 L/s	2022-2031	Pelham	A+	Satisfied	Pumping	$ 1,250,000
WW-SPS-039	Queenston SPS	New Queenston SPS with firm capacity of 45 L/s	45 L/s	2022-2031	Niagara-on-the-Lake	B	To be Satisfied Under Consolidated Queenstown Schedule B EA - Separate Study	Pumping	$ 2,996,000
WW-SS-001	Highway 406 Trunk Sewer Crossing	New trunk sewer crossing of HWY 406 between Merritt Rd and recreational waterway in Thorold to support development of the Port Robinson West area	600 mm	2017-2021	Thorold	A+	Satisfied	Sewer	$ 1,450,000
WW-SS-002	Quaker Road Trunk Sewer	New sewer on Quaker Rd. between Pelham Street trunk and Rice Road trunk sewers	600 mm	2022-2031	Welland	A+	Satisfied	Sewer	$ 1,725,000
WW-SS-003	Gravity Sewer upgrade in Grimsby	Upgrade gravity sewer downstream of Smithville forcemain from 375 mm to 525 mm	525 mm	2022-2031	Grimsby	A+	Satisfied	Sewer	$ 5,667,000
WW-SS-004	Gravity Sewer upgrade in Grimsby	Upgrade gravity sewer downstream of Smithville forcemain from 375 mm to 525 mm	525 mm	2022-2031	Grimsby	A+	Satisfied	Sewer	$ 923,000
WW-SS-005	Gravity Sewer upgrade in Smithville	Upgrade gravity sewer upstream of Smithville SPS from 450 mm to 600 mm	600 mm	2022-2031	West Lincoln	A+	Satisfied	Sewer	$ 2,286,000
WW-TP-001	Baker Road WWTP Upgrade	Baker Road WWTP Upgrade to provide an additional 16 MLD	47.3 MLD	2022-2031	Grimsby	C	Separate EA Required	Treatment	$ 41,730,000
WW-TP-002	South Niagara Falls Wastewater Treatment Plant	New South Niagara Falls WWTP	30 MLD	2022-2031	Niagara Falls	C	Separate EA Required	Treatment	$ 128,186,000
Total									**$ 500,318,000**

PART A
BAKER ROAD WASTEWATER SYSTEM

A. BAKER ROAD WASTEWATER TREATMENT PLANT

A.1 Existing System Overview

The Baker Road wastewater system services the areas of Grimsby and Beamsville in the Town of Lincoln, Vineland, and the Smithville area in the Township of West Lincoln. The system services an existing population of 52,778 and 19,144 employees. [1]

The system is serviced by the Baker Road Wastewater Treatment Plant, located on 347 Baker Road, Grimsby. Baker Road Wastewater Treatment Plant is a conventional activated sludge facility with a current rated capacity of 31.3 MLD, a peak dry weather flow capacity of 62.2 MLD and a peak wet weather flow capacity of 120.0 MLD. [2]

Figure 4.A.1 and Figure 4.A.2 present an overview of the wastewater system and a schematic of the wastewater system, respectively.

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[1] Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041

[2] Ministry of Environment and Climate Change, 26 January 2011. Ammeded Environmental Compliance Approval. Number 0643-8BBLDJ

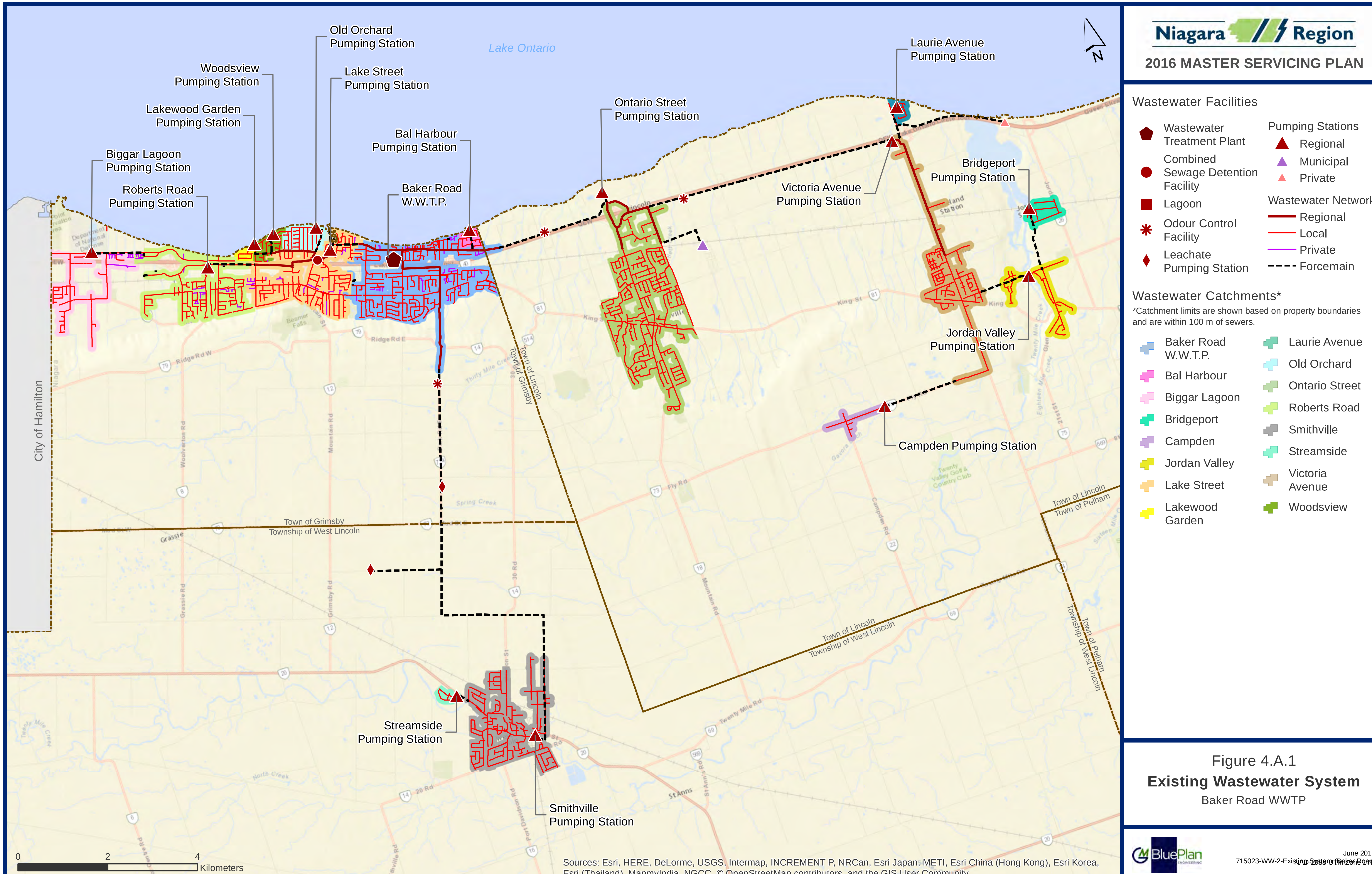


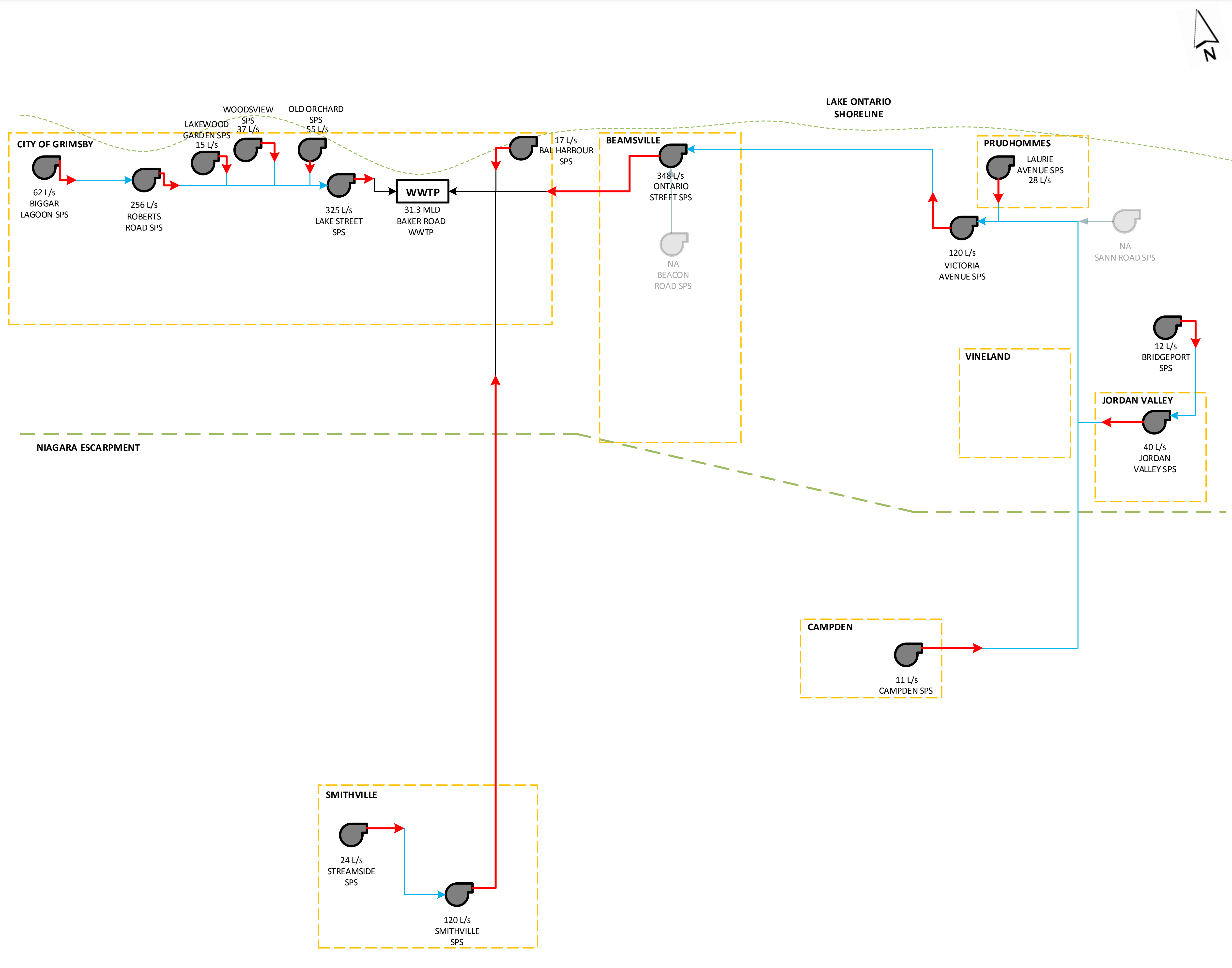
Figure 4.A.1
Existing Wastewater System
Baker Road WWTP

BluePlan
June 2017
715023-WW-2-Existing System (Baker Road)
NAD 1983 UTM Zone 17N

2016 Master Servicing Plan

Baker Road WWTP

EXISTING COLLECTION SCHEMATIC



Legend

WWTP (RATED CAPACITY)	Wastewater Treatment Plant
(FIRM CAPACITY)	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP

June 2017
Figure 4.A.2
Not to Scale

A.1.1 Service Area Overview

Table 4.A.1 provides a list of facility catchments and their areas. Refer to Figure 4.A.1 for the catchment areas of each facility.

Table 4.A.1 Facilities and Catchment Areas

Facility	Catchments	Catchment Area (ha)
Baker Road Wastewater Treatment Plant (WWTP)	**Baker Road WWTP** (Including Sub Catchments) Lake Street SPS Smithville SPS Ontario Street SPS Bal Harbour SPS	2799.8
	Baker Road WWTP (Excluding Sub Catchments)	476.9
Lake Street Sewage Pumping Station (SPS)	**Lake Street SPS** (Including Sub Catchments) Roberts Road SPS Old Orchard SPS Woodsview SPS Lakewood Garden SPS	863.4
	Lake Street SPS (Excluding Sub Catchments)	303.9
Roberts Road SPS	**Roberts Road SPS** (Including Sub Catchments) Biggar Lagoon SPS and Detention Facility	464.1
	Roberts Road SPS (Excluding Sub Catchments)	287.0
Biggar Lagoon SPS	Biggar Lagoon SPS. and Detention Facility	177.1
Old Orchard SPS	Old Orchard SPS	51.1
Woodsview SPS	Woodsview SPS	31.8
Lakewood Garden SPS	Lakewood Garden SPS	12.4
Smithville SPS	**Smithville SPS** (Including Sub Catchments) Streamside SPS	376.5
	Smithville SPS (Excluding Sub Catchments)	359.0
Streamside SPS	Streamside SPS	17.5

Facility	Catchments	Catchment Area (ha)
Ontario Street SPS	**Ontario Street SPS** (Including Sub Catchments) Victoria Avenue SPS	1063.6
	Ontario Street SPS (Excluding Sub Catchments)	562.4
Victoria Avenue SPS	**Victoria Avenue SPS** (Including Sub Catchments) Campden SPS Jordan Valley SPS Laurie Avenue SPS	501.2
	Victoria Avenue SPS (Excluding Sub Catchments)	280.7
Campden SPS	Campden SPS	43.3
Jordan Valley SPS	**Jordan Valley SPS** (Including Sub Catchments) Bridgeport SPS	156.5
	Jordan Valley SPS (Excluding Sub Catchments)	109.0
Bridgeport SPS	Bridgeport SPS	47.5
Laurie Avenue SPS	Laurie Avenue SPS	20.8
Bal Harbour SPS	Bal Harbour SPS	19.4

A.1.2 Facility Overview

Table 4.A.2 Wastewater Treatment Plant Overview

Plant Name	Baker Road Wastewater Treatment Plant
Address	347 Baker Road, Grimsby
Discharge Water	Lake Ontario
Rated Capacity: Average Daily Flow	31.3 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	62.6 MLD
Rated Capacity: Peak Flow Rate (Wet Weather)	120 MLD
Key Processes	• Conventional activated sludge treatment with screening • Grit removal • Effluent disinfection • UV treatment of secondary effluent • Chlorination of secondary bypass flow

Table 4.A.3 Wastewater Treatment Plant Effluent Objectives

Effluent Parameter	Objective Concentration[3]
$CBOD_5$	15.0 mg/L
TSS	15.0 mg/L
Total Phosphorus	0.4 mg/L
Total Ammonia Nitrogen *January – April* *May – June* *July – October* *November – December*	 8 mg/L 5 mg/L 3 mg/L 5 mg/L
E. Coli	100 organisms/100 mL
Total Chlorine Residual	0.01 mg/L

[3] *Ministry of Environment and Climate Change, 26 January 2011. Ammeded Environmental Compliance Approval. Number 0643-8BBLDJ*

Table 4.A.4 Pumping Station Overview

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Lake Street SPS	418 Robinson Road, Grimsby	4	375.0	325.0	18.0
Roberts Road SPS	323 South Service Road, Grimsby	3	295.0	256.3	20.7
Biggar Lagoon SPS	Part of 21, Broken Front Concession, Grimsby	2	95.0	61.7	Unknown
Old Orchard SPS	Old Orchard Avenue, Grimsby	2	55.0	55.0	22.2
Woodsview SPS	Lakeside Drive, Grimsby	3	Unknown	37.0	Unknown
Lakewood Garden SPS	Block 72, Grimsby	2	14.5	14.5	9.9
Smithville SPS	214 St. Catharine Street, Smithville	2	120.0	120.0	47.0
Streamside SPS	Streamside Subdivision, Smithville	2	23.6	23.6	13.3
Ontario Street SPS	4880 Ontario Street North, Lincoln	3	420.0	348.0	27.0
Victoria Avenue SPS	3450 South Service Road, Lincoln	3	120.0	120.0	25.8
Campden SPS	3985 Fly Road, Campden	2	11.0	11.0	11.3
Jordan Valley SPS	21st Street, Lincoln	2	40.0	40.0	48.0
Bridgeport SPS	4168 Bridgeport Drive, Lincoln	2	11.5	11.5	Unknown
Laurie Avenue SPS	Laurie Avenue, Lincoln	2	28.0	28.0	25.1
Bal Harbour SPS	Lot 2, Broken Front Concession, Grimsby	2	Unknown	16.6	Unknown

Table 4.A.5 Forcemain Overview

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Length (m)	Diameter (mm)	Capacity @ 2.5 m/s (L/s)
Lake Street SPS	325.0	785	500	490.9
Roberts Road SPS	256.3	1150	450	397.6
Biggar Lagoon SPS	61.7	1253	300	176.7
Old Orchard SPS	55.0	663	200	78.5
Woodsview SPS	37.0	472	200	78.5
Lakewood Garden SPS	14.5	590	150	44.2
Smithville SPS	120.0	10,788	300	176.7
Streamside	23.6	325	150	44.2
Ontario Street SPS	348.0	2,965	600	706.9
Victoria Avenue SPS	120.0	5,600	400	314.2
Campden SPS	11.0	1,700	150	44.2
Jordan Valley SPS	40.0	1,225	200	78.5
Bridgeport SPS	11.5	1,440	150	44.2
Laurie Avenue SPS	28.0	848	150	44.2
Bal Harbour SPS	16.6	440	150	44.2

A.1.3 Flows Overview

Table 4.A.6 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.A.7 shows the existing wastewater system flows by catchment.

Table 4.A.6 Historic Baker Road Wastewater Treatment Plant Flows

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	L/s	MLD	L/s	MLD	L/s
2011	21.2	245.4	23.9	276.6	66.8	773.1
2012	16.9	195.6	18.8	217.6	56.9	658.6
2013	18.9	218.8	21.3	246.5	65.9	762.7
2014	19.1	221.1	20.5	237.3	58.1	672.5
2015	16.5	191.0	18.0	208.3	52.3	605.3
5 Year Average	18.5	214.1	20.5	237.3	61.9	716.4
5 Year Peak	21.2	245.4	23.9	276.6	66.8	773.1

Table 4.A.7 Existing Wastewater System Flows by Catchment

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Baker Road Wastewater Treatment Plant (WWTP)	71,923	232.2	1265.2	1283.0	1652.0
Baker Road WWTP	14,406	17.6	171.7	297.0	446.0
Lake Street Sewage Pumping Station (SPS)	19,054	78.5	404.0	492.8	594.9
Lake Street SPS	6,731	40.4	167.7	189.0	283.0
Roberts Road SPS	9,949	27.2	187.2	298.0	397.0
Roberts Road SPS	7,149	15.7	113.5	118.0	154.0
Biggar Lagoon SPS and Detention Facility	2,801	11.5	73.7	180.0	243.0
Old Orchard SPS	966	6.6	27.8	8.4	14.9
Woodsview SPS	0	2.6	14.3	48.0	64.0
Lakewood Garden SPS	1,408	1.7	7.0	2.0	3.6
Smithville SPS	7,202	46.4	200.6	169.6	226.0
Smithville SPS	7,170	45.0	192.7	161.5	215.3
Streamside SPS	32	1.4	7.9	8.0	10.7
Ontario Street SPS	30,864	87.7	479.6	482.1	642.6
Ontario Street SPS	17,683	72.9	306.7	362.1	522.6
Victoria Avenue SPS	13,181	14.7	172.8	327.0	441.0
Victoria Avenue SPS	5,516	3.3	86.9	107.0	120.0
Campden SPS	2,030	0.7	13.8	31.0	41.0
Jordan Valley SPS	4,721	8.6	61.9	94.0	141.0
Jordan Valley SPS	1,719	6.1	43.3	65.0	98.0
Bridgeport SPS	3,001	2.5	18.5	28.0	43.0
Laurie Avenue SPS	915	2.2	10.4	102.0	136.0
Bal Harbour SPS	397	1.9	9.4	9.3	12.4

Note: Flow numbers may not sum due to rounding.

A.2 Growth Projections

A.2.1 Population Projections and Allocations

Table 4.A.8 and Table 4.A.9 outline the existing and projected serviced population and employment by catchment.

Table 4.A.8 Baker Road Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Baker Road Wastewater Treatment Plant	11,284	11,514	12,216	12,920	13,540	14,161	2,877
Bal Harbour Sewage Pumping Station (SPS)	397	413	413	411	412	414	16
Biggar Lagoon SPS and Detention Facility	1,567	2,108	2,274	2,659	2,849	3,008	1,441
Bridgeport SPS	2,014	1,925	1,925	1,926	2,323	2,449	436
Campden SPS	1,405	1,576	1,572	1,574	1,575	1,585	180
Jordan Valley SPS	846	807	806	804	1,222	1,490	644
Lake Street SPS	4,181	4,340	4,551	4,703	4,953	5,416	1,235
Lakewood Garden SPS	1,372	1,492	1,482	1,470	1,465	1,466	95
Laurie Avenue SPS	588	1,378	2,311	2,749	2,770	2,788	2,200
Old Orchard SPS	549	597	593	589	586	587	38
Ontario Street SPS	12,046	12,630	12,949	14,124	14,870	15,839	3,793
Roberts Road SPS	5,666	7,047	7,955	8,536	9,411	10,169	4,502
Smithville SPS	6,633	8,501	11,224	14,860	17,064	19,447	12,814
Streamside SPS	22	50	101	137	191	281	259
Victoria Avenue SPS	4,209	4,251	4,249	4,449	4,768	4,889	680
Woodsview SPS	0	0	0	0	0	0	0
Total	**52,778**	**58,629**	**64,621**	**71,909**	**78,000**	**83,989**	**31,211**

Note: Population numbers may not sum due to rounding.

Table 4.A.9 Baker Road Wastewater Treatment Plant Existing and Projected Serviced Employment by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Baker Road Wastewater Treatment Plant	3,122	3,620	3,787	4,003	4,222	4,535	1,413
Bal Harbour Sewage Pumping Station (SPS)	0	0	0	0	0	0	0
Biggar Lagoon SPS and Detention Facility	1,234	1,608	1,744	1,989	2,217	2,559	1,325
Bridgeport SPS	988	992	993	995	996	998	10
Campden SPS	625	679	721	805	897	910	285
Jordan Valley SPS	873	879	881	883	885	888	15
Lake Street SPS	2,550	3,002	3,156	3,344	3,540	3,816	1,266
Lakewood Garden SPS	36	40	41	43	44	46	10
Laurie Avenue SPS	328	473	520	577	649	731	403
Old Orchard SPS	417	466	482	496	512	534	117
Ontario Street SPS	5,637	6,519	6,800	7,310	7,731	8,459	2,822
Roberts Road SPS	1,483	1,820	1,938	2,114	2,287	2,538	1,055
Smithville SPS	537	1,247	1,718	2,333	3,059	3,867	3,330
Streamside SPS	10	29	38	48	61	74	65
Victoria Avenue SPS	1,306	1,373	1,410	1,455	1,511	1,546	239
Woodsview SPS	0	0	0	0	0	0	0
Total	**19,144**	**22,745**	**24,230**	**26,393**	**28,609**	**31,499**	**12,355**

Note: Population numbers may not sum due to rounding.

A.2.2 Future Flow Projections

Table 4.A.10 and Table 4.A.11 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

Table 4.A.10 Projected Peak Dry Weather Flow by Catchment

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Baker Road Wastewater Treatment Plant	41.7	49.2	57.1	64.1	71.9
Bal Harbour Sewage Pumping Station (SPS)	4.1	4.1	4.1	4.1	4.1
Biggar Lagoon SPS and Detention Facility	32.8	36.0	42.3	46.4	51.2
Bridgeport SPS	4.0	4.0	4.0	8.4	9.7
Campden SPS	3.9	4.4	5.3	6.3	6.6
Jordan Valley SPS	11.8	11.8	11.8	16.6	19.6
Lake Street SPS	86.8	90.3	93.6	97.8	104.6
Lakewood Garden SPS	4.9	4.8	4.7	4.6	4.6
Laurie Avenue SPS	15.2	25.5	30.5	31.4	32.4
Old Orchard SPS	14.3	14.4	14.6	14.7	15.0
Ontario Street SPS	158.3	163.4	177.2	186.6	199.9
Roberts Road SPS	47.9	57.3	64.0	73.2	81.9
Smithville SPS	114.3	142.2	176.7	199.2	222.9
Streamside SPS	3.5	4.3	4.9	5.8	7.1
Victoria Avenue SPS	7.7	8.0	10.5	14.3	15.8
Woodsview SPS	5.2	5.2	5.2	5.2	5.2
Total	**556.5**	**625.0**	**706.5**	**778.7**	**852.5**

The following presents an example calculation of projected peak dry weather flow.

2041 Peak Dry Weather Flow for Campden Sewage Pumping Station:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (0.70 L/s × 2.0) + (2,495 – 2,030 people) × 275 L/cap/day × 1 day/86400 s × 3.51
= 6.6 L/s

Table 4.A.11 Projected Peak Wet Weather Flow by Catchment

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Baker Road Wastewater Treatment Plant	178.1	185.6	193.5	200.5	208.3
Bal Harbour Sewage Pumping Station (SPS)	9.6	9.6	9.6	9.6	9.6
Biggar Lagoon SPS and Detention Facility	83.5	86.6	93.0	97.1	101.9
Bridgeport SPS	17.6	17.6	17.6	21.9	23.3
Campden SPS	16.3	16.7	17.7	18.7	19.0
Jordan Valley SPS	43.0	43.0	43.0	47.8	50.7
Lake Street SPS	173.7	177.3	180.5	184.7	191.5
Lakewood Garden SPS	8.4	8.3	8.2	8.2	8.2
Laurie Avenue SPS	21.1	31.5	36.5	37.4	38.4
Old Orchard SPS	28.9	29.1	29.2	29.3	29.6
Ontario Street SPS	319.2	324.2	338.0	347.4	360.8
Roberts Road SPS	129.9	139.4	146.1	155.3	163.9
Smithville SPS	217.0	244.9	279.4	301.9	325.5
Streamside SPS	8.5	9.3	9.9	10.8	12.1
Victoria Avenue SPS	88.0	88.3	90.8	94.5	96.1
Woodsview SPS	14.3	14.3	14.3	14.3	14.3
Total	**1,357.2**	**1,425.7**	**1,507.2**	**1,579.5**	**1,653.2**

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for Campden Sewage Pumping Station:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 6.6 L/s + (43.3 ha × 0.286 L/s/ha)
= 19.0 L/s

A.3 Assessment of Wastewater Infrastructure (Existing and Future)

A.3.1 Treatment Plant Capacity

Figure 4.A.3 shows the projected future flows at the Baker Road Wastewater Treatment Plant. The plant is approaching capacity, reaching the 80% planning trigger by 2025, and will require an upgrade within the 2041 time horizon.

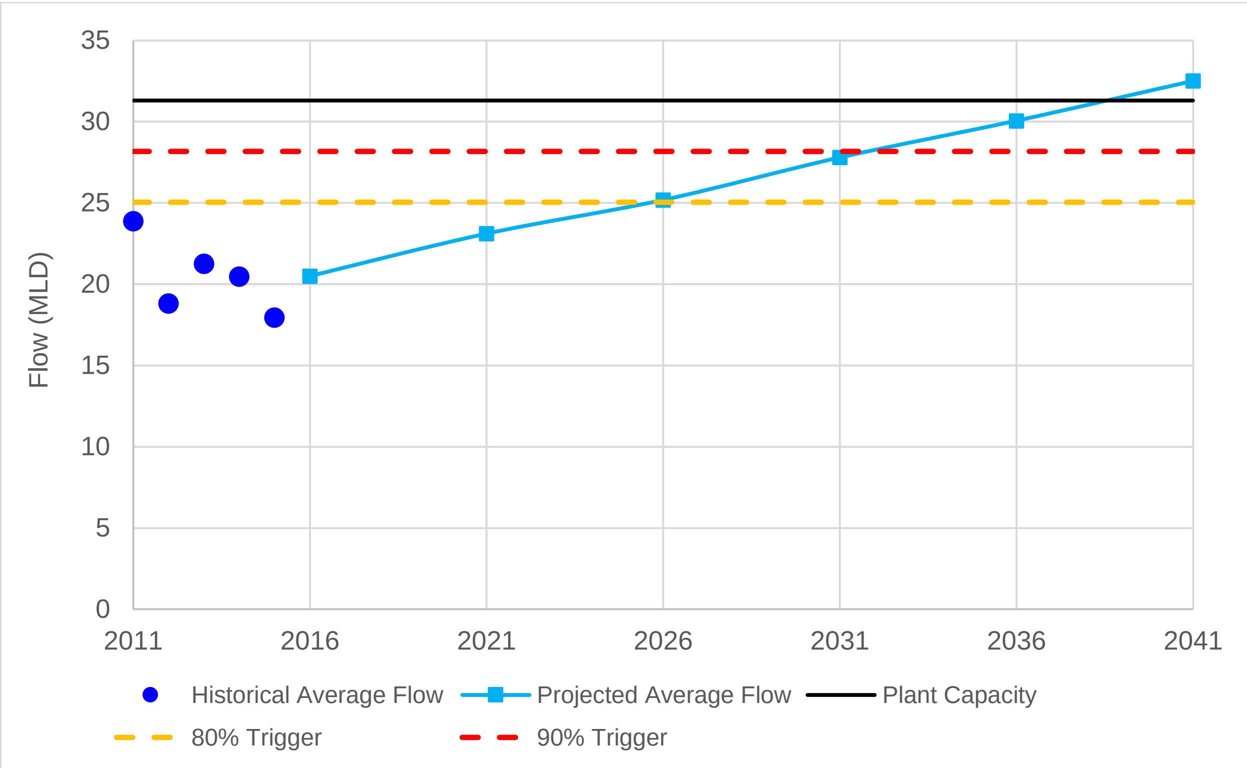


Figure 4.A.3 Projected future flows at Baker Road Wastewater Treatment Plant

A.3.2 Sewage Pumping Station

Table 4.A.12 highlights the sewage pumping station existing and projected capacity.

Table 4.A.12 System Sewage Pumping Station Performance

Sewage Pumping Station	Contributing Catchments	Facility Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Lake Street Sewage Pumping Station (SPS)	Lake Street SPS Roberts Road SPS Old Orchard SPS Woodsview SPS Lakewood Garden SPS	325.0	404.0	491.3	-166.3
Roberts Road SPS	Roberts Road SPS Biggar Lagoon SPS and Detention Facility	256.3	187.2	258.5	-2.2
Biggar Lagoon SPS	Biggar Lagoon SPS and Detention Facility	61.7	73.7	101.9	-40.2
Old Orchard SPS	Old Orchard SPS	55.0	27.8	29.6	25.4
Woodsview SPS	Woodsview SPS	37.0	14.3	14.3	22.7
Lakewood Garden SPS	Lakewood Garden SPS	14.5	7.0	8.2	6.3
Smithville SPS	Smithville SPS Streamside SPS	120.0	200.6	335.8	-215.8
Streamside SPS	Streamside SPS	23.6	7.9	12.1	11.5
Ontario Street SPS	Ontario Street SPS Victoria Avenue SPS	348.0	479.6	566.4	-218.4

Sewage Pumping Station	Contributing Catchments	Facility Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Victoria Avenue SPS	Victoria Avenue SPS Campden SPS Jordan Valley SPS Laurie Avenue SPS	120.0	172.8	216.5	-96.5
Campden SPS	Campden SPS	11.0	13.8	19.0	-8.0
Jordan Valley SPS	Jordan Valley SPS Bridgeport SPS	40.0	61.9	73.0	-33.0
Bridgeport SPS	Bridgeport SPS	11.5	18.5	23.3	-11.8
Laurie Avenue SPS	Laurie Avenue SPS	28.0	10.4	38.4	-10.4
Bal Harbour SPS	Bal Harbour SPS	16.6	9.4	9.6	7.0

The following sewage pumping stations have a projected pumping deficit:

- Lake Street SPS
- Roberts Road SPS
- Biggar Lagoon SPS
- Smithville SPS
- Ontario Street SPS
- Victoria Avenue SPS
- Campden SPS
- Jordan Valley SPS

- Bridgeport SPS
- Laurie Avenue SPS

A.3.3 Forcemain

Table 4.A.13 highlights the existing and projected forcemain performance.

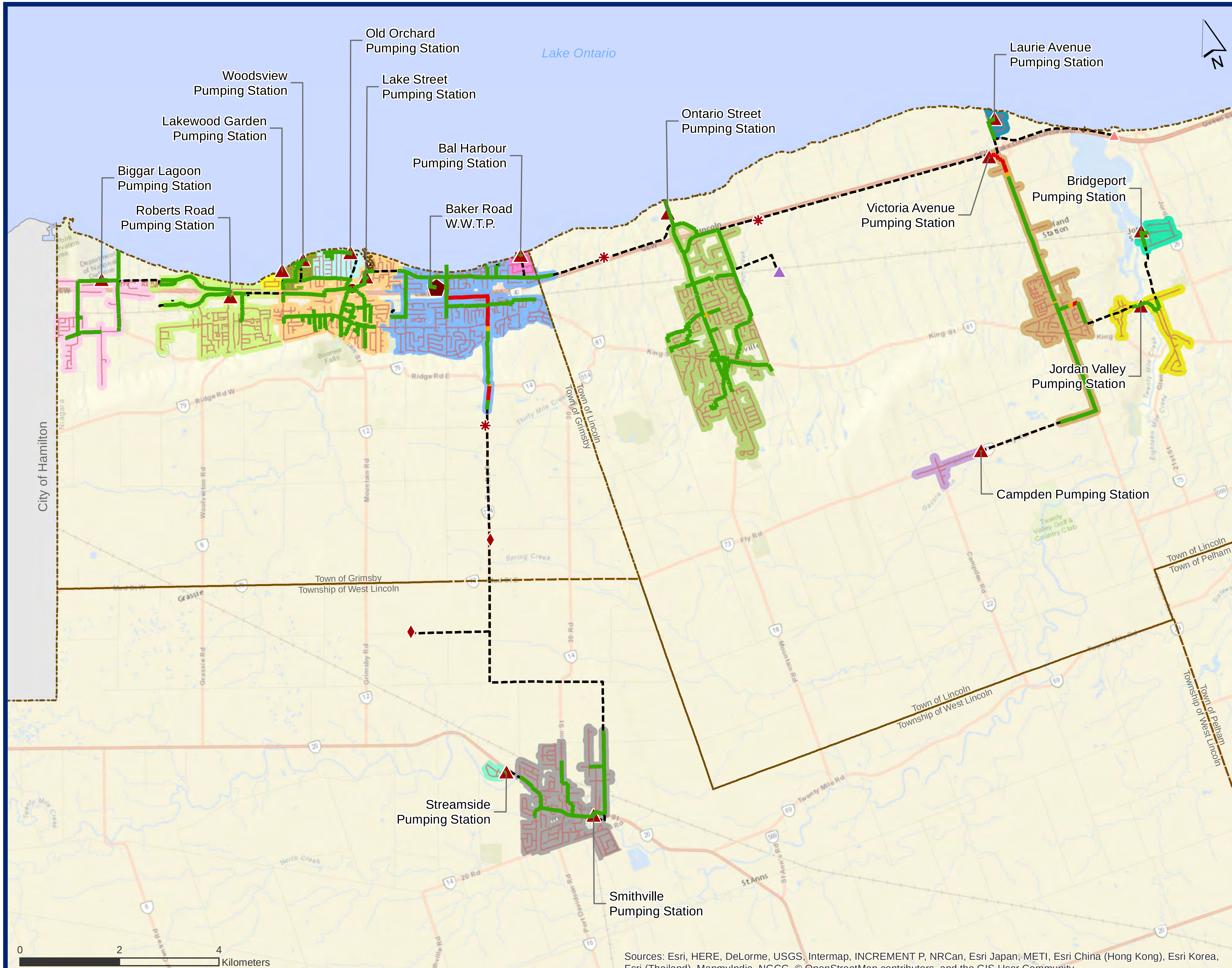
Table 4.A.13 Forcemain Performance

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Capacity @ 2.5 m/s (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Lake Street SPS	325.0	490.9	404.0	491.3	-0.4
Roberts Road SPS	256.3	397.6	187.2	258.5	139.1
Biggar Lagoon SPS	61.7	176.7	73.7	101.9	74.8
Old Orchard SPS	55.0	78.5	27.8	29.6	48.9
Woodsview SPS	37.0	78.5	14.3	14.3	64.2
Lakewood Garden SPS	14.5	44.2	7.0	8.2	36.0
Smithville SPS	120.0	176.7	200.6	335.8	-159.1
Streamside SPS	23.6	44.2	7.9	12.1	32.1
Ontario Street SPS	348.0	706.9	479.6	566.4	140.5
Victoria Avenue SPS	120.0	314.2	172.8	216.5	97.7
Campden SPS	11.0	44.2	13.8	19.0	25.2
Jordan Valley SPS	40.0	78.5	61.9	73.0	5.5
Bridgeport SPS	11.5	44.2	18.5	23.3	20.9
Laurie Avenue SPS	28.0	44.2	10.4	38.4	5.8
Bal Harbour SPS	16.6	44.2	9.4	9.6	34.6

The Smithville SPS forcemain and Laurie Avenue SPS forcemain have a projected capacity deficit. The Lake Street SPS forcemain has a marginal projected capacity deficit.

A.3.4 Trunk Sewer

Figure 4.A.4 and Figure 4.A.5 highlight the existing and projected peak wet weather flow, respectively. Trunk sewers in West Lincoln are approaching capacity within the 2041 time horizon.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Baker Road W.W.T.P.
- Bal Harbour
- Biggar Lagoon
- Bridgeport
- Campden
- Jordan Valley
- Lake Street
- Lakewood Garden
- Laurie Avenue
- Old Orchard
- Ontario Street
- Roberts Road
- Smithville
- Streamside
- Victoria Avenue
- Woodsview

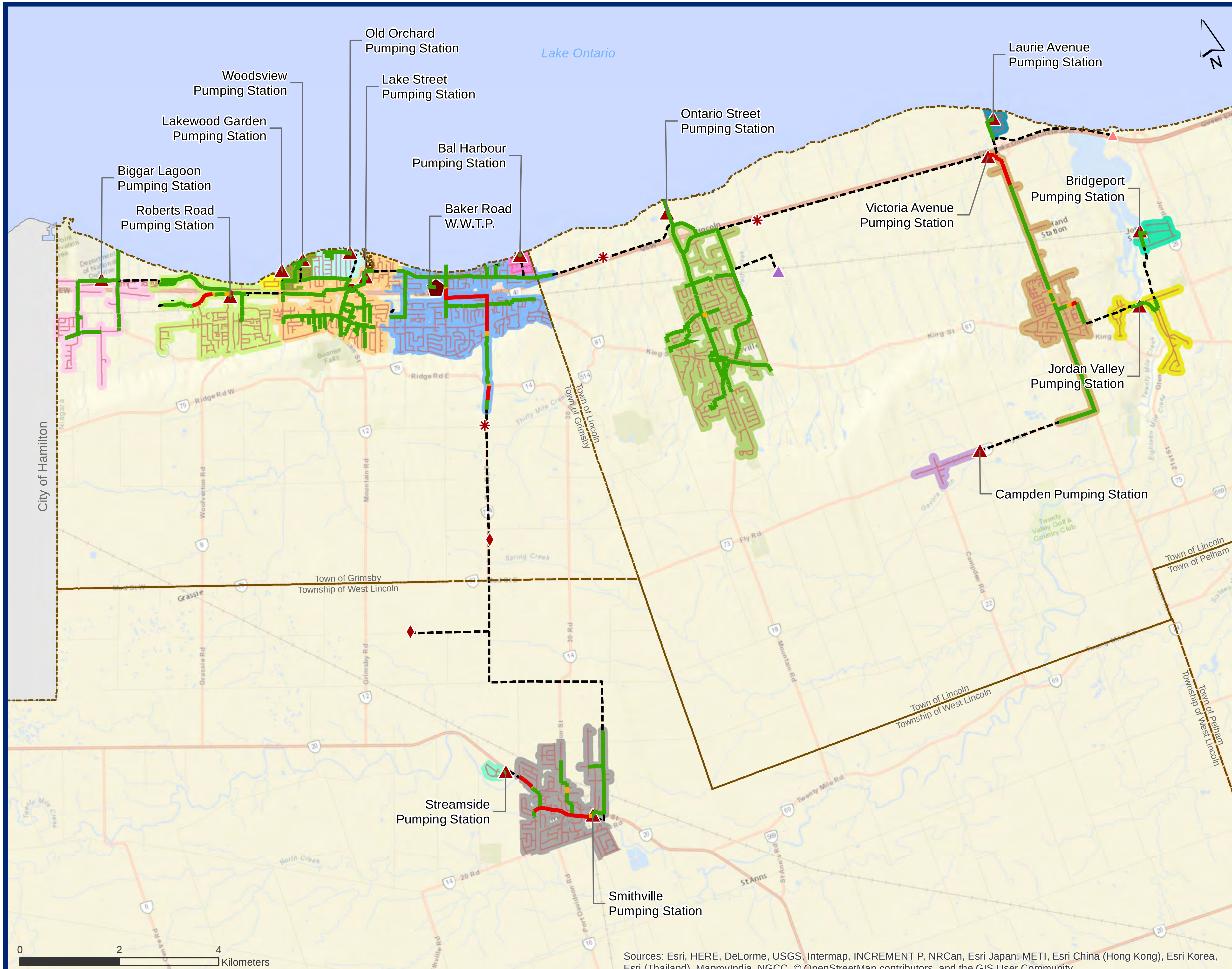
Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.A.4
Existing Peak Wet Weather Flow
Baker Road WWTP

BluePlan ENGINEERING

June 2017
715023-WW-4-Existing Wet Weather (Baker)
NAD 1983 UTM Zone 17N



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Baker Road W.W.T.P.
- Bal Harbour
- Biggar Lagoon
- Bridgeport
- Campden
- Jordan Valley
- Lake Street
- Lakewood Garden
- Laurie Avenue
- Old Orchard
- Ontario Street
- Roberts Road
- Smithville
- Streamside
- Victoria Avenue
- Woodsview

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.A.5
2041 Peak Wet Weather Flow
Baker Road WWTP

GM BluePlan Engineering

June 2017
715023-WW-5-2041 Wet Weather (Baker)
NAD 1983 UTM Zone 17N

A.4 System Opportunities and Constraints

Figure 4.A.6 highlights the existing opportunities and constraints.

A.4.1 Baker Road Wastewater Treatment Plant

- The current rated average daily flow capacity of the plant is 31.3 MLD, with an existing flow of 20.5 MLD. The plant has limited capacity in the future, with capacity upgrades required to support the projected 2041 average daily flow of 32.5 MLD.

A.4.2 Grimsby

- Residential and employment growth is spread out along the highway and service road corridors.
- Some areas of high wet weather flows, primarily in the Biggar Lagoon Sewage Pumping Station catchment and along the lakeshore.
- Existing and growth related capacity deficits at Biggar Lagoon Sewage Pumping Station.
- Growth is expected to trigger capacity deficit at Lake Street Sewage Pumping Station.

A.4.3 West Lincoln

- Significant infill and intensification growth is expected to occur in Smithville along the north, west, and south.
- Town currently undertaking works to manage existing wet weather flow issues.
- Growth will trigger upgrade needs at the Smithville Sewage Pumping Station, including downstream forcemain and sewer system.
- Increased conveyance is needed to move growth flows from the north, west, and south boundaries of the Smithville Sewage Pumping Station.
- Capacity upgrades at Streamside Sewage Pumping Station may be required depending on local growth plans and servicing strategies.

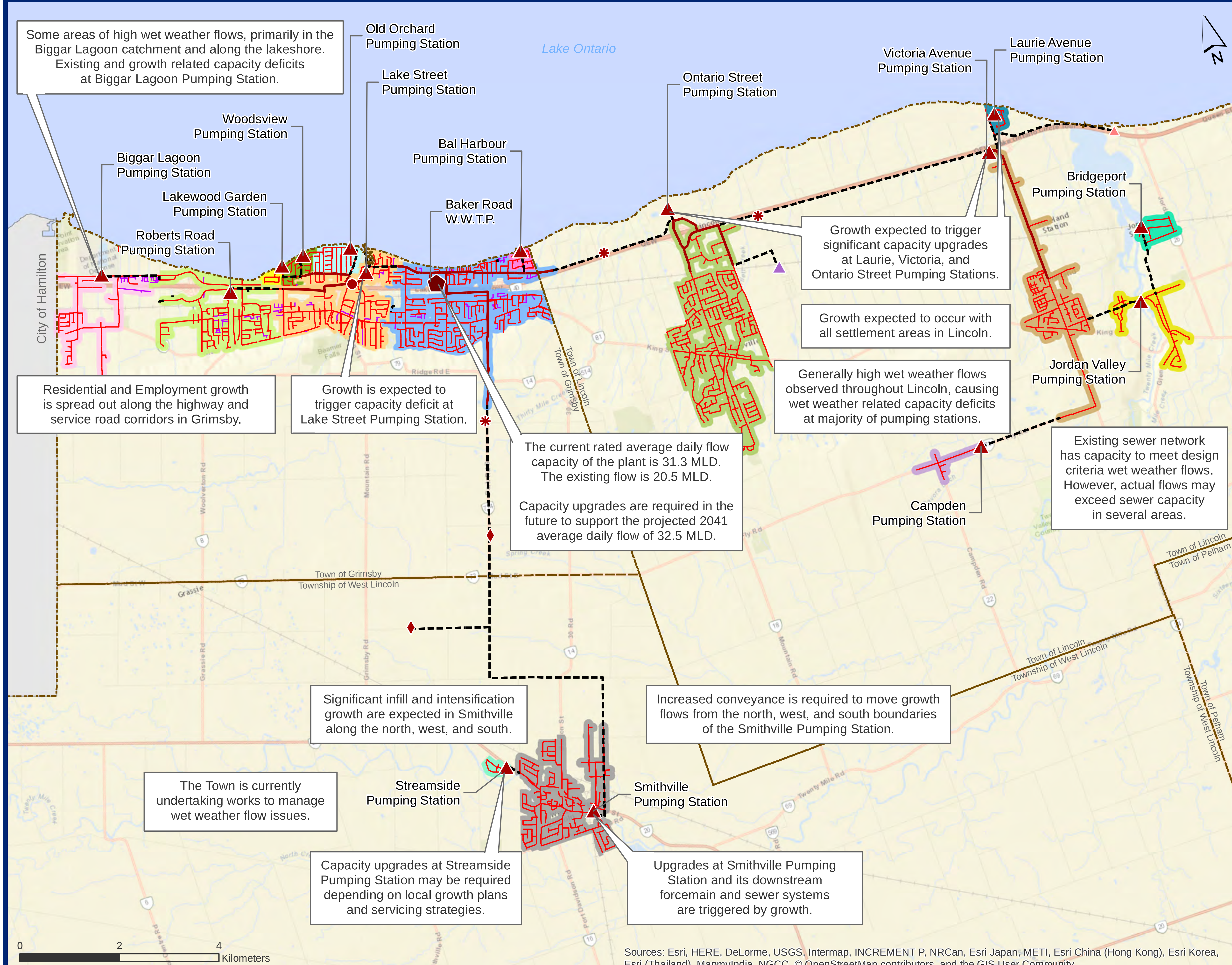
A.4.4 Lincoln

- Growth expected to occur within all settlement areas.
- Generally high wet weather flows observed across the system.

- Existing and growth-related wet weather capacity deficits in most catchments.
- Growth is expected to trigger significant capacity upgrades at Laurie Avenue Sewage Pumping Station, Victoria Avenue Sewage Pumping Station, and Ontario Street Sewage Pumping Station.
- Existing sewer network has capacity to meet design criteria wet weather flows; however, actual wet weather flows exceed sewer capacity in several areas.

A.4.5 System Optimization Opportunities

- Larger number of in-series pumping stations generates cascading impacts.
- Existing system configuration provides limited opportunities to optimize system including; system diversions to reduce sewage pumping station upgrades and/or eliminated existing sewage pumping station.
- Potential system optimization opportunities include:
  - Combination of Laurie Avenue Sewage Pumping Station and Victoria Avenue Sewage Pumping Station due to their close proximity.
  - Upsizing of Streamside Sewage Pumping Station and/or new West Smithville Sewage Pumping Station along with new West Smithville forcemain to reduce/eliminate upgrades to the existing Smithville Sewage Pumping Station and forcemain.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Baker Road W.W.T.P.
- Bal Harbour
- Biggar Lagoon
- Bridgeport
- Campden
- Jordan Valley
- Lake Street
- Lakewood Garden
- Laurie Avenue
- Old Orchard
- Ontario Street
- Roberts Road
- Smithville
- Streamside
- Victoria Avenue
- Woodsview

Figure 4.A.6
System Opportunities and Constraints
Baker Road WWTP

June 2017
715023-WW-3-Opportunities and Constraints (Baker)
NAD 1983 UTM Zone 17N

A.5 Assessment of Alternatives

The hybrid management strategy consists of:

- Providing capacity within Regional Sewage Pumping Station and trunk sewer to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Providing upstream flow management and peak flow management to address peak flows in systems where peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in potential basement flooding and overflow risks.

Further to the application of the above strategy, the following area specific alternatives were reviewed:

A.5.1 Prudhommes

Two alternatives for the Prudhommes area (Laurie Avenue Sewage Pumping Station and Victoria Avenue Sewage Pumping Station) were considered, presented in Figure 4.A.7 and Figure 4.A.8. The alternatives are as follows:

1. Maintain existing configuration, implementing upgrades to:
    - Laurie Avenue Sewage Pumping Station and forcemain
    - Victoria Avenue Sewage Pumping Station
2. Eliminate the Laurie Avenue Sewage Pumping Station and forcemain through a new gravity sewer crossing the QEW, and upgrade the Victoria Avenue Sewage Pumping Station.

It was found that Alternative 1 is preferred. While Alternative 2 allowed for the elimination of the existing Laurie Avenue Sewage Pumping Station and offset the Laurie Avenue Sewage Pumping Station and forcemain upgrades with a new gravity sewer, it presented the following disadvantages:

- Extensive re-configuration of the existing sewer system within the Prudhommes area to accommodate the QEW crossing.
- Significant construction challenges and costs associated with the new sewer QEW crossing, relative to the new forcemain crossing.
- A significant deepening of the Victoria Avenue Sewage Pumping Station would need to accommodate the Prudhommes gravity sewer, which may not be achievable at the Victoria Avenue Sewage Pumping Station site.

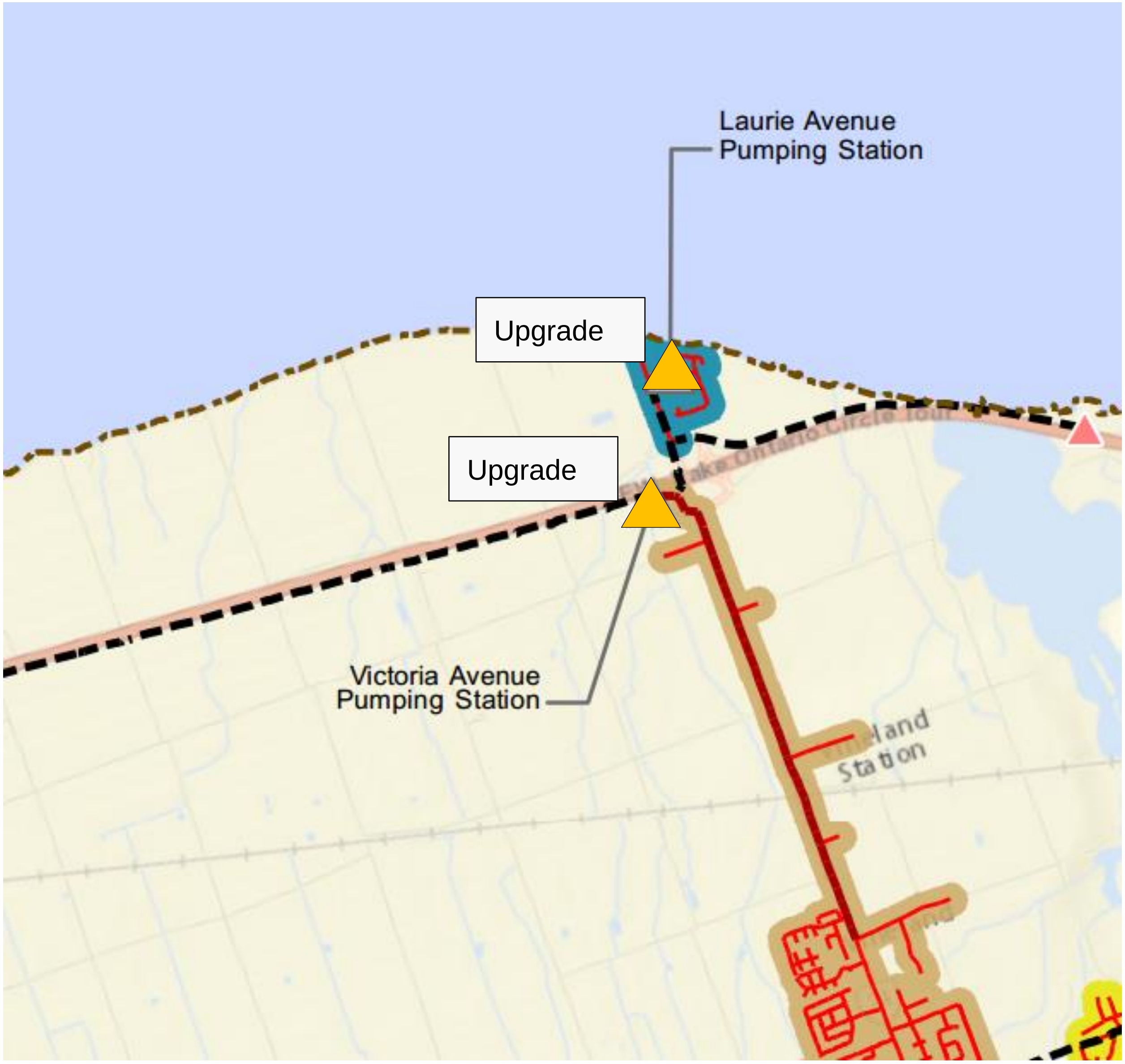


Figure 4.A.7 Alternative 1 – Upgrades to Existing Facilities

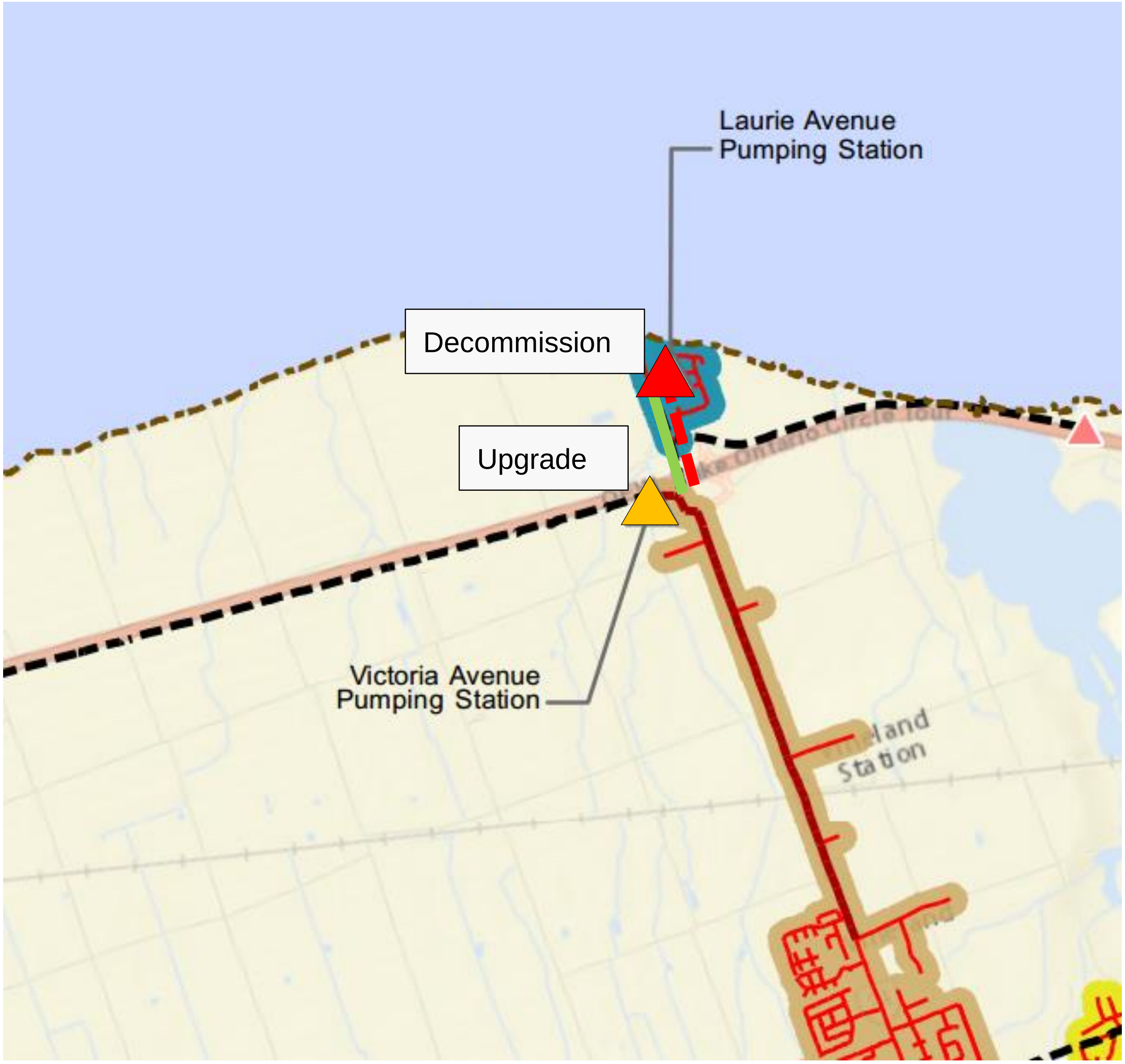


Figure 4.A.8 Alternative 2 – Decommission of Laurie Avenue Sewage Pumping Station

A.5.2 Smithville

Three alternatives for the Smithville area were considered, presented in Figure 4.A.9 through Figure 4.A.11, consisting of:

1. Maintaining existing configuration with implementation of the following:
   - Upgrade Smithville Sewage Pumping Station
   - Twin existing forcemain
   - Upgrade downstream sewers
2. Same as Alternative 1; however, includes utilization of existing abandoned parallel forcemain instead of twinning the existing forcemain.
3. Construct new West Smithville Sewage Pumping Station and new West Smithville forcemain to service growth areas.

It was found that Alternative 1 is the preferred alternative as:

- Use of the existing abandoned forcemain:
  - Still required significant large portions of rehabilitation/replacement.
  - Does not have sufficient capacity to support 2041 flows and an additional new forcemain twin would still be needed.
- New West Smithville Sewage Pumping Station and new West Smithville forcemain:
  - Does not reduce any upgrade needs downstream of the new West Smithville forcemain tie-in to the existing Smithville forcemain.
  - Requires construction of new pump station and forcemain instead of upgrades to existing infrastructure.
  - New configuration dependent on use of shared forcemain, which can present operational challenges.
- Alternative 1 allows for a tiered implementation of infrastructure, allowing upgrades to be phased with growth and potentially eliminated if growth flows are not realized, whereas Alternative 3 requires a substantial front-ending of upgrades.

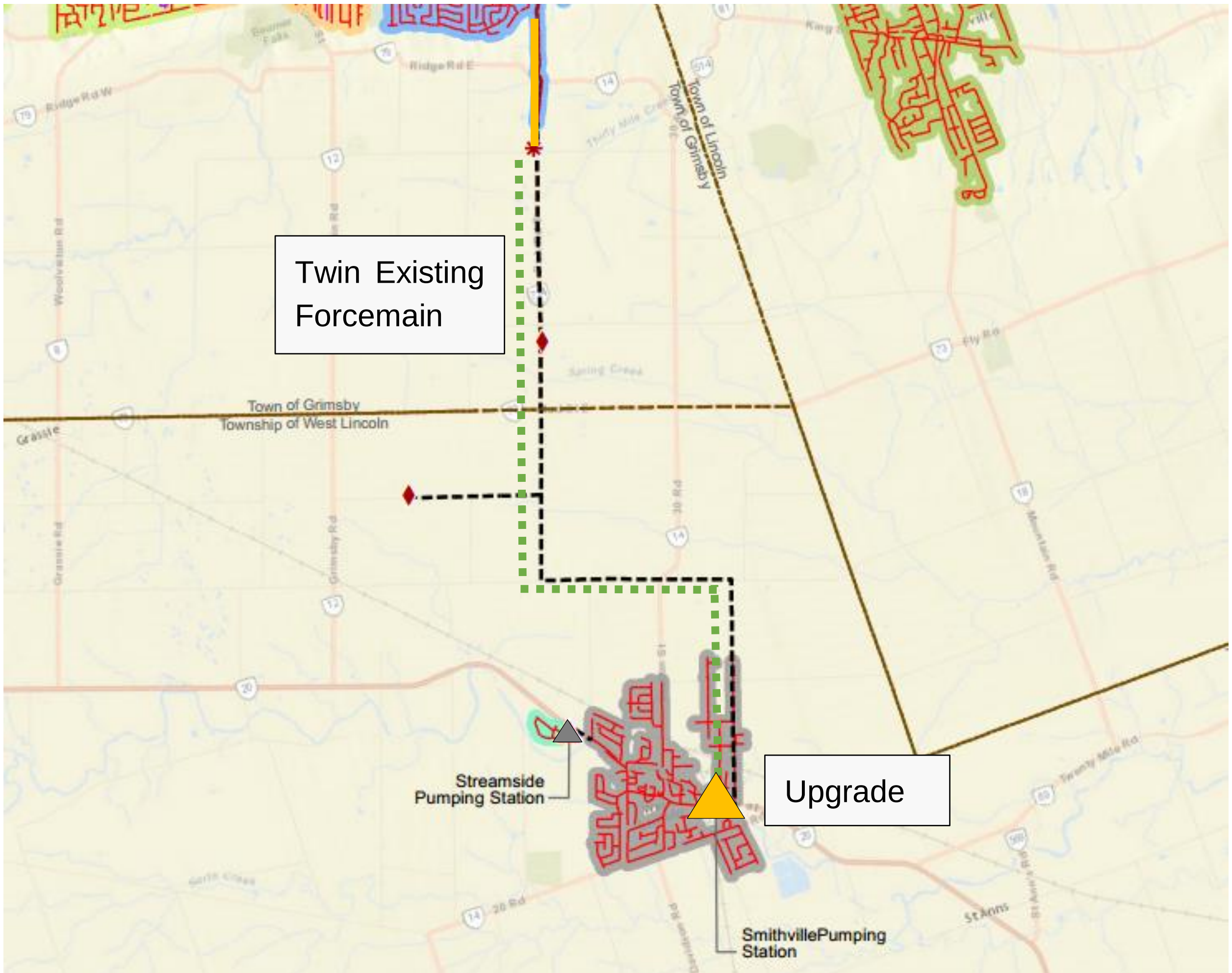


Figure 4.A.9 Alternative 1 – Upgrades and Forcemain Twinning

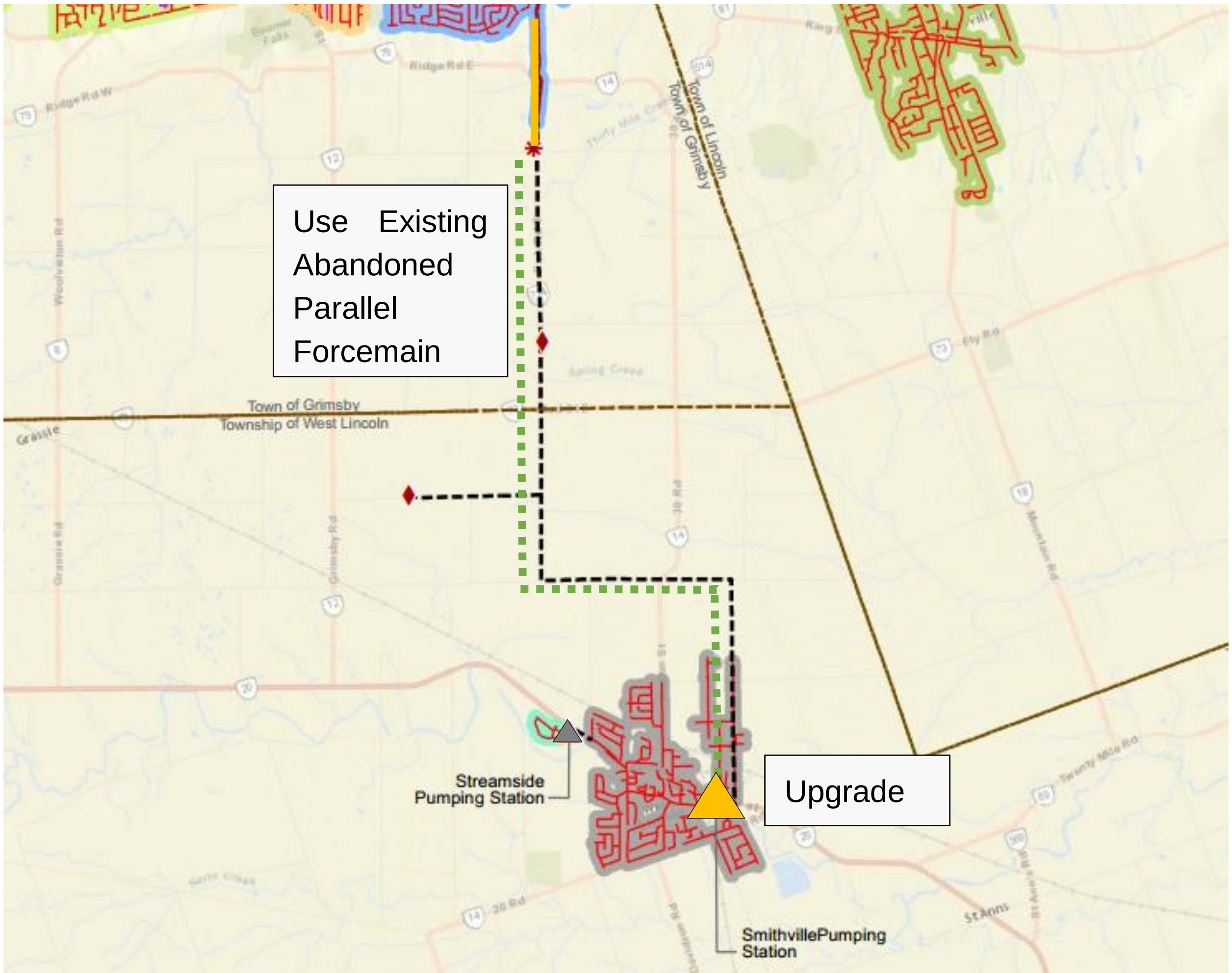


Figure 4.A.10 Alternative 2 – Upgrades and Use of Existing Abandoned Forcemian

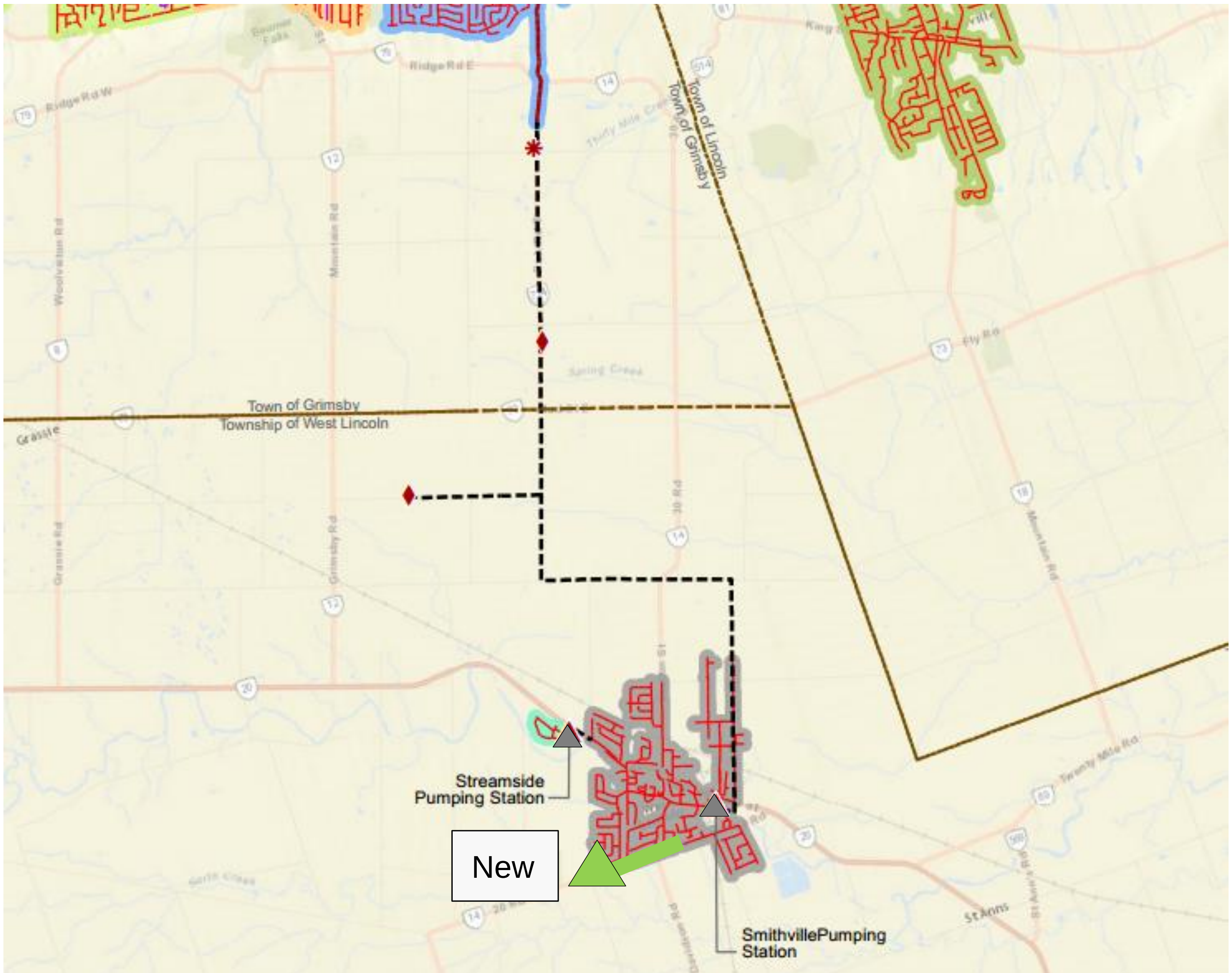


Figure 4.A.11 Alternative 3 – New West Sewage Pumping Station and Forcemain

A.6 Preferred Servicing Strategy

The following is a summary of the Baker Road wastewater servicing strategy, presented in Figure 4.A.12 and Figure 4.A.13:

- Based on the level of growth on the system, the Baker Road Wastewater Treatment Plant will require additional wastewater treatment capacity.
- The projected growth and wet weather flow needs across much of the service area has triggered sewage pumping station upgrades across many of the facilities.
- The sewage pumping station upgrades and potential trunk sewer capacity constraints will be mitigated by implementing wet weather management programs in west Grimsby, Beamsville, and Vineland.
- There is significant growth projected in Smithville in relation to existing infrastructure capacity. A new trunk sewer in the community, plus an expansion of the sewage pumping station will be required for the growth flows. The additional sewage pumping station capacity will require forcemain twinning and trunk sewer capacity upgrades downstream of the new forcemain.

Figure 4.A.12 and Figure 4.A.13 show the preferred servicing strategy and schematic, consisting of:

A.6.1 Treatment Plant

Provide an additional 16 MLD of treatment capacity at the wastewater treatment plant.

A.6.2 Pumping Station

The following sewage pumping station upgrades are required:

- Smithville Sewage Pumping Station expansion: Increase capacity from 120 L/s to 375 L/s, and new 400 mm twin forcemain
- Campden Sewage Pumping Station pump replacement: Increase capacity from 11 L/s to 19 L/s
- Laurie Avenue Sewage Pumping Station expansion: Increase capacity from 28 L/s to 48 L/s, and upgrade of forcemain from 150 mm to 250 mm
- Victoria Avenue Sewage Pumping Station upgrade: Increase capacity from 120 L/s to 230 L/s

- Bridgeport Sewage Pumping Station pump replacement: Increase capacity from 11 L/s to 24 L/s
- Jordan Valley Sewage Pumping Station pump replacement: Increase capacity from 40 L/s to 74 L/s
- Ontario Street Sewage Pumping Station upgrade: Increase capacity from 420 L/s to 600 L/s
- Biggar Lagoon Sewage Pumping Station pump replacement: Increase capacity from 95 L/s to 105 L/s
- Lake Street Sewage Pumping Station upgrade: Increase capacity from 375 L/s to 495 L/s

A.6.3 Conveyance

Sewer upgrades are recommended in Grimsby downstream of the Smithville forcemain and in Smithville upstream of the Smithville Sewage Pumping Station.

A.6.4 Wet Weather

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts. These wet weather management programs will need to be a joint initiative between the Region and local municipalities.

For the Baker Road system, the following priority areas are identified:

- West Grimsby area, consisting of the Biggar Lagoon Sewage Pumping Station, Roberts Road Sewage Pumping Station, Lakewood Garden Sewage Pumping Station, Woodsview Sewage Pumping Station, Old Orchard Sewage Pumping Station, and Lake Street Sewage Pumping Station catchments.
- Lincoln Beamsville area, consisting of the Ontario Street Sewage Pumping Station catchment.

- Lincoln Jordan Valley area, consisting of the Laurie Avenue Sewage Pumping Station, Victoria Avenue Sewage Pumping Station, Jordan Valley Sewage Pumping Station, and Bridgeport Sewage Pumping Station catchments.

Further flow monitoring and area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, Preferred Servicing Strategy are needed to identify area specific strategies and projects required to achieve the wet weather flow reduction objectives. Following the outcomes of the further studies, targeted funding can be applied outside the priority areas if the projects are found to address capacity issues and support growth capacity needs.

A.7 Capital Program

Table 4.A.14 summarizes the recommended project costing, implementation schedule and Class EA requirements.

A.7.1 Schedule B Project Files

Project files for Municipal Class Schedule B Environmental Assessment are attached in Appendix 1.

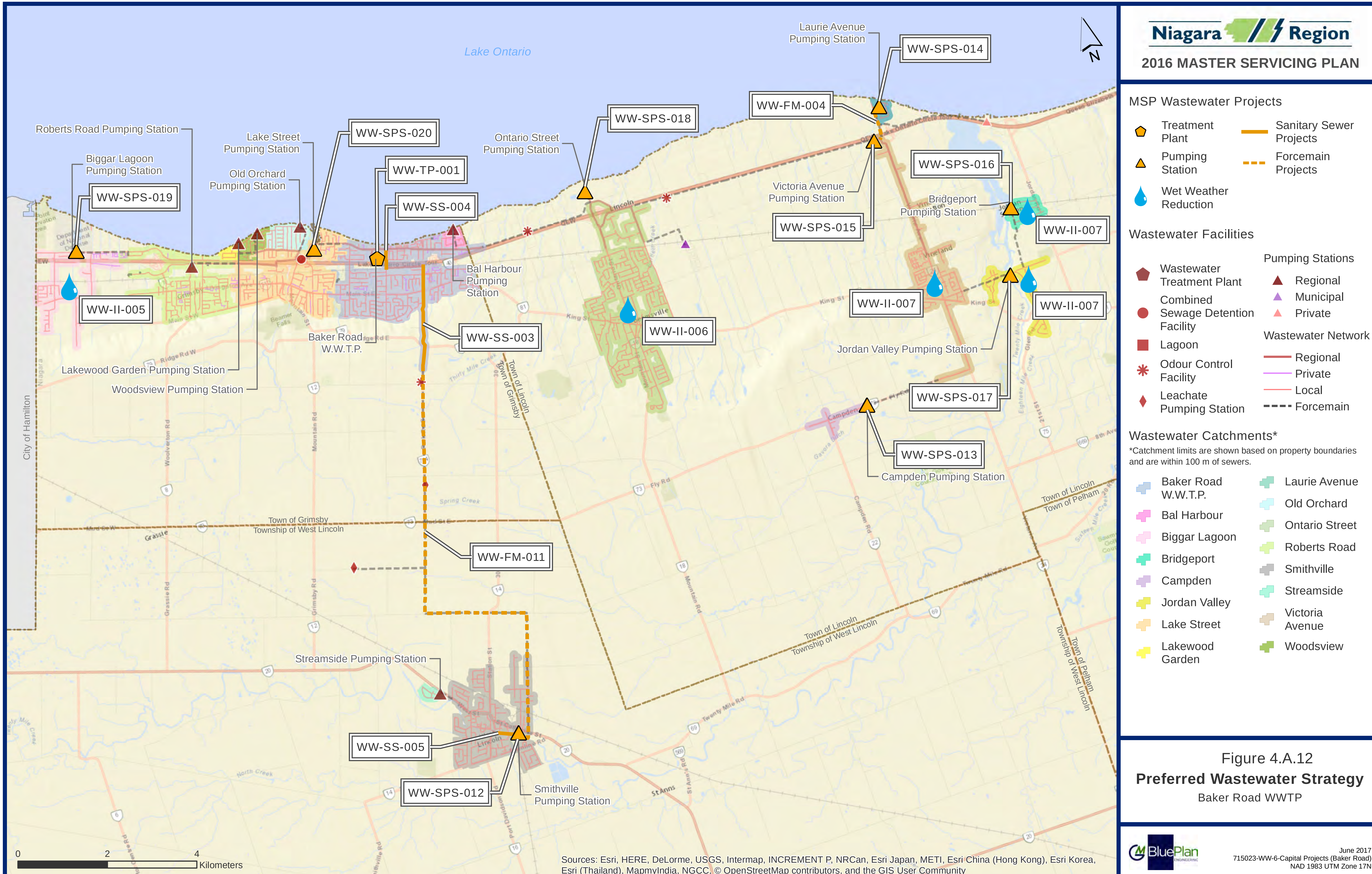
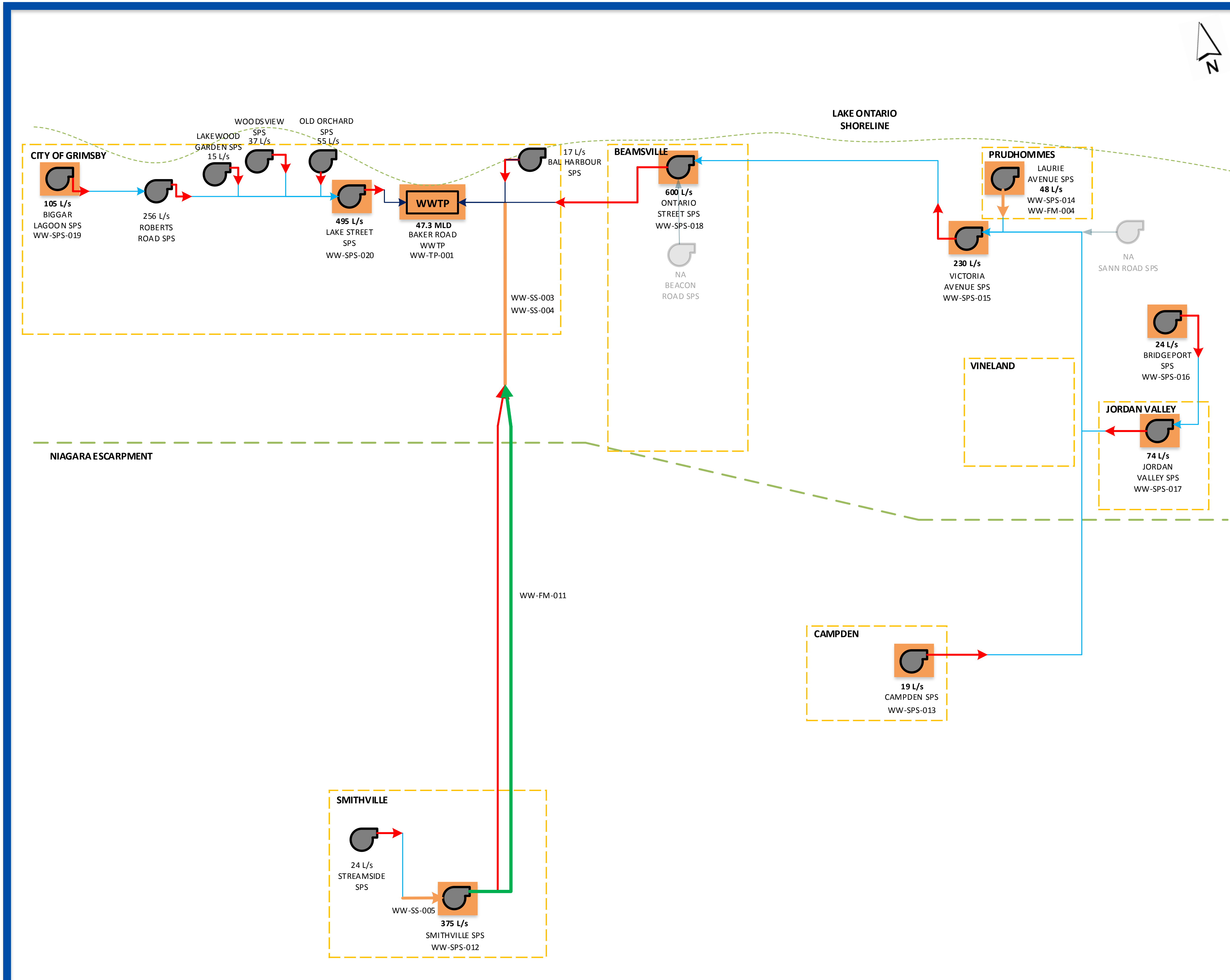


Figure 4.A.12
Preferred Wastewater Strategy
Baker Road WWTP



Niagara Region

2016 Master Servicing Plan

Baker Road WWTP

2041 COLLECTION SCHEMATIC

- WWTP (RATED CAPACITY) — Wastewater Treatment Plant
- (FIRM CAPACITY) — Sewage Pumping Station
- Forcemain
- Connection from SPS to SPS
- Connection from SPS to WWTP
- Facility Upgrade
- New Facility
- Upgrade Forcemain or Sewer
- New Forcemain or Sewer
- Decommission Project

June 2017
Figure 4.A.13
Not to Scale

GM BluePlan ENGINEERING

Table 4.A.14 Summary of Baker Road Wastewater Treatment Plant Capital Program

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-FM-004	Laurie Avenue Sewage Pumping Station (SPS) Forcemain Upgrade	Laurie Avenue SPS Forcemain Upgrade in Lincoln	250 mm	2017-2021	Lincoln	A+	Satisfied	Forcemain	$ 2,981,000
WW-FM-011	Smithville Forcemain twinning	Twin existing Smithville Forcemain	400 mm	2022-2031	West Lincoln	A+	Satisfied	Forcemain	$ 18,132,000
WW-II-005	Wet weather reduction in West Grimsby	Wet weather reduction in West Grimsby	50 L/s reduction	2022-2031	Grimsby	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 7,500,000
WW-II-006	Wet weather reduction in Beamsville	Wet weather reduction in Beamsville	20 L/s reduction	2022-2031	Lincoln	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 3,000,000
WW-II-007	Wet weather reduction in Jordan Valley	Wet weather reduction in Jordan Valley	10 L/s reduction	2022-2031	Lincoln	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 1,500,000
WW-SPS-012	Smithville SPS Expansion - Baker Road	Increase station capacity from 120 L/s to 375 L/s	375 L/s	2022-2031	West Lincoln	B	Satisfied (Project File Included)	Pumping	$ 8,241,000
WW-SPS-013	Campden SPS Pump Replacement - Baker Road	Increase station capacity from 11 L/s to 19 L/s pumps	19 L/s	2022-2031	Lincoln	A+	Satisfied	Pumping	$ 1,299,000
WW-SPS-014	Laurie Avenue SPS Expansion - Baker Road	Increase station capacity from 28 L/s to 48 L/s	48 L/s	2017-2021	Lincoln	B	Satisfied (Project File Included)	Pumping	$ 1,814,000
WW-SPS-015	Victoria Avenue SPS Upgrade - Baker Road	Increase station capacity from 120 L/s to 230 L/s	230 L/s	2017-2021	Lincoln	B	Satisfied (Project File Included)	Pumping	$ 4,051,000
WW-SPS-016	Bridgeport SPS Pump Replacement - Baker Road	Increase station capacity from 11 L/s to 24 L/s Use implementation plan prior to upgrade: Flow monitoring, validate wet weather flows, re-evaluate required upgrades	24 L/s	2022-2031	Lincoln	A+	Dependent on outcome of wet weather flow study	Pumping	$ 834,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-SPS-017	Jordan Valley SPS Pump Replacement - Baker Road	Increase station capacity from 40 L/s to 74 L/s Use implementation plan prior to upgrade: Flow monitoring, validate wet weather flows, re-evaluate required upgrades	74 L/s	2022-2031	Lincoln	A+	Dependent on outcome of wet weather flow study	Pumping	$ 1,145,000
WW-SPS-018	Ontario Street SPS Upgrade - Baker Road	Increase station capacity from 420 L/s to 600 L/s	600 L/s	2032-2041	Lincoln	B	Satisfied (Project File Included)	Pumping	$ 3,755,000
WW-SPS-019	Biggar Lagoon Pump Replacement - Baker Road	Increase station capacity from 60 L/s to 105 L/s; Also includes SOGR project as per Niagara Region capital forecast	105 L/s	2017-2021	Grimsby	A+	Satisfied	Pumping	$ 3,902,000
WW-SPS-020	Lake St SPS Upgrade - Baker Road	Increase station capacity from 375 L/s to 495 L/s	495 L/s	2017-2021	Grimsby	B	Satisfied (Project File Included)	Pumping	$ 4,410,000
WW-SS-003	Gravity Sewer upgrade in Grimsby	Upgrade gravity sewer downstream of Smithville forcemain from 375 mm to 525 mm	525 mm	2022-2031	Grimsby	A+	Satisfied	Sewer	$ 5,667,000
WW-SS-004	Gravity Sewer upgrade in Grimsby	Upgrade gravity sewer downstream of Smithville forcemain from 375 mm to 525 mm	525 mm	2022-2031	Grimsby	A+	Satisfied	Sewer	$ 923,000
WW-SS-005	Gravity Sewer upgrade in Smithville	Upgrade gravity sewer upstream of Smithville SPS from 450 mm to 600 mm	600 mm	2022-2031	West Lincoln	A+	Satisfied	Sewer	$ 2,286,000
WW-TP-001	Baker Road WWTP Upgrade	Baker Road WWTP Upgrade to provide an additional 16 MLD	47.3 MLD	2022-2031	Grimsby	C	Separate EA Required	Treatment	$ 41,730,000
Total									**$ 113,170,000**

PART B
PORT DALHOUSIE WASTEWATER SYSTEM

B. PORT DALHOUSIE WASTEWATER TREATMENT PLANT

B.1 Existing System Overview

The Port Dalhousie wastewater system services the western part of both the City of St. Catharines and the City of Thorold. The system services an existing population of 71,500 and 44,169 employees.[1]

The system is serviced by the Port Dalhousie Wastewater Treatment Plant located at 40 Lighthouse Road, City of St. Catharines. Port Dalhousie Wastewater Treatment Plant is a conventional activated sludge facility with screening, grit removal, primary clarification, aeration and secondary clarification, with a current rated capacity of 61.4 MLD, and a peak flow capacity of 100.0 MLD[2].

Figure 4.B.1 presents an overview of the wastewater system, and Figure 4.B.2 shows a schematic of the wastewater system.

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[1] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*

[2] *Ministry of Environment and Climate Change, 8 April 2015. Ammeded Environmental Compliance Approval. Number 3704-9UALK5*

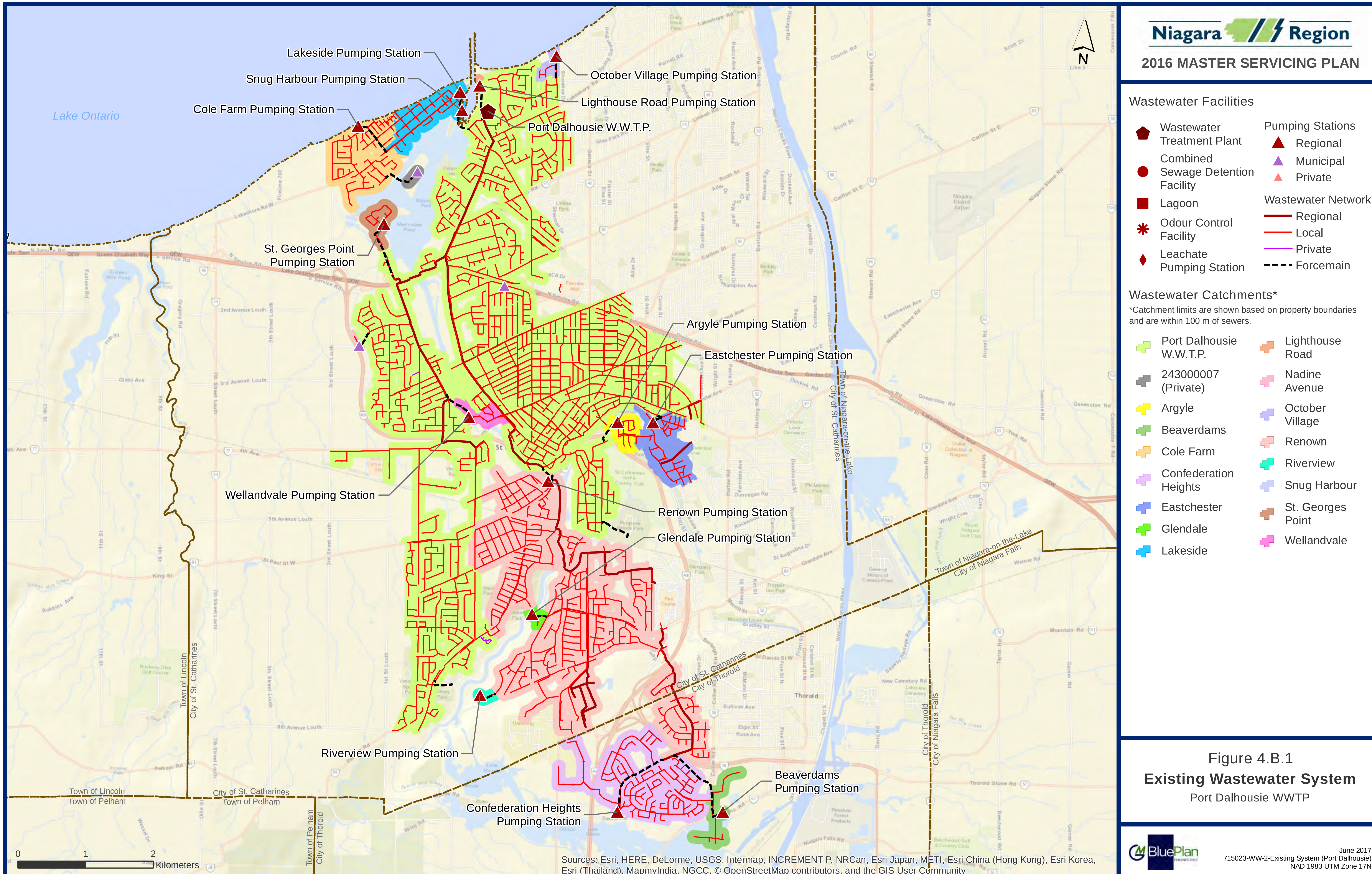
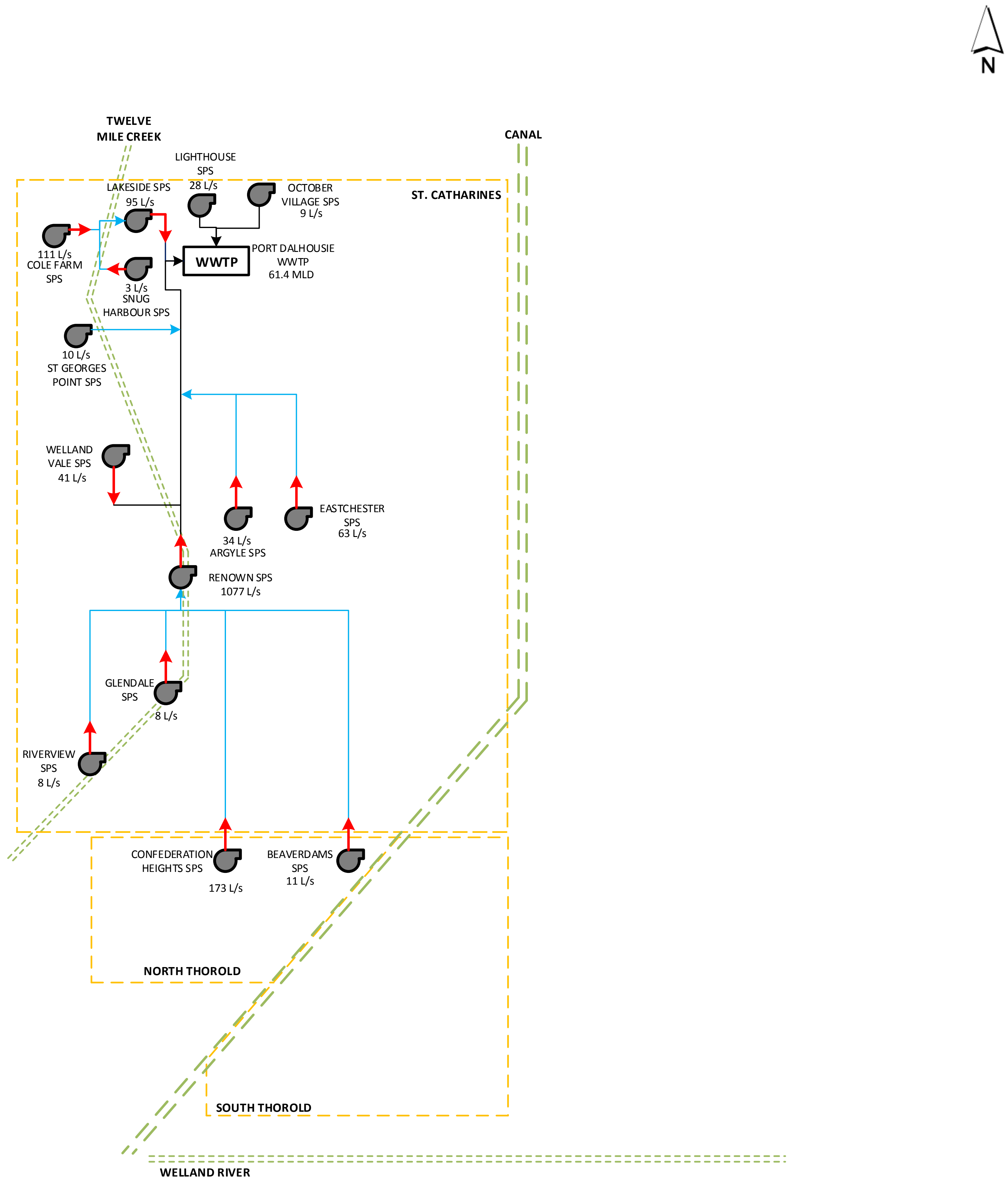


Figure 4.B.1
Existing Wastewater System
Port Dalhousie WWTP



Niagara Region

2016 Master Servicing Plan

Port Dalhousie WWTP

EXISTING COLLECTION SCHEMATIC

Legend

WWTP — RATED CAPACITY — Wastewater Treatment Plant

FIRM CAPACITY — Sewage Pumping Station

Forcemain

Connection from SPS to SPS

Connection from SPS to WWTP

June 2017
Figure 4.B.2
Not to Scale

BluePlan ENGINEERING

B.1.1 Service Area Overview

Table 4.B.1 provides a list of facility catchments and their areas. Refer to Figure 4.B.1 for the catchment areas of each facility.

Table 4.B.1 Facilities and Catchment Areas

Facility	Catchments	Catchment Area (ha)
Port Dalhousie Wastewater Treatment Plant (WWTP)	**Port Dalhousie WWTP** (Including Sub Catchments) Lakeside SPS Lighthouse Road SPS October Village SPS St. Georges Point SPS Wellandvale SPS Argyle SPS Eastchester SPS Renown SPS	3,184.1
	Port Dalhousie WWTP (Excluding Sub Catchments)	1,897.1
Lakeside Sewage Pumping Station (SPS)	**Lakeside SPS** (Including Sub Catchments) Cole Farm SPS Snug Harbour SPS	168.6
	Lakeside SPS (Excluding Sub Catchments)	58.9
Cole Farm SPS	Cole Farm SPS	107.9
Snug Harbour SPS	Snug Harbour SPS	1.9
Lighthouse Road SPS	Lighthouse Road SPS	2.2
October Village SPS	October Village SPS	11.3
St. Georges Point SPS	St. Georges Point SPS	25.5
Wellandvale SPS	Wellandvale SPS	17.9
Argyle SPS	Argyle SPS	22.8
Eastchester SPS	Eastchester SPS	67.1
Renown SPS	**Renown SPS** (Including Sub Catchments) Glendale SPS Riverview SPS Confederation Heights SPS Beaverdams SPS	971.6
	Renown SPS (Excluding Sub Catchments)	712.3

Facility	Catchments	Catchment Area (ha)
Glendale SPS	Glendale SPS	7.9
Riverview SPS	Riverview SPS	7.2
Confederation Heights SPS	Confederation Heights SPS	204.2
Beaverdams SPS	Beaverdams SPS	40.0

B.1.2 Facility Overview

Table 4.B.2 Wastewater Treatment Plant Overview

Plant Name	Port Dalhousie Wastewater Treatment Plant
Address	40 Lighthouse Road, St. Catharines
Discharge Water	Lake Ontario
Rated Capacity: Average Daily Flow	61.4 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	Not Available
Rated Capacity: Peak Flow Rate (Wet Weather)	100.0 MLD
Key Processes	• Conventional activated sludge treatment with screening • Grit removal • Primary Clarification • Aeration • Secondary clarification

Table 4.B.3 Wastewater Treatment Plant Effluent Objectives

Effluent Parameter	Objective Concentration[3]
$CBOD_5$	15.0 mg/L
TSS	15.0 mg/L
Total Phosphorus	0.5 mg/L
E. Coli	200 organisms/100 mL
Total Chlorine Residual	0.5 mg/L

Table 4.B.4 Pumping Station Overview

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Lakeside Sewage Pumping Station (SPS)	Lakeside Park, St. Catharines	3	150.0	95.0	Unknown
Cole Farm SPS	26 Colton Avenue, St. Catharines	3	111.0	111.0	18.2
Snug Harbour SPS	Lakeport Road, St. Catharines	2	3.3	3.3	Unknown
Lighthouse Road SPS	Lot 20, Concession 1 Granthem, St. Catharines	2	28.1	28.0	12.2
October Village SPS	October Drive, St. Catharines	2	9.4	9.0	10.0
St. Georges Point SPS	St. George Subdivision, St. Catharines	2	10.2	10.0	11.7
Wellandvale SPS	81 Welland Vale Road, St. Catharines	2	41.0	41.0	27.1
Argyle SPS	Argyle Crescent, St. Catharines	3	34.0	34.0	Unknown
Eastchester SPS	2A Eastchester Avenue, St. Catharines	2	63.0	63.0	28.0

[3] *Ministry of Environment and Climate Change, 8 April 2015. Ammeded Environmental Compliance Approval. Number 3704-9UALK5*

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Renown SPS	Renown Road, St. Catharines	4	1,515.0	1,077.4	15.5
Glendale SPS	Not Available	2	7.6	7.6	Unknown
Riverview SPS	Riverview Blvd, St. Catharines	2	9.5	8.0	12.5
Confederation Heights SPS	Richmond Street, St. Catharines	2	173.5	173.0	Unknown
Beaverdams SPS	Beaverdams Road, Thorold	2	14.0	10.7	20.1

Table 4.B.5 Forcemain Overview

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Length (m)	Diameter (mm)	Capacity @ 2.5 m/s (L/s)
Lakeside Sewage Pumping Station (SPS)	95.0	701	300	176.7
Cole Farm SPS	111.0	613	300	176.7
Snug Harbour SPS	3.3	58	100	19.6
Lighthouse Road SPS	28.0	499	200	78.5
October Village SPS	9.0	332	100	19.6
St. Georges Point SPS	10.0	904	150	44.2
Wellandvale SPS	41.0	506	400	314.2
Argyle SPS	34.0	396	200	78.5
Eastchester SPS	63.0	218	200	122.7
Renown SPS	1,077.4	343	750	1,104.5
Glendale SPS	7.6	250	100	19.6
Riverview SPS	8.0	292	150	44.2
Confederation Heights SPS	173.0	1,165	400	314.2
Beaverdams SPS	10.7	1,404	150	44.2

B.1.3 Flows Overview

Table 4.B.6 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.B.7 shows the existing wastewater system flows by catchment.

Table 4.B.6 Historic Port Dalhousie Wastewater Treatment Plant Flows

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	L/s	MLD	L/s	MLD	L/s
2011	36.9	427.1	38.4	444.4	134.2	1,553.2
2012	29.5	341.4	32.0	370.4	118.7	1,373.8
2013	34.3	397.0	37.7	436.3	146.0	1,689.8
2014	33.0	381.9	34.8	402.8	124.0	1,435.2
2015	29.5	341.4	30.6	354.2	98.1	1,135.4
5 Year Average	32.7	378.5	34.7	401.6	124.2	1,437.5
5 Year Peak	36.9	427.1	38.4	444.4	146.0	1,689.8

Table 4.B.7 Existing Wastewater System Flows by Catchment

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Port Dalhousie Wastewater Treatment Plant (WWTP)	115,669	377.9	1,666.5	3,868.5	6,189.6
Port Dalhousie WWTP	81,109	257.6	1,057.8	1,858.5	3,345.0
Lakeside Sewage Pumping Station (SPS)	4,608	8.4	64.9	167.1	300.3
Lakeside SPS	2,482	3.6	24.0	57.3	103.0
Cole Farm SPS	2,127	4.6	40.1	107.9	194.0
Snug Harbour SPS	0	0.1	0.8	1.9	3.3
Lighthouse Road SPS	0	0.1	0.8	2.2	4.0
October Village SPS	1,692	1.3	5.7	11.3	20.0
St. Georges Point SPS	264	0.5	8.3	25.6	46.0
Wellandvale SPS	708	7.4	20.0	81.0	146.0
Argyle SPS	599	5.1	16.7	22.8	41.0
Eastchester SPS	2,204	6.7	32.6	88.6	118.1
Renown SPS	24,486	90.9	459.6	1,585.8	2,123.2
Renown SPS	15,058	73.0	349.8	1,353.0	1,799.8
Glendale SPS	24	0.3	2.8	7.9	11.0
Riverview SPS	1,827	0.1	2.3	7.2	10.0
Confederation Heights SPS	7,169	15.7	89.8	208.2	289.7
Beaverdams SPS	408	1.7	14.8	9.5	12.7

Note: Flow numbers may not sum due to rounding.

B.2 Growth Projections

B.2.1 Population Projections and Allocations

Table 4.B.8 and Table 4.B.9 outline the existing and projected serviced population and employment by catchment.

Table 4.B.8 Port Dalhousie Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Port Dalhousie Wastewater Treatment Plant	47,135	47,937	50,497	53,566	59,305	63,672	16,536
Argyle Sewage Pumping Station (SPS)	520	567	588	602	742	838	317
Beaverdams SPS	98	142	144	149	172	184	86
Cole Farm SPS	2,079	2,020	2,015	2,028	2,053	2,074	-5
Confederation Heights SPS	4,040	4,044	4,426	5,008	7,149	8,231	4,191
Eastchester SPS	1,388	1,365	1,631	1,825	2,041	2,200	813
Glendale SPS	0	0	0	0	0	0	0
Lakeside SPS	1,959	2,063	2,135	2,331	2,554	2,721	761
Lighthouse Road SPS	0	0	0	0	0	0	0
October Village SPS	1,692	1,660	1,707	1,741	1,769	1,792	100
Renown SPS	9,994	10,487	11,155	11,744	12,081	12,246	2,252
Riverview SPS	1,827	1,760	1,792	1,820	1,849	1,873	46
Snug Harbour SPS	0	0	0	0	0	0	0
St. Georges Point SPS	147	134	134	136	138	140	-7
Wellandvale SPS	620	754	973	1,085	1,114	1,160	540
Total	**71,500**	**72,932**	**77,198**	**82,035**	**90,967**	**97,131**	**25,631**

Note: Population numbers may not sum due to rounding.

Table 4.B.9 Port Dalhousie Wastewater Treatment Plant Existing and Projected Serviced Employment by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Port Dalhousie Wastewater Treatment Plant	33,973	36,638	38,129	40,585	42,897	45,992	12,019
Argyle Sewage Pumping Station (SPS)	78	80	82	84	87	90	12
Beaverdams SPS	310	355	378	413	450	499	190
Cole Farm SPS	48	49	50	52	53	55	7
Confederation Heights SPS	3,129	3,348	3,513	3,691	3,910	4,157	1,027
Eastchester SPS	816	836	854	888	940	989	173
Glendale SPS	24	25	25	26	27	28	4
Lakeside SPS	522	535	547	561	579	600	78
Lighthouse Road SPS	0	0	0	0	0	0	0
October Village SPS	0	0	0	0	0	0	0
Renown SPS	5,064	5,192	5,306	5,450	5,618	5,961	897
Riverview SPS	0	0	0	0	0	0	0
Snug Harbour SPS	0	0	0	0	0	0	0
St. Georges Point SPS	116	119	122	125	129	134	17
Wellandvale SPS	88	90	92	97	102	115	27
Total	**44,169**	**47,268**	**49,098**	**51,972**	**54,792**	**58,620**	**14,451**

Note: Population numbers may not sum due to rounding.

B.2.2 Future Flow Projections

Table 4.B.10 and Table 4.B.11 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

Table 4.B.10 Projected Peak Dry Weather Flow by Catchment

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Port Dalhousie Wastewater Treatment Plant	538.0	564.1	599.2	649.0	694.1
Argyle Sewage Pumping Station (SPS)	10.7	11.0	11.2	12.9	14.1
Beaverdams SPS	4.5	4.8	5.3	6.1	6.8
Cole Farm SPS	8.6	8.5	8.7	9.0	9.3
Confederation Heights SPS	33.6	38.9	46.1	67.5	79.0
Eastchester SPS	13.4	16.6	19.1	22.0	24.2
Glendale SPS	0.5	0.5	0.5	0.5	0.6
Lakeside SPS	8.5	9.4	11.7	14.3	16.3
Lighthouse Road SPS	0.2	0.2	0.2	0.2	0.2
October Village SPS	2.1	2.7	3.1	3.4	3.7
Renown SPS	151.6	158.3	164.6	168.8	173.1
Riverview SPS	-0.5	-0.1	0.2	0.6	0.8
Snug Harbour SPS	0.3	0.3	0.3	0.3	0.3
St. Georges Point SPS	0.9	0.9	1.0	1.1	1.2
Wellandvale SPS	16.5	19.2	20.5	20.9	21.6
Total	**789.0**	**835.5**	**891.7**	**976.6**	**1,045.1**

The following presents an example calculation of projected peak dry weather flow.

2041 Peak Dry Weather Flow for Confederation Heights Sewage Pumping Station:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (15.71 L/s × 2.0) + (12,388 – 7,169 people) × 275 L/cap/day × 1 day/86400 s × 2.86
= 79.0 L/s

Table 4.B.11 Projected Peak Wet Weather Flow by Catchment

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Port Dalhousie Wastewater Treatment Plant	1,080.5	1,106.7	1,141.7	1,191.6	1,236.6
Argyle Sewage Pumping Station (SPS)	17.3	17.5	17.7	19.5	20.7
Beaverdams SPS	16.0	16.3	16.8	17.5	18.3
Cole Farm SPS	39.4	39.4	39.5	39.8	40.1
Confederation Heights SPS	92.0	97.3	104.5	125.9	137.4
Eastchester SPS	32.6	35.8	38.3	41.1	43.3
Glendale SPS	2.8	2.8	2.8	2.8	2.8
Lakeside SPS	25.3	26.3	28.6	31.2	33.1
Lighthouse Road SPS	0.8	0.8	0.8	0.8	0.8
October Village SPS	5.4	5.9	6.3	6.6	6.9
Renown SPS	355.3	362.0	368.3	372.6	376.8
Riverview SPS	1.6	1.9	2.3	2.6	2.9
Snug Harbour SPS	0.8	0.8	0.8	0.8	0.8
St. Georges Point SPS	8.2	8.2	8.3	8.4	8.5
Wellandvale SPS	21.7	24.3	25.6	26.0	26.7
Total	**1,699.6**	**1,746.1**	**1,802.4**	**1,887.2**	**1,955.7**

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for Confederation Heights Sewage Pumping Station:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 79.0 L/s + (204.2 ha × 0.286 L/s/ha)
= 137.4 L/s

B.3 Assessment of Wastewater Infrastructure (Existing and Future)

B.3.1 Treatment Plant Capacity

Figure 4.B.3 shows the projected future demands at the Port Dalhousie Wastewater Treatment Plant. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.

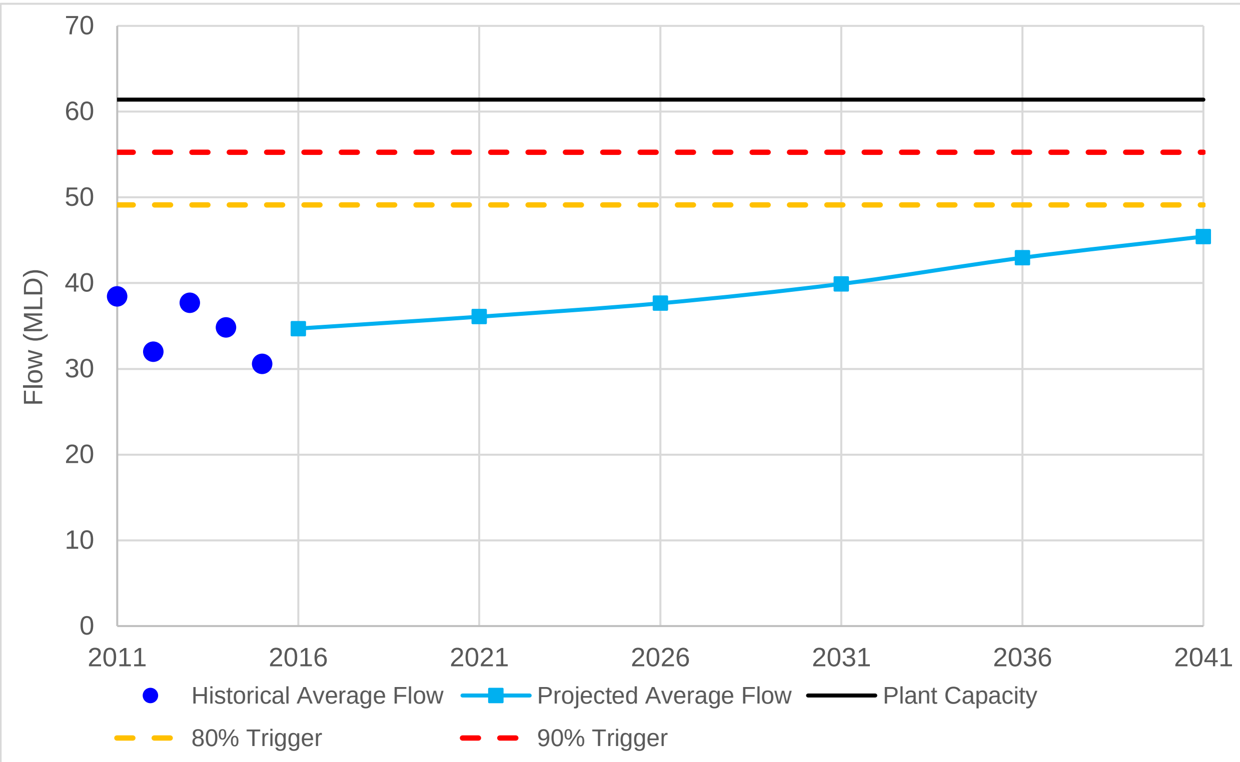


Figure 4.B.3 Projected future demands at Port Dalhousie Wastewater Treatment Plant

B.3.2 Sewage Pumping Station

Table 4.B.12 highlights the sewage pumping station existing and projected capacity.

Table 4.B.12 System Sewage Pumping Station Performance

Sewage Pumping Station	Contributing Catchments	Facility Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Lakeside Sewage Pumping Station (SPS)	Lakeside SPS Cole Farm SPS Snug Harbour SPS	95.0	64.9	73.5	21.5
Cole Farm SPS	Cole Farm SPS	111.0	40.1	40.1	70.9
Snug Harbour SPS	Snug Harbour SPS	3.3	0.8	0.8	2.5
Lighthouse Road SPS	Lighthouse Road SPS	28.0	0.8	0.8	27.2
October Village SPS	October Village SPS	9.0	5.7	6.9	2.1
St. Georges Point SPS	St. Georges Point SPS	10.0	8.3	8.5	1.5
Wellandvale SPS	Wellandvale SPS	41.0	20.0	26.7	14.3
Argyle SPS	Argyle SPS	34.0	16.7	20.7	13.3
Eastchester SPS	Eastchester SPS	63.0	32.6	43.3	19.7
Renown SPS	Renown SPS Glendale SPS Riverview SPS Confederation Heights SPS Beaverdams SPS	1,077.4	459.6	527.0	550.4
Glendale SPS	Glendale SPS	7.6	2.8	2.8	4.8
Riverview SPS	Riverview SPS	8.0	2.3	2.9	5.1
Confederation Heights SPS	Confederation Heights SPS	173.0	89.8	137.4	35.6
Beaverdams SPS	Beaverdams SPS	10.7	14.8	18.3	-7.6

The Beaverdams Sewage Pumping Station has a projected pumping deficit.

B.3.3 Forcemain

Table 4.B.13 highlights the existing and projected forcemain performance.

Table 4.B.13 Forcemain Performance

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Forcemain Capacity @ 2.5 m/s (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Lakeside Sewage Pumping Station (SPS)	95.0	176.7	64.9	73.5	103.2
Cole Farm SPS	111.0	176.7	40.1	40.1	136.6
Snug Harbour SPS	3.3	19.6	0.8	0.8	18.8
Lighthouse Road SPS	28.0	78.5	0.8	0.8	77.7
October Village SPS	9.0	19.6	5.7	6.9	12.7
St. Georges Point SPS	10.0	44.2	8.3	8.5	35.7
Wellandvale SPS	41.0	314.2	20.0	26.7	287.5
Argyle SPS	34.0	78.5	16.7	20.7	57.8
Eastchester SPS	63.0	122.7	32.6	43.3	79.4
Renown SPS	1,077.4	1,104.5	459.6	527.0	577.5
Glendale SPS	7.6	19.6	2.8	2.8	16.8
Riverview SPS	8.0	44.2	2.3	2.9	41.3
Confederation Heights SPS	173.0	314.2	89.8	137.4	176.8
Beaverdams SPS	10.7	44.2	14.8	18.3	25.9

All forcemains have a projected surplus capacity.

B.3.4 Trunk Sewer

Figure 4.B.4 and Figure 4.B.5 highlight the existing and projected peak wet weather flow, respectively. Trunk sewers in the Port Dalhousie Wastewater Treatment Plant catchment adjacent to the wastewater treatment plant, and in the southwest are approaching capacity within the 2041 time horizon.

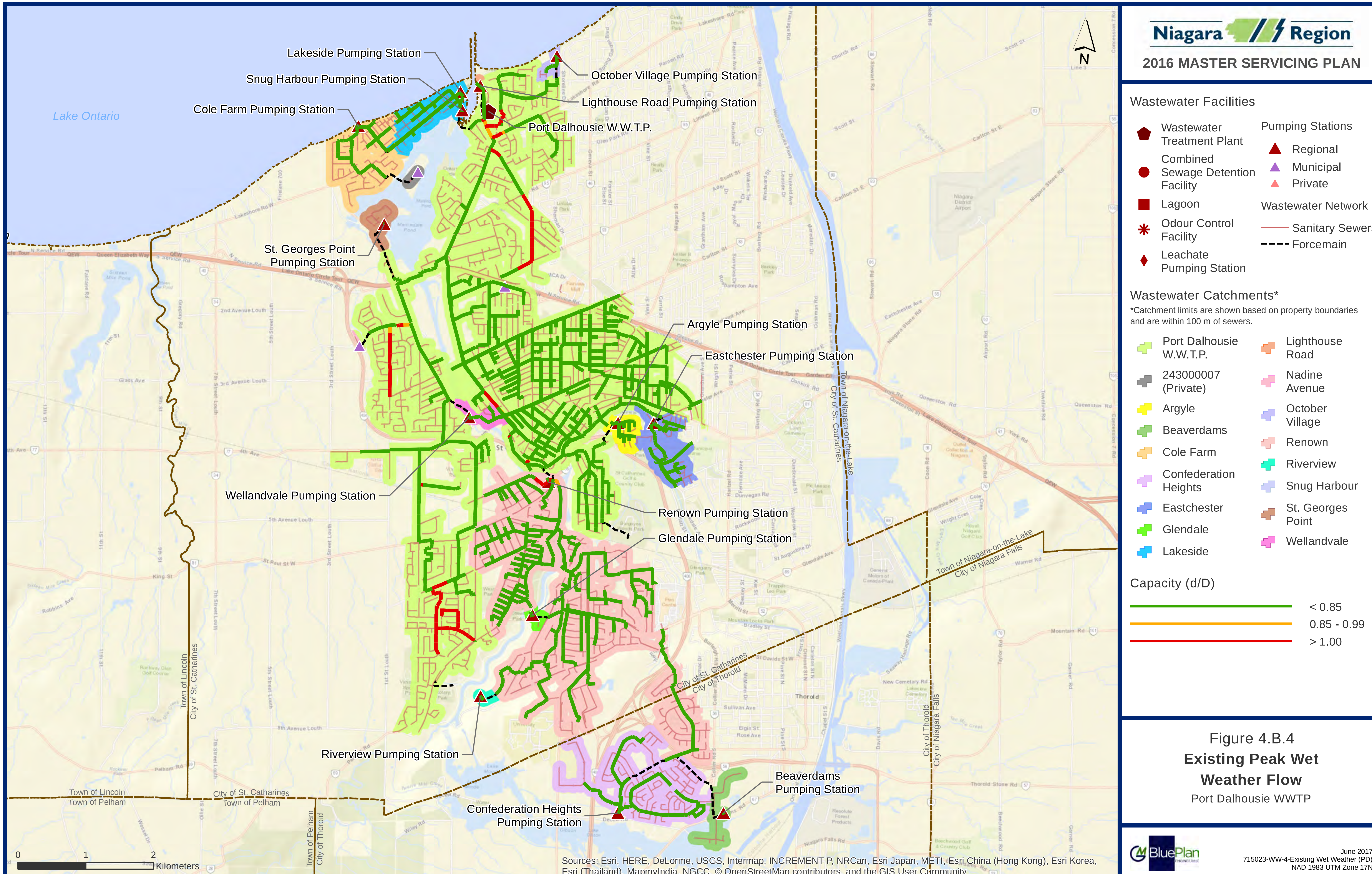
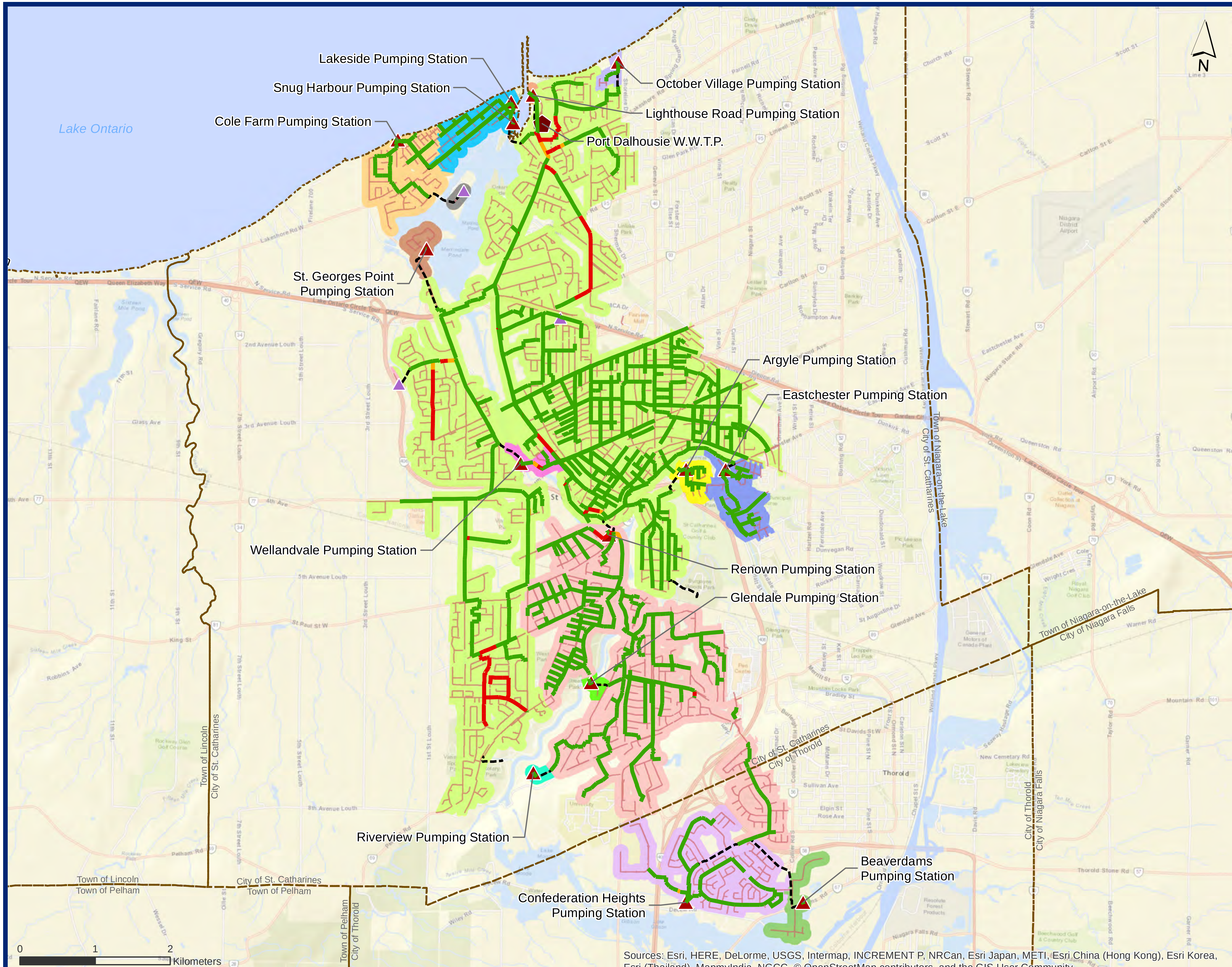


Figure 4.B.4
Existing Peak Wet Weather Flow
Port Dalhousie WWTP



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Port Dalhousie W.W.T.P.
- 243000007 (Private)
- Argyle
- Beaverdams
- Cole Farm
- Confederation Heights
- Eastchester
- Glendale
- Lakeside
- Lighthouse Road
- Nadine Avenue
- October Village
- Renown
- Riverview
- Snug Harbour
- St. Georges Point
- Wellandvale

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.B.5

2041 Peak Wet Weather Flow

Port Dalhousie WWTP

BluePlan

June 2017
715023-WW-5-2041 Wet Weather (PD)
NAD 1983 UTM Zone 17N

B.4 System Opportunities and Constraints

Figure 4.B.6 highlights the existing opportunities and constraints.

B.4.1 Port Dalhousie Wastewater Treatment Plant

- The current rated average daily flow capacity of the plant is 61.4 MLD, with an existing flow of 34.7 MLD and a projected average daily flow of 45.4 MLD, which is below 80% of the wastewater treatment plant rated capacity. As such, the wastewater treatment plant has surplus capacity to accommodate growth beyond 2041.

B.4.2 St. Catharines

- Majority of the system drains via gravity directly to the wastewater treatment plant.
- Residential and employment growth primarily consists of intensification concentrated in existing combined sewer areas.
- Significant combined sewer areas resulting in high wet weather flows and system overflows, which will need to be managed to allow for growth.
- Existing trunk infrastructure, sewers, and pumping stations have sufficient capacity to support design peak wet weather flows.

B.4.3 Thorold

- Majority of the system consists of separated sewers with moderate wet weather.
- Growth is expected to trigger capacity deficit at Beaverdams Sewage Pumping Station.

B.4.4 System Optimization Opportunities

- Significant opportunity to provide growth capacity through implementation of wet weather flow management within St. Catharines systems.

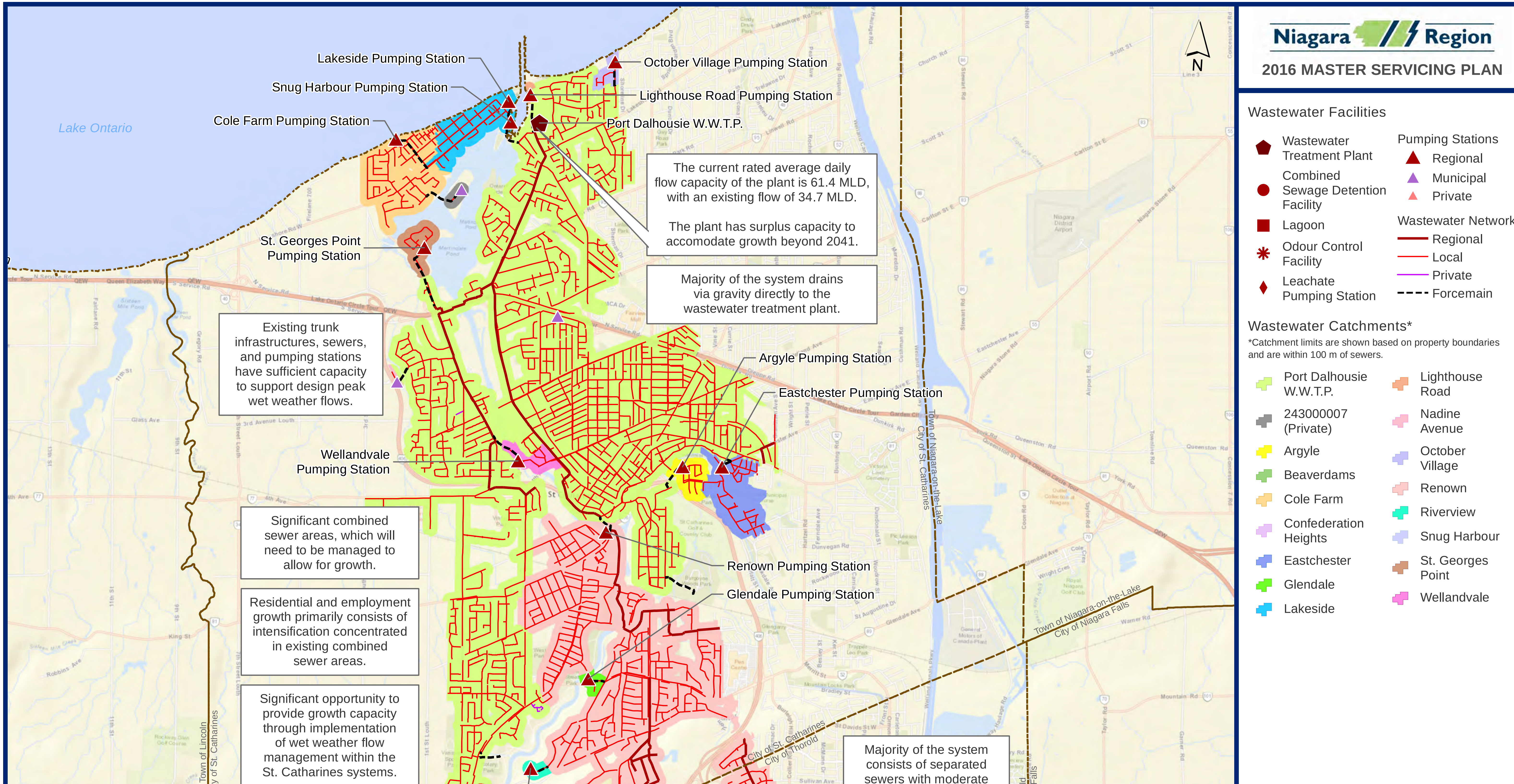


Figure 4.B.6
System Opportunities and Constraints
Port Dalhousie WWTP

BluePlan ENGINEERING

June 2017
715023-WW-3-Opportunities and Constraints (PD)
NAD 1983 UTM Zone 17N

B.5 Assessment of Alternatives

- No further alternative beyond application the hybrid management strategy below were identified.
- Providing capacity within Regional pumping stations and trunk sewers to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Provide upstream flow management and peak flow management address peak flows in systems were peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in basement flooding and overflow risks.

B.6 Preferred Servicing Strategy

The following is a summary of the Port Dalhousie wastewater servicing strategy, presented in Figure 4.B.7 and Figure 4.B.8:

- While infrastructure capacity upgrades were considered, the recommended solution for the Port Dalhousie Wastewater Treatment Plant system is to provide wet weather management across the system. This will require Regional solutions as well as local municipal solutions.
- An upgrade to the Beaverdams Sewage Pumping Station has been identified to support growth in the area.
- With implementation of the wet weather program, the Port Dalhousie Wastewater Treatment Plant will have sufficient capacity to meet growth to year 2041

B.6.1 Pumping Stations

An upgrade is required at the Beaverdams Sewage Pumping Station to increase capacity from 10.7 L/s to 20 L/s.

B.6.2 Wet Weather

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts. These wet weather management programs will need to be a joint initiative between the Region and local municipalities.

For the Port Dalhousie system, the following priority areas are identified:

- St. Catharines area, consisting of the Cole Farm, Renown, and Port Dalhousie catchments.
- Thorold area, consisting of the Confederation Heights catchment.

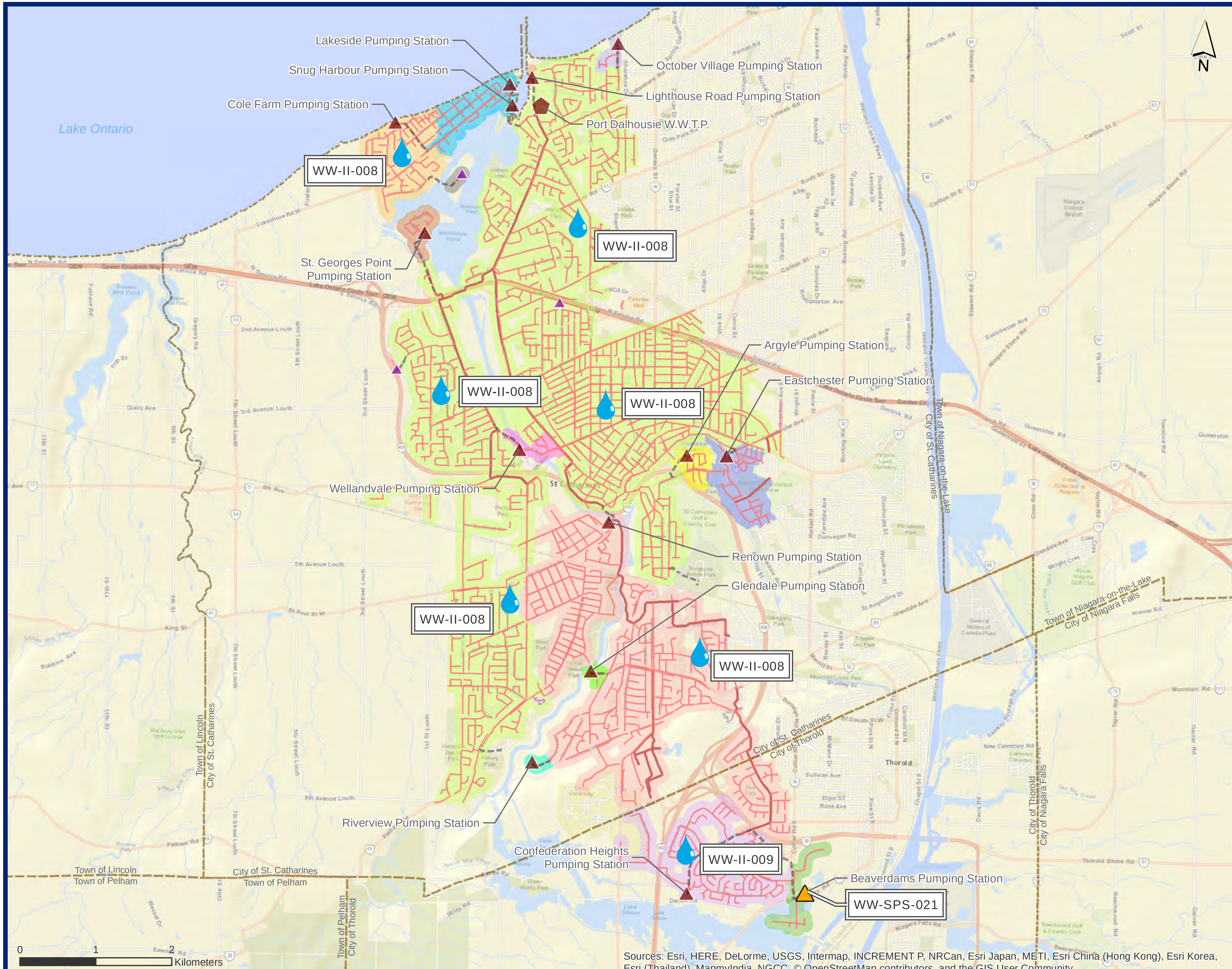
Further flow monitoring and area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, Preferred Servicing Strategy are needed to identify area specific strategies and projects required to achieve the wet weather flow reduction objectives. Following the outcomes of the further studies, targeted funding can be applied outside the priority areas if the projects are found to address capacity issues and support growth capacity needs.

B.7 Capital Program

Table 4.B.14 summarizes the recommended project costing, implementation schedule and Class EA requirements.

B.7.1 Schedule B Project Files

No Schedule B projects are anticipated for the Port Dalhousie Wastewater Treatment Plant system.



Niagara Region

2016 MASTER SERVICING PLAN

MSP Wastewater Projects

- Treatment Plant
- Pumping Station
- Wet Weather Reduction
- Sanitary Sewer Projects
- Forcemain Projects

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Private
- Local
- Forcemain

Wastewater Catchments*

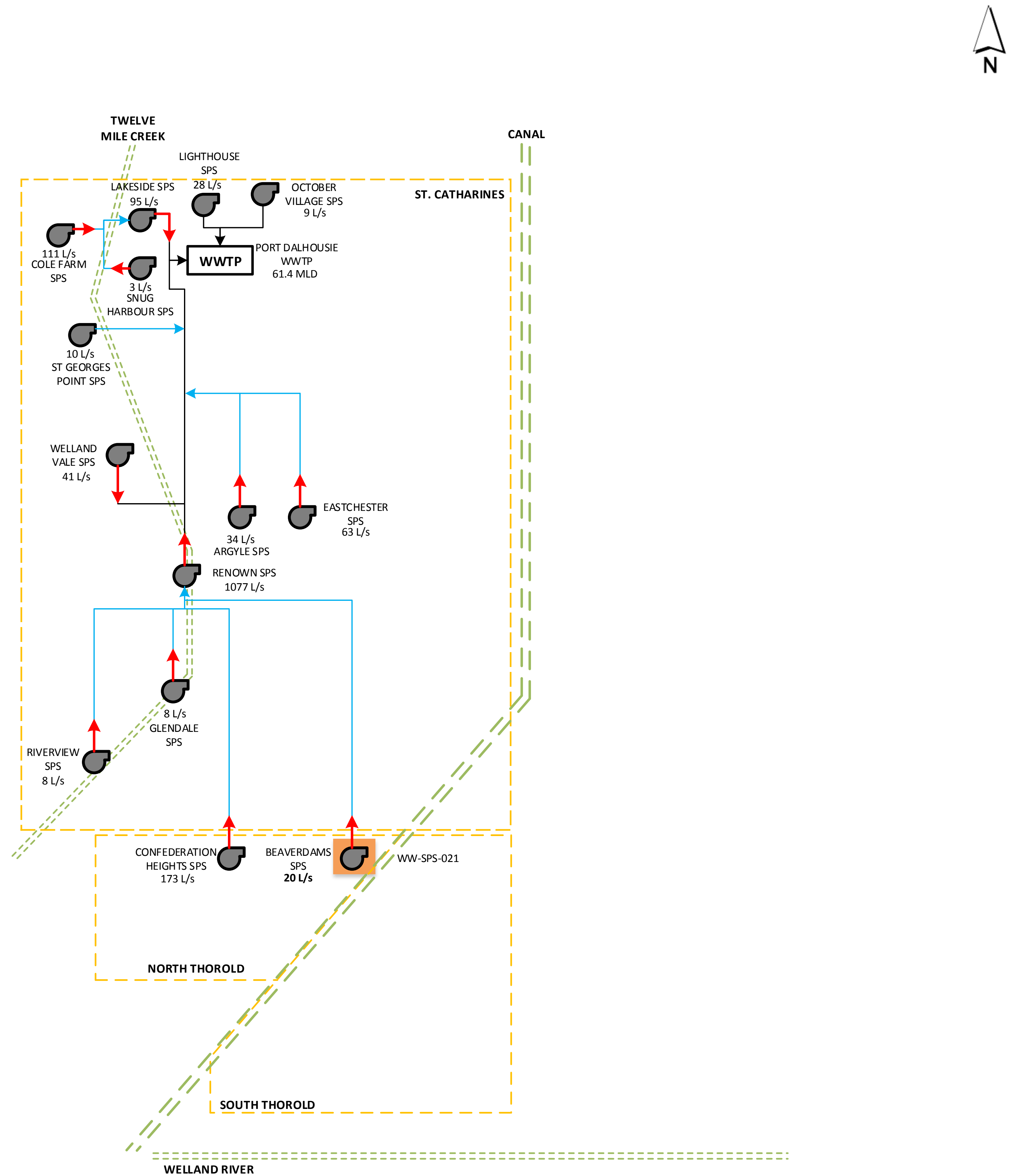
*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Port Dalhousie W.W.T.P.
- 243000007 (Private)
- Argyle
- Beaverdams
- Cole Farm
- Confederation Heights
- Eastchester
- Glendale
- Lakeside
- Lighthouse Road
- Nadine Avenue
- October Village
- Renown
- Riverview
- Snug Harbour
- St. Georges Point
- Wellandvale

Figure 4.B.7
Preferred Wastewater Strategy
Port Dalhousie WWTP

BluePlan

June 2017
715023-WW-6-Capital Projects (Port Dalhousie)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Port Dalhousie WWTP

2041 COLLECTION SCHEMATIC

WWTP RATED CAPACITY	Wastewater Treatment Plant
FIRM CAPACITY	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP
	Facility Upgrade
	Upgrade Forcemain or Sewer
	New Forcemain or Sewer
	Decommission Project

June 2017
Figure 4.B.8
Not to Scale

BluePlan ENGINEERING

Table 4.B.14 Summary of Port Dalhousie Wastewater Treatment Plant Capital Program

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-II-008	Wet weather reduction in St. Catharines - Port Dalhousie	Wet weather reduction in St. Catharines - Port Dalhousie	200 L/s reduction	2022-2031	St. Catharines	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 30,000,000
WW-II-009	Wet weather reduction in North Thorold	Wet weather reduction in North Thorold	90 L/s reduction	2022-2031	Thorold	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 13,500,000
WW-SPS-021	Beaverdams Sewage Pumping Station Pump Replacement - Port Dalhousie	Increase station capacity from 10 L/s to 20 L/s	20 L/s	2017-2021	Thorold	A+	Satisfied	Pumping	$ 665,000
Total									**$ 44,165,000**

PART C
PORT WELLER WASTEWATER SYSTEM

C. PORT WELLER WASTEWATER TREATMENT PLANT

C.1 Existing System Overview

The Port Weller wastewater system services the eastern part of St. Catharines, the eastern part of Thorold North, Thorold South, Glendale, and the Niagara District Airport. The system services an existing population of 81,113 and 26,990 employees[1].

The system is serviced by the Port Weller Wastewater Treatment Plant located at 27 Lombardy Avenue, St. Catharines. The Port Weller Wastewater Treatment Plant incorporates conventional activated sludge treatment with screening, grit removal, alum and polymer addition, phosphorus removal and secondary clarification.

Port Weller Wastewater Treatment Plant has a rated capacity of 56.2 MLD, a peak dry weather flow capacity of 120.4 MLD, and a peak wet weather flow capacity of 136.2 MLD[2].

Figure 4.C.1 presents an overview of the wastewater system, and Figure 4.C.2 shows a schematic of the wastewater system.

[1] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*

[2] *Ministry of Environment and Climate Change, 9 December 2014. Ammeded Environmental Compliance Approval. Number 6014-9QMLZL*

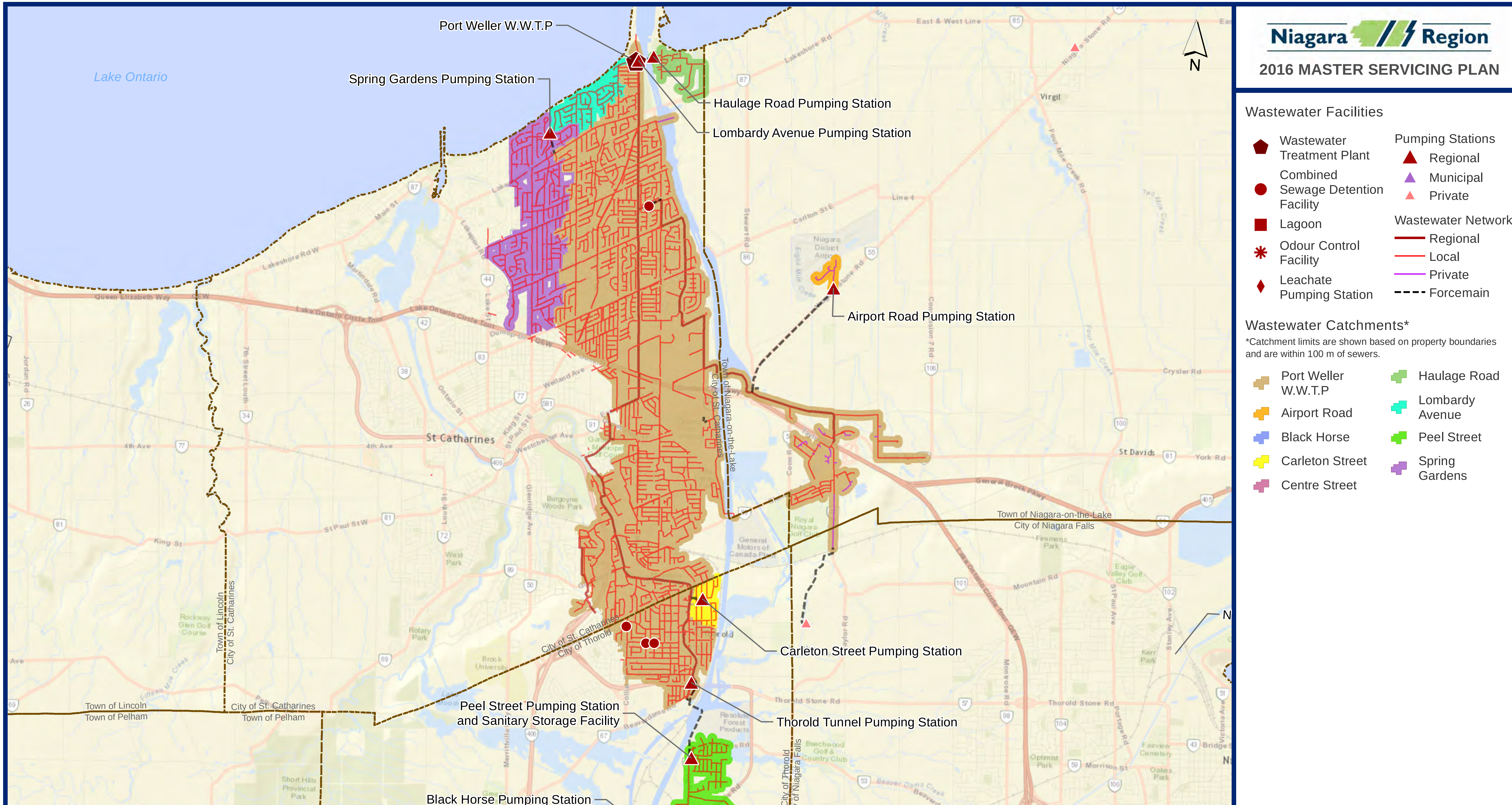
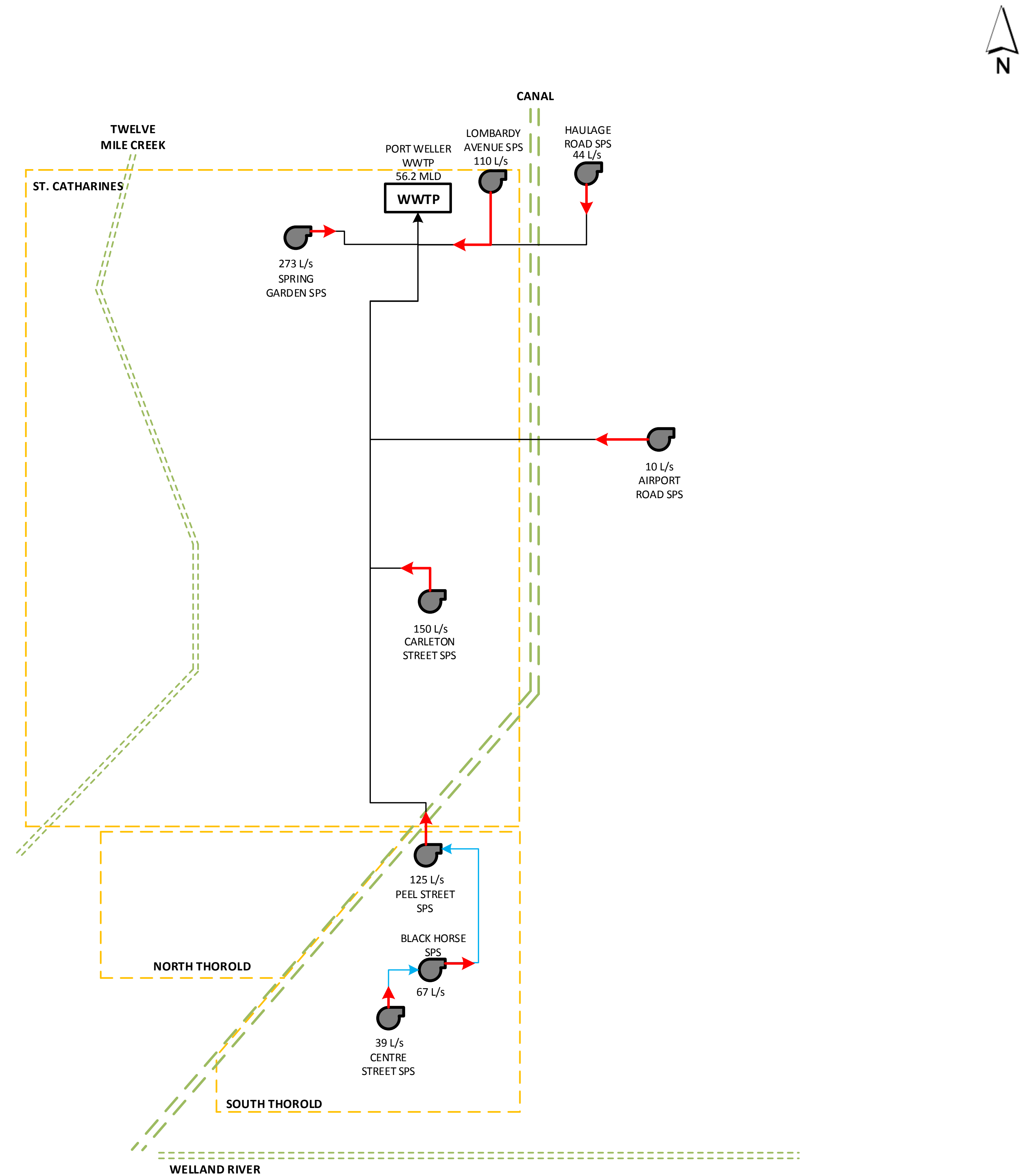


Figure 4.C.1
Existing Wastewater System
Port Weller WWTP

GM BluePlan

June 2017
715023-WW-2-Existing System (Port Weller)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Port Weller WWTP

EXISTING COLLECTION SCHEMATIC

Legend

WWTP (RATED CAPACITY)	Wastewater Treatment Plant
FIRM CAPACITY	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP

June 2017
Figure 4.C.2
Not to Scale

GM BluePlan ENGINEERING

C.1.1 Service Area Overview

Table 4.C.1 provides a list of facility catchments and their areas. Refer to Figure 4.C.1 for the catchment areas of each facility

Table 4.C.1 Facilities and Catchment Areas

Facility	Catchments	Catchment Area (ha)
Port Weller Wastewater Treatment Plant (WWTP)	**Port Weller WWTP** (Including Sub Catchments) Lombardy Avenue SPS Haulage Road SPS Spring Gardens SPS Airport Road SPS Carleton Street SPS Peel Street SPS and Sanitary Storage Facility	3,780.0
	Port Weller WWTP (Excluding Sub Catchments)	2,841.0
Lombardy Avenue Sewage Pumping Station (SPS)	Lombardy Avenue SPS	95.0
Haulage Road SPS	Haulage Road SPS	76.8
Spring Gardens SPS	Spring Gardens SPS	418.2
Airport Road SPS	Airport Road SPS	24.3
Carleton Street SPS	Carleton Street SPS	42.5
Peel Street SPS	**Peel Street SPS and Sanitary Storage Facility** (Including Sub Catchments) Black Horse SPS	282.1
	Peel Street SPS and Sanitary Storage Facility (Excluding Sub Catchments)	173.4
Black Horse SPS	**Black Horse SPS** (Including Sub Catchments) Centre Street SPS	108.7
	Black Horse SPS (Excluding Sub Catchments)	64.2
Centre Street SPS	Centre Street SPS	44.5

C.1.2 Facility Overview

Table 4.C.2 Wastewater Treatment Plant Overview

Plant Name	Port Weller Wastewater Treatment Plant
Address	27 Lombardy Avenue, St. Catharines
Discharge Water	Welland Canal
Rated Capacity: Average Daily Flow	56.2 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	120.4 MLD
Rated Capacity: Peak Flow Rate (Wet Weather)	136.2 MLD
Key Processes	• Conventional activated sludge treatment with screening • Grit removal • Alum and polymer addition • Phosphorus removal • Secondary clarification

Table 4.C.3 Wastewater Treatment Plant Effluent Objectives

Effluent Parameter	Objective Concentration[3]
$CBOD_5$	15.0 mg/L
TSS	15.0 mg/L
Total Phosphorus	1.0 mg/L
E. Coli	200 organisms/100 mL
Total Chlorine Residual	0.5 mg/L

[3] *Ministry of Environment and Climate Change, 9 December 2014. Ammeded Environmental Compliance Approval. Number 6014-9QMLZL*

Table 4.C.4 Pumping Station Overview

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Lombardy Avenue Sewage Pumping Station (SPS)	27 Lombardy Avenue, St. Catharines	3	110.0	110.0	8.5
Haulage Road SPS	Haulage Road, St. Catharines	2	37.9	44.1	Unknown
Spring Gardens SPS	Spring Garden Boulevard,	3	Unknown	273.0	Unknown
Airport Road SPS	Airport Road, Niagara-on-the-Lake	2	12.5	10.0	21.0
Carleton Street SPS	94 ½ Carleton Street, Thorold	2	150.0	150.0	19.1
Peel Street SPS	Allanburg Road, Thorold	3	170.0	125.0	41.0
Black Horse SPS	2525 Highway 58, Thorold	2	70.0	67.1	27.0
Centre Street SPS	2408 Centre Street, Thorold	2	40.0	38.6	12.0

Table 4.C.5 Forcemain Overview

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Length (m)	Diameter (mm)	Capacity @ 2.5 m/s (L/s)
Lombardy Avenue Sewage Pumping Station (SPS)	110.0	12	200	78.5
Haulage Road SPS	44.1	279	450	441.8
Spring Gardens SPS	273.0	414	400	314.2
Airport Road SPS	10.0	2,654	100	19.6
Carleton Street SPS	150.0	315	250	122.7
Peel Street SPS	125.0	1,780	350	240.5
Black Horse SPS	67.1	519	250	122.7
Centre Street SPS	38.6	528	150	44.2

C.1.3 Flows Overview

Table 4.C.6 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.C.7 shows the existing wastewater system flows by catchment.

Table 4.C.6 Historic Port Weller Wastewater Treatment Plant Flows

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	L/s	MLD	L/s	MLD	L/s
2011	34.1	394.7	43.2	500.0	149.9	1,735.0
2012	27.7	320.6	33.8	391.2	129.5	1,498.8
2013	28.8	333.3	37.4	432.9	139.8	1,618.1
2014	28.7	332.2	35.2	407.4	140.6	1,627.3
2015	26.5	306.7	30.3	350.7	128.8	1,490.7
5 Year Average	29.2	338.0	36.0	416.7	137.7	1,593.8
5 Year Peak	34.1	394.7	43.2	500.0	149.9	1,735.0

Table 4.C.7 Existing Wastewater System Flows by Catchment

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Port Weller Wastewater Treatment Plant (WWTP)	108,103	416.7	1,914.5	3,428.8	4,736.1
Port Weller WWTP	85,351	343.4	1,499.4	2,834.5	4,000.0
Lombardy Avenue Sewage Pumping Station (SPS)	3,012	8.9	45.0	95.5	134.0
Haulage Road SPS	790	4.9	31.7	33.7	82.5
Spring Gardens SPS	14,289	35.1	189.8	431.7	581.8
Airport Road SPS	0	8.6	24.2	24.5	34.0
Carleton Street SPS	1,160	3.5	19.2	46.1	64.0
Peel Street SPS and Sanitary Storage Facility	3,501	12.3	105.2	92.1	107.6
Peel Street SPS and Sanitary Storage Facility	2,501	8.5	66.5	30.1	40.5
Black Horse SPS	1,000	3.8	38.7	62.0	82.5
Black Horse SPS	439	3.1	24.6	36.6	48.7
Centre Street SPS	561	0.7	14.1	25.4	33.8

Note: Flow numbers may not sum due to rounding.

C.2 Growth Projections

C.2.1 Population Projections and Allocations

Table 4.C.8 and Table 4.C.9 outline the existing and projected serviced population and employment by catchment.

Table 4.C.8 Port Weller Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Port Weller Wastewater Treatment Plant	60,446	63,041	64,974	68,916	71,864	74,005	13,559
Airport Road Sewage Pumping Station (SPS)	0	0	0	0	0	0	0
Black Horse SPS	255	249	251	258	262	266	10
Carleton Street SPS	1,160	1,158	1,197	1,232	1,253	1,269	109
Centre Street SPS	471	480	553	588	647	708	237
Haulage Road SPS	745	963	963	969	988	1,064	319
Lombardy Avenue SPS	3,006	3,148	3,143	3,216	3,268	3,309	303
Peel Street SPS and Sanitary Storage Facility	1,749	1,839	2,096	2,848	2,894	2,927	1,179
Spring Gardens SPS	13,281	13,314	13,513	13,682	14,194	14,384	1,103
Total	**81,113**	**84,191**	**86,690**	**91,709**	**95,370**	**97,931**	**16,818**

Note: Population numbers may not sum due to rounding.

Table 4.C.9 Port Weller Wastewater Treatment Plant Existing and Projected Serviced Employment by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Port Weller Wastewater Treatment Plant	24,906	26,491	27,290	28,524	29,934	31,929	7,023
Airport Road Sewage Pumping Station (SPS)	0	0	0	0	0	0	0
Black Horse SPS	184	249	274	326	372	443	259
Carleton Street SPS	0	0	0	0	0	0	0
Centre Street SPS	90	115	124	143	161	187	97
Haulage Road SPS	45	49	52	59	63	72	27
Lombardy Avenue SPS	5	6	6	6	6	6	1
Peel Street SPS and Sanitary Storage Facility	752	797	826	857	895	938	186
Spring Gardens SPS	1,008	1,033	1,056	1,084	1,117	1,159	151
Total	**26,990**	**28,741**	**29,627**	**30,999**	**32,548**	**34,735**	**7,745**

Note: Population numbers may not sum due to rounding.

C.2.2 Future Flow Projections

Table 4.C.10 and Table 4.C.11 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

Table 4.C.10 Projected Peak Dry Weather Flow by Catchment

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Port Weller Wastewater Treatment Plant	714.0	731.5	764.2	791.2	816.6
Airport Road Sewage Pumping Station (SPS)	17.3	17.3	17.3	17.3	17.3
Black Horse SPS	8.7	10.0	11.4	12.8	14.7
Carleton Street SPS	7.0	7.5	7.9	8.1	8.3
Centre Street SPS	1.8	2.9	3.5	4.5	5.5
Haulage Road SPS	12.4	12.4	12.6	12.8	13.9
Lombardy Avenue SPS	19.3	19.3	20.1	20.6	21.1
Peel Street SPS and Sanitary Storage Facility	18.4	21.5	29.8	30.7	31.5
Spring Gardens SPS	70.7	72.7	74.4	79.2	81.2
Total	**869.7**	**895.1**	**941.1**	**977.3**	**1,009.9**

The following presents an example calculation of projected peak dry weather flow.

2041 Peak Dry Weather Flow for Spring Gardens Sewage Pumping Station:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (35.1 L/s × 2.0) + (15,544 – 14,289 people) × 275 L/cap/day × 1 day/86400 s × 2.76
= 81.2 L/s

Table 4.C.11 Projected Peak Wet Weather Flow by Catchment

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Port Weller Wastewater Treatment Plant	1,526.6	1,544.1	1,576.7	1,603.8	1,629.1
Airport Road Sewage Pumping Station (SPS)	24.2	24.2	24.2	24.2	24.2
Black Horse SPS	39.8	41.1	42.4	43.9	45.7
Carleton Street SPS	19.2	19.6	20.0	20.3	20.5
Centre Street SPS	14.6	15.6	16.3	17.2	18.2
Haulage Road SPS	34.4	34.4	34.5	34.8	35.8
Lombardy Avenue SPS	46.5	46.5	47.3	47.8	48.3
Peel Street SPS and Sanitary Storage Facility	68.0	71.1	79.4	80.3	81.0
Spring Gardens SPS	190.3	192.3	194.0	198.8	200.8
Total	**2,005.9**	**2,032.2**	**2,075.5**	**2,119.7**	**2,160.4**

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for Spring Gardens Sewage Pumping Station:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 81.2 L/s + (418.2 ha × 0.286 L/s/ha)
= 200.8 L/s

C.3 Assessment of Wastewater Infrastructure (Existing and Future)

C.3.1 Treatment Plant Capacity

Figure 4.C.3 shows the projected future demands at the Port Weller Wastewater Treatment Plant. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.

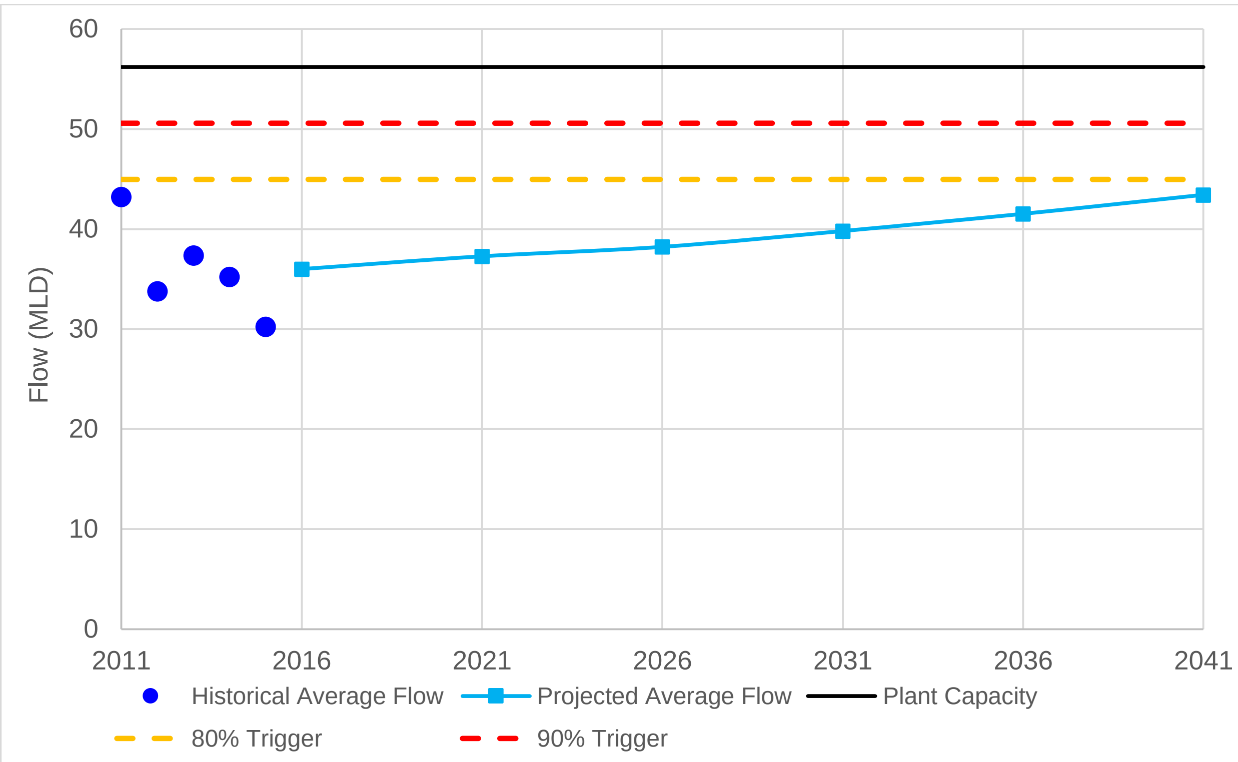


Figure 4.C.3 Projected future demands at Port Weller Road Wastewater Treatment Plant

C.3.2 Sewage Pumping Station

Table 4.C.12 highlights the sewage pumping station existing and projected capacity.

Table 4.C.12 System Sewage Pumping Station Performance

Sewage Pumping Station	Contributing Catchments	Facility Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Lombardy Avenue Sewage Pumping Station (SPS)	Lombardy Avenue SPS	110.0	45.0	48.3	61.7
Haulage Road SPS	Haulage Road SPS	44.1	31.7	35.8	8.3
Spring Gardens SPS	Spring Gardens SPS	273.0	189.8	200.8	72.2
Airport Road SPS	Airport Road SPS	10.0	24.2	24.2	-14.2
Carleton Street SPS	Carleton Street SPS	150.0	19.2	20.5	129.5
Peel Street SPS	Peel Street SPS and Sanitary Storage Facility Black Horse SPS	125.0	105.2	125.3	-0.3
Black Horse SPS	Black Horse SPS Centre Street SPS	67.1	38.7	45.7	21.4
Centre Street SPS	Centre Street SPS	38.6	14.1	18.2	20.4

The following sewage pumping stations have projected pumping deficits:

- Airport Road Sewage Pumping Station
- Peel Street Sewage Pumping Station

C.3.3 Forcemain

Table 4.C.13 highlights the existing and projected forcemain performance.

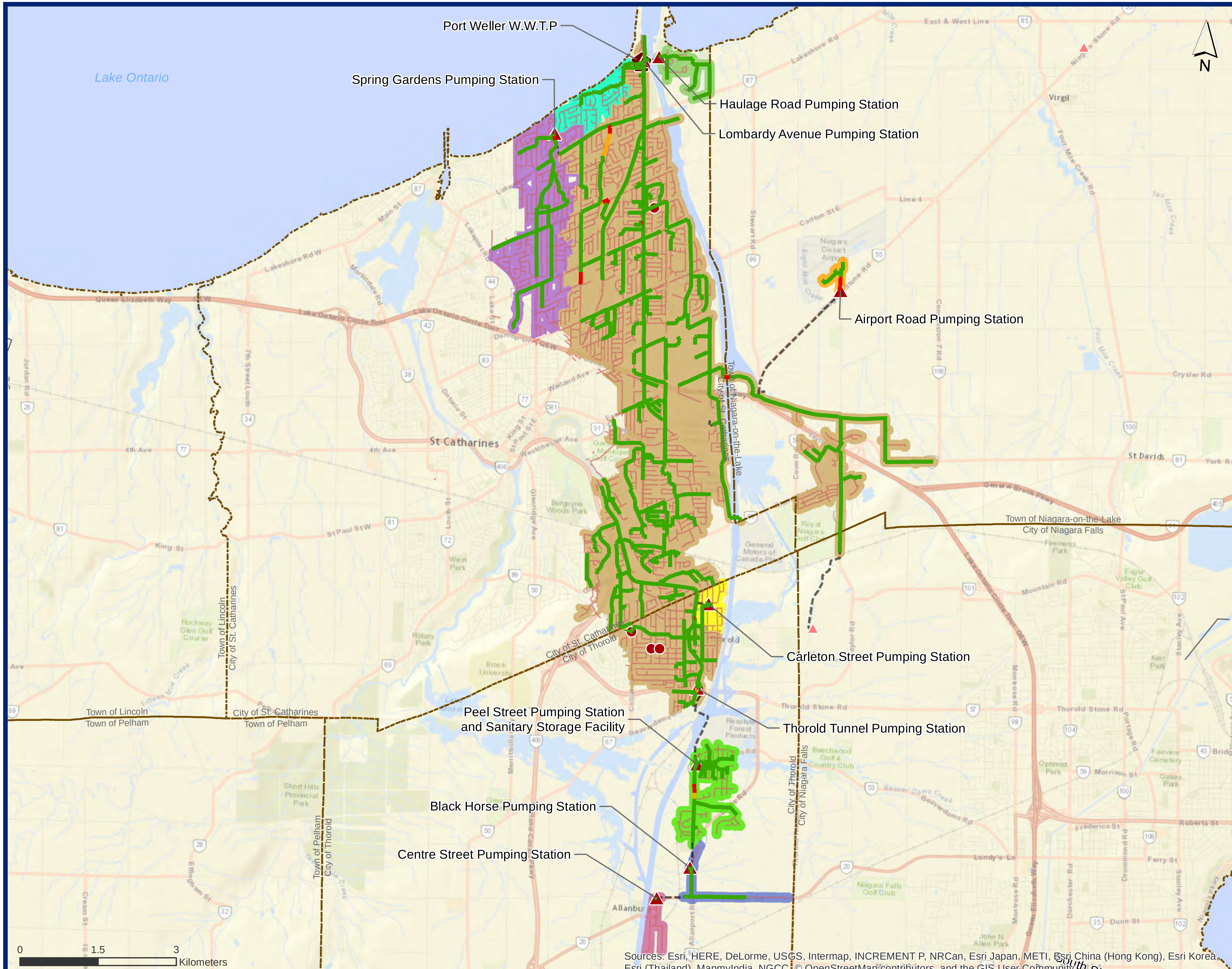
Table 4.C.13 Forcemain Performance

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Capacity @ 2.5 m/s (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Lombardy Avenue Sewage Pumping Station (SPS)	110.0	78.5	45.0	48.3	30.2
Haulage Road SPS	44.1	441.8	31.7	35.8	406.0
Spring Gardens SPS	273.0	314.2	189.8	200.8	113.4
Airport Road SPS	10.0	19.6	24.2	24.2	-4.6
Carleton Street SPS	150.0	122.7	19.2	20.5	102.2
Peel Street SPS	125.0	240.5	105.2	125.3	115.2
Black Horse SPS	67.1	122.7	38.7	45.7	77.0
Centre Street SPS	38.6	44.2	14.1	18.2	26.0

The Airport Road Sewage Pumping Station forcemain has a projected deficit.

C.3.4 Trunk Sewer

Figure 4.C.4 and Figure 4.C.5 highlight the existing and projected peak wet weather flow, respectively. The majority of trunk sewers have projected capacity, with minor upgrades triggered in localized areas in the Peel Street Sewage Pumping Station and Port Weller Wastewater Treatment Plant catchments.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Port Weller W.W.T.P
- Airport Road
- Black Horse
- Carleton Street
- Centre Street
- Haulage Road
- Lombardy Avenue
- Peel Street
- Spring Gardens

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

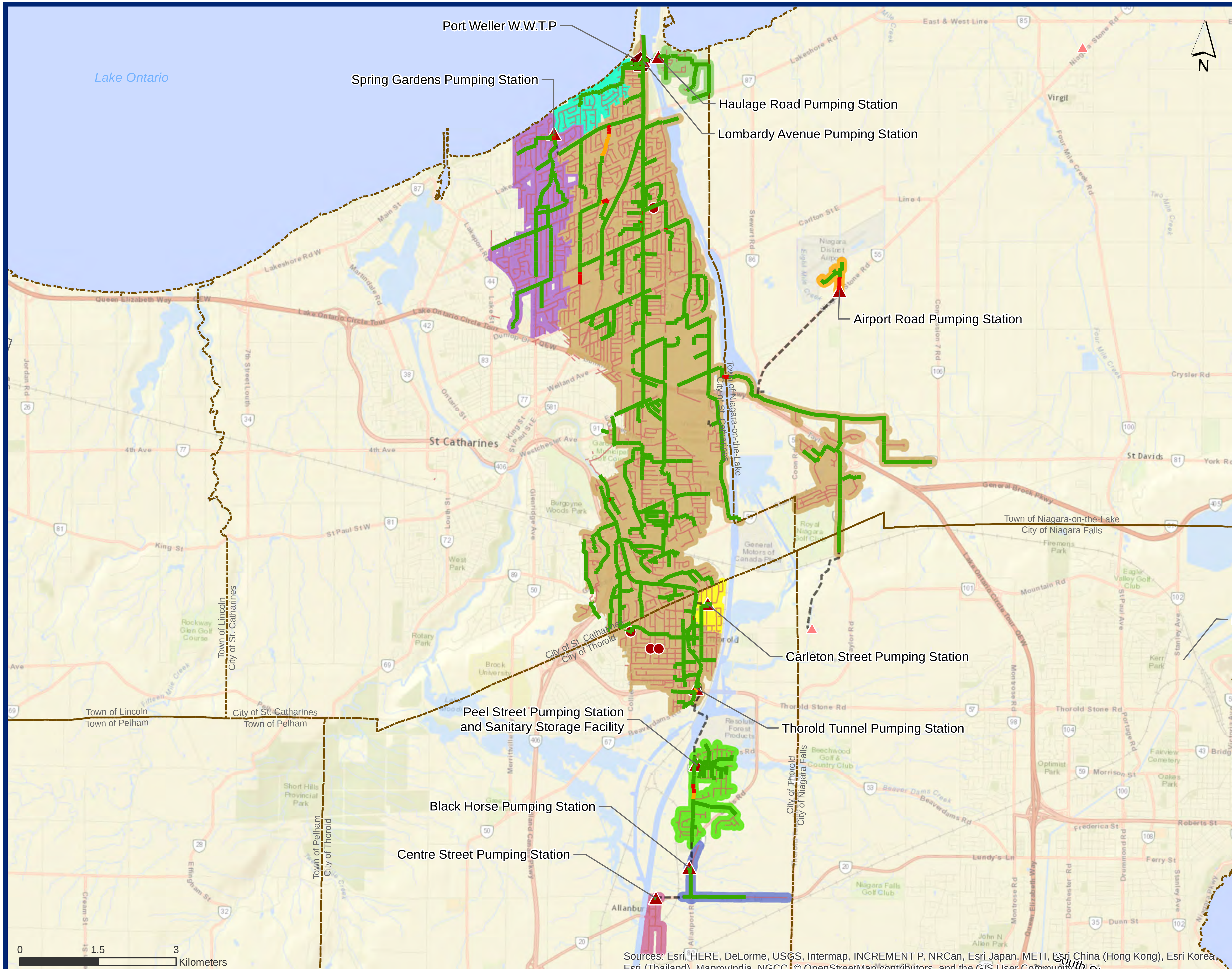
Figure 4.C.4

Existing Peak Wet Weather Flow

Port Weller WWTP

GM BluePlan ENGINEERING

June 2017
715023-WW-4-Existing Wet Weather (PW)
NAD 1983 UTM Zone 17N



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Port Weller W.W.T.P
- Airport Road
- Black Horse
- Carleton Street
- Centre Street
- Haulage Road
- Lombardy Avenue
- Peel Street
- Spring Gardens

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.C.5
2041 Peak Wet Weather Flow
Port Weller WWTP

BluePlan
June 2017
715023-WW-5-2041 Wet Weather (PW)
NAD 1983 UTM Zone 17N

C.4 System Opportunities and Constraints

Figure 4.C.6 highlights the existing opportunities and constraints.

C.4.1 Port Dalhousie Wastewater Treatment Plant

- The current rated average daily flow capacity of the plant is 56.2 MLD, with an existing flow of 36.0 MLD and projected average daily flow of 43.4 MLD, which is below 80% of the Wastewater Treatment Plant rated capacity. As such, the wastewater treatment plant has surplus capacity to accommodate growth beyond 2041.

C.4.2 St. Catharines

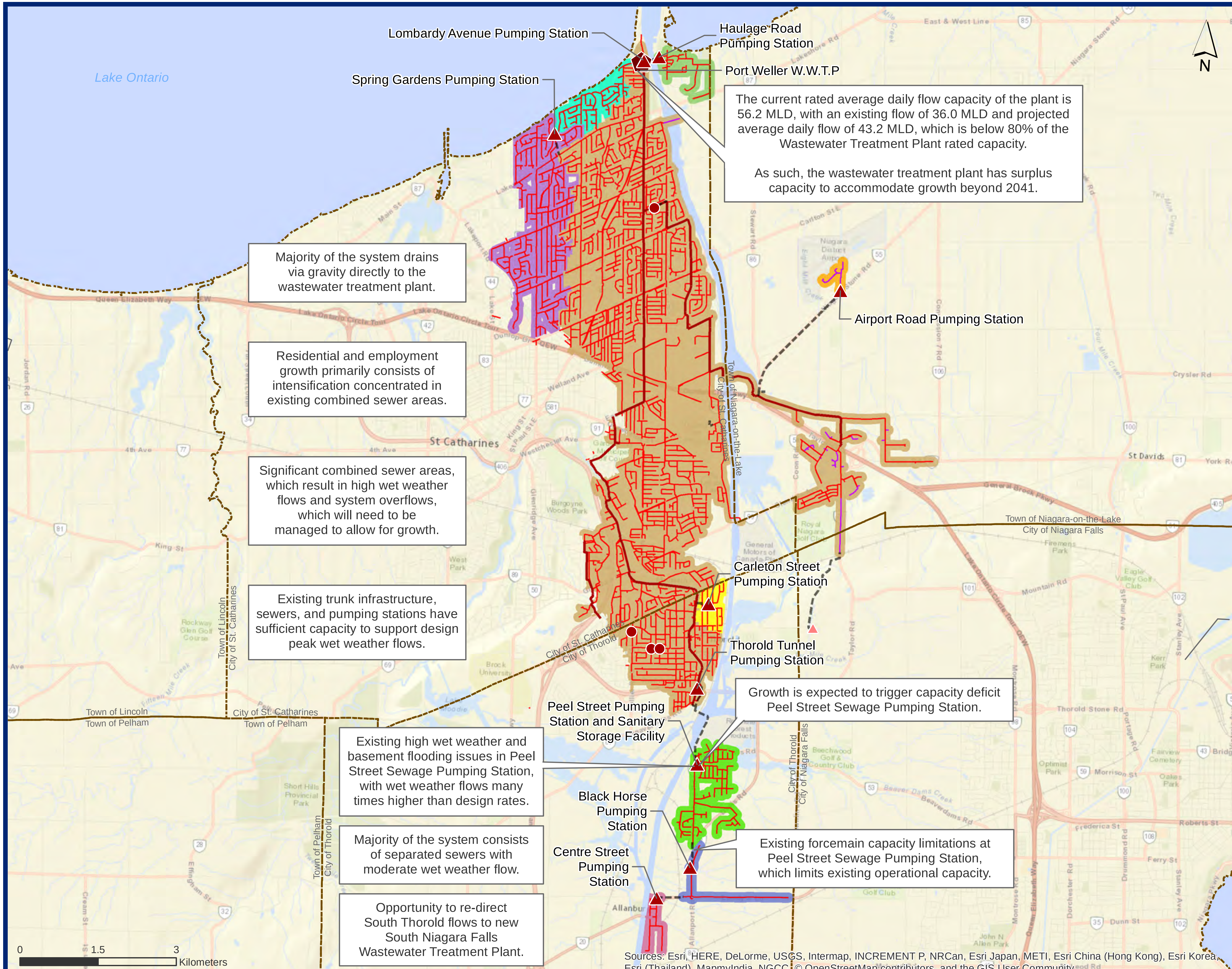
- Majority of the system drains via gravity directly to the wastewater treatment plant.
- Residential and employment growth primarily consists of intensification concentrated in existing combined sewer areas.
- Significant combined sewer areas, which result in high wet weather flows and system overflows, which will need to be managed to allow for growth.
- Existing trunk infrastructure, sewers, and pumping stations have sufficient capacity to support design peak wet weather flows.

C.4.3 Thorold

- Majority of the system consists of separated sewers with moderate wet weather flow.
- Growth is expected to trigger capacity deficit Peel Street Sewage Pumping Station.
- Existing high wet weather and basement flooding issues in Peel Street Sewage Pumping Station, with wet weather flows many times higher than design rates.
- Opportunity to re-direct South Thorold flows to new South Niagara Fall Wastewater Treatment Plant.

C.4.4 System Optimization Opportunities

- Significant opportunity to provide growth capacity through implementation of wet weather flow management within St. Catharines systems.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations
- Regional
- Municipal
- Private

Wastewater Network
- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Port Weller W.W.T.P
- Airport Road
- Black Horse
- Carleton Street
- Centre Street
- Haulage Road
- Lombardy Avenue
- Peel Street
- Spring Gardens

Figure 4.C.6
System Opportunities and Constraints
Port Weller WWTP

GM BluePlan Engineering

June 2017
715023-WW-3-Opportunities and Constraints (PW)
NAD 1983 UTM Zone 17N

C.5 Assessment of Alternatives

The hybrid management strategy consists of:

- Providing capacity within Regional sewage pumping stations and trunk sewer to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Providing upstream flow management and peak flow management to address peak flows in systems where peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in potential basement flooding and overflow risks.

Further to the application of the above strategy, the following area specific alternatives were reviewed:

C.5.1 South Thorold

Two alternatives for the Thorold South Servicing Strategy where considered. The alternatives are as follows:

1. Maintain existing configuration, implementing upgrades to:
    - Peel Street Sewage Pumping Station and forcemain
2. Redirect Thorold South flows to a new South Niagara Falls Wastewater Treatment Plant. Required works with the Thorold South area include:
    - Upgrade Black Horse Sewage Pumping Station to receive all Thorold South flows.
    - New Black Horse Sewage Pumping Station forcemain to direct flows to Niagara Falls.
    - New Peel Street Sewage Pumping Station and forcemain to direct flows to the Black Horse Sewage Pumping Station.

Implementation of Alternative 2 is dependent on the construction of the New Niagara Falls Wastewater Treatment Plant, which was identified as the preferred servicing option as outlined in Part F.

It was found that Alternative 2 is preferred as it presents the following advantages:

- Major pump station and forcemain upgrades are required for both options.

- Re-directing flows away from the Port Weller trunk system reduces peak flows resulting in :
  - Reduced risk of basement flooding and sewer overflows.
  - Increasing growth capacity within remaining system.
- Majority of Thorold growth to occur in Thorold South; Alternative 2 allows for optimized growth servicing strategy.

C.5.2 Airport Road Sewage Pumping Station

The Airport Road Sewage Pumping Station has no flow monitoring data, so flows are based on parcel allocation. Operations staff report no known capacity issues and there is no growth allocated to the catchment. As such, no project has been identified at Airport Road Sewage Pumping Station.

C.6 Preferred Servicing Strategy

The following is a summary of the Port Weller wastewater servicing strategy, presented in Figure 4.C.7 and Figure 4.C.8:

- While infrastructure capacity upgrades were considered, the recommended solution for the Port Weller Wastewater Treatment Plant system is to provide wet weather management across the system. This will require Regional solutions as well as local municipal solutions.
- Re-direct the Thorold South wastewater flows to the South Niagara Falls system. The preferred strategy includes:
  - New Peel Street Sewage Pumping Station and forcemain to direct flows to the Black Horse Sewage Pumping Station.
  - Upgrades to the Black Horse Sewage Pumping Station and forcemain to pump to the South Niagara Falls wastewater system.
- With implementation of the wet weather program, the Port Weller Wastewater Treatment Plant will have sufficient capacity to meet growth to year 2041.

C.6.1 Forcemains

A new 400 mm forcemain from the Peel Street Sewage Pumping Station to the Black Horse Sewage Pumping Station is required.

C.6.2 Pumping Stations

The following sewage pumping station strategy is required:

- Black Horse Sewage Pumping Station upgrade: Increase capacity from 21 L/s to 180 L/s.

C.6.3 Wet Weather

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts. These wet weather management programs will need to be a joint initiative between the Region and local municipalities.

For the Port Weller system, the following priority areas are identified:

- St. Catharines area, consisting of the Spring Gardens Sewage Pumping Station and Port Weller Wastewater Treatment Plant catchments.
- Thorold area, consisting of the Peel Street Sewage Pumping Station and Port Weller Wastewater Treatment Plant catchments.

Further flow monitoring and area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, Preferred Servicing Strategy are needed to identify area specific strategies and projects required to achieve the wet weather flow reduction objectives. Following the outcomes of the further studies, targeted funding can be applied outside the priority areas if the projects are found to address capacity issues and support growth capacity needs.

C.7 Capital Program

Table 4.C.14 summarizes the recommended project costing, implementation schedule and Class EA requirements.

C.7.1 Schedule B Project Files

No Schedule B projects are anticipated for the Port Weller Wastewater Treatment Plant system.

Niagara Region

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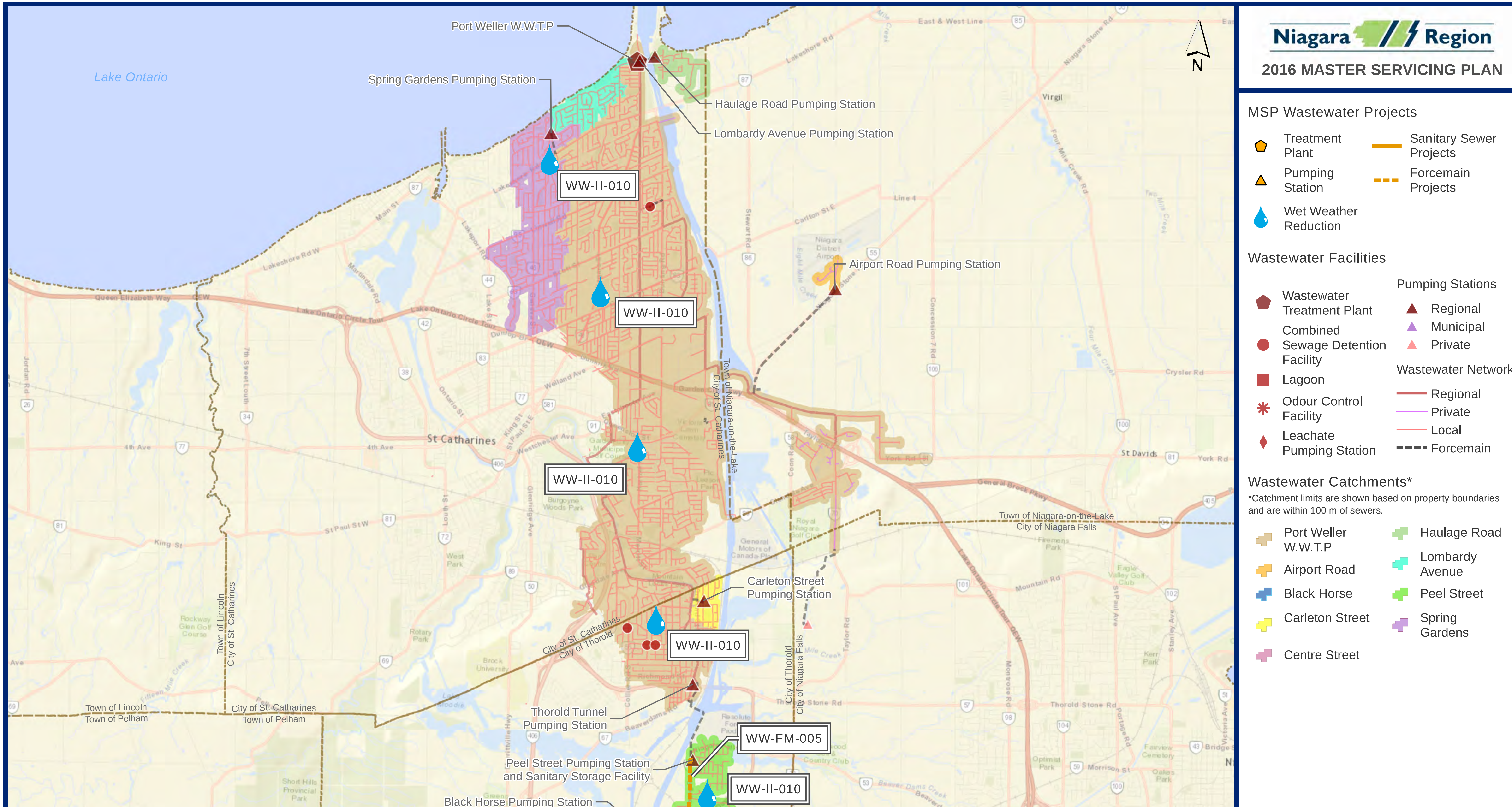
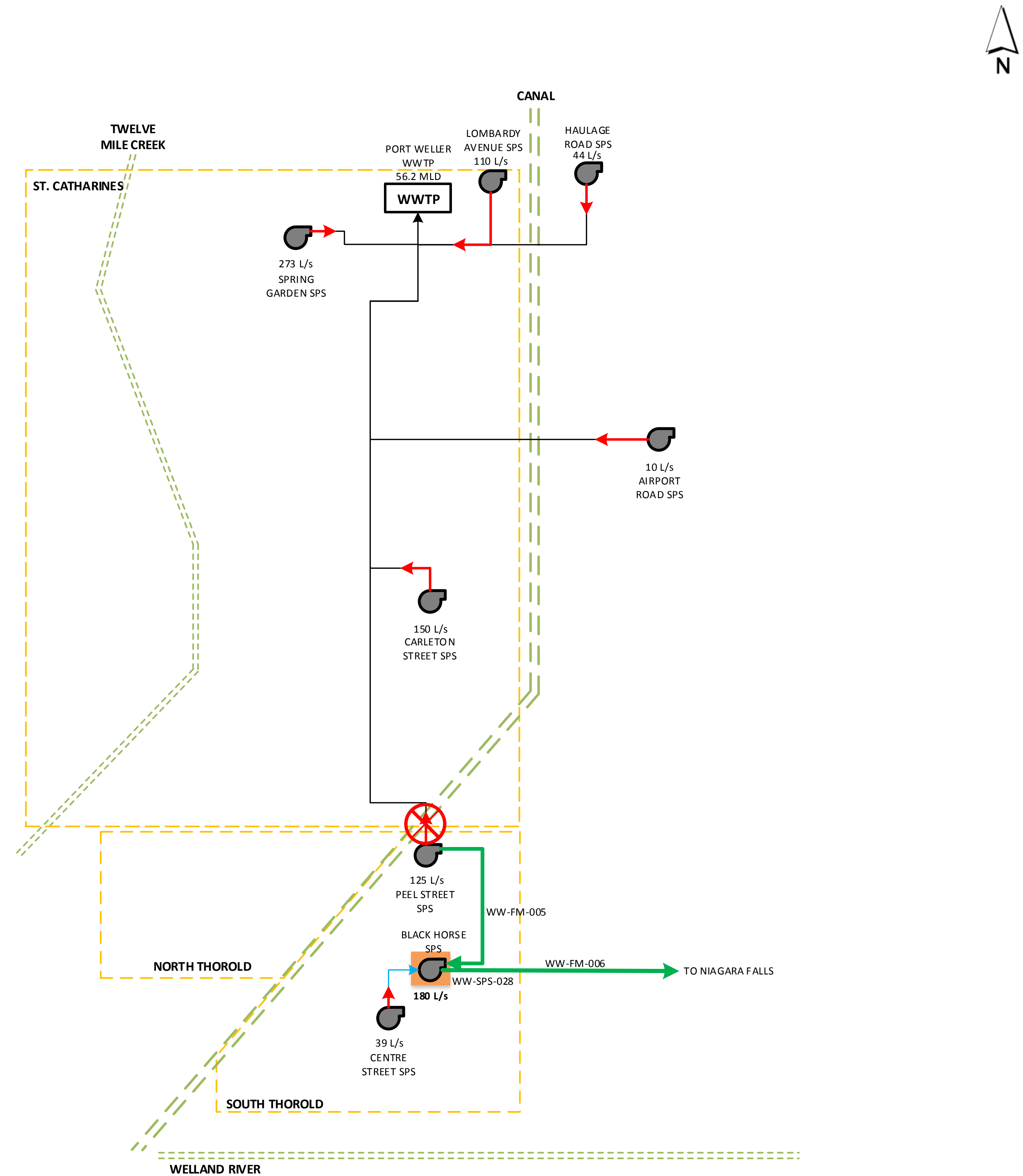


Figure 4.C.7
Preferred Wastewater Strategy
Port Weller WWTP

GM BluePlan Engineering

June 2017
715023-WW-6-Capital Projects (Port Weller)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Port Weller WWTP

2041 COLLECTION SCHEMATIC

WWTP RATED CAPACITY — Wastewater Treatment Plant

FIRM CAPACITY — Sewage Pumping Station

Forcemain

Connection from SPS to SPS

Connection from SPS to WWTP

Facility Upgrade

New Facility

Upgrade Forcemain or Sewer

New Forcemain or Sewer

Decommission Project

June 2017
Figure 4.C.8
Not to Scale

BluePlan ENGINEERING

Table 4.C.14 Summary of Port Weller Wastewater Treatment Plant Capital Program

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-FM-005	New Peel Street Sewage Pumping Station (SPS) Forcemain	New Peel Street SPS Forcemain in Thorold from station to Black Horse SPS	400 mm	2022 – 2031	Thorold	A+	To be Satisfied Under Consolidated South NF Schedule C EA - Separate Study	Forcemain	$ 4,889,000
WW-SPS-028	Black Horse SPS Upgrade	Increase station capacity from 21 L/s to 180 L/s	180 L/s	2022 – 2031	Thorold	C	To be Satisfied under Consolidated South NF Schedule C EA – Separate Study	Pumping	$ 4,620,000
WW-II-010	Wet weather reduction in St. Catharines and Thorold	Wet weather reduction in St. Catharines and Thorold - Port Weller	134 L/s reduction	2017 – 2021	St. Catharines	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$ 20,100,000
Total									**$ 29,609,000**

PART D
NIAGARA-ON-THE-LAKE WASTEWATER SYSTEM

D. NIAGARA-ON-THE-LAKE WASTEWATER TREATMENT PLANT

D.1 Existing System Overview

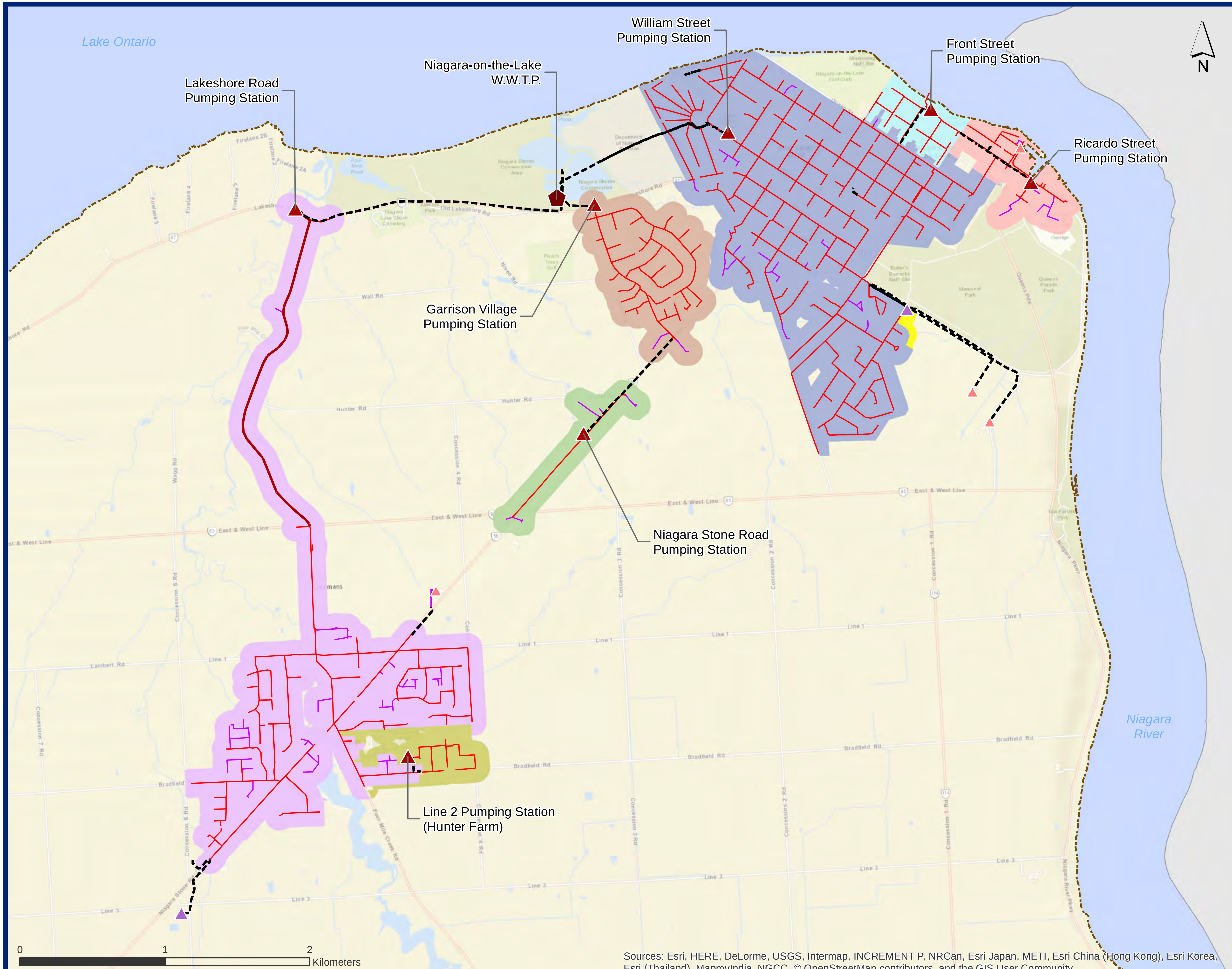
The Niagara-on-the-Lake wastewater system services the Old Town and Virgil areas of the Town of Niagara-on-the-Lake. The system services an existing population of 10,297 and 5,990 employees.[1]

The system is serviced by the Niagara-on-the-Lake Wastewater Treatment Plant, located on 1550 Lakeshore Road, Niagara-on-the-Lake. The Niagara-on-the-Lake Wastewater Treatment Plant is a conventional treatment facility with a current rated capacity of 8.0 MLD, a peak flow capacity of 34.7 MLD[2].

Figure 4.D.1 presents an overview of the wastewater system, and Figure 4.D.2 shows a schematic of the wastewater system.

[1] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*

[2] *Ministry of Environment, 10 September 2014. Ammeded Environmental Compliance Approval. Number 8314-9MHHJQ*



Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations
- Regional
- Municipal
- Private

Wastewater Network
- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

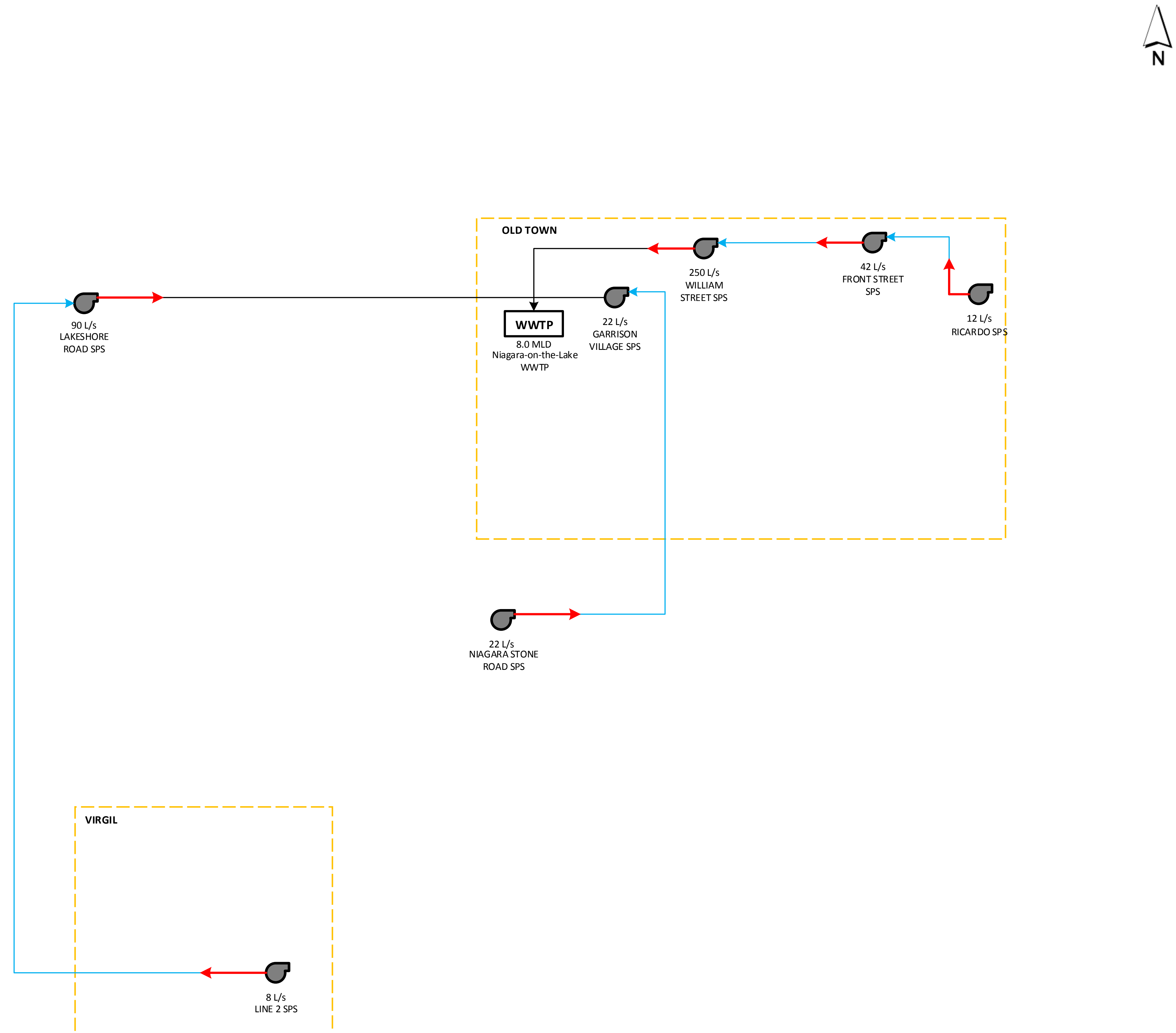
*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Front Street
- Garrison Village
- Lakeshore Road
- Line 2 (Hunter Farm)
- Niagara Stone Road
- Ricardo Street
- Romance Cards Inc.
- St. Michaels Catholic Elementary School
- William Street

Figure 4.D.1
Existing Wastewater System
Niagara-on-the-Lake WWTP

BluePlan ENGINEERING

June 2017
715023-WW-2-Existing System (NOTL)
NAD 1983 UTM Zone 17N



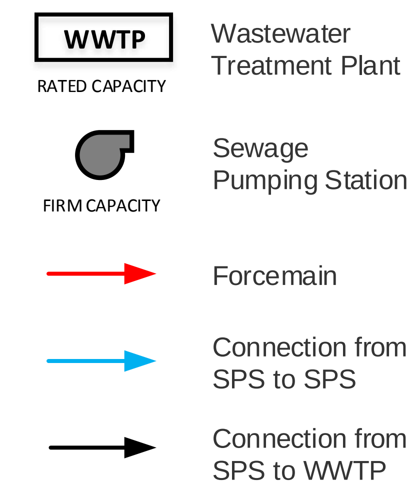
Niagara Region

2016 Master Servicing Plan

Niagara-on-the-Lake WWTP

EXISTING COLLECTION SCHEMATIC

Legend



June 2017
Figure 4.D.2
Not to Scale

GM BluePlan ENGINEERING

D.1.1 Service Area Overview

Table 4.D.1 provides a list of facility catchments and their areas. Refer to Figure 4.D.1 for the catchment areas of each facility.

Table 4.D.1 Facilities and Catchment Areas

Facility	Catchments	Catchment Area (ha)
Niagara-on-the-Lake Wastewater Treatment Plant (WWTP)	**Niagara-on-the-Lake WWTP** (Including Sub Catchments) Garrison Village SPS Lakeshore Road SPS William Street SPS	785.7
	Niagara-on-the-Lake WWTP (Excluding Sub Catchments)	0.0
Garrison Village Sewage Pumping Station (SPS)	**Garrison Village SPS** (Including Sub Catchments) Niagara Stone Road SPS	112.3
	Garrison Village SPS (Excluding Sub Catchments)	78.9
Niagara Stone Road SPS	Niagara Stone Road SPS	33.4
Lakeshore Road SPS	**Lakeshore Road SPS** (Including Sub Catchments) Line 2 SPS	295.4
	Lakeshore Road SPS (Excluding Sub Catchments)	267.3
Line 2 SPS	Line 2 SPS	28.0
William Street SPS	**William Street SPS** (Including Sub Catchments) Front Street SPS	378.1
	William Street SPS (Excluding Sub Catchments)	321.1
Front Street SPS	**Front Street SPS** (Including Sub Catchments) Ricardo Street SPS	56.9
	Front Street SPS (Excluding Sub Catchments)	20.8
Ricardo Street SPS	Ricardo Street SPS	36.1

D.1.2 Facility Overview

Table 4.D.2 Wastewater Treatment Plant Overview

Plant Name	Niagara-on-the-Lake Wastewater Treatment Plant
Address	1550 Lakeshore Road, Niagara-on-the-Lake
Discharge Water	Lake Ontario
Rated Capacity: Average Daily Flow	8.0 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	Not Available
Rated Capacity: Peak Flow Rate (Wet Weather)	34.7 MLD
Key Processes	• Mechanical bar screens with air bubble diffuser system • Grit classifier with cyclone separators • Aeration • Final clarification • Sludge thickening • Anaerobic digestion

Table 4.D.3 Wastewater Treatment Plant Effluent Objectives

Effluent Parameter	Objective Concentration[3]
$CBOD_5$	15.0 mg/L
TSS	15.0 mg/L
Total Phosphorus	0.5 mg/L
Total Ammonia Nitrogen *April, May, and October* *June – September* *November – March*	 5 mg/L 2 mg/L 10 mg/L
E. Coli	100 organisms/100 mL
Total Chlorine Residual	0.01 mg/L

[3] *Ministry of Environment, 10 September 2014. Ammeded Environmental Compliance Approval. Number 8314-9MHHJQ*

Table 4.D.4 Pumping Station Overview

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Garrison Village Sewage Pumping Station (SPS)	1788 Lakeshore Road, Niagara-on-the-Lake	2	62.0	21.7	25.0
Niagara Stone Road SPS	1974 Niagara Stone Road, Niagara-on-the-Lake	3	24.0	22.0	20.5
Lakeshore Road SPS	1340 Lakeshore Road, Niagara-on-the-Lake	2	90.0	90.0	31.5
Line 2 SPS	Hunter Farm Subdivision, Line 2 Road, Virgil	2	Unknown	8.0	Unknown
William Street SPS	433 William Street, Niagara-on-the-Lake	3	250.0	250.0	35.0
Front Street SPS	Front Street, Niagara-on-the-Lake	2	41.5	41.5	10.7
Ricardo Street SPS	Ricardo Street, Niagara-on-the-Lake	2	17.6	11.9	14.0

Table 4.D.5 Forcemain Overview

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Length (m)	Diameter (mm)	Capacity @ 2.5 m/s (L/s)
Garrison Village Sewage Pumping Station (SPS)	21.7	355	200	78.5
Niagara Stone Road SPS	22.0	902	150	44.2
Lakeshore Road SPS	90.0	2,078	300	176.7
Line 2 SPS	8.0	175	100	19.6
William Street SPS	250.0	846	400	436.9
Front Street SPS	41.5	360	200	78.5
Ricardo Street SPS	11.9	624	150	44.2

D.1.3 Flows Overview

Table 4.D.6 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.D.7 shows the existing wastewater system flows by catchment.

Table 4.D.6 Historic Niagara-on-the-Lake Wastewater Treatment Plant Flows

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	L/s	MLD	L/s	MLD	L/s
2011	4.8	55.6	5.0	57.9	16.1	186.3
2012	3.9	45.1	4.1	47.5	8.7	100.7
2013	4.8	55.6	4.9	56.7	8.6	99.5
2014	4.1	47.5	4.3	49.8	10.2	118.1
2015	3.9	45.1	4.0	46.3	8.2	94.9
5 Year Average	4.3	49.8	4.4	50.9	10.3	119.2
5 Year Peak	4.8	55.6	5.0	57.9	16.1	186.3

Table 4.D.7 Existing Wastewater System Flows by Catchment

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Niagara-on-the-Lake Wastewater Treatment Plant (WWTP)	16,287	50.9	326.4	276.7	358.8
Niagara-on-the-Lake WWTP	0	0.0	0.0	0.0	0.0
Garrison Village Sewage Pumping Station (SPS)	4,082	7.3	46.7	37.0	50.0
Garrison Village SPS	769	6.5	35.6	27.2	36.7
Niagara Stone Road SPS	3,313	0.8	11.1	9.8	13.3
Lakeshore Road SPS	4,866	12.8	110.1	75.0	101.0
Lakeshore Road SPS	3,533	9.8	96.1	68.1	91.7
Line 2 SPS	1,333	3.0	14.1	6.9	9.3
William Street SPS	7,339	30.7	169.6	180.0	247.1
William Street SPS	7,058	21.2	134.3	156.0	211.0
Front Street SPS	281	9.5	35.3	24.0	36.1
Front Street SPS	211	3.4	12.8	9.4	14.1
Ricardo Street SPS	70	6.1	22.5	14.6	22.0

Note: Flow numbers may not sum due to rounding.

D.2 Growth Projections

D.2.1 Population Projections and Allocations

Table 4.D.8 and Table 4.D.9 outline the existing and projected serviced population and employment by catchment.

Table 4.D.8 Niagara-on-the-Lake Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Front Street Sewage Pumping Station (SPS)	102	106	107	108	111	115	12
Garrison Village SPS	742	870	983	1,071	1,103	1,111	369
Lakeshore Road SPS	2,069	2,448	3,008	3,192	3,257	3,317	1,248
Line 2 SPS	1,333	1,368	1,391	1,414	1,469	1,485	152
Niagara Stone Road SPS	1,776	1,666	1,656	1,768	2,013	2,129	353
Ricardo Street SPS	44	46	46	46	47	48	3
William Street SPS	4,229	4,458	4,492	4,536	4,636	4,748	518
Total	**10,297**	**10,961**	**11,684**	**12,135**	**12,635**	**12,953**	**2,657**

Note: Population numbers may not sum due to rounding.

Table 4.D.9 Niagara-on-the-Lake Wastewater Treatment Plant Existing and Projected Serviced Employment by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Front Street Sewage Pumping Station (SPS)	108	115	116	117	117	119	10
Garrison Village SPS	26	56	63	67	81	101	74
Lakeshore Road SPS	1,464	1,637	1,667	1,696	1,728	1,776	312
Line 2 SPS	0	0	0	0	0	0	0
Niagara Stone Road SPS	1,537	1,786	1,859	1,925	2,013	2,133	596
Ricardo Street SPS	26	27	27	27	27	28	2
William Street SPS	2,829	2,960	2,997	3,024	3,061	3,117	288
Total	**5,990**	**6,582**	**6,729**	**6,856**	**7,028**	**7,273**	**1,282**

Note: Population numbers may not sum due to rounding.

D.2.2 Future Flow Projections

Table 4.D.10 and Table 4.D.11 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

Table 4.D.10 Projected Peak Dry Weather Flow by Catchment

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Front Street Sewage Pumping Station (SPS)	6.9	7.0	7.0	7.0	7.1
Garrison Village SPS	15.0	16.4	17.5	18.0	18.4
Lakeshore Road SPS	25.4	31.5	33.6	34.6	35.7
Line 2 SPS	6.5	6.7	7.0	7.6	7.8
Niagara Stone Road SPS	3.0	3.7	5.6	9.1	11.5
Ricardo Street SPS	12.2	12.2	12.2	12.2	12.3
William Street SPS	46.0	46.7	47.4	48.7	50.3
Total	**115.1**	**124.2**	**130.3**	**137.3**	**143.1**

The following presents an example calculation of projected peak dry weather flow.

2041 Peak Dry Weather Flow for William Street Sewage Pumping Station:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (21.23 L/s × 2.0) + (7,865 – 7,058 people) × 275 L/cap/day × 1 day/86400 s × 3.06
= 50.3 L/s

Table 4.D.11 Projected Peak Wet Weather Flow by Catchment

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Front Street Sewage Pumping Station (SPS)	12.9	12.9	12.9	13.0	13.1
Garrison Village SPS	37.6	39.0	40.1	40.6	40.9
Lakeshore Road SPS	101.9	108.0	110.1	111.1	112.1
Line 2 SPS	14.5	14.7	15.0	15.7	15.8
Niagara Stone Road SPS	12.6	13.3	15.1	18.7	21.1
Ricardo Street SPS	22.6	22.6	22.6	22.6	22.6
William Street SPS	137.8	138.5	139.2	140.5	142.1
Total	**339.8**	**348.9**	**355.0**	**362.1**	**367.8**

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for William Street Sewage Pumping Station:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 50.3 L/s + (321.1 ha × 0.286 L/s/ha)
= 142.1 L/s

D.3 Assessment of Wastewater Infrastructure (Existing and Future)

D.3.1 Treatment Plant Capacity

Figure 4.D.3 shows the projected future demands at the Niagara-on-the-Lake Wastewater Treatment Plant. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.

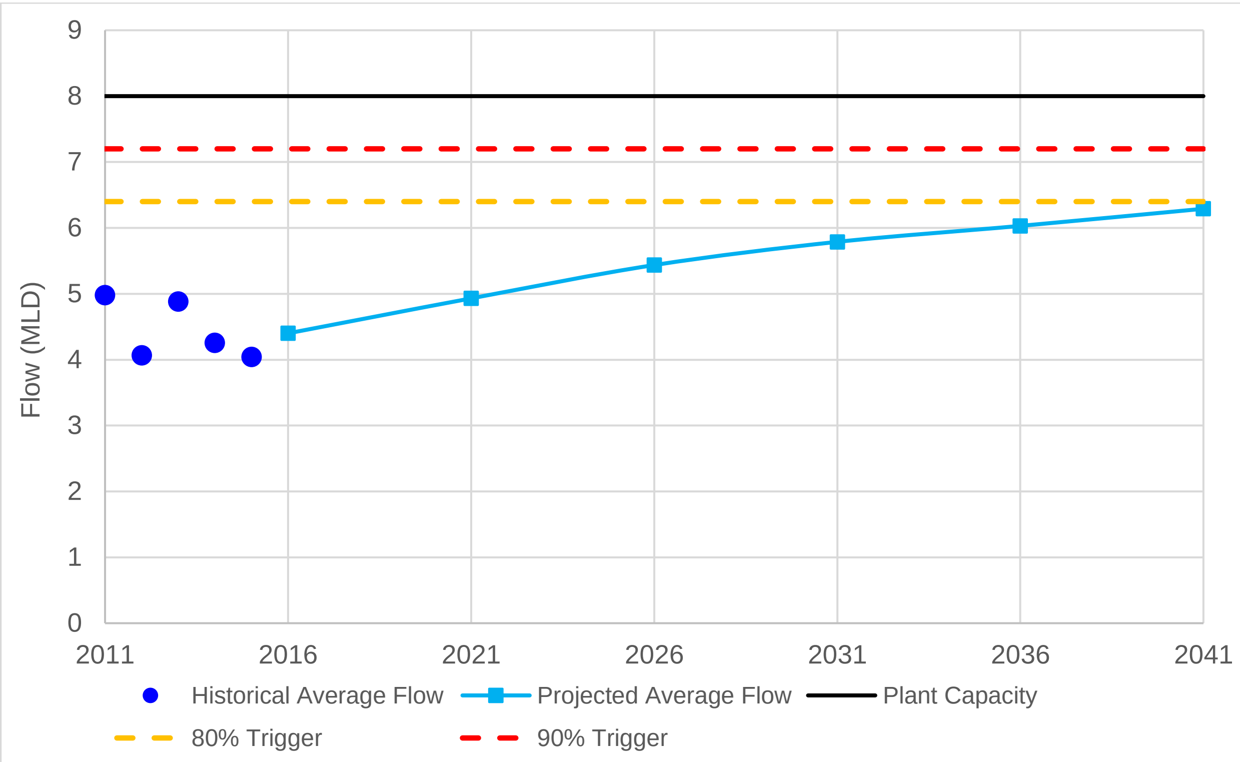


Figure 4.D.3 Projected future demands at Niagara-on-the-Lake Wastewater Treatment Plant

D.3.2 Sewage Pumping Station

Table 4.D.12 highlights the sewage pumping station existing and projected capacity.

Table 4.D.12 System Sewage Pumping Station Performance

Sewage Pumping Station	Contributing Catchments	Facility Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Garrison Village Sewage Pumping Station (SPS)	Garrison Village SPS Niagara Stone Road SPS	21.7	46.7	60.9	-39.2
Niagara Stone Road SPS	Niagara Stone Road SPS	22.0	11.1	21.1	0.9
Lakeshore Road SPS	Lakeshore Road SPS Line 2 SPS	90.0	110.1	127.2	-37.2
Line 2 SPS	Line 2 SPS	8.0	14.1	15.8	-7.8
William Street SPS	William Street SPS Front Street SPS	250.0	169.6	177.7	72.3
Front Street SPS	Front Street SPS Ricardo Street SPS	41.5	35.3	35.6	5.9
Ricardo Street SPS	Ricardo Street SPS	11.9	22.5	22.6	-10.7

The following sewage pumping stations have projected pumping deficits:

- Garrison Village Sewage Pumping Station
- Lakeshore Road Sewage Pumping Station
- Line 2 Sewage Pumping Station
- Ricardo Street Sewage Pumping Station

D.3.3 Forcemain

Table 4.D.13 highlights the existing and projected forcemain performance.

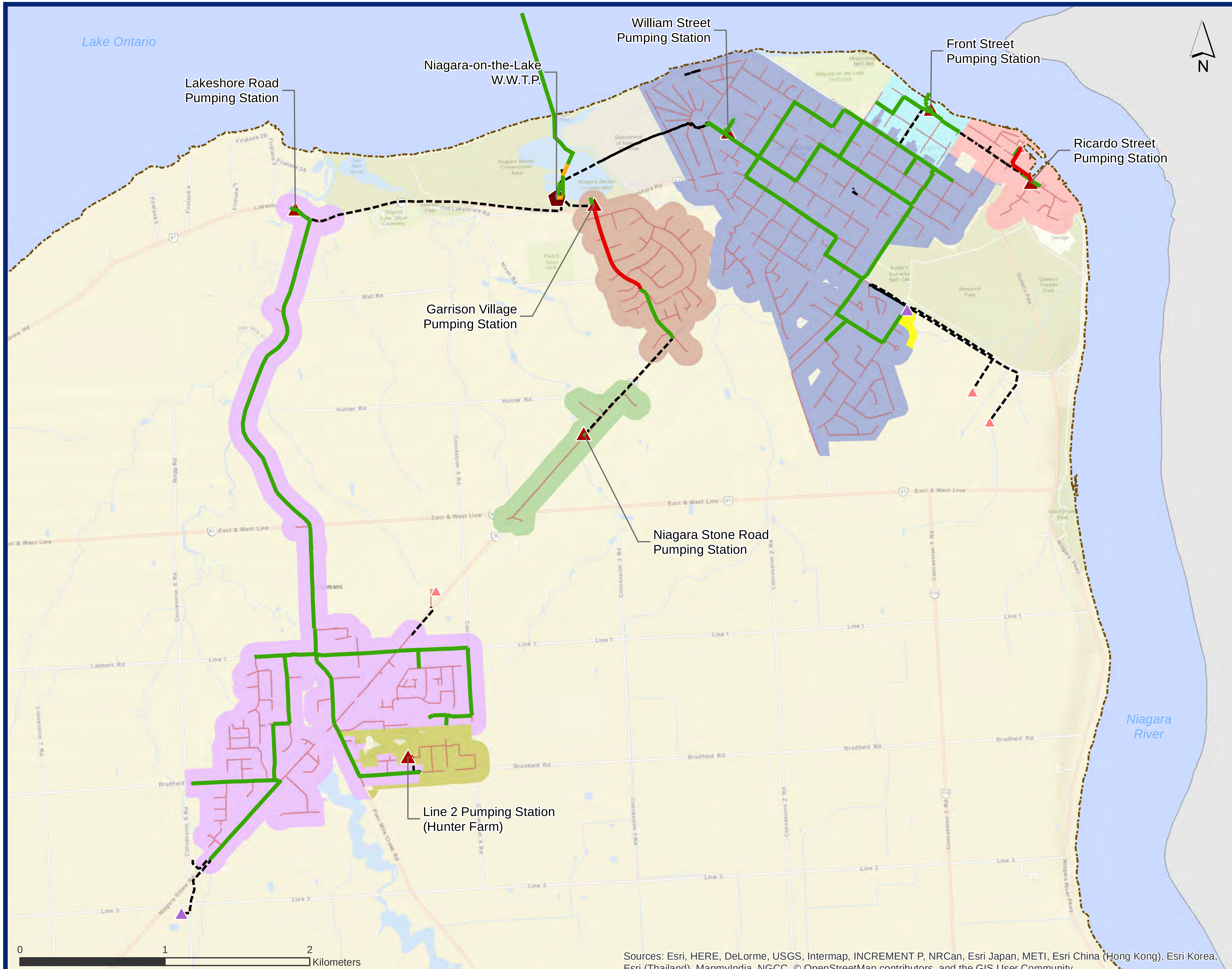
Table 4.D.13 Forcemain Performance

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Capacity @ 2.5 m/s (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Garrison Village SPS	21.7	78.5	46.7	60.9	17.6
Niagara Stone Road SPS	22.0	44.2	11.1	21.1	23.1
Lakeshore Road SPS	90.0	176.7	110.1	127.2	49.5
Line 2 SPS	8.0	19.6	14.1	15.8	3.8
William Street SPS	250.0	436.9	169.6	177.7	259.2
Front Street SPS	41.5	78.5	35.3	35.6	42.9
Ricardo Street SPS	11.9	44.2	22.5	22.6	21.6

All forcemains have a projected surplus capacity.

D.3.4 Trunk Sewer

Figure 4.D.4 and Figure 4.D.5 highlight the existing and projected peak wet weather flow, respectively. Trunk sewers in the Garrison Village Sewage Pumping Station and Ricardo Street Sewage Pumping Station catchments are approaching capacity within the 2041 time horizon.



Niagara Region

2016 MASTER SERVICING PLAN

Figure 4.D.4

Existing Peak Wet Weather Flow

Niagara-on-the-Lake WWTP

BluePlan

June 2017
715023-WW-4-Existing Wet Weather (NOTL)
NAD 1983 UTM Zone 17N

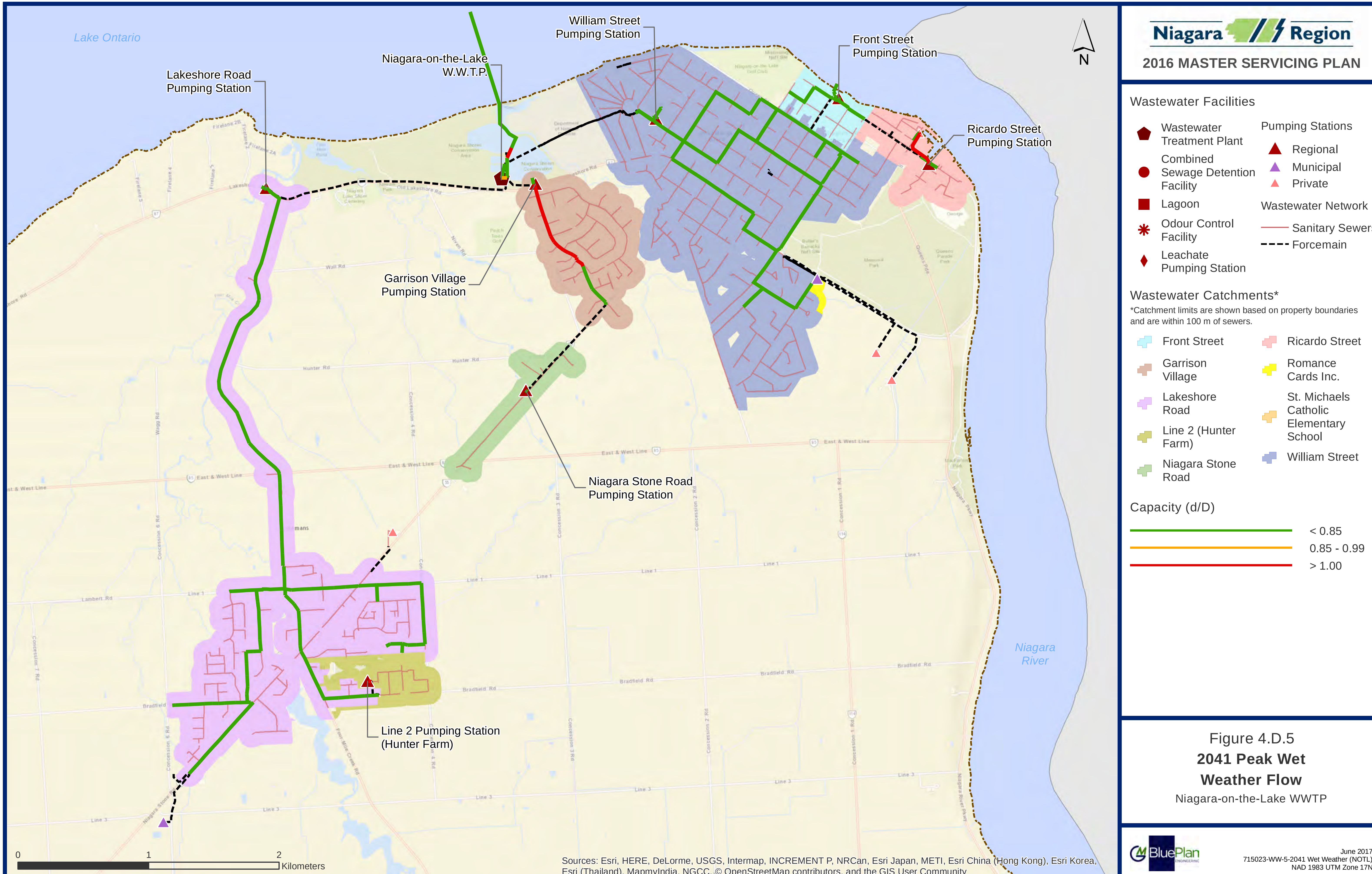


Figure 4.D.5
2041 Peak Wet Weather Flow
Niagara-on-the-Lake WWTP

June 2017
715023-WW-5-2041 Wet Weather (NOTL)
NAD 1983 UTM Zone 17N

D.4 System Opportunities and Constraints

Figure 4.D.6 highlights the existing opportunities and constraints.

D.4.1 Niagara-on-the-Lake Wastewater Treatment Plant

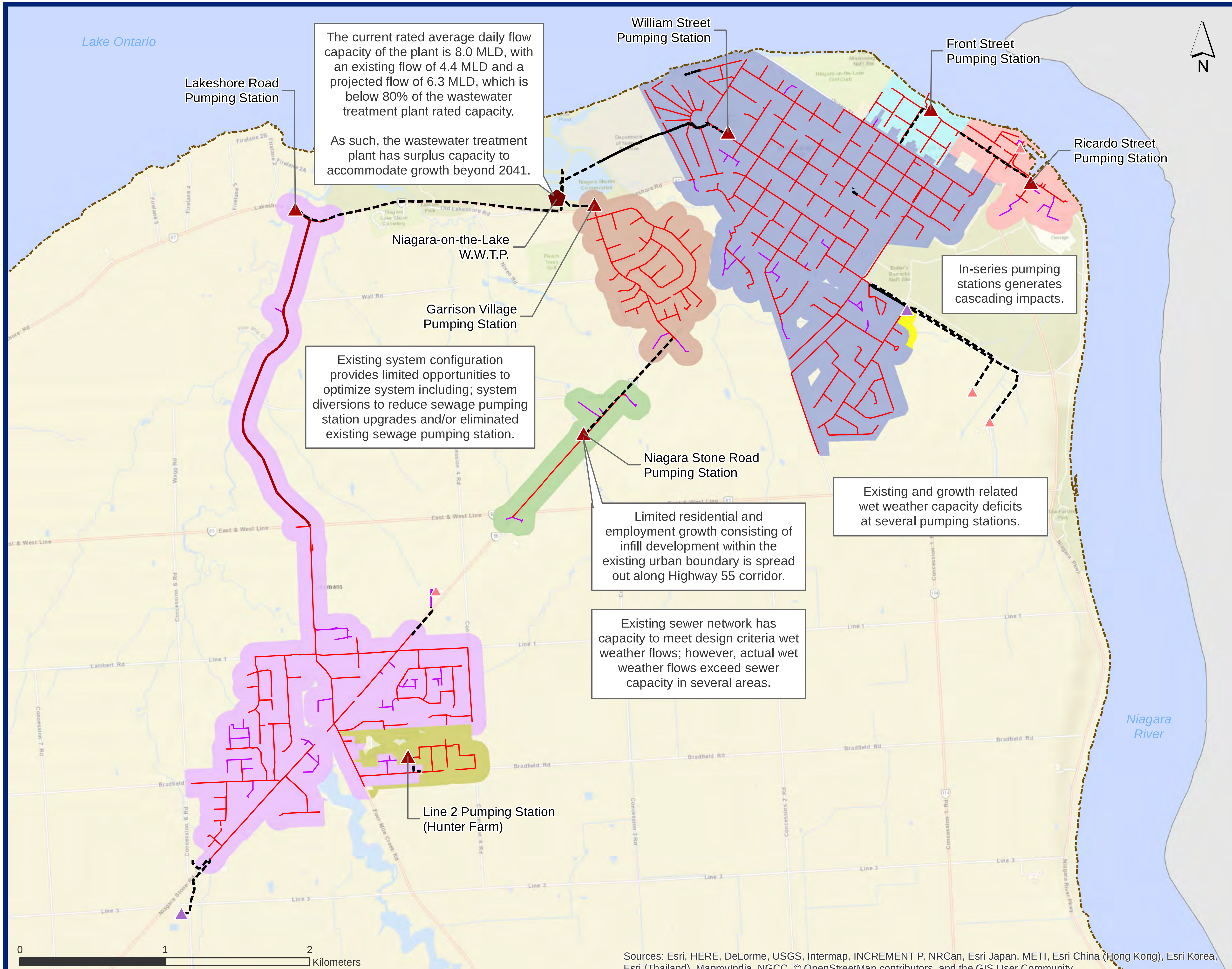
- The current rated average daily flow capacity of the plant is 8.0 MLD, with an existing flow of 4.4 MLD and a projected flow of 6.3 MLD, which is below 80% of the wastewater treatment plant rated capacity. As such, the wastewater treatment plant has surplus capacity to accommodate growth beyond 2041.

D.4.2 Niagara-on-the-Lake

- Limited residential and employment growth consisting of infill development within the existing urban boundary is spread out along the Highway 55 corridor.
- Existing and growth related wet weather capacity deficits at several pumping stations.
- Existing sewer network has capacity to meet design criteria wet weather flows; however, actual wet weather flows exceed sewer capacity in several areas.

D.4.3 System Optimization Opportunities

- In-series pumping stations generates cascading impacts.
- Existing system configuration provides limited opportunities to optimize system, including system diversions to reduce sewage pumping station upgrades and/or eliminate existing sewage pumping stations.



Niagara Region
2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Front Street
- Garrison Village
- Lakeshore Road
- Line 2 (Hunter Farm)
- Niagara Stone Road
- Ricardo Street
- Romance Cards Inc.
- St. Michaels Catholic Elementary School
- William Street

Figure 4.D.6
System Opportunities and Constraints
Niagara-on-the-Lake WWTP

GM BluePlan Engineering
June 2017
715023-WW-3-Opportunities and Constraints (NOTL)
NAD 1983 UTM Zone 17N

D.5 Assessment of Alternatives

No further alternatives beyond application of the hybrid management strategy below were identified.

- Provide capacity within Regional pumping stations and trunk sewers to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Provide upstream flow management and peak flow management to address peak flows in systems where peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in potential basement flooding and overflow risks.

D.6 Preferred Servicing Strategy

The following is a summary of the Niagara-on-the-Lake wastewater servicing strategy, presented in Figure 4.D.7 and Figure 4.D.8:

- The Niagara-on-the-Lake Wastewater Treatment Plant is a newly constructed facility. The wastewater treatment plant has sufficient capacity to support growth to year 2041.
- The wastewater strategy comprises only of a few sewage pumping station capacity upgrades to address additional flows from growth.

D.6.1 Pumping Stations

The following sewage pumping station upgrades are required:

- Lakeshore Road Sewage Pumping Station pump replacement: Increase capacity from 90 L/s to 142 L/s.
- Niagara Stone Road Sewage Pumping Station pump replacement: Increase capacity from 22 L/s to 27 L/s.
- Line 2 SPS pump replacement: Increase capacity from 8 L/s to 17 L/s.
- Garrison Village SPS pump replacement: Increase capacity from 62 L/s to 68 L/s.
- Ricardo SPS has no flow monitoring data, so flows are based on parcel allocation. Operations staff report no known capacity issues and there is no growth allocated to the catchment. As such, no project has been identified at Ricard SPS.

D.6.2 Wet Weather

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts. These wet weather management programs will need to be a joint initiative between the Region and local municipalities.

For the Niagara-on-the-Lake system, the following priority areas are identified:

- Virgil area, consisting of the Lakeshore Road Sewage Pumping Station catchment.
- Niagara-on-the-Lake, consisting of the William Street Sewage Pumping Station catchment.

Further flow monitoring and area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, Preferred Servicing Strategy are needed to identify area specific strategies and projects required to achieve the wet weather flow reduction objectives. Following the outcomes of the further studies, targeted funding can be applied outside the priority areas if the projects are found to address capacity issues and support growth capacity needs.

D.7 Capital Program

Table 4.D.14 summarizes the recommended project costing, implementation schedule and Class EA requirements.

D.7.1 Schedule B Project Files

No Schedule B projects are anticipated for the Niagara-on-the-Lake Wastewater Treatment Plant system.

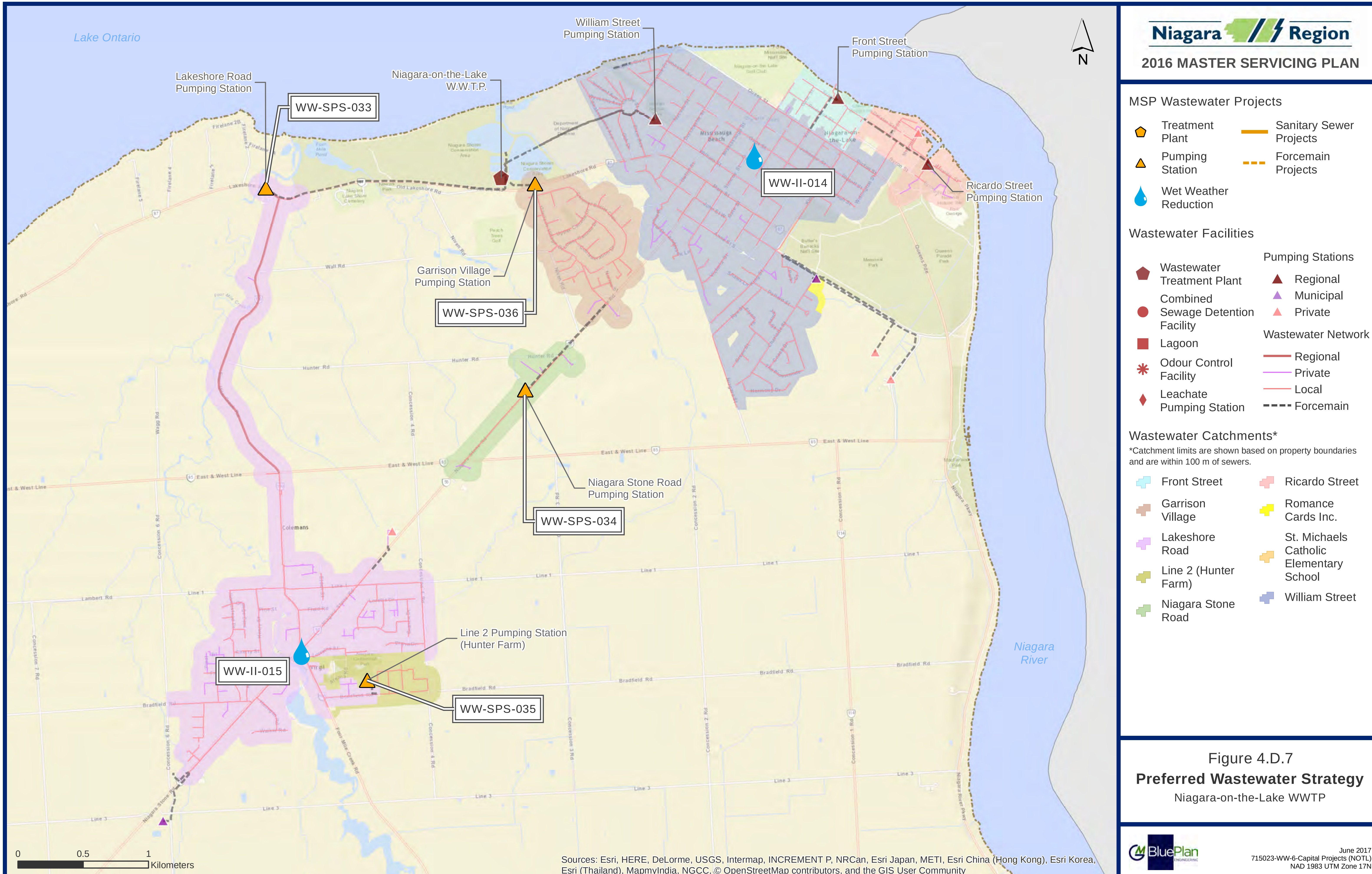


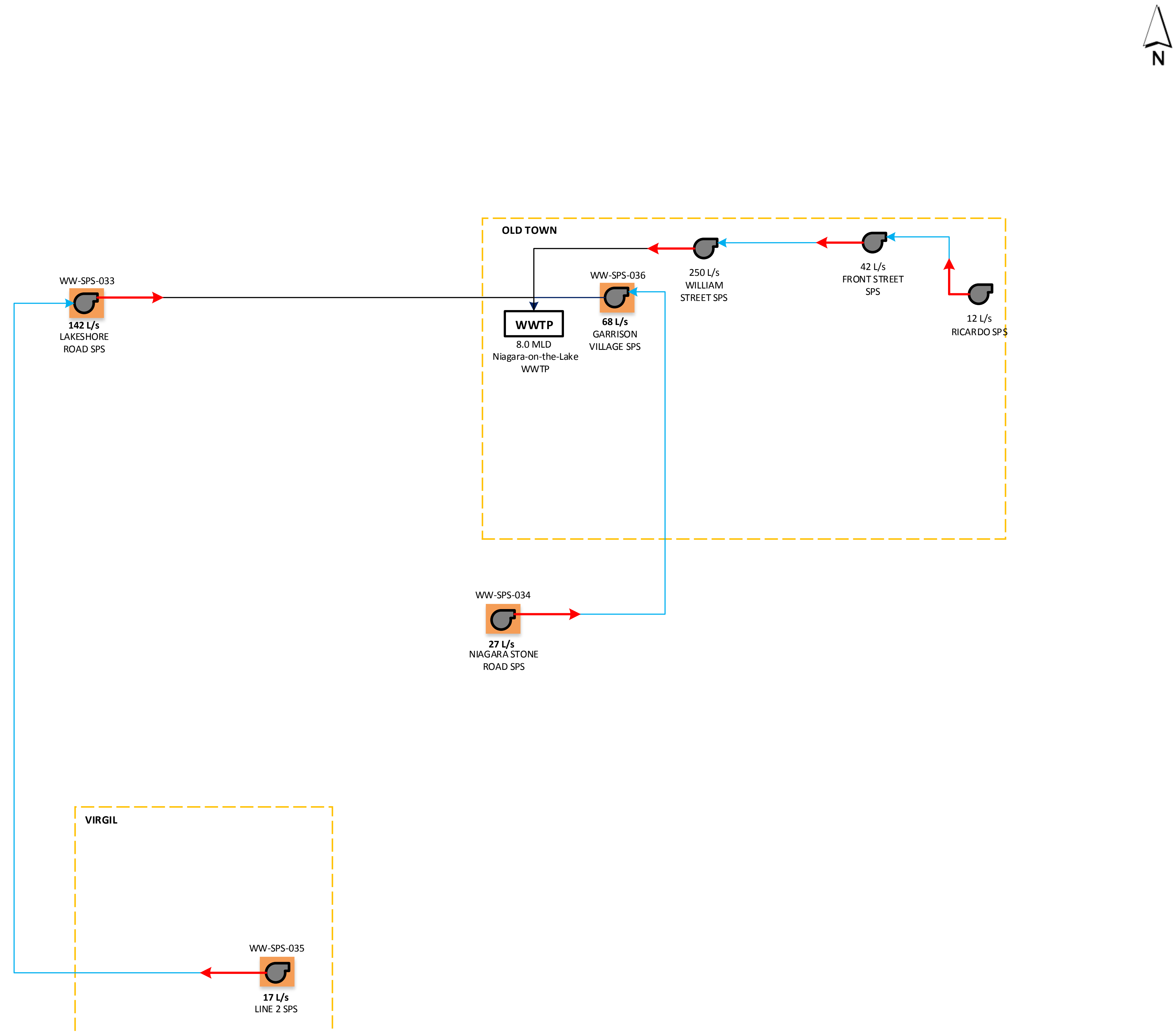
Figure 4.D.7
Preferred Wastewater Strategy
Niagara-on-the-Lake WWTP

Niagara Region

2016 Master Servicing Plan

Niagara-on-the-Lake WWTP

2041 COLLECTION SCHEMATIC



WWTP — RATED CAPACITY — Wastewater Treatment Plant

FIRM CAPACITY — Sewage Pumping Station

Forcemain

Connection from SPS to SPS

Connection from SPS to WWTP

Facility Upgrade

Upgrade Forcemain or Sewer

New Forcemain or Sewer

Decommission Project

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Figure 4.D.8
Not to Scale

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Table 4.D.14 Summary of Niagara-on-the-Lake Wastewater Treatment Plant Capital Program

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-II-014	Wet weather reduction in Northeast Niagara-on-the-Lake	Wet weather reduction in Northeast Niagara-on-the-Lake	5 L/s reduction	2022-2031	Niagara-on-the-Lake	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$750,000
WW-II-015	Wet weather reduction in Virgil	Wet weather reduction in Virgil – Niagara-on-the-Lake	5 L/s reduction	2022-2031	Niagara-on-the-Lake	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$750,000
WW-SPS-033	Lakeshore Road Sewage Pumping Station (SPS) Pump Replacement - Niagara-on-the-Lake	Increase station capacity from 90 L/s to 142 L/s	142 L/s	2032-2041	Niagara-on-the-Lake	A+	Satisfied	Pumping	$1,512,000
WW-SPS-034	Niagara Stone Road SPS Pump Replacement - Niagara-on-the-Lake	Increase station capacity from 22 L/s to 27 L/s	27 L/s	2032-2041	Niagara-on-the-Lake	A+	Satisfied	Pumping	$834,000
WW-SPS-035	Line 2 SPS Pump Replacement - Niagara-on-the-Lake	Increase station capacity from 8 L/s to 17 L/s	17 L/s	2017-2021	Niagara-on-the-Lake	A+	Satisfied	Pumping	$665,000
WW-SPS-036	Garrison Village SPS Pump Replacement - Niagara-on-the-Lake	Increase station capacity from 62 L/s to 68 L/s	68 L/s	2032-2041	Niagara-on-the-Lake	A+	Satisfied	Pumping	$1,250,000
Total									**$5,761,000**

PART E
QUEENSTON WASTEWATER SYSTEM

E. QUEENSTON WASTEWATER TREATMENT PLANT

E.1 Existing System Overview

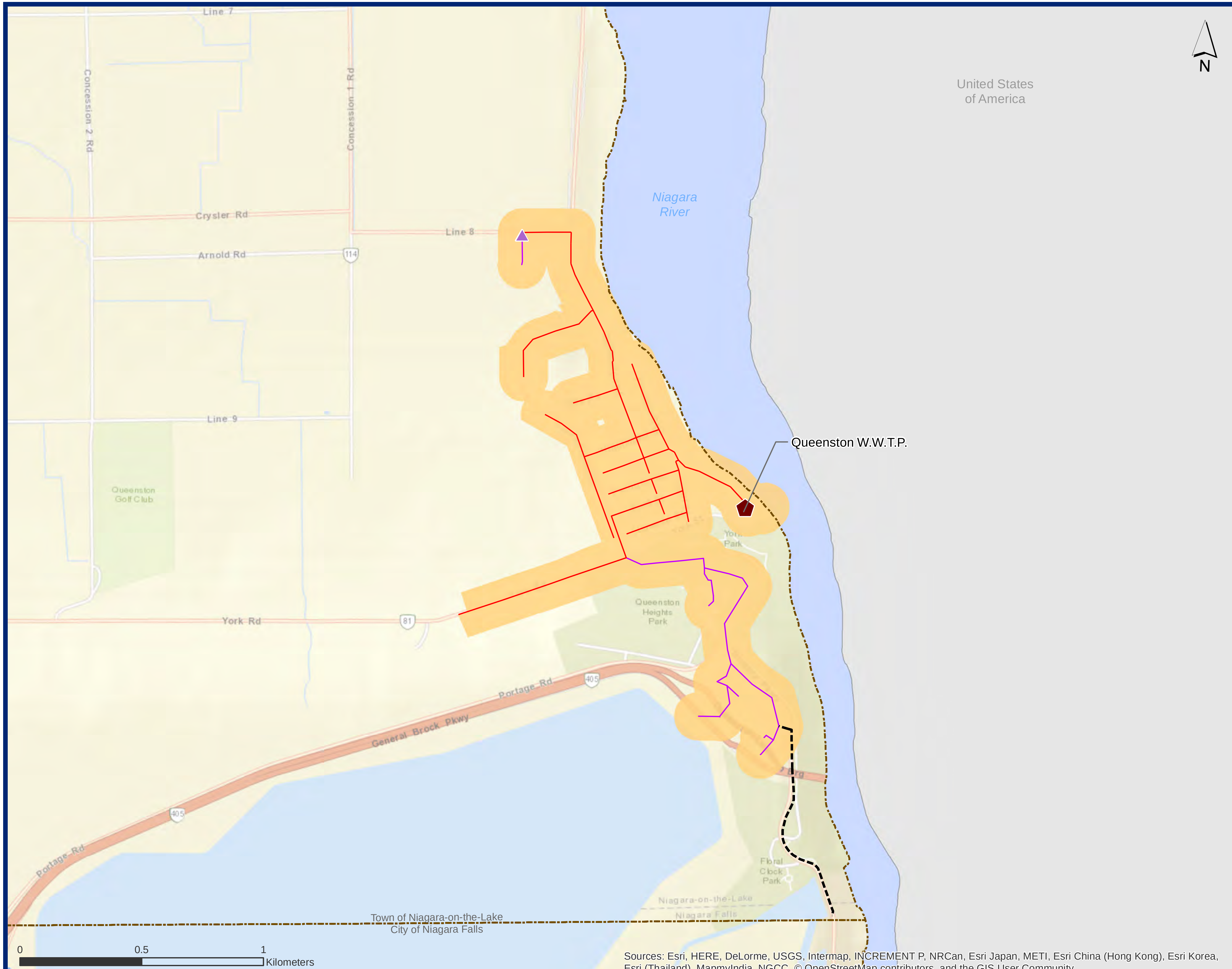
The Queenston wastewater system services the Community of Queenston. The system services an existing population of 1,798 and 1,298 employees.[1]

The system is serviced by the Queenston Wastewater Treatment Plant, located on 30 Front Street, Niagara-on-the-Lake. The Queenston Wastewater Treatment Plant is a conventional treatment plant with a current rated average daily flow capacity of 0.5 MLD, and a peak design flow rate of 1.7 MLD.[2]

Figure 4.E.1 presents an overview of the wastewater system, and Figure 4.E.2 shows a schematic of the wastewater system.

[1] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*

[2] *Ministry of Environment, 22 February 2013. Ammeded Certificate of Approval. Number 0371-93YM2L*



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Queenston W.W.T.P.

Figure 4.E.1

Existing Wastewater System

Queenston WWTP

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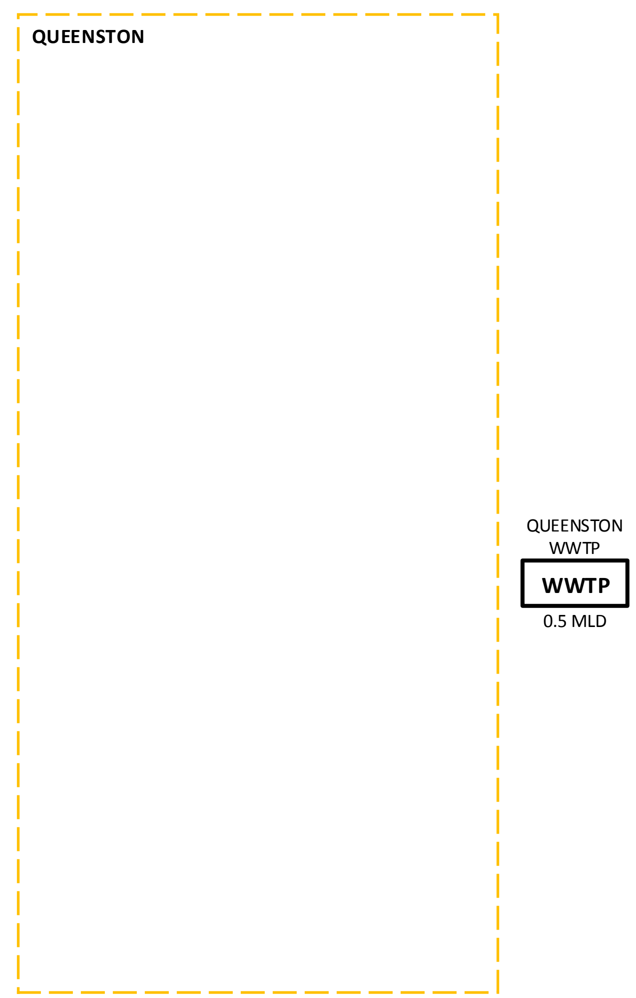
715023-WW-2-Existing System (Queenston)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Queenston WWTP

EXISTING COLLECTION SCHEMATIC

Legend

WWTP (RATED CAPACITY)	Wastewater Treatment Plant
FIRM CAPACITY	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP

June 2017
Figure 4.E.2
Not to Scale

GM BluePlan ENGINEERING

E.1.1 Service Area Overview

Table 4.E.1 provides a list of facility catchments and their areas. Refer to Figure 4.E.1 for the catchment areas of each facility

Table 4.E.1 Facilities and Catchment Areas

Facility	Catchments	Catchment Area (ha)
Queenston Wastewater Treatment Plant (WWTP)	Queenston WWTP	121.8

E.1.2 Facility Overview

Table 4.E.2 Wastewater Treatment Plant Overview

Plant Name	Queenston Wastewater Treatment Plant
Address	30 Front Street, Niagara-on-the-Lake
Discharge Water	Niagara River
Rated Capacity: Average Daily Flow	0.5 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	Not available
Rated Capacity: Peak Flow Rate (Wet Weather)	1.7 MLD
Key Processes	• Total Phosphorus Treatment • Biological Reactors • Return Activated Sludge/Waste Activated Sludge Pumping Station • Treated Effluent Outfall • Biosolids Storage and Disposal

Table 4.E.3 Wastewater Treatment Plant Effluent Objectives

Effluent Parameter	Objective Concentration[3]
$CBOD_5$	15.0 mg/L
TSS	15.0 mg/L
Total Phosphorus	1.0 mg/L
E. Coli	200 organisms/100 mL
Total Chlorine Residual	0.5 mg/L

E.1.3 Flows Overview

Table 4.E.4 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.E.5 shows the existing wastewater system flows by catchment.

Table 4.E.4 Historic Queenston Wastewater Treatment Plant Flows

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	L/s	MLD	L/s	MLD	L/s
2011	0.3	3.4	0.3	3.4	2.3	26.3
2012	0.2	2.9	0.3	2.9	1.6	18.1
2013	0.3	3.1	0.3	3.3	2.1	24.0
2014	0.2	2.6	0.2	2.6	1.3	14.5
2015	0.2	2.9	0.2	2.8	0.9	10.4
5 Year Average	0.3	3.0	0.3	3.0	1.6	18.6
5 Year Peak	0.3	3.4	0.3	3.4	2.3	26.3

[3] *Ministry of Environment, 22 February 2013. Ammeded Certificate of Approval. Number 0371-93YM2L*

Table 4.E.5 Existing Wastewater System Flows by Catchment

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Queenston	3,014	3.0	40.8	N/A	N/A
Total	**3,014**	**3.0**	**40.8**	**N/A**	**N/A**

Note: Flow numbers may not sum due to rounding.

E.2 Growth Projections

E.2.1 Population Projections and Allocations

Table 4.E.6 and Table 4.E.7 outline the existing and projected serviced population and employment by catchment.

Table 4.E.6 Queenston Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Queenston	1,798	1,809	1,812	1,822	1,840	1,866	68
Total	**1,798**	**1,809**	**1,812**	**1,822**	**1,840**	**1,866**	**68**

Note: Population numbers may not sum due to rounding.

Table 4.E.7 Queenston Wastewater Treatment Plant Existing and Projected Serviced Employment by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Queenston	1,298	1,450	1,484	1,516	1,556	1,614	316
Total	**1,298**	**1,450**	**1,484**	**1,516**	**1,556**	**1,614**	**316**

Note: Population numbers may not sum due to rounding.

E.2.2 Future Flow Projections

Table 4.E.8 and Table 4.E.9 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

Table 4.E.8 Projected Peak Dry Weather Flow by Catchment

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Queenston	7.8	8.2	8.6	9.2	10.1
Total	**7.8**	**8.2**	**8.6**	**9.2**	**10.1**

The following presents an example calculation of projected peak dry weather flow.

2041 Peak Dry Weather Flow for Queenston Wastewater Treatment Plant:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (3.0 L/s × 2.0) + (3,480 – 3,096 people) × 275 L/cap/day × 1 day/86400 s × 3.39
= 10.1 L/s

Table 4.E.9 Projected Peak Wet Weather Flow by Catchment

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Queenston	42.6	43.0	43.5	44.1	45.0
Total	**42.6**	**43.0**	**43.5**	**44.1**	**45.0**

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for Queenston Wastewater Treatment Plant:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 10.1 L/s + (121.8 ha × 0.286 L/s/ha)
= 45.0 L/s

E.3 Assessment of Wastewater Infrastructure (Existing and Future)

E.3.1 Treatment Plant Capacity

Figure 4.E.3 shows the projected future demands at the Queenston Wastewater Treatment Plant. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.

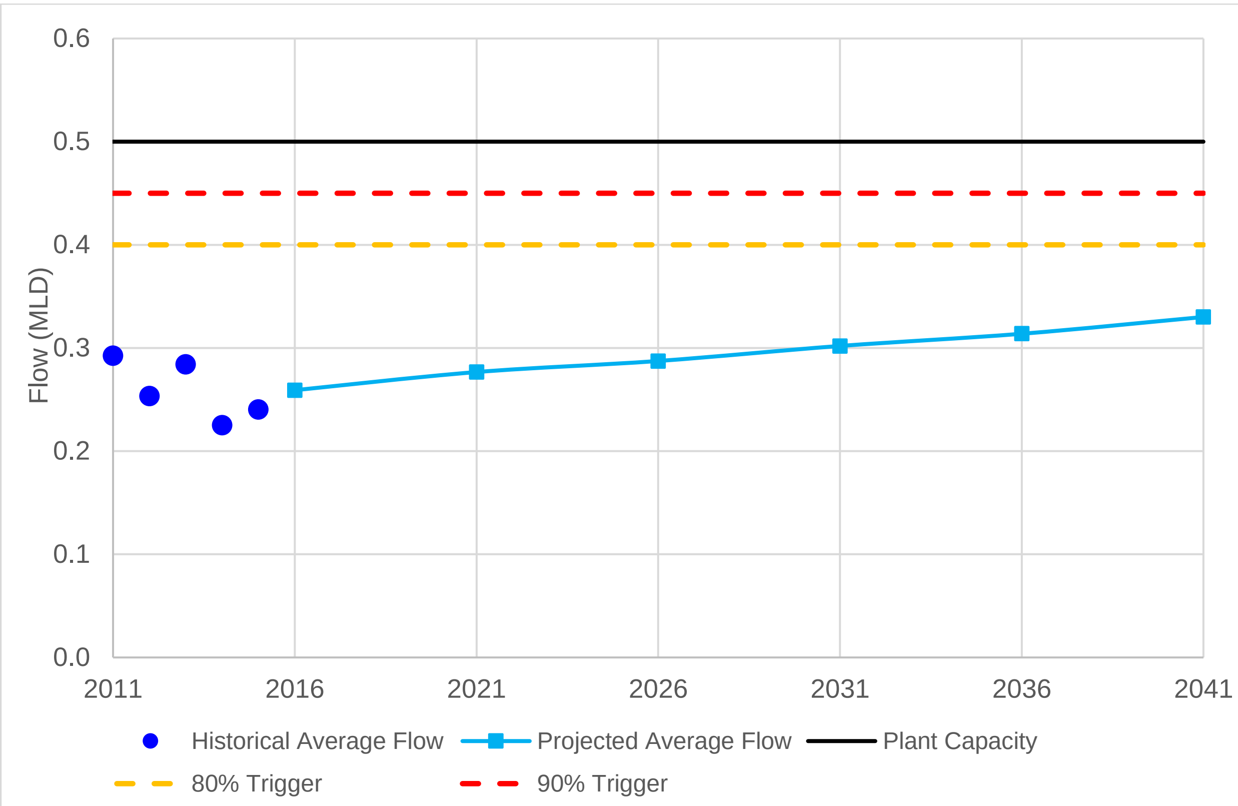


Figure 4.E.3 Projected future demands at Queenston Wastewater Treatment Plant

E.4 System Opportunities and Constraints

Figure 4.E.4 highlights the existing opportunities and constraints.

B.4.1 Queenston Wastewater Treatment Plant

- The current rated average daily flow capacity of the plant is 0.5 MLD, with an existing flow of 0.26 MLD and a projected average daily flow of 0.33 MLD. As such, the wastewater treatment plant has surplus capacity to accommodate growth beyond 2041.

B.4.2 Niagara-on-the-Lake

- Limited residential and employment growth consisting of infill development within existing urban boundary.
- No Regional conveyance infrastructure.

B.4.3 System Optimization Opportunities

- Opportunity to decommission Queenston Wastewater Treatment Plant and convey flows to the Niagara Falls Wastewater Treatment Plant.

Niagara Region

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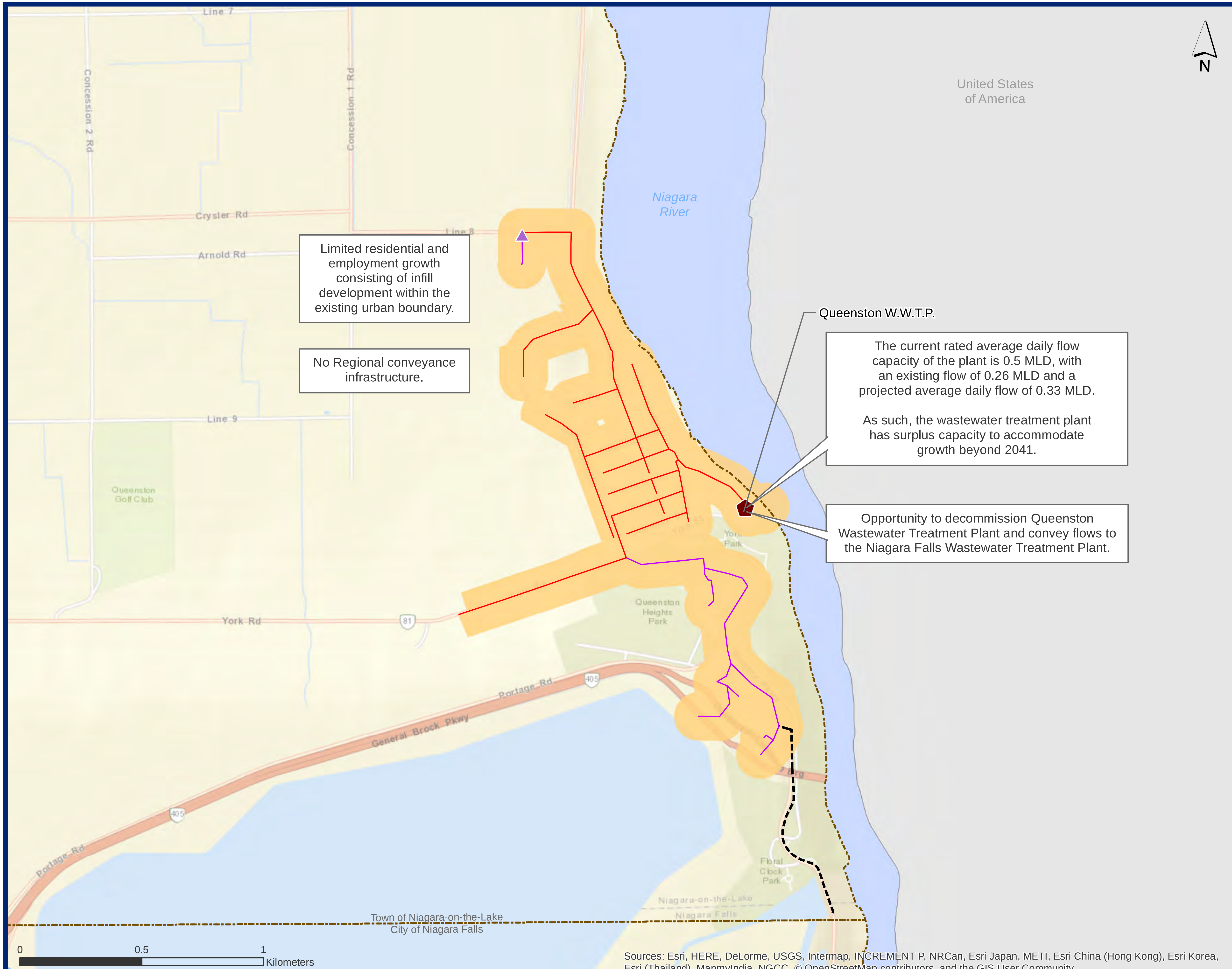

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Queenston W.W.T.P.

Figure 4.E.4

System Opportunities and Constraints

Queenston WWTP

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June 2017
715023-WW-3-Opps and Cons (Queenston)
NAD 1983 UTM Zone 17N

E.5 Assessment of Alternatives

Two alternatives for the Queenston Servicing Strategy were considered. The alternatives are as follows:

1. Maintain existing configuration:
    - No system upgrades
2. Decommission the Queenston Wastewater Treatment Plan and redirect flows to the Niagara Falls Wastewater Treatment Plant. Required works include:
    - New Queenston Sewage Pumping Station and forcemain
    - Decommission the Queenston Wastewater Treatment Plant

Implementation of Alternative 2 is not dependent on the construction of the New Niagara Falls Wastewater Treatment Plant (which was identified as the preferred servicing option, outlined in Part F); however, the new wastewater treatment plant would provide additional capacity at the Niagara Falls Wastewater Treatment Plant, improving the long-term viability of decommissioning the Queenston Wastewater Treatment Plant.

It was found that Alternative 2 is preferred as it:

- Provides an opportunity to consolidate a smaller treatment plant into a larger treatment plant catchment, improving system operations and efficiency.
- Provides flexibility in implementation, as it can be completed at any time.

E.6 Preferred Servicing Strategy

The following is a summary of the Queenston wastewater servicing strategy, presented in Figure 4.E.5 and Figure 4.E.6:

- The Queenston wastewater system is a small system in Niagara-on-the-Lake. There is not much growth projected and the system has capacity to support its needs. However, from a lifecycle perspective, it can be inefficient to operate small independent systems.
- The South Niagara Falls wastewater strategy presents opportunities for adjacent systems. On this basis, it is recommended to redirect the Queenston flows to Niagara Falls and decommission the Queenston Wastewater Treatment Plant.

E.6.1 Pumping Stations

A new Queenston Sewage Pumping Station with a capacity of 45 L/s and an associated 250 mm forcemain is required.

E.6.2 Decommissioning of Existing Facilities

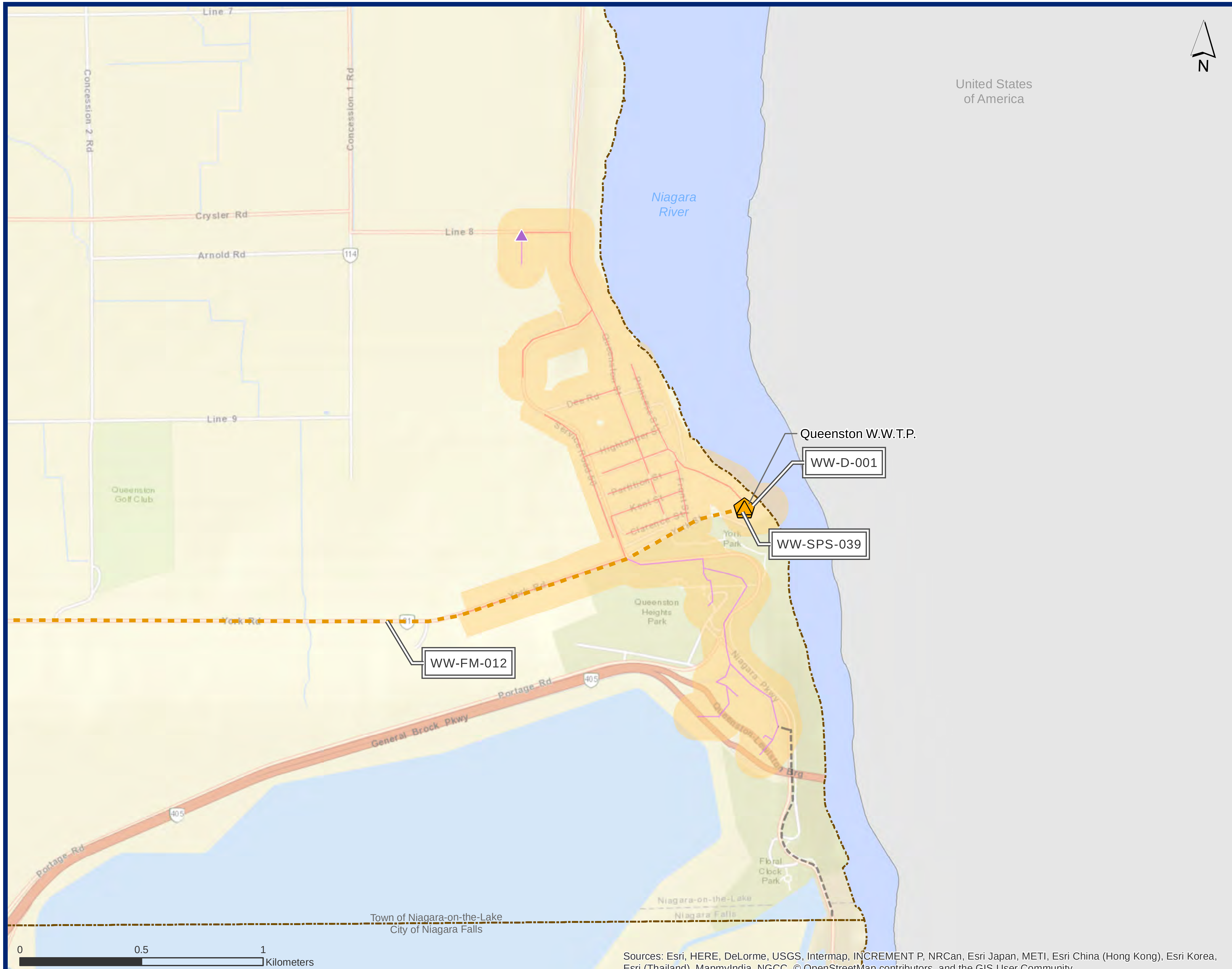
Decommissioning of the existing Queenston Wastewater Treatment Plant is required, which will be replaced by a new Queenston Sewage Pumping Station and forcemain.

E.7 Capital Program

Table 4.E.10 summarizes the recommended project costing, implementation schedule and Class EA requirements.

E.7.1 Schedule B Project Files

Schedule B projects for the Queenston Wastewater Treatment Plant system shall be satisfied under a separate study for the Consolidated Queenstown Schedule B Environmental Assessment.



Niagara Region

2016 MASTER SERVICING PLAN

MSP Wastewater Projects

- Treatment Plant
- Sanitary Sewer Projects
- Pumping Station
- Forcemain Projects
- Wet Weather Reduction

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Queenston W.W.T.P.

Figure 4.E.5

Preferred Wastewater Strategy

Queenston WWTP

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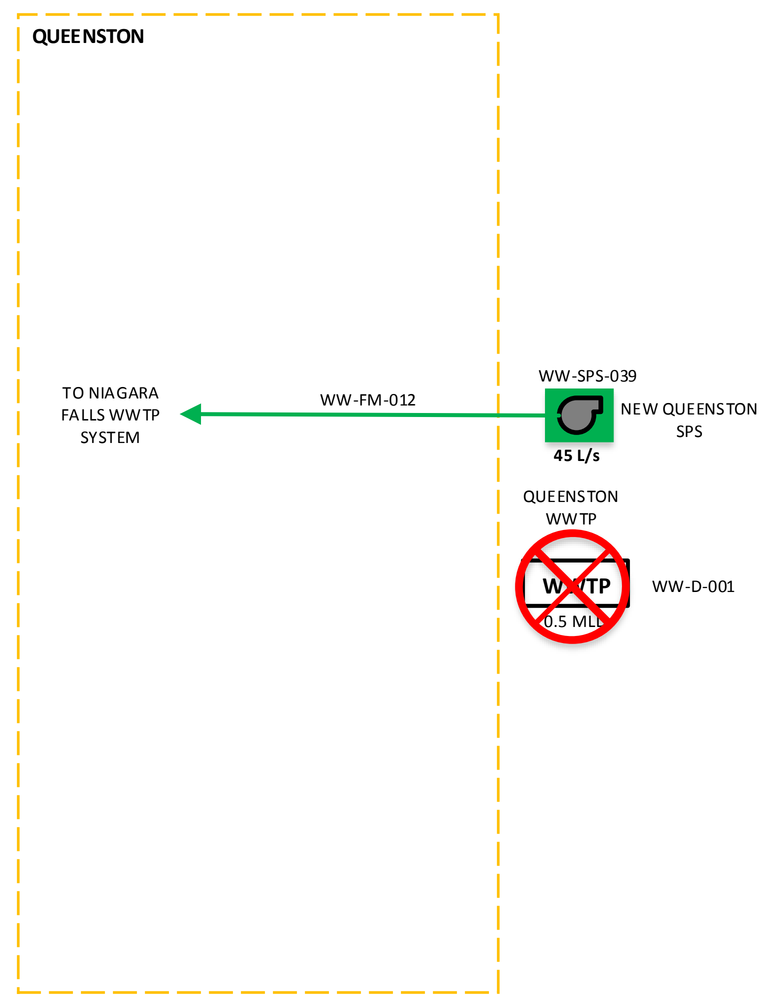
June 2017
715023-WW-6-Capital Projects (Queenston)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Queenston WWTP

2041 COLLECTION SCHEMATIC

WWTP RATED CAPACITY	Wastewater Treatment Plant
FIRM CAPACITY	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP
	Facility Upgrade
	New Facility
	Upgrade Forcemain or Sewer
	New Forcemain or Sewer
	Decommission Project

June 2017
Figure 4.E.6
Not to Scale

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Table 4.E.10 Summary of Queenston Wastewater Treatment Plant Capital Program

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-D-001	Decommissioning of Queenston Wastewater Treatment Plant (WWTP)	Decommissioning of Queenston WWTP, to be replaced by new Sewage Pumping Station (SPS) and forcemain to St. David's #1 SPS	N/A	2022-2031	Niagara-on-the-Lake	A+	To be Satisfied Under Consolidated Queenstown Schedule B EA - Separate Study	Treatment	$1,979,000
WW-FM-012	New Queenston Forcemain	New Queenston Forcemain into Niagara Falls system	250 mm	2022-2031	Niagara-on-the-Lake	A+	To be Satisfied Under Consolidated Queenstown Schedule B EA - Separate Study	Forcemain	$11,136,000
WW-SPS-039	Queenston SPS	New Queenston SPS with firm capacity of 45 L/s	45 L/s	2022-2031	Niagara-on-the-Lake	B	To be Satisfied Under Consolidated Queenstown Schedule B EA - Separate Study	Pumping	$2,996,000
Total									**$16,111,000**

PART F
NIAGARA FALLS WASTEWATER SYSTEM

F. NIAGARA FALLS WASTEWATER TREATMENT PLANT

F.1 Existing System Overview

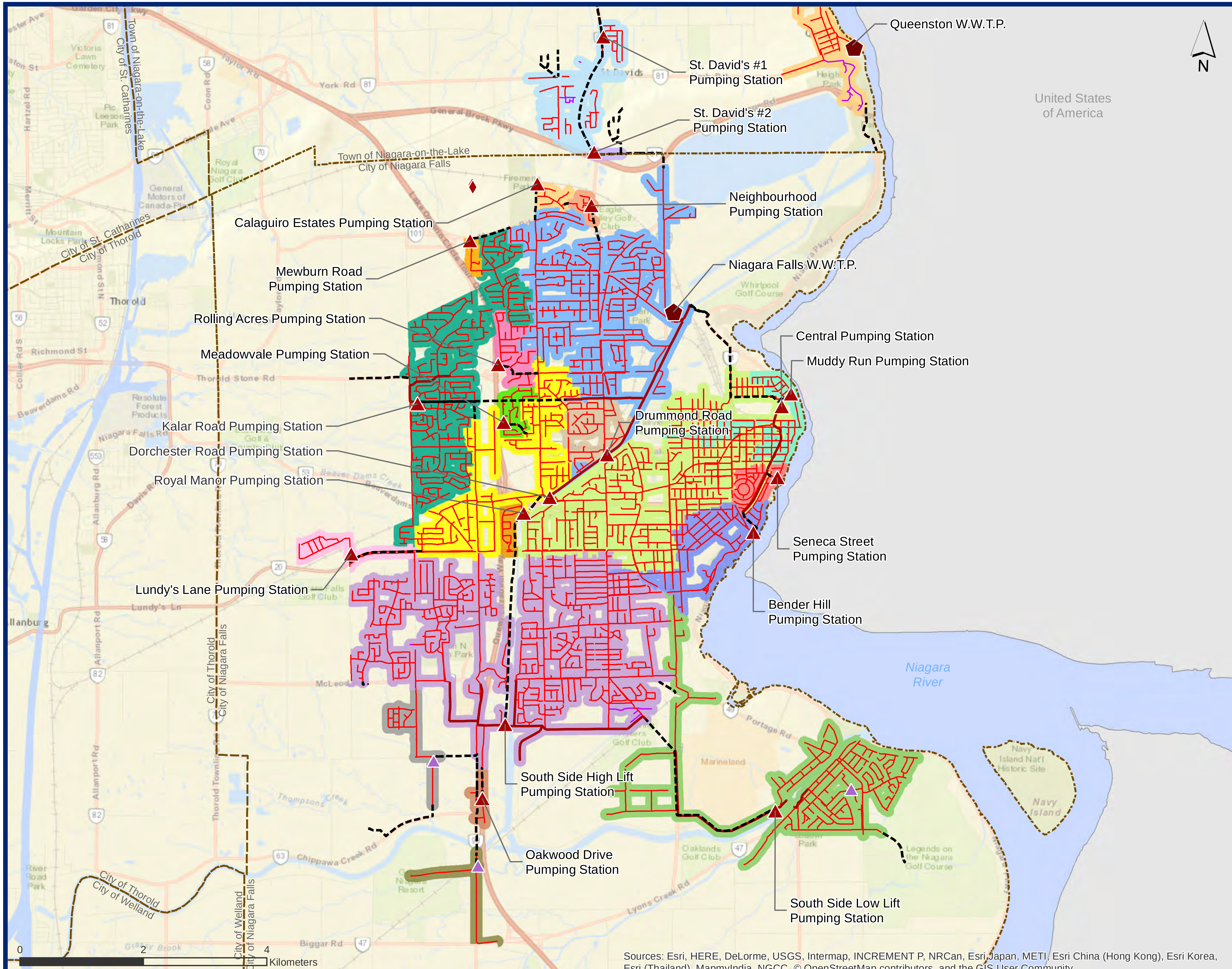
The Niagara Falls wastewater system services the City of Niagara Falls, and the Town of Niagara-on-the-Lake. The system services an existing population of 87,043 and 43,793 employees.[1]

The system is serviced by the Niagara Falls Wastewater Treatment Plant, located on 3450 Stanley Avenue, Niagara Falls. The Niagara Falls Wastewater Treatment Plant is a rotating biological contacting plant with a current rated capacity of 68.3 MLD, a peak dry weather flow capacity of 136.4 MLD and a peak wet weather flow capacity of 205.0 MLD.[2]

Figure 4.F.1 presents an overview of the wastewater system, and Figure 4.F.2 shows a schematic of the wastewater system.

[1] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*

[2] *Ministry of the Environment, 3 February 2010. Ammeded Certificate of Approval. Number 7962-7ZLKR6*



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Niagara Falls W.W.T.P.
- Queenston W.W.T.P.
- Bender Hill
- Calaguiro Estates
- Central
- Dorchester Road
- Drummond Road
- Garner Road South West
- Grassy Brook
- Kalar Road
- Lundy's Lane
- Meadowvale
- Mewburn Road
- Muddy Run
- Neighbourhood
- Oakwood Drive
- Rolling Acres
- Royal Manor
- Seneca Street
- South Side High Lift
- South Side Low Lift
- St. David's #1
- St. David's #2

Figure 4.F.1

Existing Wastewater System

Niagara Falls WWTP

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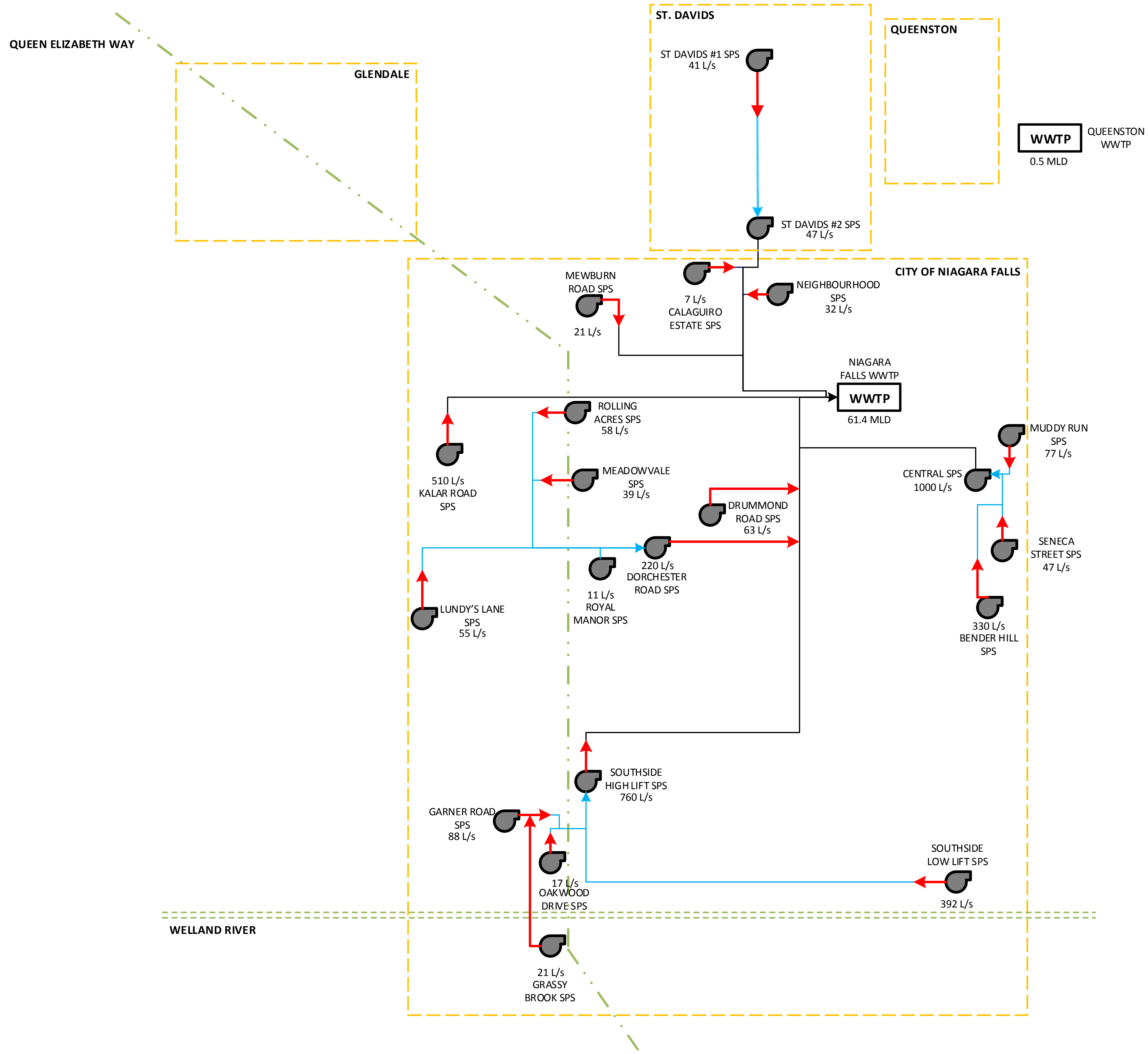
June 2017
715023-WW-2-Existing System (Niagara Falls)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Niagara Falls WWTP

EXISTING COLLECTION SCHEMATIC

Legend

WWTP RATED CAPACITY	Wastewater Treatment Plant
FIRM CAPACITY	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP

June 2017
Figure 4.F.2
Not to Scale

BluePlan ENGINEERING

F.1.1 Service Area Overview

Table 4.F.1 provides a list of facility catchments and their areas. Refer to Figure 4.F.1 for the catchment areas of each facility

Table 4.F.1 Facilities and Catchment Areas

Facility	Catchments	Catchment Area (ha)
Niagara Falls Wastewater Treatment Plant (WWTP)	**Niagara Falls WWTP** (Including Sub Catchments) Calaguiro Estates SPS Central SPS Dorchester SPS Drummond SPS Kalar Road SPS Mewburn Road SPS Neighbourhood of St. David's SPS South Side High Lift SPS St. Davids #2 SPS	4646.1
	Niagara Falls WWTP (Excluding Sub Catchments)	658.6
Calaguiro Estates Sewage Pumping Station (SPS)	Calaguiro Estates S.P.S.	23.4
Central SPS	**Central SPS** (Including Sub Catchments) Bender Hill SPS Muddy Run SPS Seneca Street SPS	922.1
	Central SPS (Excluding Sub Catchments)	617.1
Bender Hill SPS	Bender Hill SPS	163.2
Muddy Run SPS	Muddy Run SPS	100.2
Seneca Street SPS	Seneca Street SPS	41.7
Dorchester Road SPS	**Dorchester Road SPS** (Including Sub Catchments) Lundy's Lane SPS Meadowvale SPS Rolling Acres SPS Royal Manor SPS	507.0
	Dorchester Road SPS (Excluding Sub Catchments)	322.8
Lundy's Lane SPS	Lundy's Lane SPS	62.9
Meadowvale SPS	Meadowvale SPS	35.5

Facility	Catchments	Catchment Area (ha)
Rolling Acres SPS	Rolling Acres SPS	59.5
Royal Manor SPS	Royal Manor SPS	26.3
Drummond Road SPS	Drummond Road SPS	84.3
Kalar Road SPS	Kalar Road SPS	455.0
Mewburn Road SPS	Mewburn Road SPS	15.0
Neighbourhood of St. David's SPS	Neighbourhood of St. David's SPS	19.5
South Side High Lift SPS	**South Side High Lift SPS** (Including Sub Catchments) South Side Low Lift SPS Garner Road South West SPS Oakwood Drive SPS Grassy Brook SPS	1772.6
	South Side High Lift SPS (Excluding Sub Catchments)	1099.9
South Side Low Lift SPS	South Side Low Lift SPS	519.1
Garner Road South West SPS	Garner Road South West SPS	69.1
Oakwood Drive SPS	Oakwood Drive SPS	27.4
Grassy Brook SPS	Grassy Brook SPS	57.0
St. David’s #2 SPS	**St. David’s #2 SPS** (Including Sub Catchments) St. David's #1 SPS	188.6
	St. David’s #2 SPS (Excluding Sub Catchments)	4.8
St. David's #1 SPS	St. David's #1 SPS	183.7

F.1.2 Facility Overview

Table 4.F.2 Wastewater Treatment Plant Overview

Plant Name	Niagara Falls Wastewater Treatment Plant
Address	3450 Stanley Avenue, Niagara Falls City
Discharge Water	Niagara River
Rated Capacity: Average Daily Flow	68.3 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	136.4 MLD
Rated Capacity: Peak Flow Rate (Wet Weather)	205.0 MLD
Key Processes	• Rotating biological contactors • Ferric chloride addition for phosphorous removal

Table 4.F.3 Wastewater Treatment Plant Effluent Objectives

Effluent Parameter	Objective Concentration[3]
$CBOD_5$	15.0 mg/L
TSS	15.0 mg/L
Total Phosphorus	0.5 mg/L
E. Coli	200 organisms/100 mL
Total Chlorine Residual	0.5 mg/L

[3] *Ministry of the Environment, 3 February 2010. Ammeded Certificate of Approval. Number 7962-7ZLKR6*

Table 4.F.4 Pumping Station Overview

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Calaguiro Estate Sewage Pumping Station (SPS)	Calaguiro Subdivision, Niagara Falls	2	7.0	7.0	4.7
Central SPS	4300 Buttrey Street, Niagara Falls	5	1,000.0	1,000.0	25.0
Bender Hill SPS	Bender Street, Niagara Falls	4	330.0	330.0	35.0
Muddy Run SPS	4222 May Avenue, Niagara Falls	2	100.0	77.0	19.0
Seneca Street SPS	Seneca Street, Niagara Falls	2	67.7	47.0	15.4
Dorchester Road SPS	Dorchester Road, Niagara Falls	3	270.0	220.0	13.5
Lundy's Lane SPS	8971 Lundy's Lane, Niagara Falls	3	98.4	55.0	17.3
Meadowvale SPS	4491 Sussex Drive, Niagara Falls	2	38.9	39.0	10.6
Rolling Acres SPS	Rolling Acres Drive, Niagara Falls	2	Not Available	58.0	Not Available
Royal Manor SPS	7006 Windsor Crescent, Niagara Falls	2	10.5	11.0	7.0
Drummond Road SPS	Drummond Road, Niagara Falls	2	46.0	63.0	7.0
Kalar Road SPS	4254 Kalar Road, Niagara Falls	4	510.0	510.0	35.0
Mewburn Road SPS	Mewburn Road, Niagara Falls	2	23.0	21.0	16.7
Neighbourhood SPS	St. Paul Avenue, Niagara Falls	2	40	32.0	24.9
Southside High Lift SPS	7606 Oakwood Drive, Niagara Falls	5	760	760.0	40.0

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Southside Low Lift SPS	4414 Chippawa Parkway	4	582	392.0	47.5
Garner Road SPS	Garner Southwest, Niagara Falls	2	309	88.0	13.4
Oakwood Drive SPS	8555 Oakwood Drive, Niagara Falls	2	16.7	17.0	12.2
Grassybrook SPS	9240 Montrose Road, Niagara Falls	2	20.9	21.0	33.6
St. David’s #2 SPS	383 Four Mile Creek Road, Niagara Falls	2	43.6	47.3	55.8
St. David’s #1 SPS	383 Four Mile Creek Road, Niagara Falls	2	40.9	41.0	52.5

Table 4.F.5 Forcemain Overview

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Length (m)	Diameter (mm)	Capacity @ 2.5 m/s (L/s)
Calaguiro Estate Sewage Pumping Station (SPS)	7.0	601	100	19.6
Central SPS	1,000.0	2,776	900	1,590.4
Bender Hill SPS	330.0	439	600	706.9
Muddy Run SPS	77.0	252	250	122.7
Seneca Street SPS	47.0	188	200	78.5
Dorchester Road SPS	220.0	48	350	240.5
Lundy's Lane SPS	55.0	1,349	250	122.7
Meadowvale SPS	39.0	460	200	78.5
Rolling Acres SPS	58.0	728	300	176.7
Royal Manor SPS	11.0	5	100	19.6
Drummond Road SPS	63.0	12	150	88.4
Kalar Road SPS	510.0	2,448	600	706.9
Mewburn Road SPS	21.0	685	200	78.5
Neighbourhood SPS	32.0	626	200	78.5
Southside High Lift SPS	760.0	3,983	750	1,104.5
Southside Low Lift SPS	392.0	3,517	600	706.9
Garner Road SPS	88.0	756	350	240.5
Oakwood Drive SPS	17.0	506	150	44.2
Grassybrook SPS	21.0	1,838	150	44.2
St. David's #2 SPS	47.3	1,425	250	122.7
St. David's #1 SPS	41.0	2,032	200	78.5

F.1.3 Flows Overview

Table 4.F.6 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.F.7 shows the existing wastewater system flows by catchment.

Table 4.F.6 Historic Niagara Falls Wastewater Treatment Plant Flows

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	L/s	MLD	L/s	MLD	L/s
2011	44.5	515.0	45.5	526.6	134.1	1,552.1
2012	37.4	432.9	39.6	458.3	138.7	1,605.3
2013	41.6	481.5	43.9	508.1	136.9	1,584.5
2014	35.3	408.6	36.8	425.9	134.1	1,552.1
2015	42.4	490.7	41.9	485.0	125.7	1,454.9
5 Year Average	39.7	459.5	41.5	480.3	135.9	1,572.9
5 Year Peak	44.5	515.0	45.5	526.6	138.7	1,605.3

Table 4.F.7 Existing Wastewater System Flows by Catchment

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Niagara Falls Wastewater Treatment Plant (WWTP)	130,837	460.2	2249.1	7,463.6	11,808.8
Niagara Falls WWTP	16,370	118.0	424.3	1,007.0	1,342.0
Calaguiro Estates Sewage Pumping Station (SPS)	530	0.8	8.2	7.4	10.0
Central SPS	39,873	93.2	450.2	1,000.0	1,857.2
Central SPS	25,548	45.0	266.5	617.0	1,234.0
Bender Hill SPS	11,640	36.1	118.8	165.0	330.0
Muddy Run SPS	1,447	7.7	44.1	103.1	138.4

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Seneca Street SPS	1,239	4.4	20.8	114.9	154.9
Dorchester Road SPS	16,950	47.9	240.8	613.2	1,050.9
Dorchester Road SPS	11,370	26.6	145.5	323.0	646.0
Lundy's Lane SPS	2,822	4.1	26.3	147.7	197.0
Meadowvale SPS	70	3.1	16.4	51.9	69.6
Rolling Acres SPS	1,773	3.0	23.0	63.5	85.3
Royal Manor SPS	916	11.0	29.6	27.0	53.0
Drummond Road SPS	776	4.7	33.6	26.2	35.4
Kalar Road SPS	12,358	80.5	291.0	296.0	395.0
Mewburn Road SPS	689	0.6	5.5	10.1	13.5
Neighbourhood of St. David's SPS	253	0.5	6.7	1.4	1.9
South Side High Lift SPS	41,322	109.4	725.7	4,047.7	5,466.5
South Side High Lift SPS	26,387	60.9	436.3	885.0	1,217.0
South Side Low Lift SPS	11,684	42.4	233.3	416.7	559.2
Garner Road South West	2,257	3.6	26.9	124.2	166.2
Oakwood Drive SPS	228	1.0	9.8	25.4	34.1
Grassy Brook SPS	765	1.6	19.4	82.8	110.9
St. David's #2 SPS	1,715	4.5	63.0	141.1	190.2
St. David's #2 SPS	493	0.3	2.0	106.5	143.7
St. David's #1 SPS	1,221	4.2	61.0	34.6	46.5

Note: Flow numbers may not sum due to rounding.

F.2 Growth Projections

F.2.1 Population Projections and Allocations

Table 4.F.8 and Table 4.F.9 outline the existing and projected serviced population and employment by catchment.

Table 4.F.8 Niagara Falls Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Niagara Falls Wastewater Treatment Plant	11,912	11,893	12,187	12,659	13,122	13,248	1,336
Bender Hill Sewage Pumping Station (SPS)	510	428	444	464	725	978	468
Calaguiro Estates SPS	530	539	541	545	545	547	17
Central SPS	16,942	17,157	17,298	17,554	19,582	21,336	4,394
Dorchester Road SPS	8,118	8,278	8,504	8,799	9,154	9,650	1,533
Drummond Road SPS	174	180	189	198	200	281	107
Garner Road South West	966	2,621	2,846	3,084	3,686	4,377	3,411
Grassy Brook SPS	612	1,742	4,112	6,544	7,984	8,439	7,827
Kalar Road SPS	10,326	9,951	10,227	10,567	10,672	10,996	671
Lundy's Lane SPS	1,985	2,505	2,803	3,114	3,259	3,415	1,431
Meadowvale SPS	43	51	55	56	56	57	14
Mewburn Road SPS	634	640	659	681	687	690	56
Muddy Run SPS New	606	588	591	598	1,583	1,965	1,360
Neighbourhood of St. David's SPS	253	258	258	260	261	261	8

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Oakwood Drive SPS	0	2	5	8	9	9	8
Rolling Acres SPS	1,596	1,625	1,641	1,662	1,745	1,754	159
Royal Manor SPS	523	493	503	516	521	524	1
Seneca Street SPS	951	959	967	983	1,036	1,091	140
South Side High Lift SPS	21,784	22,729	23,990	25,367	26,793	28,169	6,385
South Side Low Lift SPS	7,214	9,148	11,128	14,057	14,985	15,730	8,516
St. David's #1 SPS	979	1,297	1,721	2,173	2,651	3,142	2,163
St. David's #2 SPS	387	513	680	859	1,048	1,242	855
Total	**87,043**	**93,595**	**101,347**	**110,748**	**120,303**	**127,901**	**40,858**

Note: Population numbers may not sum due to rounding.

Table 4.F.9 Niagara Falls Wastewater Treatment Plant Existing and Projected Serviced Employment by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Niagara Falls Wastewater Treatment Plant	4,459	5,171	5,426	5,633	5,813	6,239	1,780
Bender Hill Sewage Pumping Station (SPS)	11,130	11,854	11,985	12,112	12,226	12,453	1,324
Calaguiro Estates SPS	0	0	0	0	0	0	0
Central SPS	8,606	9,171	9,416	9,693	9,940	10,254	1,648
Dorchester Road SPS	3,252	3,460	3,529	3,628	3,740	3,873	620
Drummond Road SPS	603	639	656	673	692	715	112
Garner Road South West	1,290	1,474	1,522	1,610	1,661	1,781	491
Grassy Brook SPS	154	163	811	1,753	2,975	4,001	3,848
Kalar Road SPS	2,033	2,266	2,324	2,389	2,462	2,548	516
Lundy's Lane SPS	838	889	912	936	963	995	157
Meadowvale SPS	27	29	29	30	31	32	5
Mewburn Road SPS	54	168	167	207	252	304	250
Muddy Run SPS New	841	942	951	974	1,002	1,033	192
Neighbourhood of St. David's SPS	0	0	0	0	0	0	0
Oakwood Drive SPS	228	284	292	317	322	356	127
Rolling Acres SPS	177	188	192	197	203	210	33
Royal Manor SPS	393	417	428	439	452	467	74
Seneca Street SPS	288	305	313	321	331	342	54

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
South Side High Lift SPS	4,603	5,078	5,209	5,413	5,554	5,858	1,256
South Side Low Lift SPS	4,470	4,900	4,996	5,150	5,245	5,512	1,042
St. David's #1 SPS	242	276	287	290	295	303	61
St. David's #2 SPS	106	121	126	127	129	133	27
Total	**43,793**	**47,793**	**49,572**	**51,895**	**54,289**	**57,409**	**13,615**

Note: Population numbers may not sum due to rounding.

F.2.2 Future Flow Projections

Table 4.F.10 and Table 4.F.11 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

Table 4.F.10 Projected Peak Dry Weather Flow by Catchment

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Niagara Falls Wastewater Treatment Plant	242.0	246.7	252.4	257.8	262.4
Bender Hill Sewage Pumping Station (SPS)	78.0	79.3	80.6	84.0	88.3
Calaguiro Estates SPS	1.6	1.7	1.7	1.7	1.7
Central SPS	96.3	99.4	103.7	121.5	137.3
Dorchester Road SPS	56.6	59.3	62.8	67.0	72.5
Drummond Road SPS	10.0	10.3	10.6	10.9	12.1
Garner Road South West	26.6	29.3	32.5	38.8	46.4
Grassy Brook SPS	16.2	46.2	75.9	97.7	109.4
Kalar Road SPS	159.6	162.7	166.3	167.9	171.6
Lundy's Lane SPS	14.5	17.8	21.3	23.0	24.9
Meadowvale SPS	6.4	6.4	6.5	6.5	6.5
Mewburn Road SPS	2.7	2.9	3.7	4.3	5.0
Muddy Run SPS New	16.4	16.5	16.9	28.1	32.4
Neighbourhood of St. David's SPS	1.1	1.2	1.2	1.2	1.2
Oakwood Drive SPS	2.6	2.8	3.1	3.2	3.7
Rolling Acres SPS	6.5	6.7	7.0	8.0	8.2
Royal Manor SPS	22.0	22.2	22.5	22.7	23.0
Seneca Street SPS	9.2	9.4	9.6	10.4	11.1
South Side High Lift SPS	133.1	144.0	156.2	168.1	180.7
South Side Low Lift SPS	106.0	123.7	148.8	156.9	164.7
St. David's #1 SPS	12.6	17.4	22.3	27.4	32.4
St. David's #2 SPS	2.4	4.4	6.6	8.8	11.0
Total	**1,022.3**	**1,110.3**	**1,212.4**	**1,315.9**	**1,406.5**

The following presents an example calculation of projected peak dry weather flow.

2041 Peak Dry Weather Flow for Kalar Road Sewage Pumping Station:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (80.46 L/s × 2.0) + (13,545 – 12,358 people) × 275 L/cap/day × 1 day/86400 s × 2.82
= 171.6 L/s

Table 4.F.11 Projected Peak Wet Weather Flow by Catchment

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Niagara Falls Wastewater Treatment Plant	430.3	435.0	440.8	446.2	450.7
Bender Hill Sewage Pumping Station (SPS)	124.7	126.0	127.3	130.7	134.9
Calaguiro Estates SPS	8.3	8.3	8.4	8.4	8.4
Central SPS	272.8	275.9	280.1	297.9	313.7
Dorchester Road SPS	148.9	151.6	155.1	159.3	164.9
Drummond Road SPS	34.1	34.4	34.7	35.0	36.2
Garner Road South West	46.3	49.1	52.3	58.5	66.1
Grassy Brook SPS	32.5	62.5	92.2	114.0	125.7
Kalar Road SPS	289.8	292.8	296.5	298.0	301.7
Lundy's Lane SPS	32.4	35.8	39.3	41.0	42.9
Meadowvale SPS	16.5	16.6	16.6	16.6	16.7
Mewburn Road SPS	7.0	7.2	8.0	8.6	9.2
Muddy Run SPS New	45.0	45.2	45.5	56.7	61.1
Neighbourhood of St. David's SPS	6.7	6.7	6.8	6.8	6.8
Oakwood Drive SPS	10.5	10.6	11.0	11.1	11.5
Rolling Acres SPS	23.5	23.7	24.0	25.1	25.2
Royal Manor SPS	29.5	29.8	30.0	30.3	30.5
Seneca Street SPS	21.1	21.3	21.6	22.3	23.1
South Side High Lift SPS	447.7	458.6	470.8	482.7	495.3
South Side Low Lift SPS	254.4	272.1	297.2	305.3	313.2
St. David's #1 SPS	65.1	70.0	74.9	79.9	85.0
St. David's #2 SPS	3.8	5.8	8.0	10.2	12.4
Total	**2,351.0**	**2,439.1**	**2,541.2**	**2,644.7**	**2,735.3**

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for Kalar Road Sewage Pumping Station:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 171.6 L/s + (455.0 ha × 0.286 L/s/ha)
= 301.7 L/s

F.3 Assessment of Wastewater Infrastructure (Existing and Future)

F.3.1 Treatment Plant Capacity

Figure 4.F.3 shows the projected future demands at the Niagara Falls Wastewater Treatment Plant. The plant is approaching 80% capacity within the 2041 planning horizon.

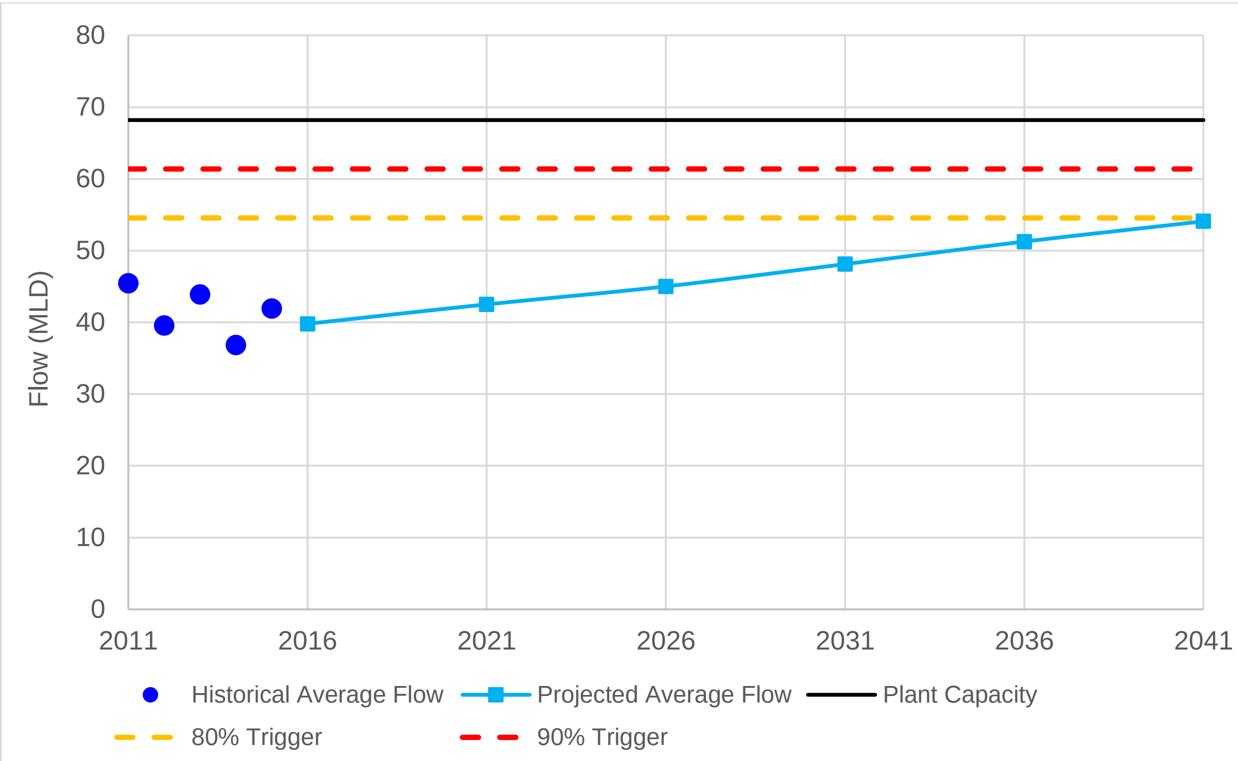


Figure 4.F.3 Projected future demands at Niagara Falls Wastewater Treatment Plant

F.3.2 Sewage Pumping Station

Table 4.F.12 highlights the sewage pumping station existing and projected capacity.

Table 4.F.12 System Sewage Pumping Station Performance

Sewage Pumping Station	Contributing Catchments	Facility Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus / Deficit (L/s)
Calaguiro Estate Sewage Pumping Station (SPS)	Calaguiro Estates SPS	6.9	8.2	8.4	-1.5
Central SPS	Central SPS Bender Hill SPS Muddy Run SPS Seneca Street SPS	1,000.0	450.2	519.4	480.6
Bender Hill SPS	Bender Hill SPS	329.9	118.8	134.9	195
Muddy Run SPS	Muddy Run SPS	77.5	44.1	61.1	16.4
Seneca Street SPS	Seneca Street SPS	47.5	20.8	11.9	35.6
Dorchester Road SPS	Dorchester Road SPS Lundy's Lane SPS Meadowvale SPS Rolling Acres SPS Royal Manor SPS	219.9	240.8	274.5	-54.6
Lundy's Lane SPS	Lundy's Lane SPS	55.6	26.3	42.9	12.7
Meadowvale SPS	Meadowvale SPS	39.4	16.4	16.7	22.7
Rolling Acres SPS	Rolling Acres SPS	57.9	23.0	25.2	32.7
Royal Manor SPS	Royal Manor SPS	11.6	29.6	30.5	-18.9
Drummond Road SPS	Drummond Road SPS	62.5	33.6	36.2	26.3
Kalar Road SPS	Kalar Road SPS	510.4	291.0	301.7	208.7
Mewburn Road SPS	Mewburn Road SPS	20.8	5.5	9.2	11.6
Neighbourhood SPS	Neighbourhood of St. David's SPS	32.4	6.7	6.8	25.6

Sewage Pumping Station	Contributing Catchments	Facility Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus / Deficit (L/s)
Southside High Lift SPS	South Side High Lift SPS South Side Low Lift SPS Garner Road South West SPS Oakwood Drive SPS Grassy Brook SPS	760.4	725.7	946.7	-186.3
Southside Low Lift SPS	South Side Low Lift SPS	392.4	233.3	313.2	79.2
Garner Road SPS	Garner Road South West SPS	88.0	26.9	66.1	21.9
Oakwood Drive SPS	Oakwood Drive SPS	17.4	9.8	11.5	5.9
Grassybrook SPS	Grassy Brook SPS	20.8	19.4	125.7	-104.9
St. David’s #2 SPS	St. David’s #2 SPS St. David's #1 SPS	47.5	63.0	95.2	-47.7
St. David’s #1 SPS	St. David's #1 SPS	40.5	61.0	85.0	-44.5

The following sewage pumping stations have projected pumping deficits:

- Calaguiro Estates Sewage Pumping Station
- Dorchester Road Sewage Pumping Station
- Royal Manor Sewage Pumping Station
- Southside High Lift Sewage Pumping Station
- Grassybrook Sewage Pumping Station
- St. David’s #2 Sewage Pumping Station
- St. David’s #1 Sewage Pumping Station

F.3.3 Forcemain

Table 4.F.13 highlights the existing and projected forcemain performance.

Table 4.F.13 Forcemain Performance

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Capacity @ 2.5 m/s (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus / Deficit (L/s)
Calaguiro Estate Sewage Pumping Station (SPS)	6.9	19.6	8.2	8.4	11.2
Central SPS	1,000.0	1,590.4	450.2	519.4	1071.0
Bender Hill SPS	329.9	706.9	118.8	134.9	572.0
Muddy Run SPS	77.5	122.7	44.1	61.1	61.6
Seneca Street SPS	47.5	78.5	20.8	11.9	66.6
Dorchester Road SPS	219.9	240.5	240.8	274.5	-34.0
Lundy's Lane SPS	55.6	122.7	26.3	42.9	79.8
Meadowvale SPS	39.4	78.5	16.4	16.7	61.8
Rolling Acres SPS	57.9	176.7	23.0	25.2	151.5
Royal Manor SPS	11.6	19.6	29.6	30.5	-10.9
Drummond Road SPS	62.5	88.4	33.6	36.2	52.2
Kalar Road SPS	510.4	706.9	291.0	301.7	405.2
Mewburn Road SPS	20.8	78.5	5.5	9.2	69.3
Neighbourhood SPS	32.4	78.5	6.7	6.8	71.7
Southside High Lift SPS	760.4	1104.5	725.7	946.7	157.8
Southside Low Lift SPS	392.4	706.9	233.3	313.2	393.7
Garner Road SPS	88.0	240.5	26.9	66.1	174.4
Oakwood Drive SPS	17.4	44.2	9.8	11.5	32.7
Grassybrook SPS	20.8	44.2	19.4	125.7	-81.5
St. David's #2 SPS	47.5	122.7	63.0	95.2	27.5
St. David's #1 SPS	40.5	78.5	61.0	85.0	-6.5

The following forcemains have projected capacity deficits:

- Dorchester Road Sewage Pumping Station
- Royal Manor Sewage Pumping Station
- Grassybrook Sewage Pumping Station
- St. David's #1 Sewage Pumping Station

F.3.4 Trunk Sewer

Figure 4.F.4 and Figure 4.F.5 highlight the existing and projected peak wet weather flow, respectively. Trunk sewers in the St. David's #1 Sewage Pumping Station, South Side High Lift Sewage Pumping Station, and Niagara Falls Wastewater Treatment Plant catchments are approaching capacity within the 2041 time horizon.

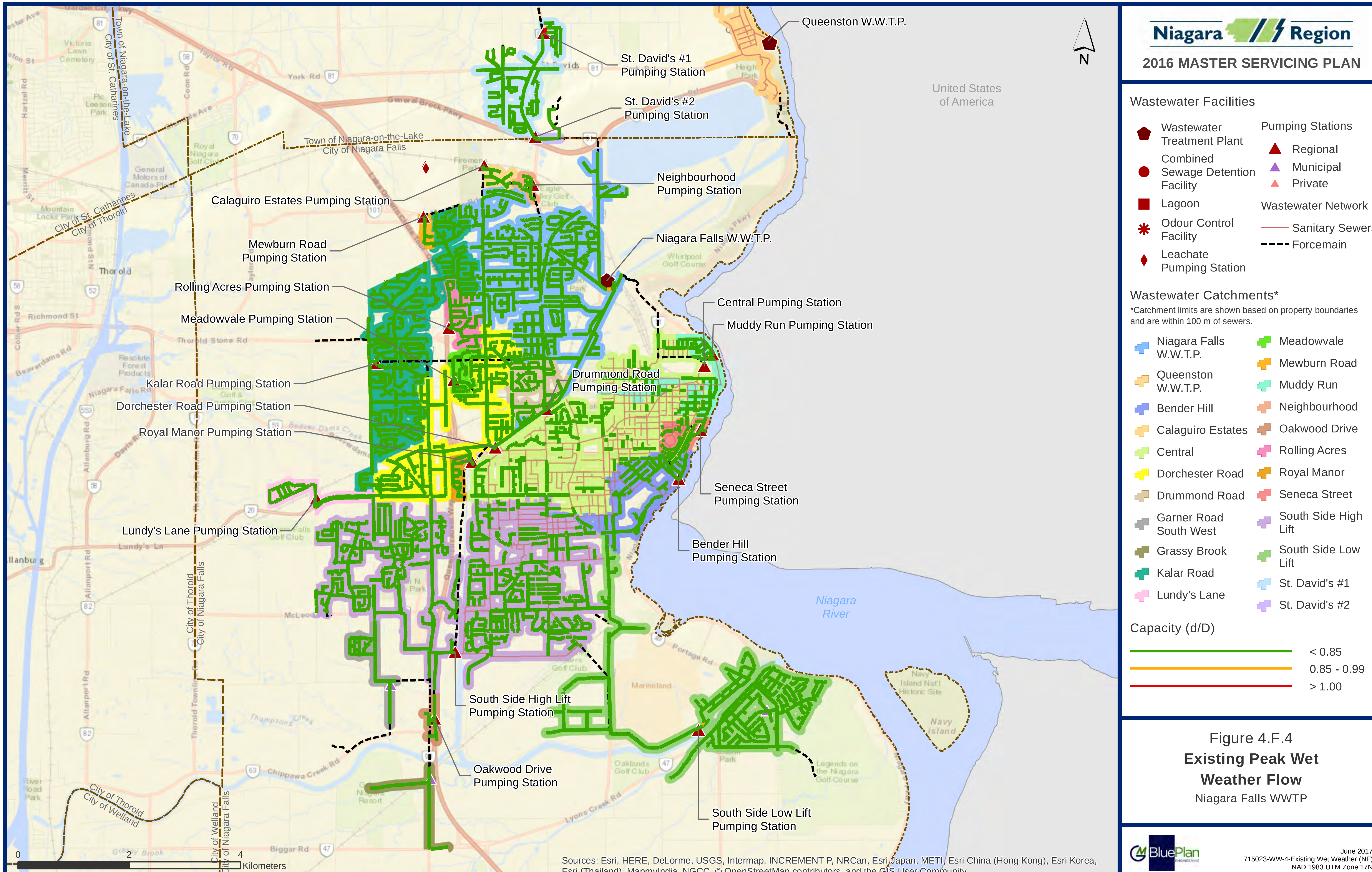


Figure 4.F.4
Existing Peak Wet Weather Flow
Niagara Falls WWTP

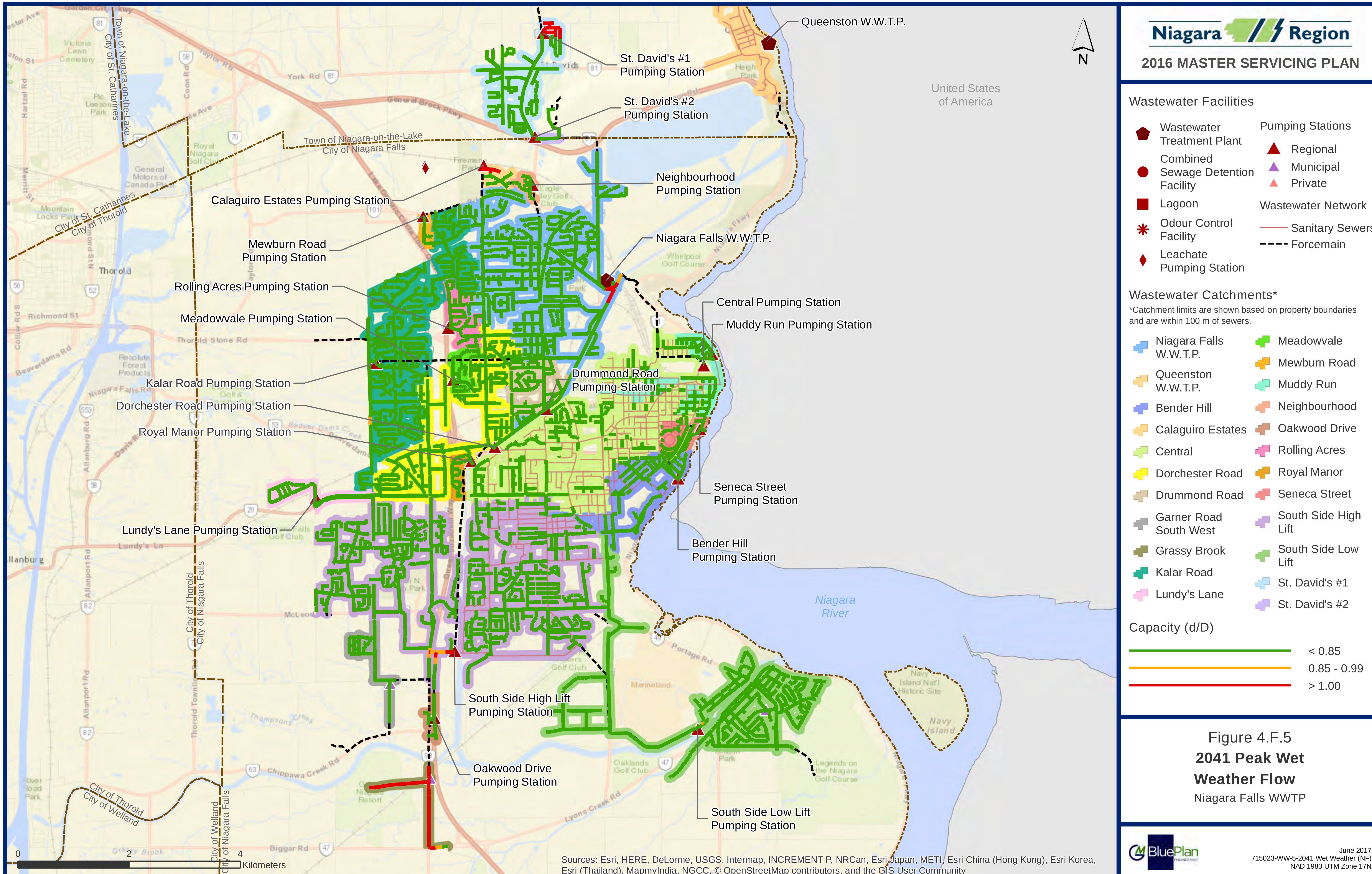


Figure 4.F.5
2041 Peak Wet Weather Flow
Niagara Falls WWTP

F.4 System Opportunities and Constraints

Figure 4.F.6 highlights the existing opportunities and constraints.

F.4.1 Niagara Falls Wastewater Treatment Plant

- The current rated average daily flow capacity of the plant is 68.3 MLD, with an existing flow of 39.8 MLD and a projected average daily flow of 54.1, which is below 80% of the wastewater treatment plant rated capacity. As such, the wastewater treatment plant has surplus capacity to accommodate growth beyond 2041.

F.4.2 Niagara Falls

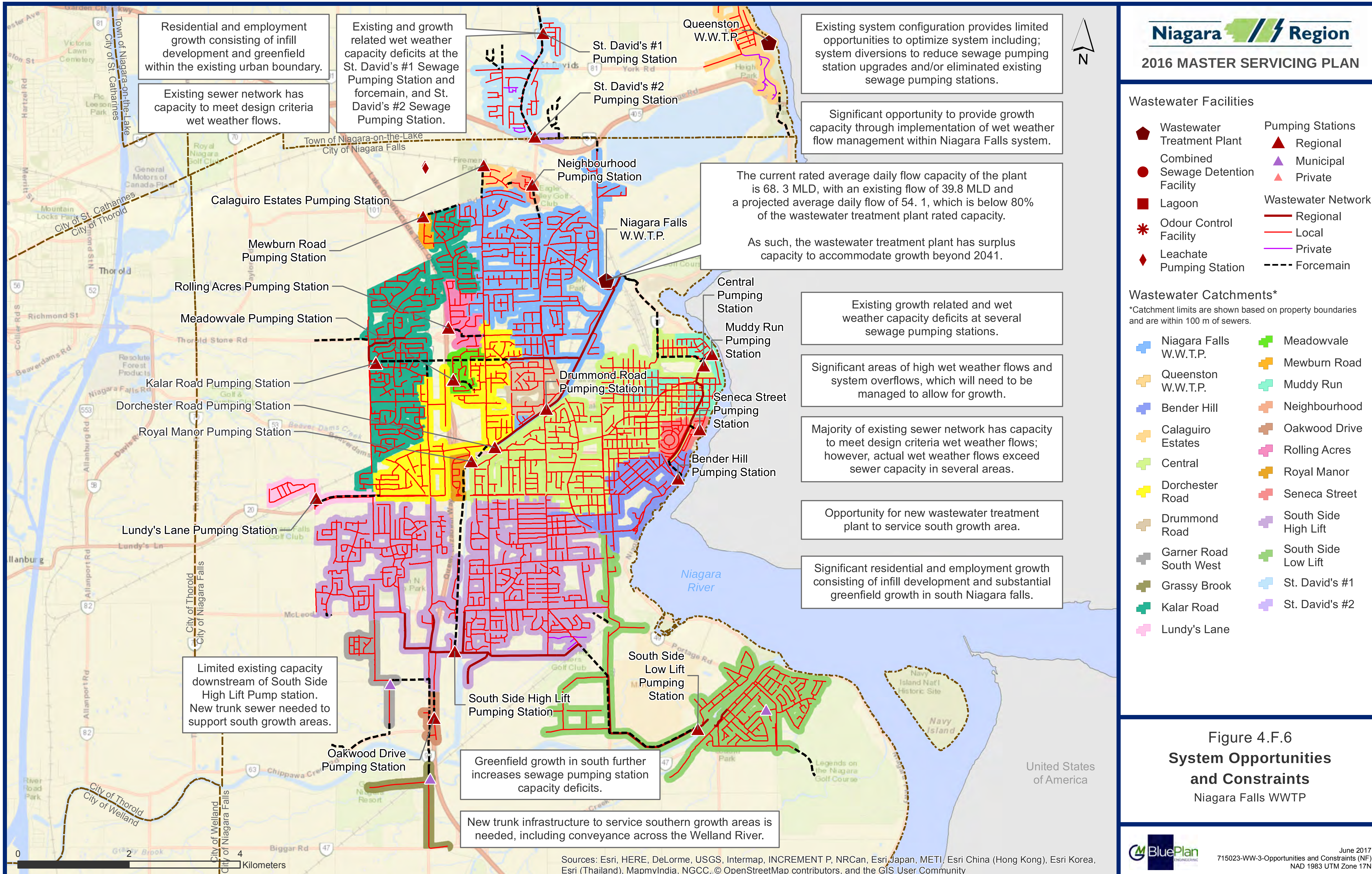
- Significant residential and employment growth consisting of:
  - Infill development
  - Substantial greenfield growth in south Niagara falls
- Existing, growth related and wet weather capacity deficits at several sewage pumping stations.
- Greenfiled growth in south further increases sewage pumping station capacity deficits.
- Significant areas of high wet weather flows and system overflows, which will need to be managed to allow for growth.
- Majority of existing sewer network has capacity to meet design criteria wet weather flows; however, actual wet weather flows exceed sewer capacity in several areas.
- New trunk infrastructure to service southern growth areas is needed, including conveyance across the Welland River.
- Limited existing capacity downstream of South Side High Lift Sewage Pumping Station. New trunk sewer needed to support south growth areas.

F.4.3 Niagara-on-the Lake

- Residential and employment growth consisting of infill development and greenfield within the existing urban boundary.
- Existing and growth related wet weather capacity deficits at the St. David's #1 Sewage Pumping Station and forcemain, and St. David's #2 Sewage Pumping Station.
- Existing sewer network has capacity to meet design criteria wet weather flows.

F.4.4 System Optimization Opportunities

- Existing system configuration provides limited opportunities to optimize system, including system diversions to reduce sewage pumping station upgrades and/or eliminate existing sewage pumping stations.
- Significant opportunity to provide growth capacity through implementation of wet weather flow management within Niagara Falls system.
- Opportunity for new wastewater treatment plant to service south growth area.


Niagara Region
2016 MASTER SERVICING PLAN
Residential and employment growth consisting of infill development and greenfield within the existing urban boundary.
Existing sewer network has capacity to meet design criteria wet weather flows.
Existing and growth related wet weather capacity deficits at the St. David's #1 Sewage Pumping Station and forcemain, and St. David's #2 Sewage Pumping Station.
Queenston W.W.T.P.
St. David's #1 Pumping Station
St. David's #2 Pumping Station
Existing system configuration provides limited opportunities to optimize system including; system diversions to reduce sewage pumping station upgrades and/or eliminated existing sewage pumping stations.
Significant opportunity to provide growth capacity through implementation of wet weather flow management within Niagara Falls system.
Neighbourhood Pumping Station
Calaguiro Estates Pumping Station
Niagara Falls W.W.T.P.
The current rated average daily flow capacity of the plant is 68. 3 MLD, with an existing flow of 39.8 MLD and a projected average daily flow of 54. 1, which is below 80% of the wastewater treatment plant rated capacity.
As such, the wastewater treatment plant has surplus capacity to accommodate growth beyond 2041.
Mewburn Road Pumping Station
Rolling Acres Pumping Station
Central Pumping Station
Meadowvale Pumping Station
Muddy Run Pumping Station
Existing growth related and wet weather capacity deficits at several sewage pumping stations.
Significant areas of high wet weather flows and system overflows, which will need to be managed to allow for growth.
Kalar Road Pumping Station
Drummond Road Pumping Station
Dorchester Road Pumping Station
Seneca Street Pumping Station
Royal Manor Pumping Station
Majority of existing sewer network has capacity to meet design criteria wet weather flows; however, actual wet weather flows exceed sewer capacity in several areas.
Bender Hill Pumping Station
Lundy's Lane Pumping Station
Opportunity for new wastewater treatment plant to service south growth area.
Niagara River
Significant residential and employment growth consisting of infill development and substantial greenfield growth in south Niagara falls.
Limited existing capacity downstream of South Side High Lift Pump station. New trunk sewer needed to support south growth areas.
South Side Low Lift Pumping Station
South Side High Lift Pumping Station
Oakwood Drive Pumping Station
Greenfield growth in south further increases sewage pumping station capacity deficits.
New trunk infrastructure to service southern growth areas is needed, including conveyance across the Welland River.
United States of America
Town of Niagara-on-the-Lake
City of Niagara Falls
City of St. Catharines
City of Thorold
City of Welland
0 2 4 Kilometers
N
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community
Wastewater Facilities
Wastewater Treatment Plant
Combined Sewage Detention Facility
Lagoon
Odour Control Facility
Leachate Pumping Station
Pumping Stations
Regional
Municipal
Private
Wastewater Network
Regional
Local
Private
Forcemain
Wastewater Catchments*
*Catchment limits are shown based on property boundaries and are within 100 m of sewers.
Niagara Falls W.W.T.P.
Queenston W.W.T.P.
Bender Hill
Calaguiro Estates
Central
Dorchester Road
Drummond Road
Garner Road South West
Grassy Brook
Kalar Road
Lundy's Lane
Meadowvale
Mewburn Road
Muddy Run
Neighbourhood
Oakwood Drive
Rolling Acres
Royal Manor
Seneca Street
South Side High Lift
South Side Low Lift
St. David's #1
St. David's #2
Figure 4.F.6
System Opportunities and Constraints
Niagara Falls WWTP
BluePlan
June 2017
715023-WW-3-Opportunities and Constraints (NF)
NAD 1983 UTM Zone 17N

F.5 Assessment of Alternatives

The hybrid management strategy consists of:

- Providing capacity within Regional sewage pumping stations and trunk sewers to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Providing upstream flow management and peak flow management to address peak flows in systems where peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in potential basement flooding and overflow risks.

Further to the application of the above strategy, the following area specific alternatives were reviewed:

F.5.1 South Niagara Falls

The Niagara 2041 planning exercise resulted in significant growth in South Niagara Falls partly based on the extension of the planning horizon from 2031 to 2041. It is noted that 64% of the growth in Niagara Falls is projected south of Lundy's Lane and 22.5% of the growth is projected south of the Welland River. This growth in combination with wet weather issues in South Niagara Falls as well as servicing constraints in adjacent wastewater systems including Thorold South and St. Catharines, prompted a broader review of wastewater servicing strategies for the area.

Two alternatives for the South Niagara Falls area were considered, presented in Figure 4.F.7 and Figure 4.F.8.

The analysis developed and evaluated two options for the servicing of future growth:

1. Accommodate only the south Niagara Falls growth through the existing Niagara Falls Wastewater Treatment Plant (Go North) including all necessary upgrades / upsizing of existing infrastructure.
2. Construct a new South Niagara Falls Wastewater Treatment Plant (New Plant), divide the Niagara Falls service area into two, provide additional capacity suitable for the servicing of Thorold South, introduce additional capacity in the Port Weller catchment area of St. Catharines, create the opportunity to service future growth in the St. David's area of Niagara-on-the-Lake, and introduce significant capacity in the north catchment area of Niagara Falls for intensification and growth.

The analysis for the South Niagara Falls servicing strategy followed these principal steps:

- Review of system integration opportunities

- Hydraulic analysis of the systems
- Preliminary identification of infrastructure needs and alignments/sites
- Detailed cost benefit analysis considering capital, lifecycle and offsetting cost components
- Multiple bottom line evaluation process

Option 2 – New Plant was selected as the preferred South Niagara Falls servicing strategy. Overall comments related to the selection of the New Plant option are:

- Providing a new South Niagara Falls Wastewater Treatment Plant provides the greatest flexibility and support for long term servicing and benefit to the Niagara Falls and surrounding systems.
- A new plant provides the greatest opportunity to mitigate risks including cost risks, implementation risks, and capacity risks.
- The New Plant option does have higher capital costs for the 2041 program and higher annual lifecycle costs than the Go North option. However, the New Plant can provide more flexible and less expensive post 2041 costs.
- Based on the opportunity to implement green technologies and address wet weather issues, the New Plant provides opportunity for other funding sources similar to the Niagara-on-the-Lake Wastewater Treatment Plant.
- Under either option, continued sustainability upgrades will be required for existing infrastructure including the existing Niagara Falls Wastewater Treatment Plant.

F.6 Preferred Servicing Strategy

The following is a summary of the Niagara Falls wastewater servicing strategy, presented in Figure 4.F.7 and Figure 4.F.8:

- Based on the level of growth on the system, the Niagara Falls Wastewater Treatment Plant is approaching capacity within the 2041 planning horizon. The plant is aging and requires sustainability upgrades to maintain level of service.
- Conveying growth flows to the Niagara Falls Wastewater Treatment Plant will require significant infrastructure upgrades across the system and within the built boundary of the City.
- Given the level of impact on the existing system based on current system conveyance, a broader evaluation process was undertaken to develop Niagara Falls servicing alternatives. A South Niagara Falls wastewater strategy was developed and evaluated. This process is documented in subsequent sections.
- The South Niagara Falls wastewater strategy resulted in the recommendation for a new South Niagara Falls Wastewater Treatment Plant.
- The Niagara Falls service area south of Lundy's Lane will convey flows to the new plant. The remaining service areas will continue to convey flows to the existing plant.
- Capacity upgrades in the St. David's area are required to support growth. This area as well as the Queenston service area will direct flows to the existing plant.
- The Thorold South service area will be directed to the new South Niagara Falls Wastewater Treatment Plant.
- The South Side High Lift pumping station will be directed south to the new South Niagara Falls Wastewater Treatment Plant.
- Isolated pumping stations will require capacity upgrades to support the projected growth.
- In order to minimize infrastructure upgrades, wet weather management will be required across the Niagara Falls system.

F.6.1 Treatment Plant

- A new 30 MLD South Niagara Falls Wastewater Treatment Plant is required as part of the recommended servicing strategy.
- Decommissioning of existing Queenstown Wastewater Treatment Plant and replacement with new 45 L/s Sewage Pumping Station and forcemain Niagara Falls gravity collection system.

F.6.2 Pumping Stations

The following sewage pumping station upgrades are required:

- Garner Road Sewage Pumping Station pump replacement: Increase capacity from 81 L/s to 206 L/s.
- Dorchester Sewage Pumping Station pump replacement: Increase capacity from 220 L/s to 270 L/s, and twin 300 mm forcemain.
- Black Horse Sewage Pumping Station upgrade: Increase capacity from 21 L/s to 180 L/s, and 400 mm forcemain to Niagara Falls.
- St. David's #2 Sewage Pumping Station expansion: Increase capacity from 44 L/s to 104 L/s.
- St. David's #1 Sewage Pumping Station upgrade: Increase capacity from 41 L/s to 88 L/s, and twin 300 mm forcemain.
- Decommissioning of existing South Side High Lift Sewage Pumping Station; flow to be re-directed to the new South Niagara Falls Wastewater Treatment Plant via new gravity sewer.
- Decommissioning of existing Grassy Brook Sewage Pumping Station, with direct conveyance of flow to adjacent the new South Niagara Falls Wastewater Treatment Plant via new gravity sewer; gravity sewer included as part of the New South Niagara Falls Wastewater Treatment Plant works.

F.6.3 Gravity Sewers

- New 900 mm gravity sewer from the existing South Side High Lift Sewage Pumping Station to new South Niagara Falls Wastewater Treatment Plant.

F.6.4 Wet Weather

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts.

These wet weather management programs will need to be a joint initiative between the Region and local municipalities.

For the Niagara Falls system, the following priority areas are identified:

- Central Niagara Falls area, consisting of the Central Sewage Pumping Station, Kalar Sewage Pumping Station, Royal Manor Sewage Pumping Station, Dorchester Sewage Pumping Station, and Niagara Falls Wastewater Treatment Plant catchments.
- South Niagara Falls area, consisting of the South Side High Lift Sewage Pumping Station, South Side Low Lift Sewage Pumping Station, and Garner Road Sewage Pumping Station catchments.

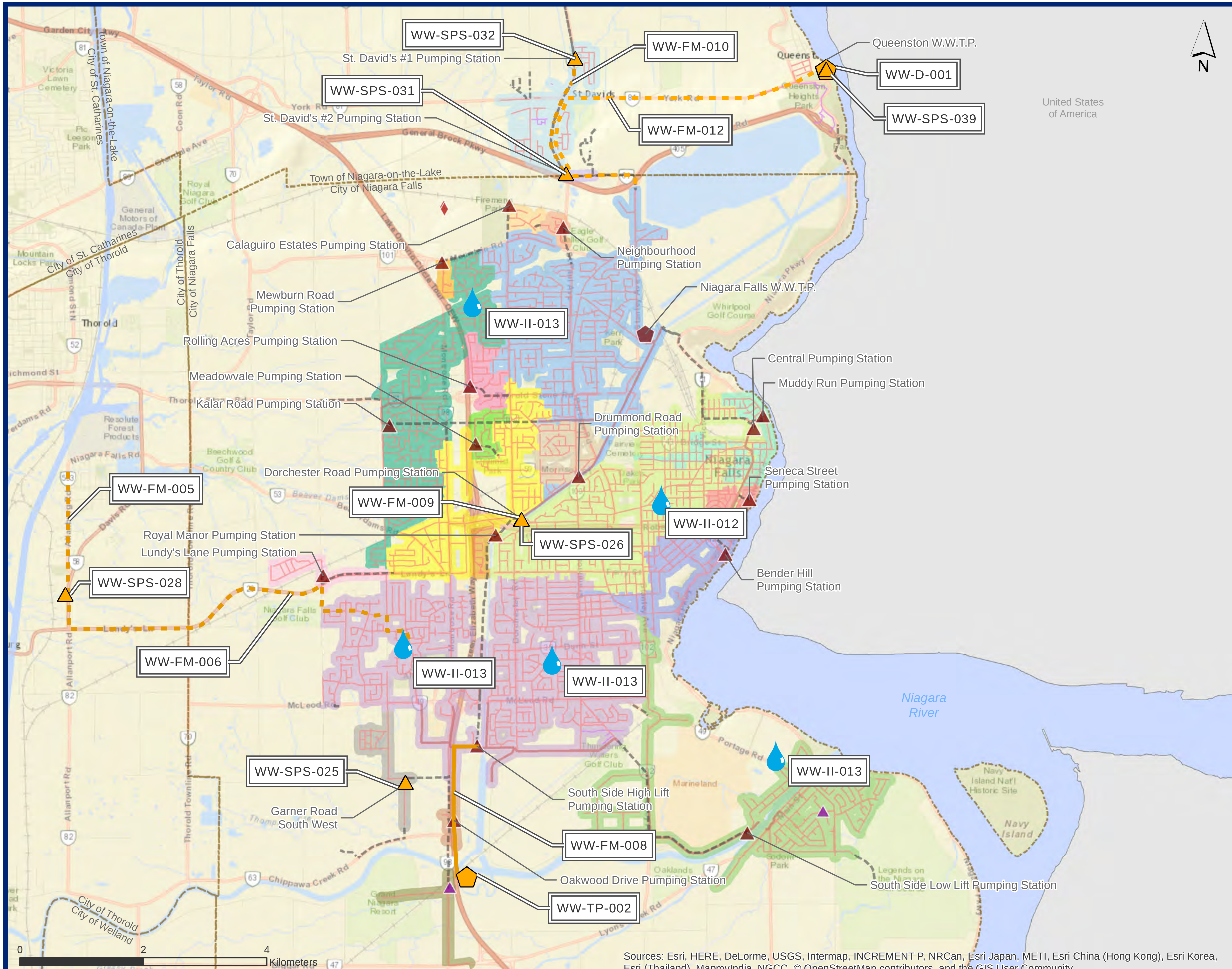
Further flow monitoring and area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, Preferred Servicing Strategy are needed to identify area specific strategies and projects required to achieve the wet weather flow reduction objectives. Following the outcomes of the further studies, targeted funding can be applied outside the priority areas if the projects are found to address capacity issues and support growth capacity needs.

F.7 Capital Program

Table 4.F.14 summarizes the recommended project costing, implementation schedule and Class EA requirements.

F.7.1 Schedule B Project Files

Project files for Municipal Class Schedule B Environmental Assessment are attached in Appendix 1.



Niagara Region

2016 MASTER SERVICING PLAN

MSP Wastewater Projects

- Treatment Plant
- Pumping Station
- Wet Weather Reduction
- Sanitary Sewer Projects
- Forcemain Projects

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Private
- Local
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Niagara Falls W.W.T.P.
- Bender Hill
- Calaguiro Estates
- Central
- Dorchester Road
- Drummond Road
- Garner Road South West
- Grassy Brook
- Kalar Road
- Lundy's Lane
- Meadowvale
- Mewburn Road
- Muddy Run
- Neighbourhood
- Oakwood Drive
- Rolling Acres
- Royal Manor
- Seneca Street
- South Side High Lift
- South Side Low Lift
- St. David's #1
- St. David's #2

Figure 4.F.7
Preferred Wastewater Strategy
Niagara Falls WWTP

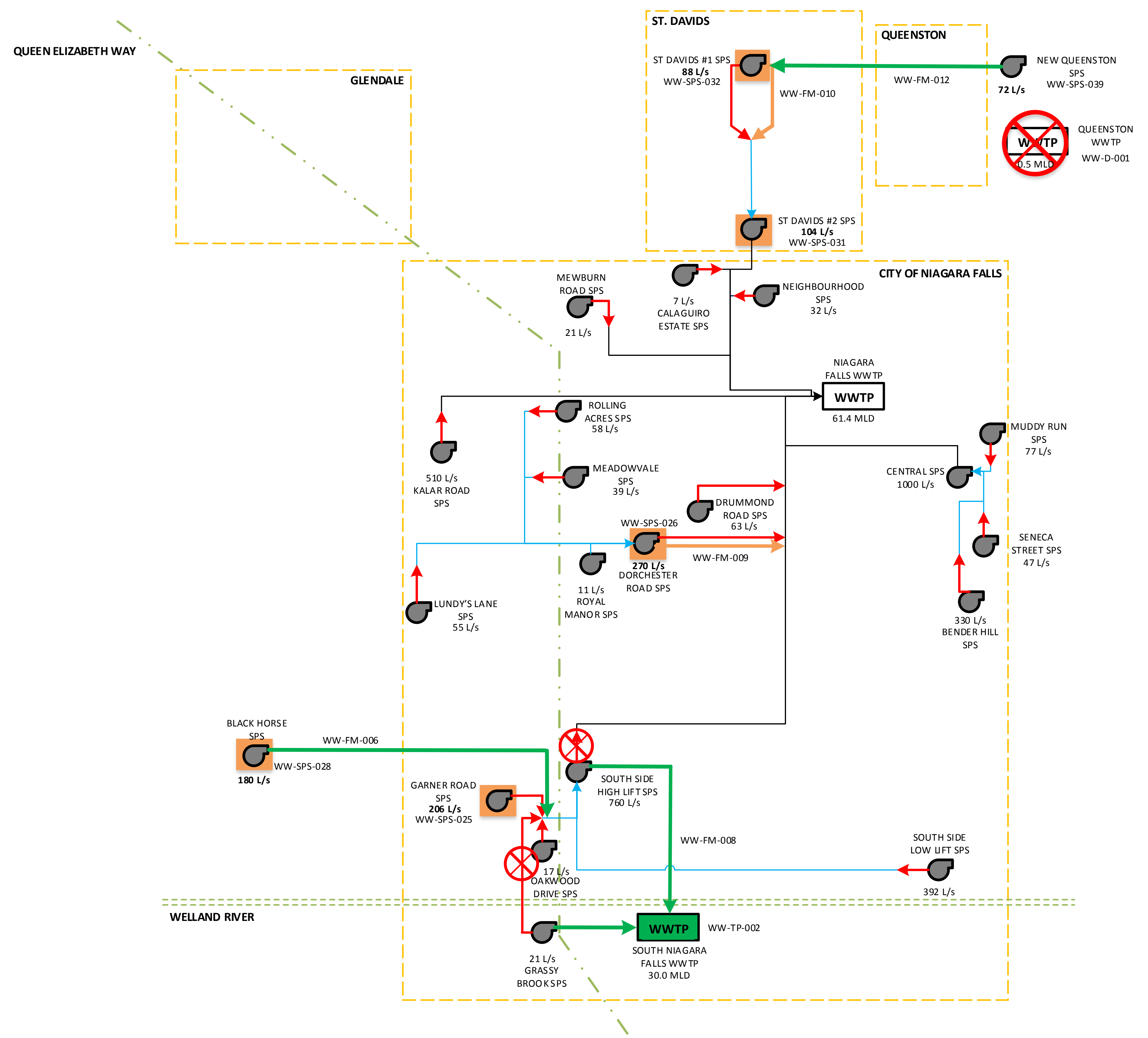
GM BluePlan ENGINEERING

June 2017
715023-WW-6-Capital Projects (Niagara Falls)
NAD 1983 UTM Zone 17N

2016 Master Servicing Plan

Niagara Falls WWTP

2041 COLLECTION SCHEMATIC



WWTP (RATED CAPACITY)	Wastewater Treatment Plant
FIRM CAPACITY	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP
	Facility Upgrade
	New Facility
	Upgrade Forcemain or Sewer
	New Forcemain or Sewer
	Decommission Project

June 2017
Figure 4.F.8
Not to Scale

Table 4.F.14 Summary of Niagara Falls Wastewater Treatment Plant Capital Program

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-D-001	Decommissioning of Queenston Wastewater Treatment Plant (WWTP)	Decommissioning of Queenston WWTP, to be replaced by new Sewage Pumping Station (SPS) and forcemain to St. David's #1 SPS	N/A	2022-2031	Niagara-on-the-Lake	A+	To be Satisfied Under Consolidated Queenstown Schedule B EA - Separate Study	Treatment	$1,979,000
WW-FM-006	New Black Horse Forcemain to Niagara Falls	New Black Horse Forcemain to Niagara Falls	400 mm	2022-2031	Niagara Falls	A+	To be Satisfied Under Consolidated South NF Schedule C EA - Separate Study	Forcemain	$9,820,000
WW-FM-008	South Side High Lift conveyance	South Side High Lift to new South Niagara Falls Wastewater Treatment Plant	900 mm	2022-2031	Niagara Falls	A+	To be Satisfied Under Consolidated South NF Schedule C EA - Separate Study	Sewer	$38,039,000
WW-FM-009	Dorchester Forcemain twinning	Twin existing Dorchester Forcemain in Niagara Falls	300 mm	2022-2031	Niagara Falls	A+	Satisfied	Forcemain	$303,000
WW-FM-010	St. David's #1 Forcemain twinning	Twin existing St. David's #1 Forcemain in Niagara-on-the-Lake	300 mm	2022-2031	Niagara-on-the-Lake	A+	Dependent on outcome of wet weather flow study	Forcemain	$3,923,000
WW-FM-012	New Queenston Forcemain	New Queenston Forcemain into Niagara Falls system	250 mm	2022-2031	Niagara-on-the-Lake	A+	To be Satisfied Under Consolidated Queenstown Schedule B EA - Separate Study	Forcemain	$11,136,000
WW-II-012	Wet weather reduction in Central Niagara Falls	Wet weather reduction in Central Niagara Falls	100 L/s reduction	2022-2031	Niagara Falls	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$15,000,000
WW-II-013	Wet weather reduction in South Niagara Falls	Wet weather reduction in South Niagara Falls	100 L/s reduction	2017-2021	Niagara Falls	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$15,000,000
WW-SPS-025	Garner Road Sewage Pumping Station (SPS) Pump Replacement - Niagara Falls	Increase station capacity from 81 L/s to 206 L/s. Addition of a third 103 L/s pump.	206 L/s	2032-2041	Niagara Falls	B	Satisfied (Project File Included)	Pumping	$824,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-SPS-026	Dorchester SPS Pump Replacement - Niagara Falls	Increase station capacity from 220 L/s to 270 L/s	270 L/s	2022-2031	Niagara Falls	A+	Satisfied	Pumping	$2,414,000
WW-SPS-028	Black Horse SPS Upgrade - South Niagara Falls	Increase station capacity from 21 L/s to 180 L/s	180 L/s	2022-2031	Thorold	C	To be Satisfied Under Consolidated South NF Schedule C EA - Separate Study	Pumping	$4,620,000
WW-SPS-031	St. David's #2 SPS Expansion - Niagara Falls	Increase station capacity from 44 L/s to 104 L/s	104 L/s	2022-2031	Niagara-on-the-Lake	B	Dependent on outcome of wet weather flow study	Pumping	$3,836,000
WW-SPS-032	St. David's #1 SPS Upgrade - Niagara Falls	Increase station capacity from 41 L/s to 88 L/s	88 L/s	2022-2031	Niagara-on-the-Lake	B	Dependent on outcome of wet weather flow study	Pumping	$1,794,000
WW-SPS-039	Queenston SPS	New Queenston SPS with firm capacity of 45 L/s	45 L/s	2022-2031	Niagara-on-the-Lake	B	To be Satisfied Under Consolidated Queenstown Schedule B EA - Separate Study	Pumping	$2,996,000
WW-TP-002	South Niagara Falls Wastewater Treatment Plant	New South Niagara Falls Wastewater Treatment Plant	30 MLD	2022-2031	Niagara Falls	C	Separate EA Required	Treatment	$128,186,000
Total									**$239,870,000**

PART G
STEVENSVILLE DOUGLASTOWN
WASTEWATER SYSTEM

G. STEVENSVILLE DOUGLASTOWN LAGOONS

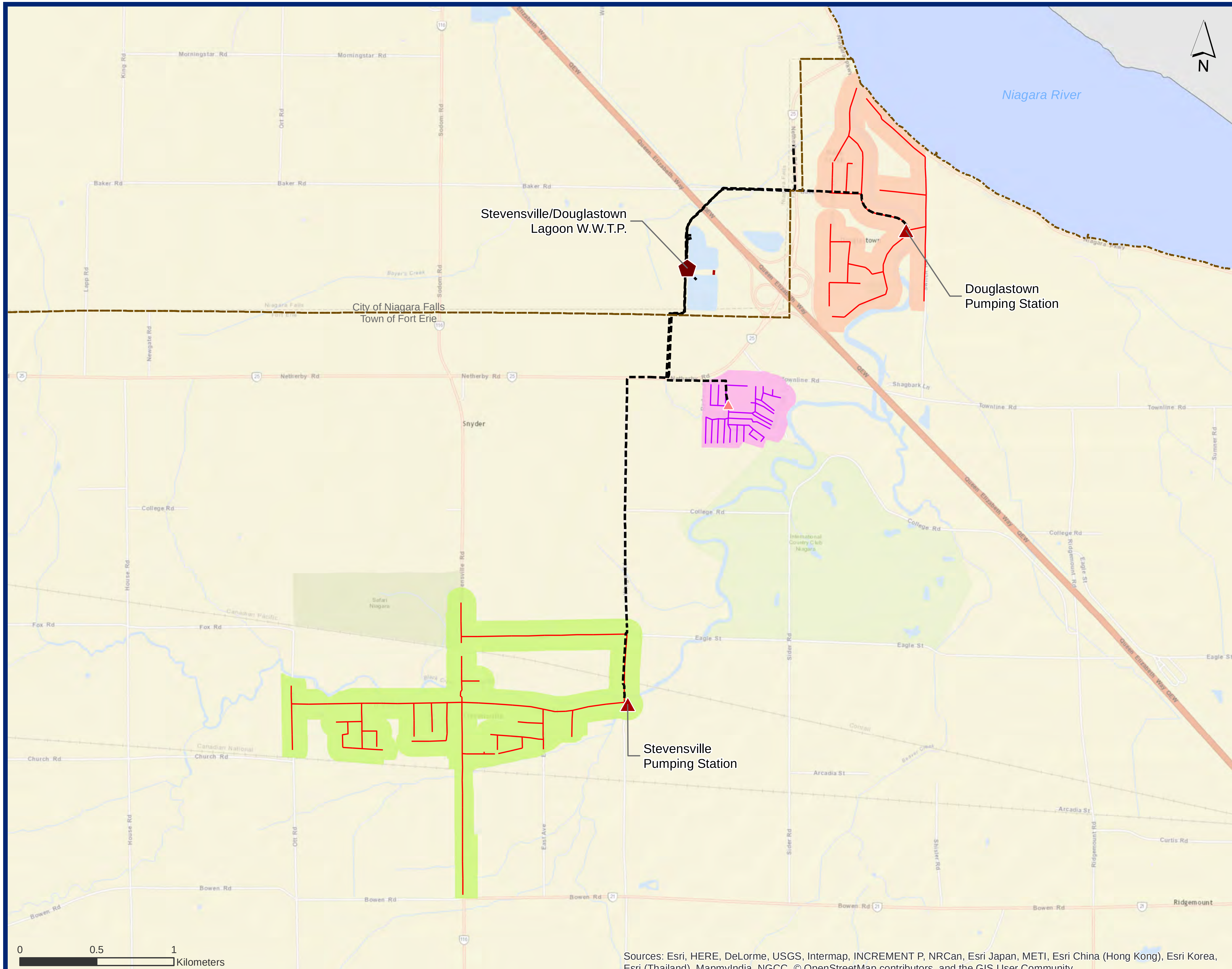
G.1 Existing System Overview

The Stevensville Douglastown wastewater system services the areas of Stevensville and Douglastown in northern part of the Town of Fort Erie. The system services an existing population of 3,421 and 439 employees. [1]

The system is serviced by the Stevensville Douglastown Lagoons located at 3274 Netherby Road, Niagara Falls. The Lagoons consists of two ponds operating in series with pumped sanitary flows received at the inlet box where ferric chloride is added for odour control. The Lagoons have a current rated capacity of 2.7 MLD.[2]

Figure 4.G.1 presents an overview of the wastewater system, and Figure 4.G.2 shows a schematic of the wastewater system.

[1] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*
[2] *Ministry of Environment, 02 October 2008. Ammeded Certificate of Approval. Number 2588-7JTL5C*



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Black Creek
- Stevensville
- Douglastown

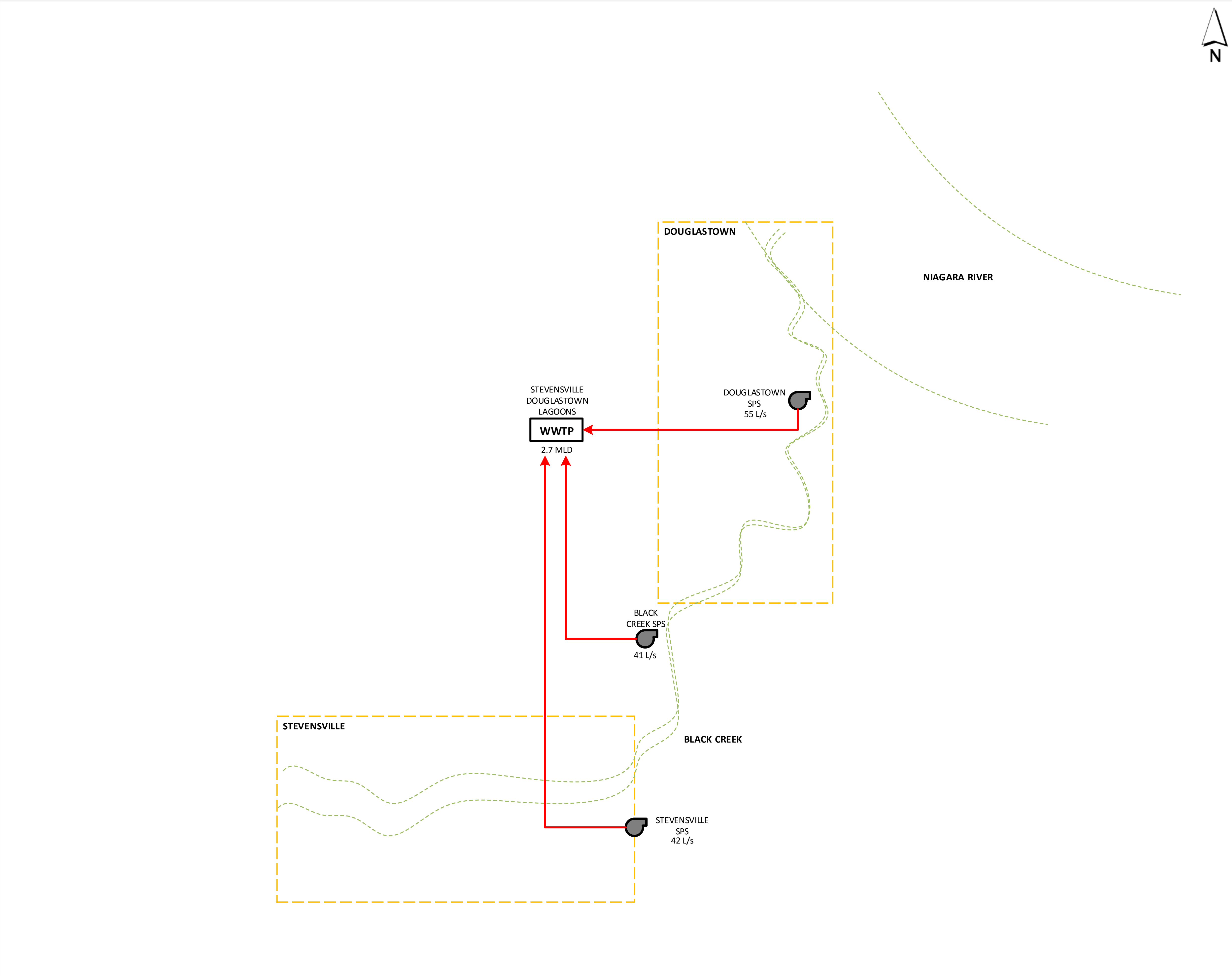
Figure 4.G.1

Existing Wastewater System

Stevensville Douglastown Lagoons

BluePlan

June 2017
715023-WW-2-Existing System (SD)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Stevensville Douglastown WWTP

EXISTING COLLECTION SCHEMATIC

Legend

WWTP — RATED CAPACITY — Wastewater Treatment Plant

FIRM CAPACITY — Sewage Pumping Station

Forcemain

Connection from SPS to SPS

Connection from SPS to WWTP

June 2017
Figure 4.G.2
Not to Scale

GM BluePlan ENGINEERING

G.1.1 Service Area Overview

Table 4.G.1 provides a list of facility catchments and their areas. Refer to Figure 4.G.1 for the catchment areas of each facility.

Table 4.G.1 Facilities and Catchment Areas

Facility	Catchments	Catchment Area (ha)
Stevensville Douglastown Lagoons	**Stevensville Douglastown Lagoons** (Including Sub Catchments) Stevensville SPS Black Creek SPS Douglastown SPS	256.5
	Stevensville Douglastown Lagoons (Excluding Sub Catchments)	0.0
Stevensville Sewage Pumping Station (SPS)	Stevensville SPS	145.0
Black Creek SPS	Black Creek SPS	26.1
Douglastown SPS	Douglastown SPS	85.5

G.1.2 Facility Overview

Table 4.G.2 Wastewater Treatment Plant Overview

Plant Name	Stevensville Douglastown Lagoons
Address	3274 Netherby Road, Niagara Falls
Discharge Water	Niagara River
Rated Capacity: Average Daily Flow	2.7 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	N/A
Rated Capacity: Peak Flow Rate (Wet Weather)	N/A
Key Processes	• Odour Control • Grit removal • Sludge thickening • Effluent disinfection

Table 4.G.3 Wastewater Treatment Plant Effluent Objectives

Effluent Parameter	Objective Concentration[3]
$CBOD_5$	15.0 mg/L
TSS	15.0 mg/L
Total Phosphorus	0.75 mg/L
Total Ammonia Nitrogen *January – April* *May – October* *November – December*	 15 mg/L 10 mg/L 15 mg/L

Table 4.G.4 Pumping Station Overview

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Stevensville Sewage Pumping Station (SPS)	2550 Winger Road, Fort Erie	2	50.0	41.8	22.6
Black Creek SPS	Black Creek Trailer Park, Fort Erie	2	41.0	41.0	22.0
Douglastown SPS	River Trail, Fort Erie	2	55.0	55.0	23.6

Table 4.G.5 Forcemain Overview

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Length (m)	Diameter (mm)	Capacity @ 2.5 m/s (L/s)
Stevensville Sewage Pumping Station (SPS)	41.8	3,185	250	122.7
Black Creek SPS	41.0	1,596	200	78.5
Douglastown SPS	55.0	1,984	250	122.7

[3] *Ministry of Environment, 02 October 2008. Ammeded Certificate of Approval. Number 2588-7JTL5C*

G.1.3 Flows Overview

Table 4.G.6 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.G.7 shows the existing wastewater system flows by catchment.

Table 4.G.6 Historic Stevensville Douglastown Lagoons Flows

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	L/s	MLD	L/s	MLD	L/s
2011	1.5	17.4	1.5	17.4	2.1	24.3
2012	1.1	12.7	1.1	12.7	1.4	16.2
2013	1.3	15.0	1.3	15.0	4.7	54.4
2014	1.2	13.9	1.2	13.9	4.3	49.8
2015	1.2	13.9	1.2	13.9	3.8	44.0
5 Year Average	1.2	13.9	1.3	15.0	3.3	38.2
5 Year Peak	1.3	17.4	1.5	17.4	4.7	54.4

Table 4.G.7 Existing Wastewater System Flows by Catchment

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Stevensville Douglastown Wastewater Treatment Plant	3,860	13.9	101.2	99.0	109.0
Stevensville Douglastown WWTP	0	0.0	0.0	0.0	0.0
Stevensville Sewage Pumping Station (SPS)	1,740	7.6	56.7	79.0	127.0
Black Creek SPS	597	3.7	14.8	17.0	27.0
Douglastown SPS	1,523	2.7	29.8	57.0	92.0

Note: Flow numbers may not sum due to rounding.

G.2 Growth Projections

G.2.1 Population Projections and Allocations

Table 4.G.8 and Table 4.G.9 outline the existing and projected serviced population and employment by catchment.

Table 4.G.8 Stevensville Douglastown Lagoons Existing and Projected Serviced Population by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Stevensville Sewage Pumping Station (SPS)	1,691	1,648	1,648	1,663	1,689	2,298	607
Black Creek SPS	285	275	275	276	280	283	-1
Douglastown SPS	1,445	1,991	2,028	2,425	2,453	2,477	1,032
Total	**3,421**	**3,914**	**3,951**	**4,364**	**4,422**	**5,058**	**1,638**

Note: Population numbers may not sum due to rounding.

Table 4.G.9 Stevensville Douglastown Lagoons Existing and Projected Serviced Employment by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Stevensville Sewage Pumping Station (SPS)	49	95	99	128	137	174	125
Black Creek SPS	313	315	315	321	339	361	48
Douglastown SPS	78	173	208	258	313	384	306
Total	**440**	**583**	**622**	**707**	**789**	**919**	**479**

Note: Population numbers may not sum due to rounding.

G.2.2 Future Flow Projections

Table 4.G.10 and Table 4.G.11 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

Table 4.G.10 Projected Peak Dry Weather Flow by Catchment

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Stevensville Sewage Pumping Station (SPS)	15.3	15.3	15.8	16.2	23.4
Black Creek SPS	7.2	7.2	7.3	7.6	7.9
Douglastown SPS	12.6	13.4	18.2	19.0	20.1
Total	**35.0**	**35.9**	**41.3**	**42.8**	**51.4**

The following presents an example calculation of projected peak dry weather flow.

2041 Peak Dry Weather Flow for Douglastown Sewage Pumping Station:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (2.66 L/s × 2.0) + (2,861 – 1,523 people) × 275 L/cap/day × 1 day/86400 s × 3.46
= 20.1 L/s

Table 4.G.11 Projected Peak Wet Weather Flow by Catchment

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Stevensville Sewage Pumping Station (SPS)	56.7	56.8	57.3	57.7	64.9
Black Creek SPS	14.7	14.7	14.8	15.1	15.4
Douglastown SPS	37.0	37.8	42.6	43.5	44.5
Total	**108.4**	**109.3**	**114.7**	**116.2**	**124.7**

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for Douglastown Sewage Pumping Station:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 20.1 L/s + (85.5 ha × 0.286 L/s/ha)
= 44.5 L/s

G.3 Assessment of Wastewater Infrastructure (Existing and Future)

G.3.1 Treatment Plant Capacity

Figure 4.G.3 shows the projected future demands at the Stevensville Douglastown Lagoons. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.

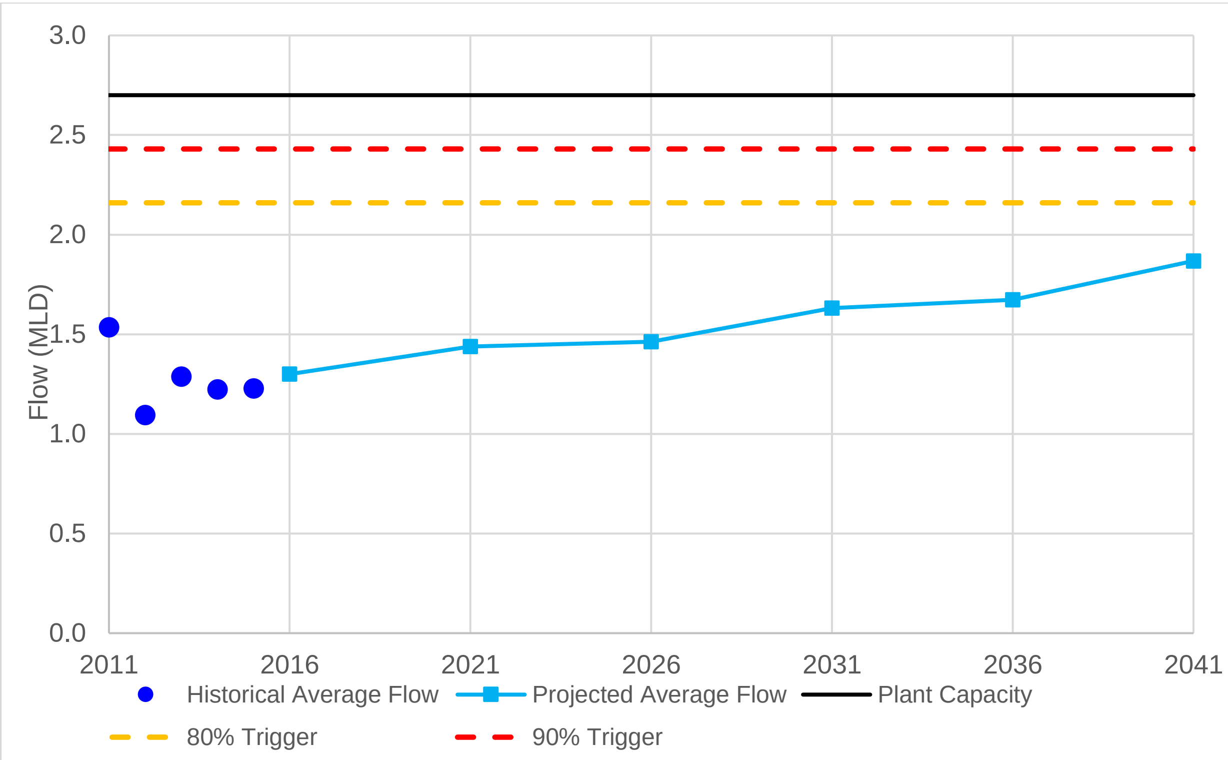


Figure 4.G.3 Projected future demands at Stevensville Douglastown Lagoons

G.3.2 Sewage Pumping Station

Table 4.G.12 highlights the sewage pumping station existing and projected capacity.

Table 4.G.12 System Sewage Pumping Station Performance

Sewage Pumping Station	Contributing Catchments	Facility Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Stevensville Sewage Pumping Station (SPS)	Stevensville Douglastown Lagoons Stevensville SPS Black Creek SPS Douglastown SPS	41.8	56.7	64.9	-23.1
Black Creek SPS	Black Creek SPS	41.0	14.8	15.4	25.6
Douglastown SPS	Douglastown SPS	55.0	29.8	44.5	10.5

The Stevensville Sewage Pumping Station has a projected pumping deficit.

G.3.3 Forcemain

Table 4.G.13 highlights the existing and projected forcemain performance.

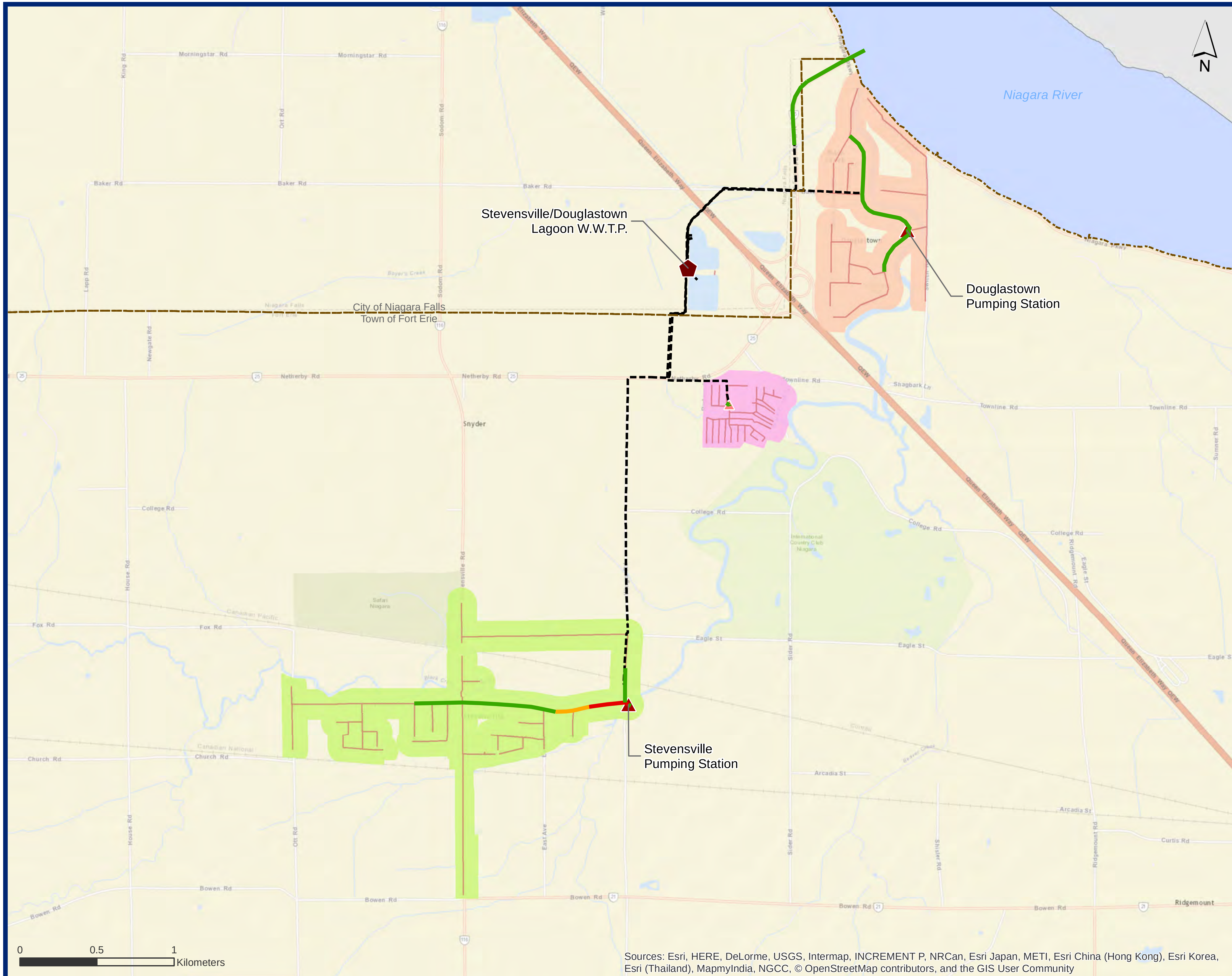
Table 4.G.13 Forcemain Performance

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Capacity @ 2.5 m/s (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Stevensville Sewage Pumping Station (SPS)	41.8	122.7	56.7	64.9	57.8
Black Creek SPS	41.0	78.5	14.8	15.4	63.1
Douglastown SPS	55.0	122.7	29.8	44.5	78.2

All forcemains have a projected surplus capacity.

G.3.4 Trunk Sewer

Figure 4.G.4 and Figure 4.G.5 highlight the existing and projected peak wet weather flow, respectively. Trunk sewers upstream of the Stevensville Sewage Pumping Station are approaching capacity within the 2041 time horizon.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Black Creek
- Stevensville
- Douglastown

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

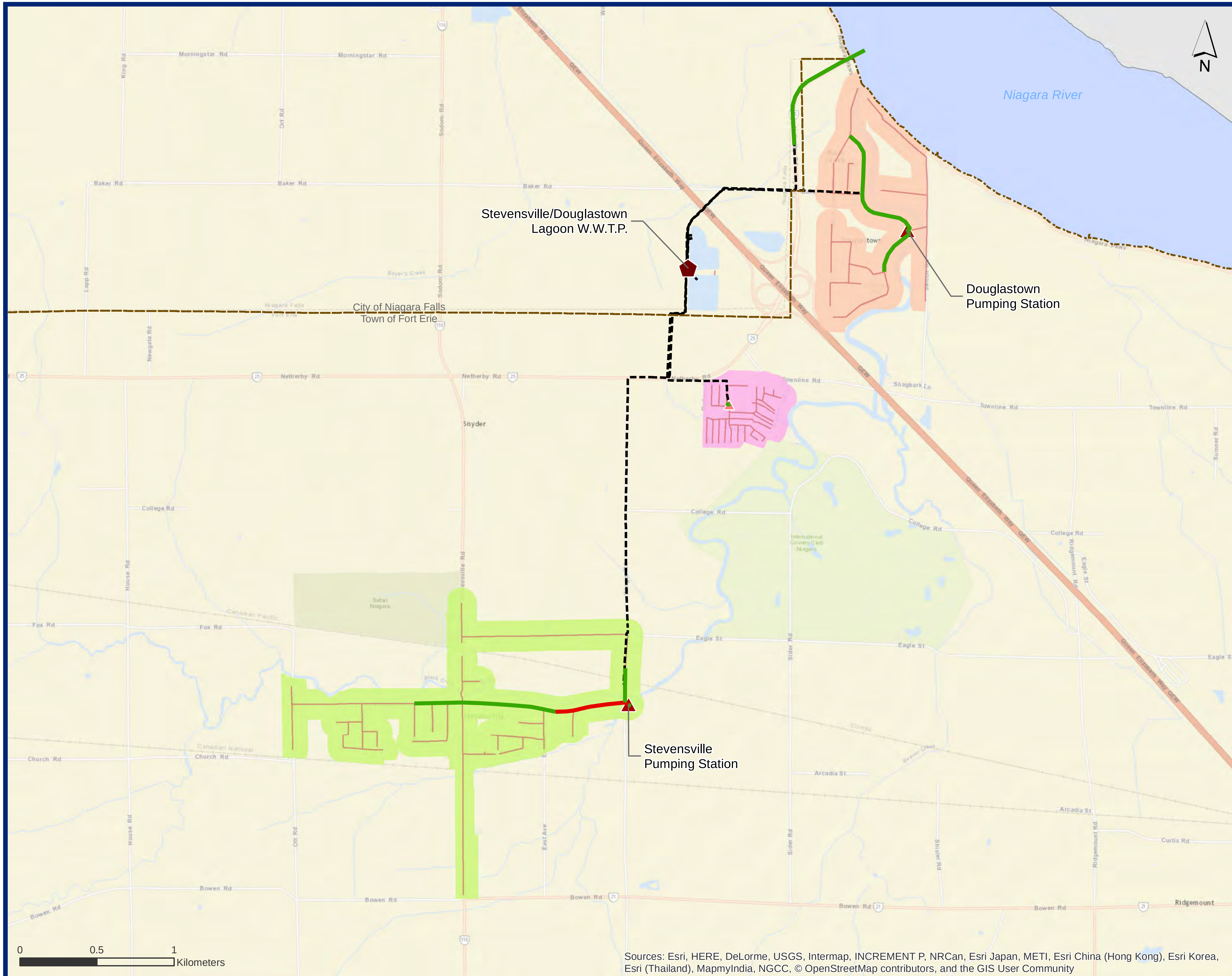
Figure 4.G.4

Existing Peak Wet Weather Flow

Stevensville Douglastown Lagoons

BluePlan ENGINEERING

June 2017
715023-WW-4-Existing Wet Weather (SD)
NAD 1983 UTM Zone 17N



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Black Creek
- Stevensville
- Douglastown

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.G.5

2041 Peak Wet Weather Flow

Stevensville Douglastown Lagoons

BluePlan ENGINEERING

June 2017
715023-WW-5-2041 Wet Weather (SD)
NAD 1983 UTM Zone 17N

G.4 System Opportunities and Constraints

Figure 4.G.6 highlights the existing opportunities and constraints.

G.4.1 Stevensville and Douglastown Lagoons

- The current rated average daily flow capacity of the lagoons is 2.7 MLD, with an existing flow of 1.3 MLD and a projected average daily flow of 1.9 MLD, which is below 80% of the lagoons rated capacity. As such, the lagoons have surplus capacity to accommodate growth beyond 2041.
- Maintenance and rehabilitation of the lagoons is needed to maintain the rated capacity.

G.4.2 Stevensville

- Limited residential and employment growth consisting of infill development within existing urban boundary.
- Existing and growth related wet weather capacity deficit at Stevensville Sewage Pumping Station.
- Existing sewer network has capacity to meet design criteria wet weather flows; however, actual wet weather flows exceed sewer capacity in several areas.

G.4.3 Douglastown

- Limited residential and employment growth consisting of infill development within existing urban boundary.
- Douglastown Sewage Pumping Station has sufficient capacity to meet 2041 design flow rate.

G.4.4 System Optimization Opportunities

- Opportunity to decommission lagoons and convey flows to the new South Niagara Falls Wastewater Treatment Plant.

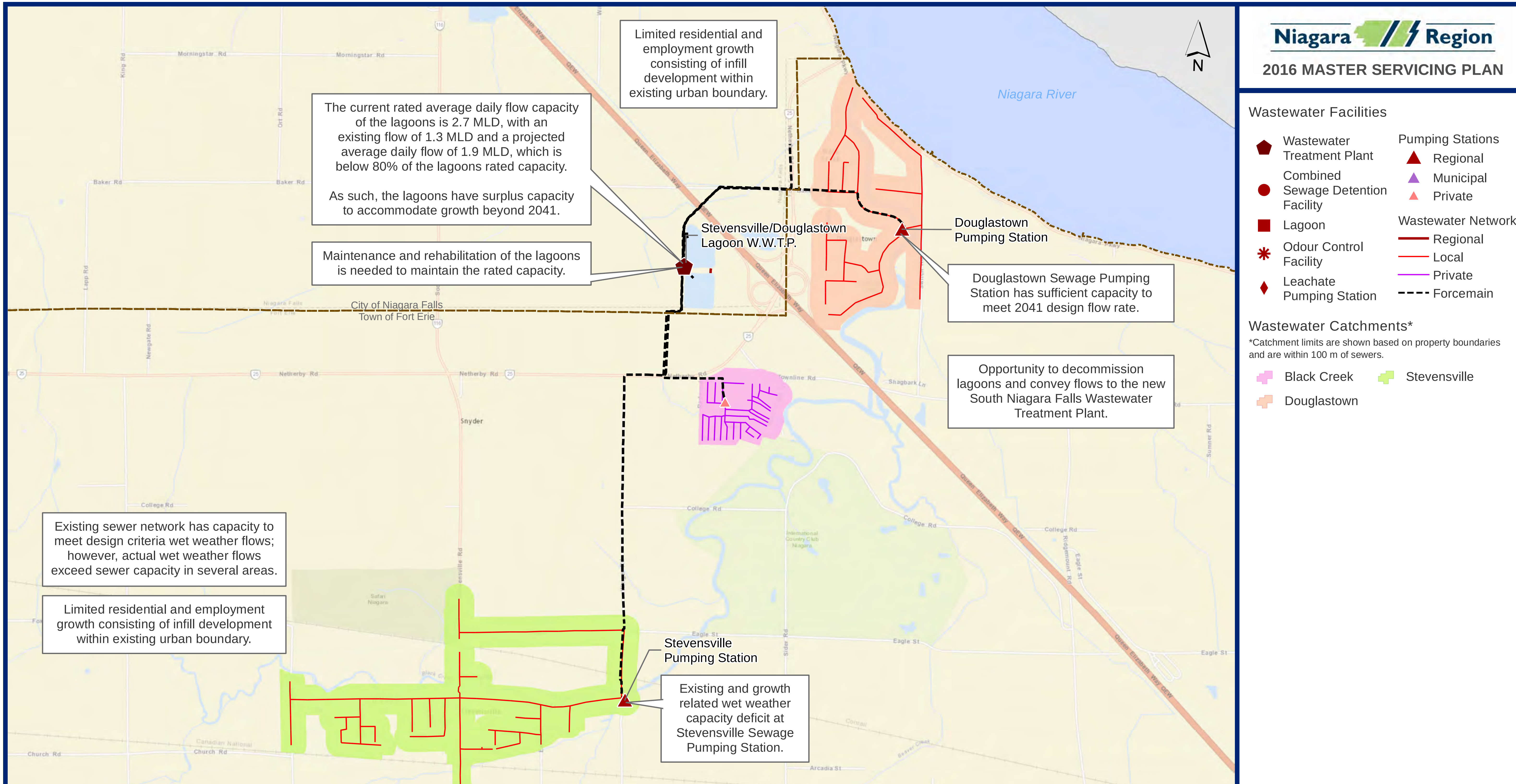


Figure 4.G.6
System Opportunities and Constraints
Stevensville Douglastown Lagoons

BluePlan
June 2017
715023-WW-3-Opportunities and Constraints (SD)
NAD 1983 UTM Zone 17N

G.5 Assessment of Alternatives

The hybrid management strategy consists of:

- Providing capacity within Regional sewage pumping stations and trunk sewers to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Providing upstream flow management and peak flow management to address peak flows in systems where peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in potential basement flooding and overflow risks.

Further to the application of the above strategy two treatment plant alternatives for the Stevensville and Douglastown Servicing area where considered, presented in Figure 4.G.7 and Figure 4.G.8. The alternatives are as follows:

1. Maintain existing configuration.
2. Decommission the Lagoons and redirect flows to the new South Niagara Falls Wastewater Treatment Plant. Required works include:
    - New Lagoons Sewage Pumping Station and forcemain
    - Decommissioning of the Stevensville Douglastown Lagoons

Implementation of Alternative 2 is dependent on the construction of the New Niagara Falls Wastewater Treatment Plant, which was identified as the preferred servicing option as outlined in Part F.

It was found that Alternative 1 is preferred as the distance between the existing Lagoons and new treatment plant presents the following challenges:

- Generally low flow rate relative to the forcemain length and volume would generate significant operational challenges and increase cost.
- Generally high cost of construction due to distance, and potential additional design considerations to address operational challenges.

G.6 Preferred Servicing Strategy

The following is a summary of the Stevensville and Douglastown wastewater servicing strategy, presented in Figure 4.G.7 and Figure 4.G.8:

- The Stevensville and Douglastown system is currently serviced by a lagoon treatment plant. Based on the projected growth in the area, the treatment plant will have sufficient capacity to support growth to 2041.
- The Stevensville Sewage Pumping Station will require additional capacity and wet weather management is recommended for the system.

G.6.1 Pumping Stations

The following sewage pumping station upgrade is required:

- Stevensville Sewage Pumping Station pump replacement: Increase capacity from 42 L/s to 65 L/s.

G.6.2 Wet Weather

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts. These wet weather management programs will need to be a joint initiative between the Region and local municipalities.

For the Stevensville and Douglastown system, the following priority areas are identified:

- Stevensville Sewage Pumping Station catchment
- Douglastown Sewage Pumping Station catchment

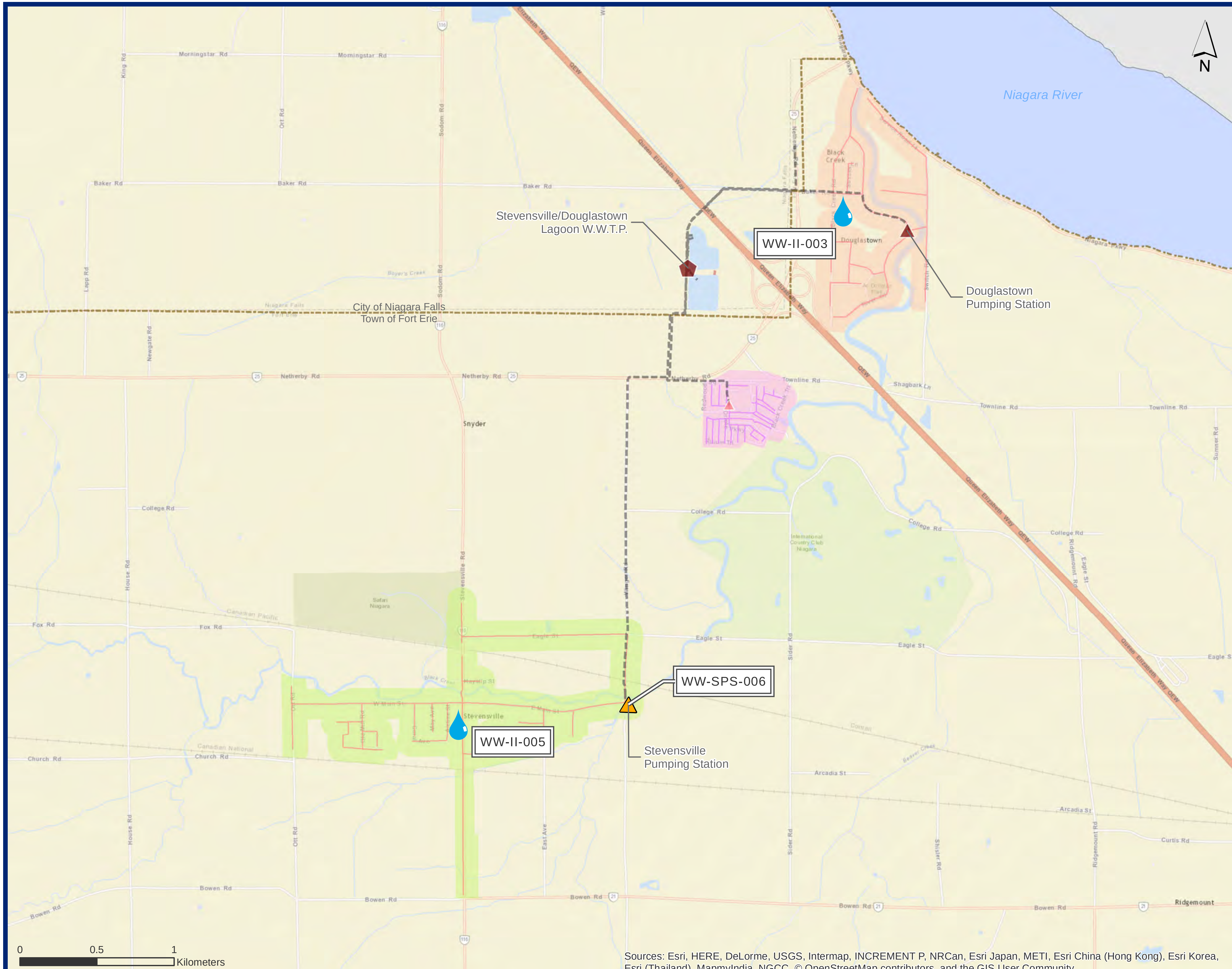
Further flow monitoring and area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, Preferred Servicing Strategy are needed to identify area specific strategies and projects required to achieve the wet weather flow reduction objectives. Following the outcomes of the further studies, targeted funding can be applied outside the priority areas if the projects are found to address capacity issues and support growth capacity needs.

G.7 Capital Program

Table 4.G.14 summarizes the recommended project costing, implementation schedule and Class EA requirements.

G.7.1 Schedule B Project Files

No Schedule B projects are anticipated for the Stevensville Douglastown Lagoons system.



Niagara Region

2016 MASTER SERVICING PLAN

MSP Wastewater Projects

- Treatment Plant
- Sanitary Sewer Projects
- Pumping Station
- Forcemain Projects
- Wet Weather Reduction

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Private
- Local
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Stevensville
- Douglastown
- Black Creek

Figure 4.G.7

Preferred Wastewater Strategy

Stevensville Douglastown Lagoons

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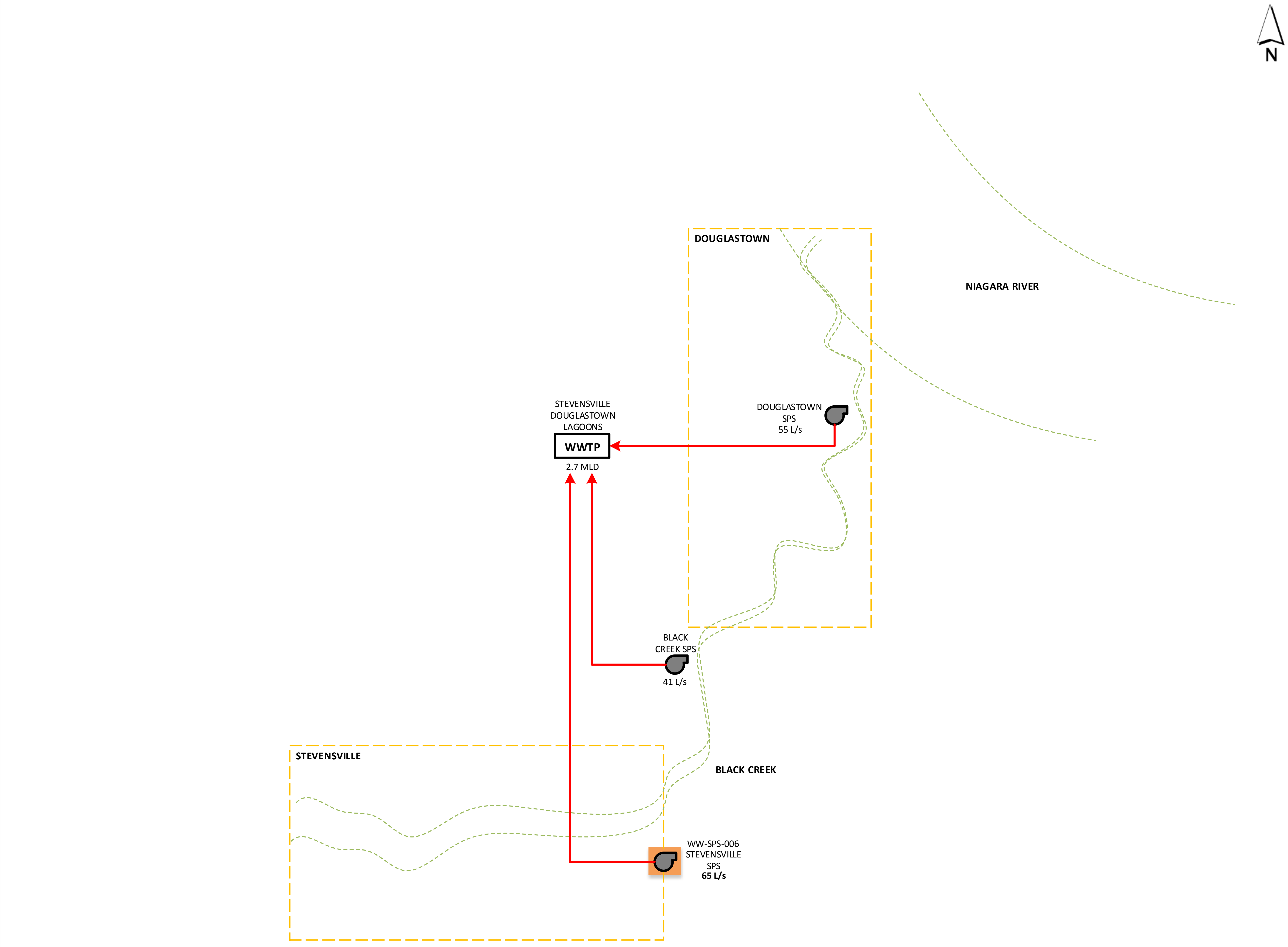
June 2017
715023-WW-6-Capital Projects (SD)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Stevensville Douglastown WWTP

2041 COLLECTION SCHEMATIC

WWTP (RATED CAPACITY)	Wastewater Treatment Plant
(FIRM CAPACITY)	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP
	Facility Upgrade
	Upgrade Forcemain or Sewer
	New Forcemain or Sewer
	Decommission Project

June 2017
Figure 4.G.8
Not to Scale

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Table 4.G.14 Summary of Stevensville Douglastown Wastewater Treatment Plant Capital Program

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-II-003	Wet weather reduction in Stevensville Douglastown	Wet weather reduction in Stevensville Douglastown	30 L/s reduction	2022-2031	Fort Erie	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$4,500,000
WW-SPS-006	Stevensville Sewage Pumping Station Upgrade - Stevensville Douglastown	Increase station capacity from 42 L/s to 65 L/s	65 L/s	2022-2031	Fort Erie	A+	Satisfied	Pumping	$1,022,000
Total									**$5,522,000**

PART H
ANGER WASTEWATER SYSTEM

H. ANGER AVENUE WASTEWATER TREATMENT PLANT

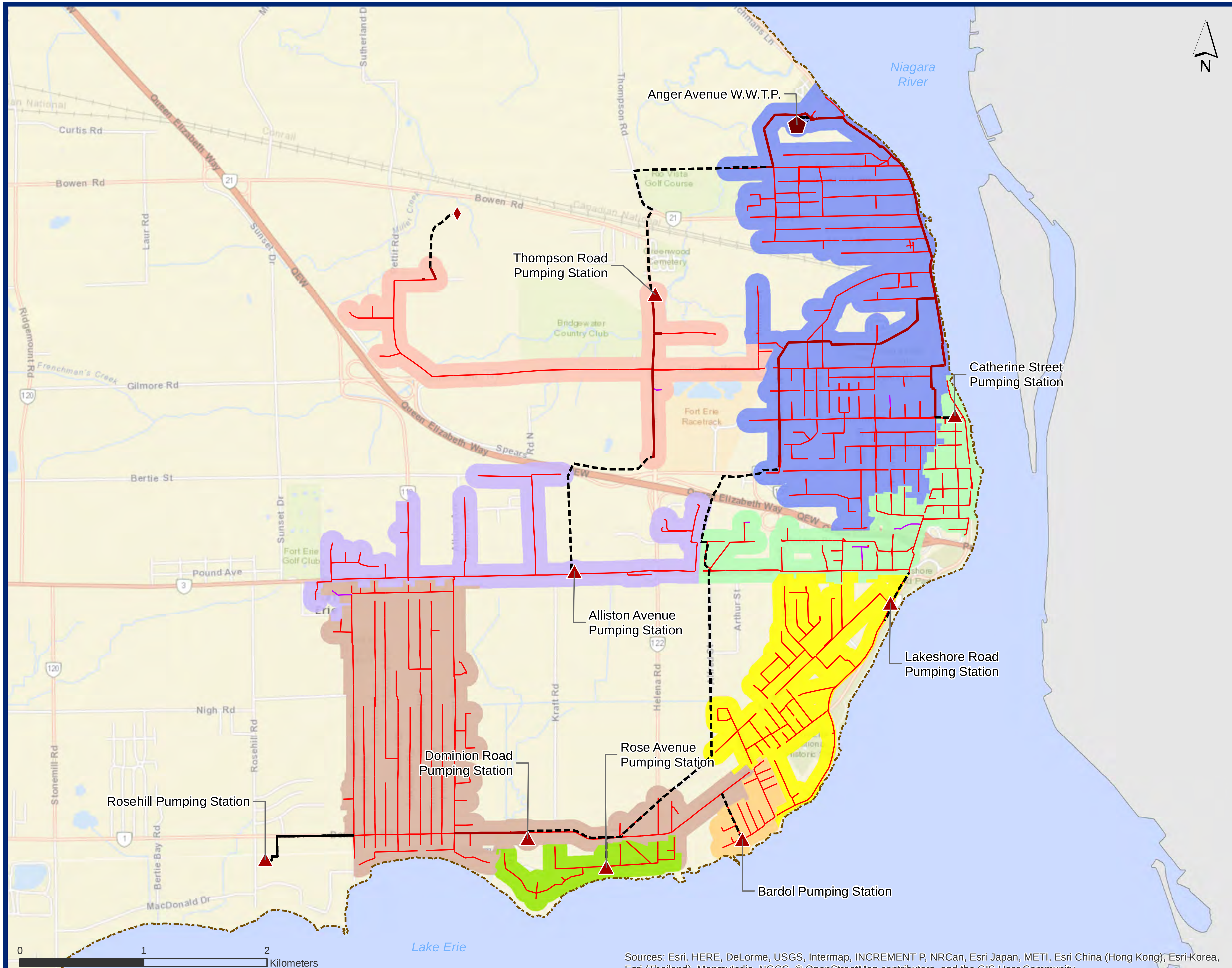
H.1 Existing System Overview

The Anger Avenue wastewater system services the eastern part of the Town of Fort Erie. The system in services an existing population of 16,265 and 9,165 employees.[1]

The system is serviced by the Anger Avenue Wastewater Treatment Plant, located on 1 Anger Avenue, Fort Erie. The Anger Avenue Wastewater Treatment Plant is a conventional facility with a current rated capacity of 24.5 MLD, a peak dry weather flow capacity of 49.0 MLD and a peak wet weather flow capacity of 98.0 MLD. [2]

Figure 4.H.1 presents an overview of the wastewater system, and Figure 4.H.2 shows a schematic of the wastewater system.

[1] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*
[2] *Ministry of Environment, 24 October 2011. Ammeded Certificate of Approval. Number 0421-8LVJ3N*



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

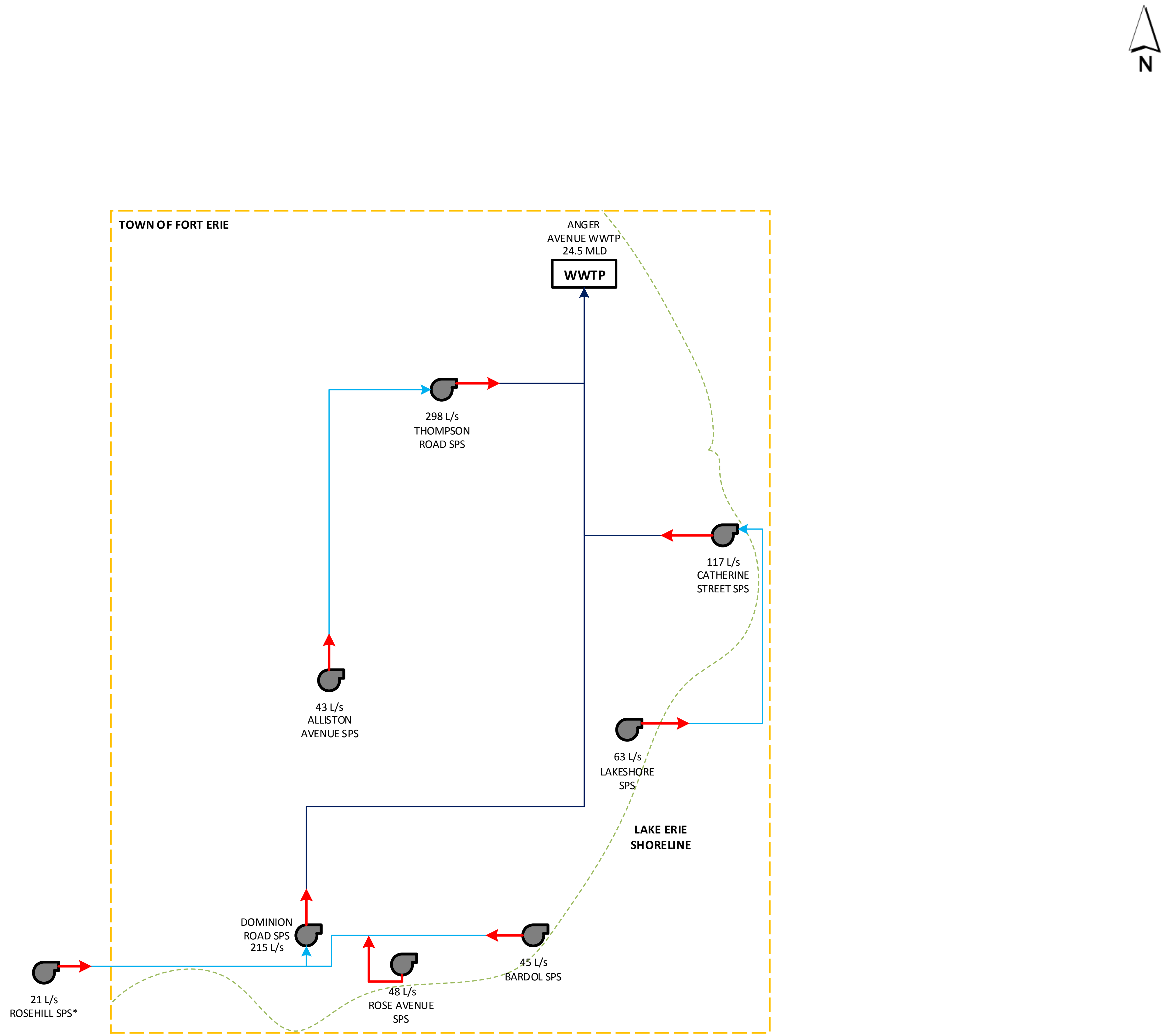
*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Anger Avenue W.W.T.P.
- Alliston Avenue
- Bardol
- Catherine Street
- Dominion Road
- Lakeshore Road
- Rose Avenue
- Thompson Road

Figure 4.H.1
Existing Wastewater System
Anger Avenue WWTP

BluePlan ENGINEERING

June 2017
715023-WW-2-Existing System (Anger Avenue)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Anger Avenue WWTP

EXISTING COLLECTION SCHEMATIC

Legend

WWTP — RATED CAPACITY — Wastewater Treatment Plant

FIRM CAPACITY — Sewage Pumping Station

Forcemain

Connection from SPS to SPS

Connection from SPS to WWTP

*Rosehill Sewage Pumping Station only services the Rosehill Water Treatment Plant.

June 2017
Figure 4.H.2
Not to Scale

GM BluePlan ENGINEERING

H.1.1 Service Area Overview

Table 4.H.1 provides a list of facility catchments and their areas. Refer to Figure 4.H.1 for the catchment areas of each facility

Table 4.H.1 Facilities and Catchment Areas

Facility	Catchments	Catchment Area (ha)
Anger Avenue Wastewater Treatment Plant (WWTP)	**Anger Avenue WWTP** (Including Sub Catchments) Thompson Road SPS Catherine Street SPS Dominion Road SPS	1342.9
	Anger Avenue WWTP (Excluding Sub Catchments)	420.8
Thompson Road Sewage Pumping Station (SPS)	**Thompson Road SPS** (Including Sub Catchments) Alliston Avenue SPS	274.7
	Thompson Road SPS (Excluding Sub Catchments)	131.6
Alliston Avenue SPS	Alliston Avenue SPS	143.1
Catherine Street SPS	**Catherine Street SPS** (Including Sub Catchments) Lakeshore Road SPS	269.3
	Catherine Street SPS (Excluding Sub Catchments)	122.9
Lakeshore Road SPS	Lakeshore Road SPS	146.4
Dominion Road SPS	**Dominion Road SPS** (Including Sub Catchments) Rose Avenue SPS Bardol SPS	378.1
	Dominion Road SPS (Excluding Sub Catchments)	305.6
Rose Avenue SPS	Rose Avenue SPS	45.0
Bardol SPS	Bardol SPS	27.4

H.1.2 Facility Overview

Table 4.H.2 Wastewater Treatment Plant Overview

Plant Name	Anger Avenue Wastewater Treatment Plant
Address	1 Anger Avenue, Fort Erie
Discharge Water	Niagara River
Rated Capacity: Average Daily Flow	24.5 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	49.0 MLD
Rated Capacity: Peak Flow Rate (Wet Weather)	98.0 MLD
Key Processes	• Conventional activated sludge treatment with screening • Grit removal • Sludge thickening • Effluent disinfection • Phosphorus removal • Chlorination of secondary bypass flow

Table 4.H.3 Wastewater Treatment Plant Effluent Objectives

Effluent Parameter	Objective Concentration[3]
$CBOD_5$	15.0 mg/L
TSS	15.0 mg/L
Total Phosphorus	1.0 mg/L
E. Coli	200 organisms/100 mL (Monthly geometric mean density)
Total Chlorine Residual	0.5 mg/L (Maximum concentration during disinfection period: April 01 to October 31)

[3] *Ministry of Environment, 24 October 2011. Ammeded Certificate of Approval. Number 0421-8LVJ3N*

Table 4.H.4 Pumping Station Overview

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Thompson Road Sewage Pumping Station (SPS)	1800 Thompson Road, Fort Erie	3	680.0	298.0	34.7
Alliston Avenue SPS	900 Garrison Road, Fort Erie	2	43.0	43.0	18.0
Catherine Street SPS	8 Catherine Street, Fort Erie	2	228.0	117.0	15.0
Lakeshore SPS	Lakeshore Road, Fort Erie	2	36.6	63.0	10.4
Dominion Road SPS	1027 Dominion Road, Fort Erie	3	256.0	215.0	63.1
Rose Avenue SPS	Rose Avenue at Edgemere Road, Fort Erie	2	43.2	48.0	10.6
Bardol SPS	Lakeshore Road at Bardol Road, Fort Erie	2	50.6	45.0	10.7

Note: Rosehill Sewage Pumping Station only services the Rosehill Water Treatment Plant.

Table 4.H.5 Forcemain Overview

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Length (m)	Diameter (mm)	Capacity @ 2.5 m/s (L/s)
Thompson Road Sewage Pumping Station (SPS)	298.0	2,145	600	706.9
Alliston Avenue SPS	43.0	1,556	250	122.7
Catherine Street SPS	117.0	165	250	122.7
Lakeshore SPS	63.0	178	300	176.7
Dominion Road SPS	215.0	3,550	450	397.6
Rose Avenue SPS	48.0	245	200	78.5
Bardol SPS	45.0	397	250	122.7

H.1.3 Flows Overview

Table 4.H.6 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.H.7 shows the existing wastewater system flows by catchment.

Table 4.H.6 Historic Anger Avenue Wastewater Treatment Plant Flows

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	L/s	MLD	L/s	MLD	L/s
2011	12.0	138.9	14.5	167.8	53.1	614.6
2012	10.4	120.4	11.1	128.5	51.5	596.1
2013	11.2	129.6	12.7	147.0	94.3	1,091.4
2014	13.6	157.4	14.3	165.5	59.3	686.3
2015	12.4	143.5	12.9	149.3	46.7	540.5
5 Year Average	11.9	137.7	13.1	151.6	61.0	706.0
5 Year Peak	13.6	157.4	14.5	167.8	94.3	1,091.4

Table 4.H.7 Existing Wastewater System Flows by Catchment

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Anger Avenue Wastewater Treatment Plant (WWTP)	25,431	136.7	657.5	784.6	841.6
Anger Avenue WWTP	10,702	75.9	272.2	340.0	420.0
Thompson Road Sewage Pumping Station (SPS)	6,579	19.0	116.5	169.0	226.0
Thompson Road SPS	2,104	13.2	64.0	122.0	164.0
Alliston Avenue SPS	4,475	5.8	52.5	47.0	62.0
Catherine Street SPS	2,783	24.4	125.8	180.0	270.0
Catherine Street SPS	1,324	17.0	69.1	77.0	126.0
Lakeshore SPS	1,459	7.4	56.7	103.0	144.0
Dominion Road SPS	5,366	17.4	143.0	1107.0	1540.0
Dominion Road SPS	4,686	13.4	114.2	897.5	1248.5
Rose Avenue SPS	363	1.6	16.1	129.0	179.5
Bardol SPS	317	2.4	12.7	80.5	112.0

Note: Flow numbers may not sum due to rounding.

H.2 Growth Projections

H.2.1 Population Projections and Allocations

Table 4.H.8 and Table 4.H.9 outline the existing and projected serviced population and employment by catchment.

Table 4.H.8 Anger Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Anger Avenue Wastewater Treatment Plant	7,363	7,336	8,030	8,888	11,229	12,296	4,933
Alliston Avenue Sewage Pumping Station (SPS)	3,117	3,237	3,542	3,572	3,600	3,633	516
Bardol SPS	317	353	456	546	626	649	331
Catherine Street SPS	107	122	170	206	212	214	107
Dominion Road SPS	3,946	4,136	4,649	4,975	5,167	5,249	1,303
Lakeshore Road SPS (Fort Erie)	929	985	1,212	1,376	1,521	1,565	636
Rose Avenue SPS	305	314	385	451	484	495	190
Thompson Road SPS	180	265	305	307	311	314	135
Total	**16,265**	**16,747**	**18,749**	**20,323**	**23,151**	**24,416**	**8,151**

Note: Population numbers may not sum due to rounding.

Table 4.H.9 Anger Wastewater Treatment Plant Existing and Projected Serviced Employment by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Anger Avenue Wastewater Treatment Plant	3,339	3,545	3,602	3,674	3,734	3,914	575
Alliston Avenue Sewage Pumping Station (SPS)	1,358	1,488	1,581	1,701	1,827	2,000	642
Bardol SPS	0	0	0	0	0	7	7
Catherine Street SPS	1,217	1,250	1,261	1,273	1,278	1,300	84
Dominion Road SPS	740	765	791	822	852	896	156
Lakeshore Road SPS (Fort Erie)	530	542	549	556	560	590	60
Rose Avenue SPS	58	60	61	62	67	74	16
Thompson Road SPS	1,924	2,656	3,104	3,729	4,438	5,178	3,254
Total	**9,165**	**10,306**	**10,948**	**11,817**	**12,756**	**13,958**	**4,793**

Note: Population numbers may not sum due to rounding.

H.2.2 Future Flow Projections

Table 4.H.10 and Table 4.H.11 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

Table 4.H.10 Projected Peak Dry Weather Flow by Catchment

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Anger Avenue Wastewater Treatment Plant	153.5	160.4	168.8	189.5	200.0
Alliston Avenue Sewage Pumping Station (SPS)	14.2	18.3	19.8	21.3	23.4
Bardol SPS	5.3	6.6	7.7	8.7	9.1
Catherine Street SPS	34.5	35.2	35.8	35.9	36.2
Dominion Road SPS	29.0	34.5	38.1	40.3	41.5
Lakeshore Road SPS	15.6	18.3	20.2	21.9	22.7
Rose Avenue SPS	3.4	4.3	5.1	5.6	5.8
Thompson Road SPS	35.3	40.4	46.8	53.8	60.9
Total	**290.9**	**318.1**	**342.3**	**377.1**	**399.5**

The following presents an example calculation of projected peak dry weather flow.

2041 Peak Dry Weather Flow for Lakeshore Road Sewage Pumping Station:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (7.41 L/s × 2.0) + (2,155 – 1,459 people) × 275 L/cap/day × 1 day/86400 s × 3.56
= 22.7 L/s

Table 4.H.11 Projected Peak Wet Weather Flow by Catchment

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Anger Avenue Wastewater Treatment Plant	273.9	280.7	289.1	309.9	320.3
Alliston Avenue Sewage Pumping Station (SPS)	55.1	59.2	60.7	62.3	64.3
Bardol SPS	13.1	14.4	15.6	16.5	16.9
Catherine Street SPS	69.7	70.4	70.9	71.1	71.4
Dominion Road SPS	116.5	121.9	125.5	127.7	128.9
Lakeshore Road SPS (Fort Erie)	57.5	60.2	62.1	63.8	64.6
Rose Avenue SPS	16.2	17.2	18.0	18.5	18.7
Thompson Road SPS	72.9	78.1	84.4	91.4	98.5
Total	**675.0**	**702.1**	**726.4**	**761.2**	**783.6**

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for Lakeshore Road Sewage Pumping Station:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 22.7 L/s + (146.4 ha × 0.286 L/s/ha)
= 64.6 L/s

H.3 Assessment of Wastewater Infrastructure (Existing and Future)

H.3.1 Treatment Plant Capacity

Figure 4.H.3 shows the projected future demands at the Anger Wastewater Treatment Plant. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.

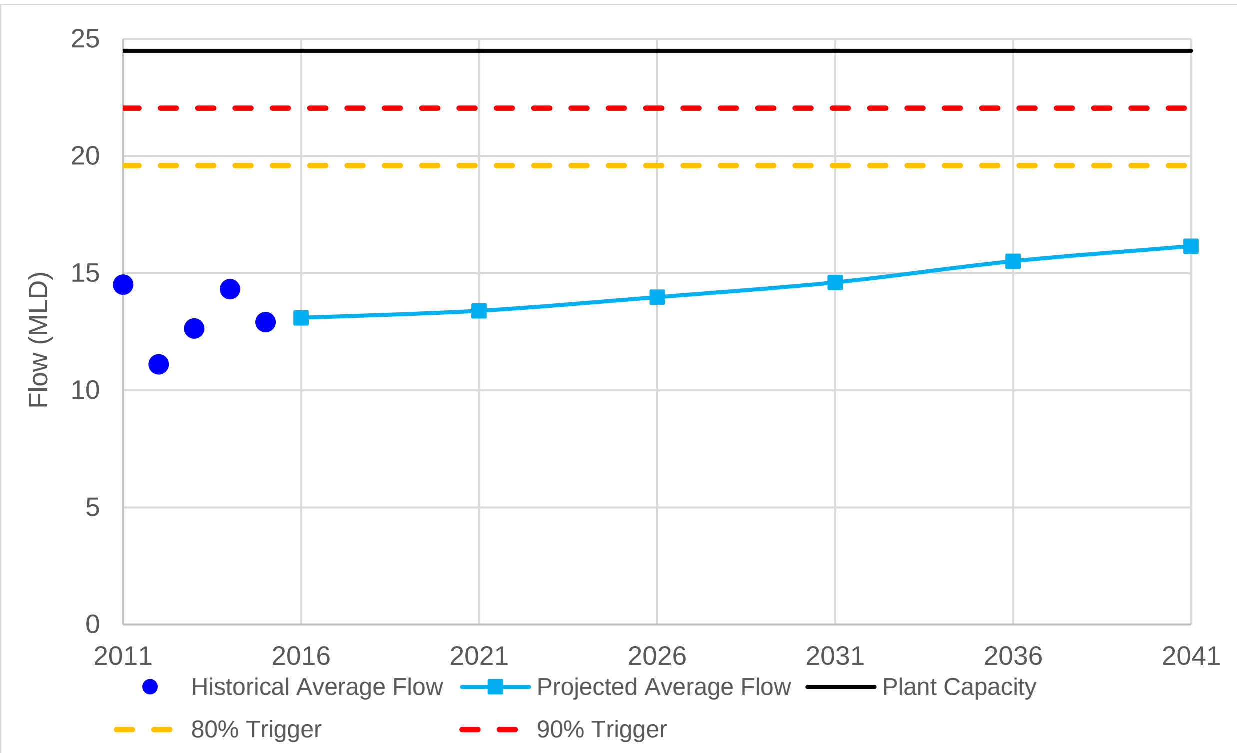


Figure 4.H.3 Projected future demands at Anger Wastewater Treatment Plant

H.3.2 Sewage Pumping Station

Table 4.H.12 highlights the sewage pumping station existing and projected capacity.

Table 4.H.12 System Sewage Pumping Station Performance

Sewage Pumping Station	Contributing Catchments	Facility Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Thompson Road Sewage Pumping Station (SPS)	Thompson Road SPS (Including Sub Catchments) Alliston Avenue SPS	298.0	116.5	158.6	139.4
Alliston Avenue SPS	Alliston Avenue SPS	43.0	52.5	64.3	-21.3
Catherine Street SPS	Catherine Street SPS (Including Sub Catchments) Lakeshore Road SPS	117.0	125.8	135.3	-18.3
Lakeshore Road SPS	Lakeshore Road SPS	63.0	56.7	64.6	-1.6
Dominion Road SPS	Dominion Road SPS (Including Sub Catchments) Rose Avenue SPS Bardol SPS	215.0	143.0	162.7	52.3
Rose Avenue SPS	Rose Avenue SPS	48.0	16.1	18.7	29.3
Bardol SPS	Bardol SPS	45.0	12.7	16.9	28.1

The following sewage pumping stations have projected pumping deficits:

- Alliston Avenue Sewage Pumping Station
- Catherine Street Sewage Pumping Station
- Lakeshore Road Sewage Pumping Station

H.3.3 Forcemain

Table 4.H.13 highlights the existing and projected forcemain performance.

Table 4.H.13 Forcemain Performance

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Capacity @ 2.5 m/s (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Thompson Road Sewage Pumping Station (SPS)	298.0	706.9	116.5	158.6	548.3
Alliston Avenue SPS	43.0	122.7	52.5	64.3	58.4
Catherine Street SPS	117.0	122.7	125.8	135.3	-12.6
Lakeshore Road SPS	63.0	176.7	56.7	64.6	112.1
Dominion Road SPS	215.0	397.6	143.0	162.7	234.9
Rose Avenue SPS	48.0	78.5	16.1	18.7	59.8
Bardol SPS	45.0	122.7	12.7	16.9	105.8

The Catherine Street Sewage Pumping Station forcemain has a projected capacity deficit.

H.3.4 Trunk Sewer

Figure 4.H.4 and Figure 4.H.5 highlight the existing and projected peak wet weather flow, respectively. Trunk sewers in the Thompson Road Sewage Pumping Station catchment are approaching capacity within the 2041 time horizon.

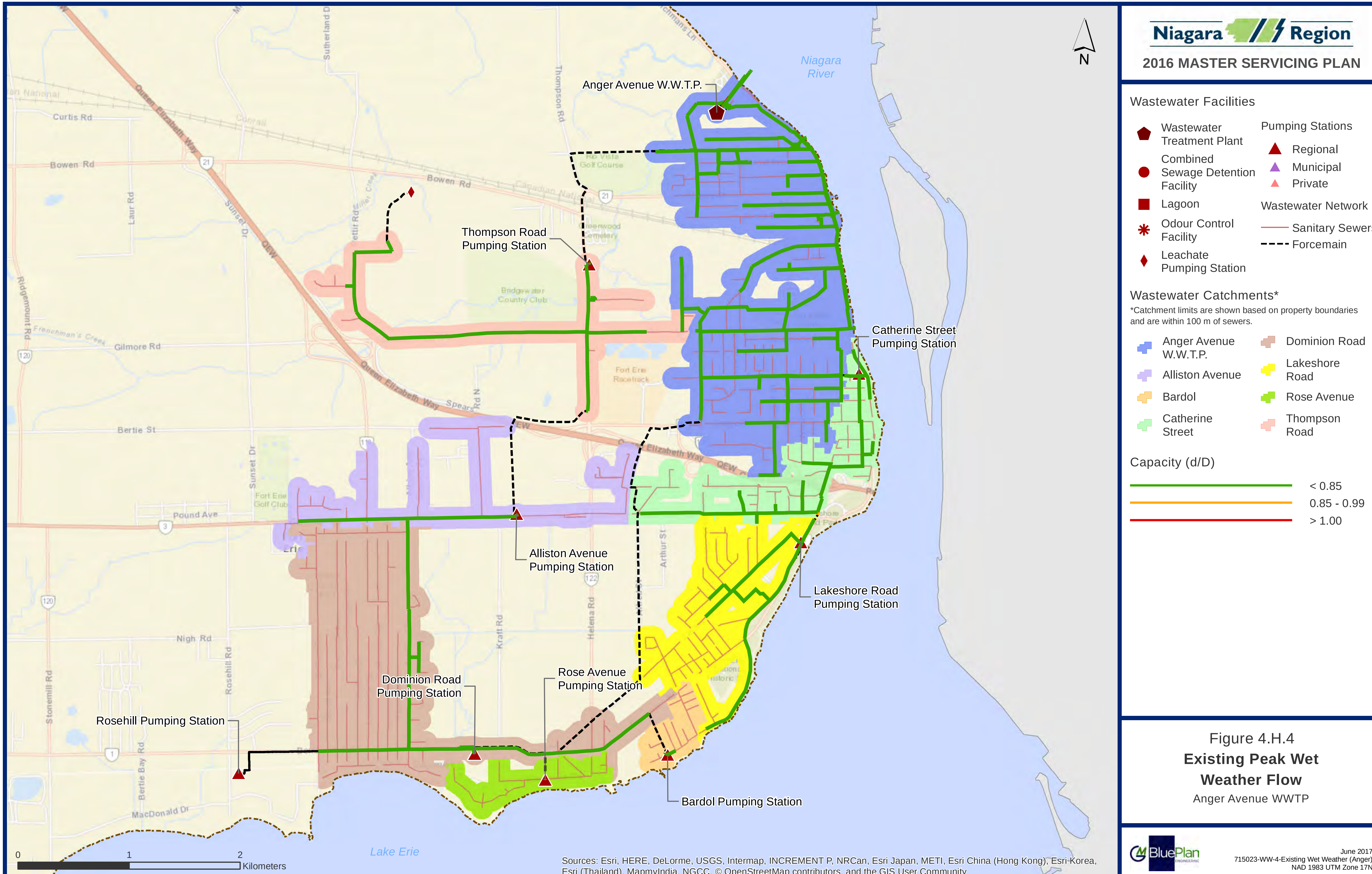


Figure 4.H.4
Existing Peak Wet Weather Flow
Anger Avenue WWTP

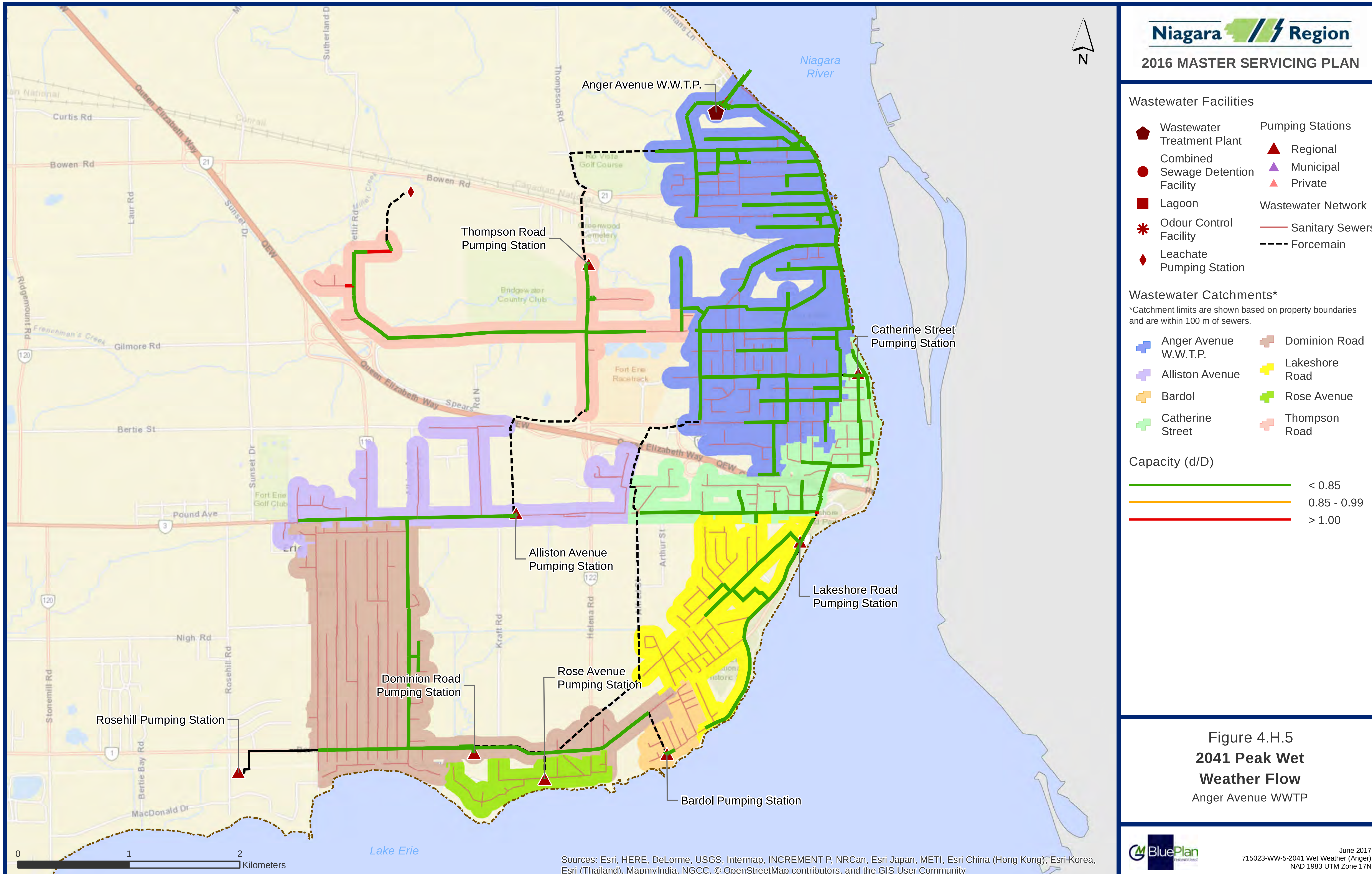


Figure 4.H.5
2041 Peak Wet Weather Flow
Anger Avenue WWTP

H.4 System Opportunities and Constraints

Figure 4.H.6 highlights the existing opportunities and constraints.

H.4.1 Anger Avenue Wastewater Treatment Plant

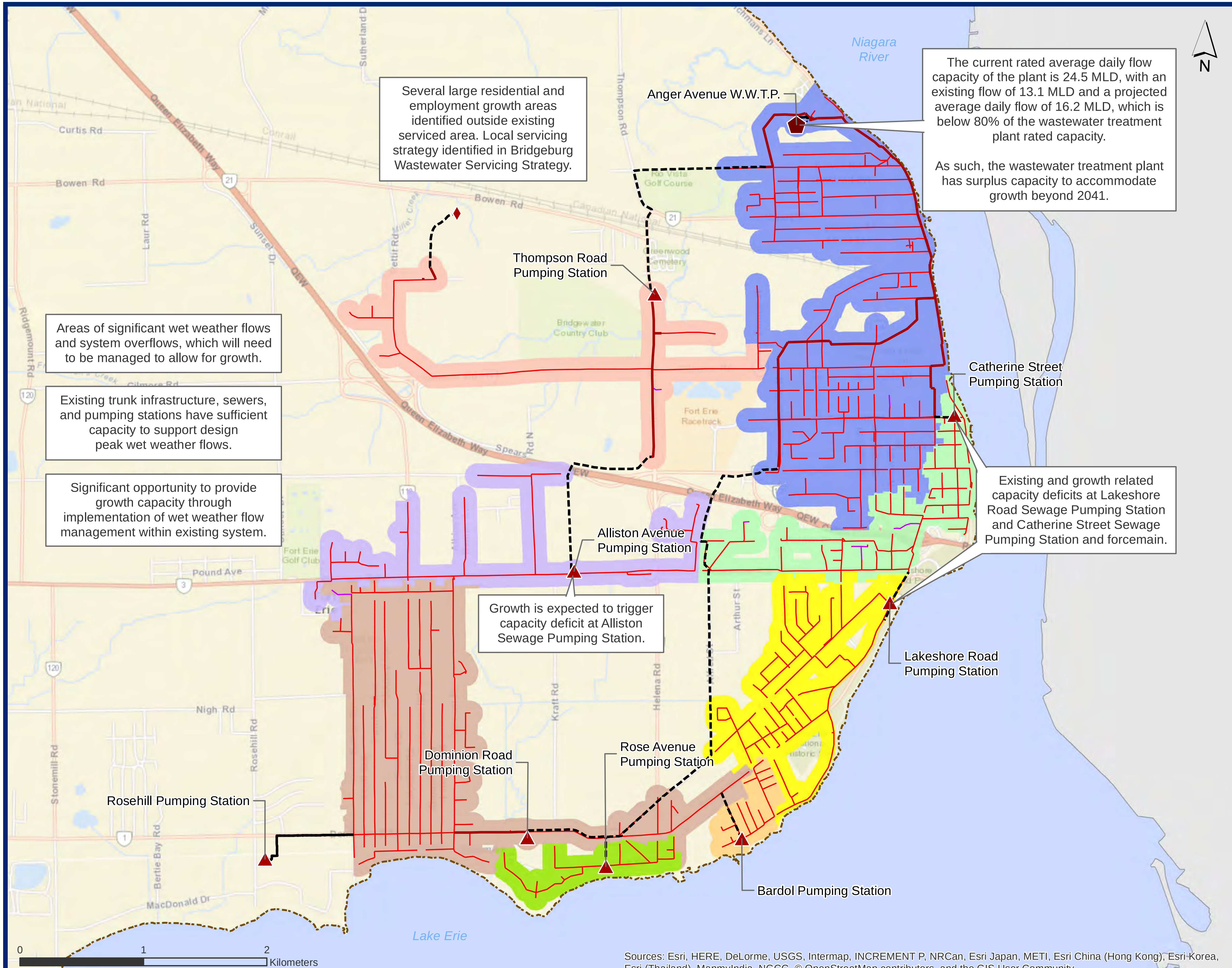
- The current rated average daily flow capacity of the plant is 24.5 MLD, with an existing flow of 13.1 MLD and a projected average daily flow of 16.2 MLD, which is below 80% of the wastewater treatment plant rated capacity. As such, the wastewater treatment plant has surplus capacity to accommodate growth beyond 2041.

H.4.2 Fort Erie

- Several large residential and employment growth areas identified outside existing serviced area. Local servicing strategy identified in Bridgeburg Wastewater Servicing Strategy.
- Existing and growth related capacity deficits at Lakeshore Road Sewage Pumping Station and Catherine Street Sewage Pumping Station and forcemain.
- Growth is expected to trigger capacity deficit at Alliston Sewage Pumping Station.
- Areas of significant wet weather flows and system overflows, which will need to be managed to allow for growth.
- Existing trunk infrastructure, sewers, and pumping stations have sufficient capacity to support design peak wet weather flows.

H.4.3 System Optimization Opportunities

- Significant opportunity to provide growth capacity through implementation of wet weather flow management within existing Anger Avenue system.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Anger Avenue W.W.T.P.
- Alliston Avenue
- Bardol
- Catherine Street
- Dominion Road
- Lakeshore Road
- Rose Avenue
- Thompson Road

Figure 4.H.6
System Opportunities and Constraints
Anger Avenue WWTP

BluePlan ENGINEERING

June 2017
715023-WW-3-Opportunities and Constraints (Anger)
NAD 1983 UTM Zone 17N

H.5 Assessment of Alternatives

No further alternative beyond application the hybrid management strategy below were identified.

- Providing capacity within regional pumping stations and trunk sewers to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Provide upstream flow management and peak flow management to address peak flows in systems where peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in potential basement flooding and overflow risks.

H.6 Preferred Servicing Strategy

The following is a summary of the Anger Avenue wastewater servicing strategy, presented in Figure 4.H.7 and Figure 4.H.8:

- The Anger Avenue wastewater system will experience additional flows from intensification and greenfield growth as well as a large amount of employment growth in central Fort Erie.
- The Anger Avenue Wastewater Treatment Plant has sufficient capacity to support growth to year 2041.
- The projected growth will require pumping station expansions at Alliston Avenue Sewage Pumping Station, Lakeshore Road Sewage Pumping Station and Catherine Street Sewage Pumping Station and forcemain.
- Additional wet weather management is recommended to minimize impact to existing infrastructure and support the growth to year 2041.

H.6.1 Pumping Stations

The following sewage pumping station upgrades are required:

- Alliston Avenue Sewage Pumping Station pump replacement: Increase capacity from 43 L/s to 129 L/s.
- Two additional pumps of 43 L/s to be added to accommodate growth due to sewage pumping station design configuration and efficiencies.
- Catherine Street Sewage Pumping Station expansion: Increase capacity from 117 L/s to 140 L/s, and new 300 mm forcemain.
- Lakeshore Road Sewage Pumping Station upgrade: Increase capacity from 63 L/s to 70 L/s.

H.6.2 Wet Weather

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts. These wet weather management programs will need to be a joint initiative between the Region and local municipalities.

For the Anger Avenue system, the following priority areas are identified:

- East Fort Erie, consisting of the Lakeshore Road Sewage Pumping Station, Catherine Street Sewage Pumping Station, and Anger Avenue Wastewater Treatment Plant catchments.

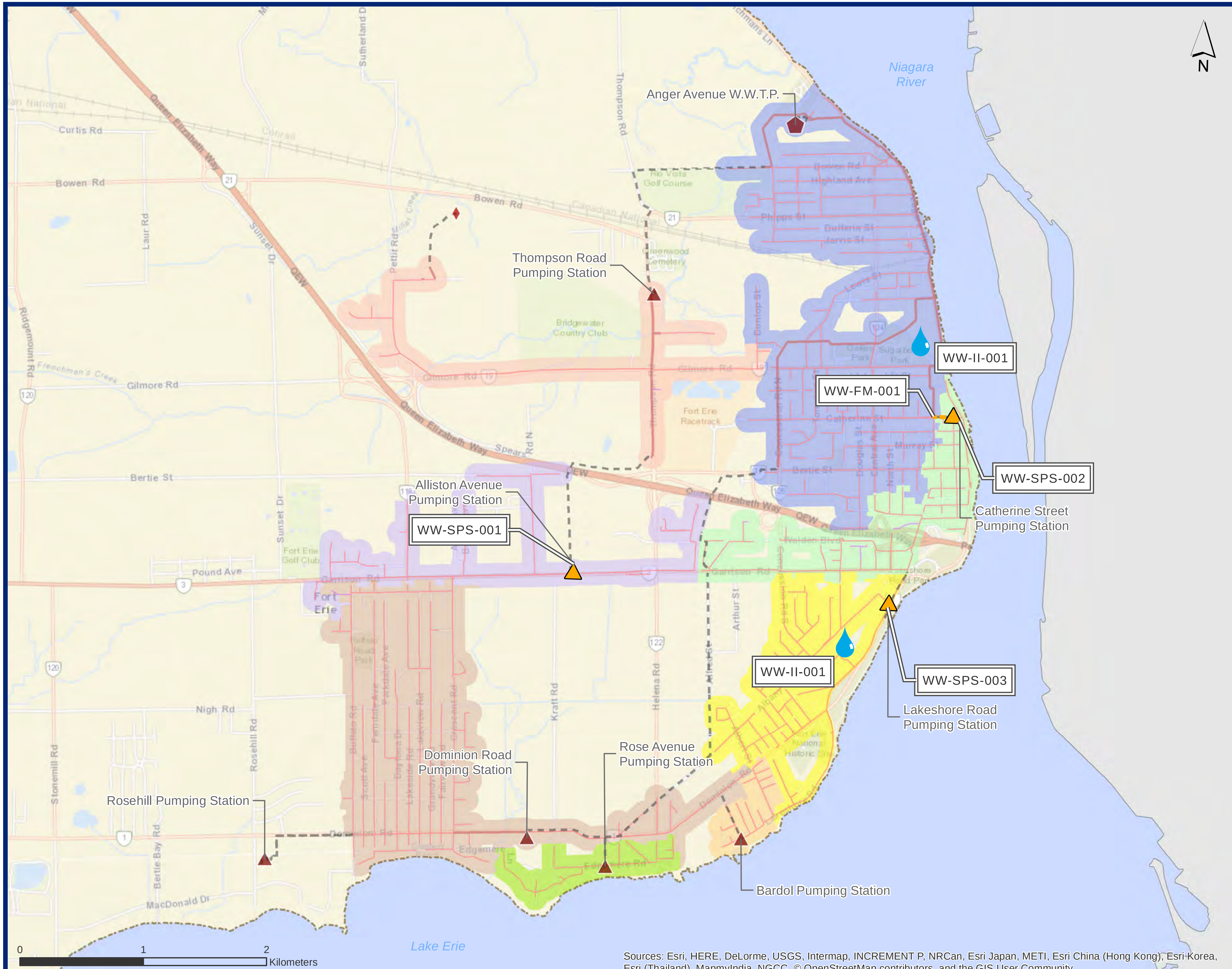
Further flow monitoring and area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, Preferred Servicing Strategy are needed to identify area specific strategies and projects required to achieve the wet weather flow reduction objectives. Following the outcomes of the further studies, targeted funding can be applied outside the priority areas if the projects are found to address capacity issues and support growth capacity needs.

H.7 Capital Program

Table 4.H.14 summarizes the recommended project costing, implementation schedule and Class EA requirements.

H.7.1 Schedule B Project Files

No Schedule B projects are anticipated for the Anger Avenue Wastewater Treatment Plant system.



Niagara Region

2016 MASTER SERVICING PLAN

MSP Wastewater Projects

- Treatment Plant
- Pumping Station
- Wet Weather Reduction
- Sanitary Sewer Projects
- Forcemain Projects

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Private
- Local
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Anger Avenue W.W.T.P.
- Alliston Avenue
- Bardol
- Catherine Street
- Dominion Road
- Lakeshore Road
- Rose Avenue
- Thompson Road

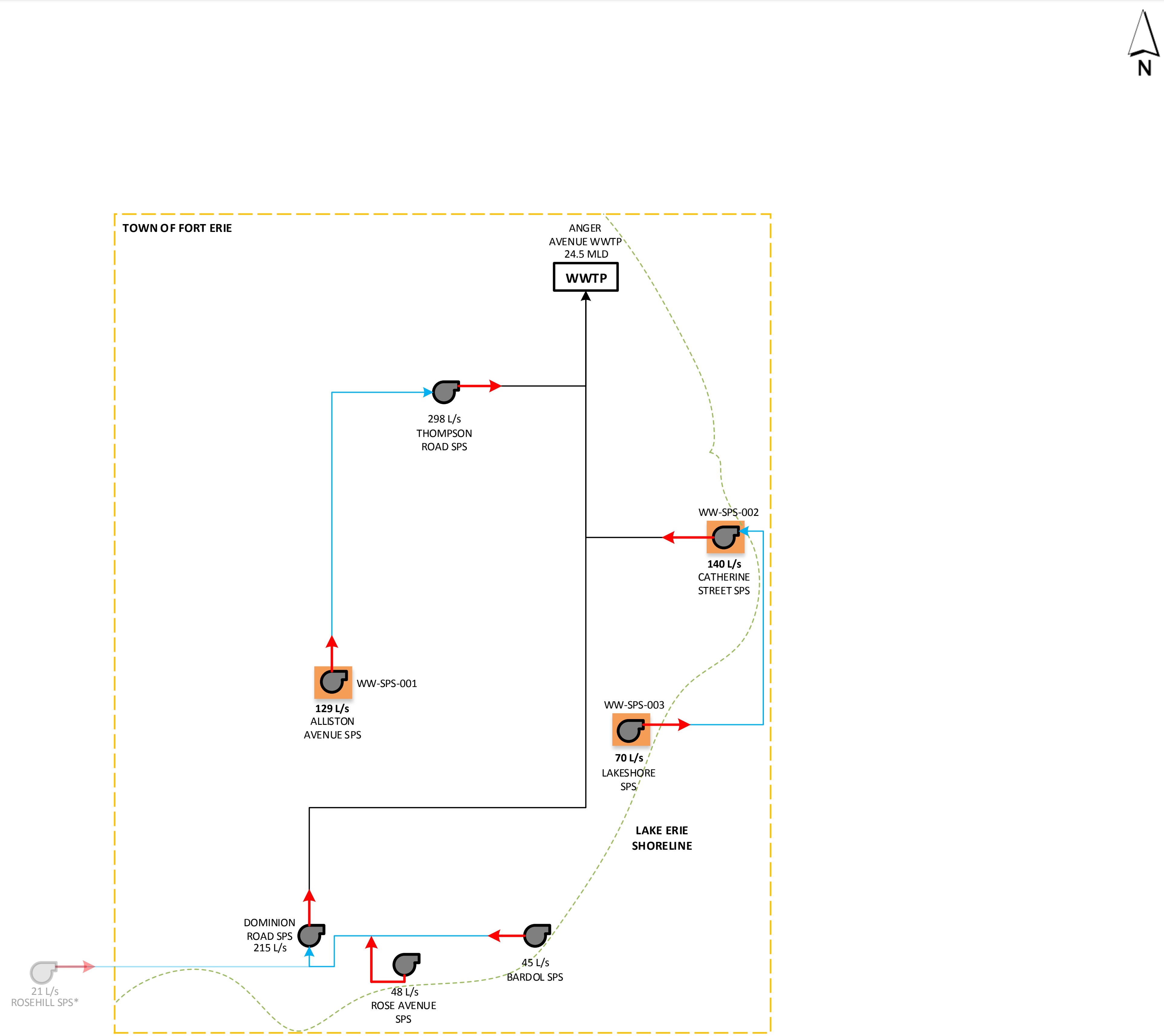
Figure 4.H.7

Preferred Wastewater Strategy

Anger Avenue WWTP

BluePlan

June 2017
715023-WW-6-Capital Projects (Anger Ave)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Anger Avenue WWTP

2041 COLLECTION SCHEMATIC

WWTP (RATED CAPACITY)	Wastewater Treatment Plant
(FIRM CAPACITY)	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP
	Facility Upgrade
	Upgrade Forcemain or Sewer
	New Forcemain or Sewer
	Decommission Project

*Rosehill Sewage Pumping Station only services the Rosehill Water Treatment Plant.

June 2017
Figure 4.H.8
Not to Scale

GM BluePlan ENGINEERING

Table 4.H.14 Summary of Anger Avenue Wastewater Treatment Plant Capital Program

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-FM-001	Upgrade Catherine Street Sewage Pumping Station (SPS) Forcemain	Upgrade Catherine Street SPS Forcemain in Fort Erie	300 mm	2032-2041	Fort Erie	A+	Satisfied	Forcemain	$467,000
WW-II-001	Wet weather reduction in East Fort Erie	Wet weather reduction in East Fort Erie	30 L/s reduction	2022-2031	Fort Erie	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$4,500,000
WW-SPS-001	Alliston Avenue SPS Pump Replacement - Anger Avenue	Increase station capacity from 43 L/s to 129 L/s.	129 L/s	2022-2031	Fort Erie	A+	Satisfied	Pumping	$989,000
WW-SPS-002	Catherine Street SPS Expansion - Anger Avenue	Increase station capacity from 117 L/s to 140 L/s	140 L/s	2032-2041	Fort Erie	A+	Satisfied	Pumping	$2,945,000
WW-SPS-003	Lakeshore Road SPS Upgrade - Anger Avenue	Increase station capacity from 63 L/s to 70 L/s	70 L/s	2022-2031	Fort Erie	A+	Satisfied	Pumping	$2,618,000
Total									**$11,519,000**

PART I
CRYSTAL BEACH WASTEWATER SYSTEM

I. CRYSTAL BEACH WASTEWATER TREATMENT PLANT

I.1 Existing System Overview

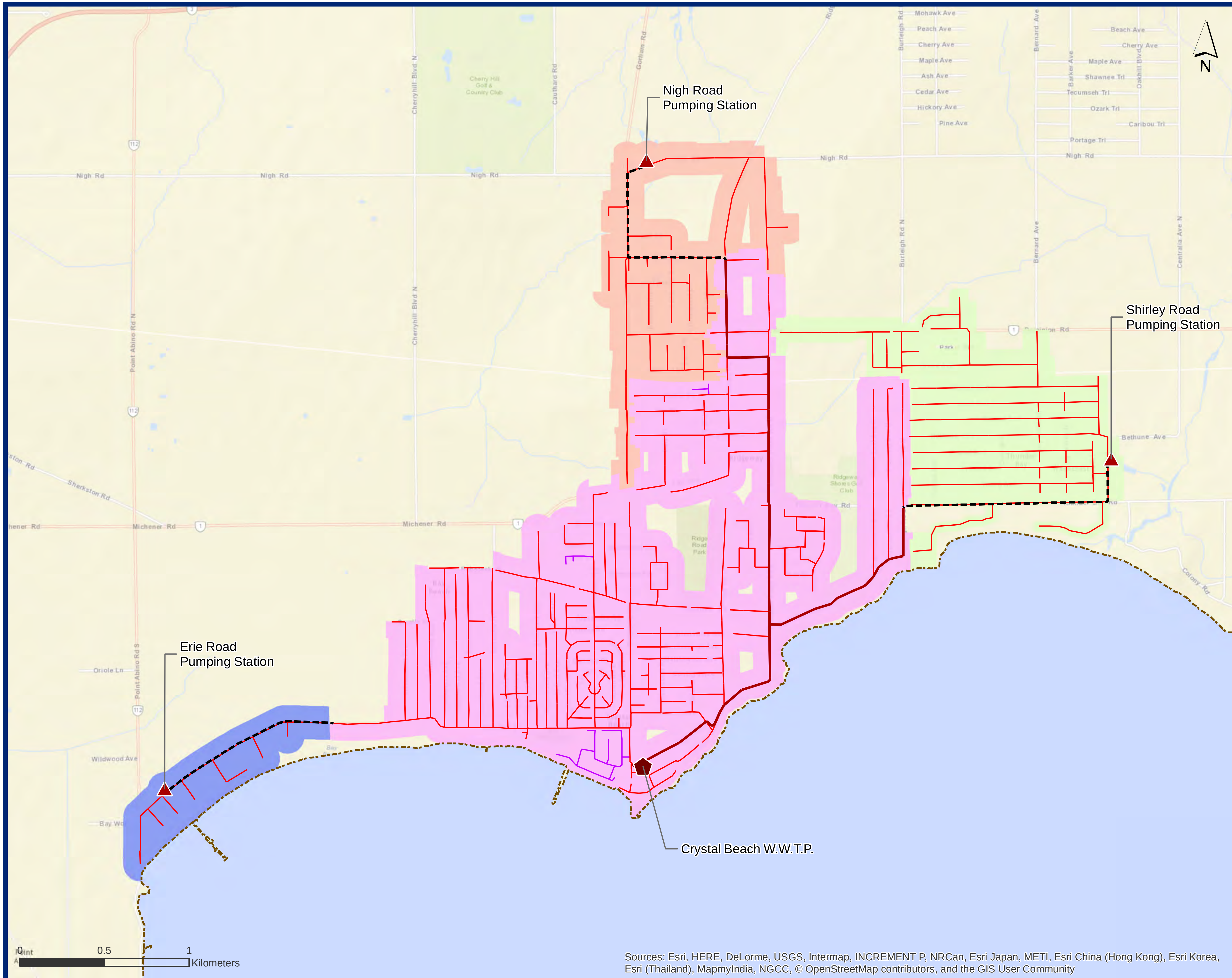
The Crystal Beach wastewater system services the southwestern part of the Town of Fort Erie. The system in services an existing population of 10,793 and 1,568 employees.[1]

The system is serviced by the Crystal Beach Wastewater Treatment Plant, located on 500 Ridgeway Road, Fort Erie. The Crystal Beach Wastewater Treatment Plant is a conventional facility with a current rated capacity of 9.1 MLD, a peak dry weather flow capacity of 16.8 MLD, and a peak wet weather flow capacity of 27.3 MLD. [2]

Figure 4.I.1 presents an overview of the wastewater system, and Figure 4.I.2 shows a schematic of the wastewater system.

[1] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*

[2] *Ministry of Environment, 9 June 2011. Ammeded Certificate of Approval. Number 7162-8G5GVU*



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Crystal Beach W.W.T.P.
- Erie Road
- Nigh Road
- Shirley Road

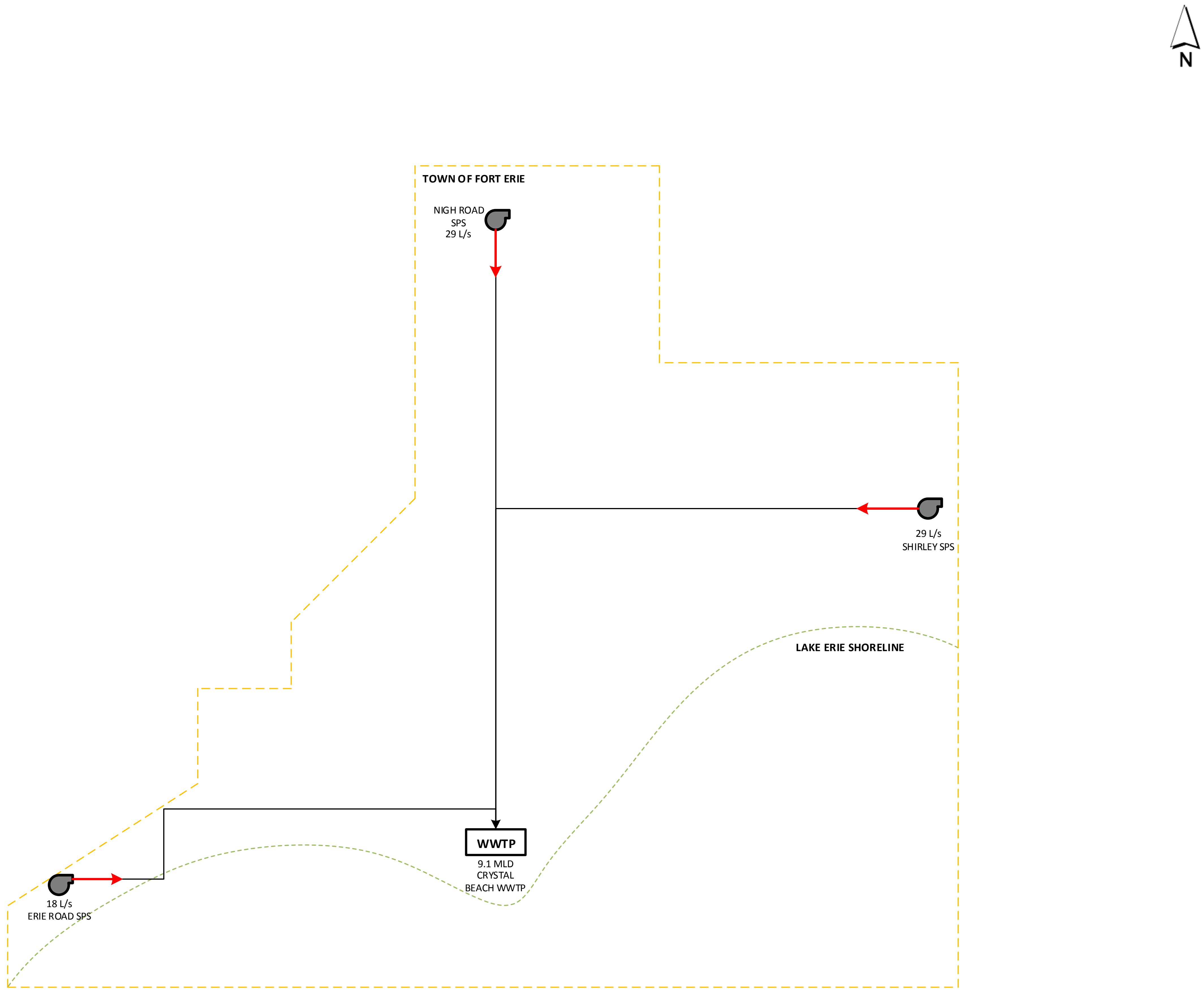
Figure 4.I.1

Existing Wastewater System

Crystal Beach WWTP

GM BluePlan

June 2017
715023-WW-2-Existing System (Crystal Beach)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Crystal Beach WWTP

EXISTING COLLECTION SCHEMATIC

Legend

WWTP
RATED CAPACITY
Wastewater Treatment Plant

FIRM CAPACITY
Sewage Pumping Station

Forcemain

Connection from SPS to SPS

Connection from SPS to WWTP

June 2017
Figure 4.1.2
Not to Scale

BluePlan ENGINEERING

I.1.1 Service Area Overview

Table 4.I.1 provides a list of facility catchments and their areas. Refer to Figure 4.I.1 for the catchment areas of each facility

Table 4.I.1 Facilities and Catchment Areas

Facility	Catchments	Catchment Area (ha)
Crystal Beach Wastewater Treatment Plant (WWTP)	**Crystal Beach WWTP** (Including Sub Catchments) Nigh Road SPS Shirley Road SPS Erie Road SPS	764.8
	Crystal Beach WWTP (Excluding Sub Catchments)	460.2
Nigh Road Sewage Pumping Station (SPS)	Nigh Road SPS	113.8
Shirley Road SPS	Shirley Road SPS	146.0
Erie Road SPS	Erie Road SPS	44.7

I.1.2 Facility Overview

Table 4.I.2 Wastewater Treatment Plant Overview

Plant Name	Crystal Beach Wastewater Treatment Plant
Address	500 Ridgeway Road, Fort Erie
Discharge Water	Lake Erie
Rated Capacity: Average Daily Flow	9.1 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	16.8 MLD
Rated Capacity: Peak Flow Rate (Wet Weather)	27.3 MLD
Key Processes	• Conventional activated sludge treatment with screening • Grit removal • Sludge thickening • Effluent disinfection

Table 4.I.3 Wastewater Treatment Plant Effluent Objectives

Effluent Parameter	Objective Concentration[3]
$CBOD_5$	15.0 mg/L
TSS	15.0 mg/L
Total Phosphorus	0.4 mg/L
E. Coli	200 organisms/100 mL
Total Chlorine Residual	0.5 mg/L

Table 4.I.4 Pumping Station Overview

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Nigh Road Sewage Pumping Station (SPS)	3828 Nigh Road, Fort Erie	2	31.8	29.0	Not Available
Shirley Road SPS	120 Shirley Road, Fort Erie	2	34	29.0	17.6
Erie Road SPS	Erie Road, Fort Erie	2	20.7	18.0	12.8

Table 4.I.5 Forcemain Overview

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Length (m)	Diameter (mm)	Capacity @ 2.5 m/s (L/s)
Nigh Road Sewage Pumping Station (SPS)	29.0	1,246	275	148.5
Shirley Road SPS	29.0	1,489	200	78.5
Erie Road SPS	18.0	1,121	150	44.2

[3] *Ministry of Environment, 9 June 2011. Ammeded Certificate of Approval. Number 7162-8G5GVU*

I.1.3 Flows Overview

Table 4.I.6 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.I.7 shows the existing wastewater system flows by catchment.

Table 4.I.6 Historic Crystal Beach Wastewater Treatment Plant Flows

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	L/s	MLD	L/s	MLD	L/s
2011	5.6	64.8	6.3	72.9	23.4	270.8
2012	4.5	52.1	4.7	54.4	17.8	206.0
2013	5.5	63.7	5.8	67.1	24.3	281.3
2014	5.6	64.8	5.8	67.1	30.5	353.0
2015	5.0	57.9	5.1	59.0	16.1	186.3
5 Year Average	5.2	60.2	5.5	63.7	22.4	259.3
5 Year Peak	5.6	64.8	6.3	72.9	30.5	353.0

Table 4.I.7 Existing Wastewater System Flows by Catchment

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Crystal Beach Wastewater Treatment Plant (WWTP)	12,361	60.3	339.4	379.0	528.0
Crystal Beach WWTP	6,480	52.5	236.6	202.1	105.3
Nigh Road Sewage Pumping Station (SPS)	1,520	2.5	37.6	51.3	29.0
Shirley SPS	3,873	4.9	51.5	30.0	40.0
Erie Road SPS	489	0.4	13.7	19.1	18.0

Note: Flow numbers may not sum due to rounding.

I.2 Growth Projections

I.2.1 Population Projections and Allocations

Table 4.I.8 and Table 4.I.9 outline the existing and projected serviced population and employment by catchment.

Table 4.I.8 Crystal Beach Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Crystal Beach Wastewater Treatment Plant	5,283	5,755	6,090	6,773	7,019	7,509	2,226
Erie Road Sewage Pumping Station (SPS)	324	319	328	336	341	345	21
Nigh Road SPS	1,412	1,480	1,487	1,505	1,565	1,730	318
Shirley Road SPS	3,775	3,687	3,709	4,073	4,309	4,360	585
Total	**10,793**	**11,239**	**11,614**	**12,686**	**13,234**	**13,944**	**3,151**

Note: Population numbers may not sum due to rounding.

Table 4.I.9 Crystal Beach Wastewater Treatment Plant Existing and Projected Serviced Employment by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Crystal Beach Wastewater Treatment Plant	1,197	1,240	1,261	1,294	1,322	1,356	159
Erie Road Sewage Pumping Station (SPS)	165	168	169	171	173	175	10
Nigh Road SPS	108	121	128	138	150	164	56
Shirley Road SPS	98	109	112	116	121	127	29
Total	**1,568**	**1,638**	**1,670**	**1,719**	**1,766**	**1,823**	**255**

Note: Population numbers may not sum due to rounding.

I.1.4 Future Flow Projections

Table 4.I.10 and Table 4.I.11 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

Table 4.I.10 Projected Peak Dry Weather Flow by Catchment

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Crystal Beach Wastewater Treatment Plant	39.9	43.4	50.2	52.8	57.6
Erie Road Sewage Pumping Station (SPS)	0.9	1.0	1.1	1.2	1.3
Nigh Road SPS	6.0	6.2	6.5	7.3	9.4
Shirley Road SPS	8.9	9.2	13.1	15.6	16.2
Total	**55.7**	**59.7**	**70.9**	**76.9**	**84.4**

The following presents an example calculation of projected peak dry weather flow.

2041 Peak Dry Weather Flow for Nigh Road Sewage Pumping Station:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (2.53 L/s × 2.0) + (1,894 – 1,520 people) × 275 L/cap/day × 1 day/86400 s × 3.60
= 9.4 L/s

Table 4.I.11 Projected Peak Wet Weather Flow by Catchment

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Crystal Beach Wastewater Treatment Plant	241.7	245.1	252.0	254.5	259.4
Erie Road Sewage Pumping Station (SPS)	13.6	13.8	13.9	14.0	14.1
Nigh Road SPS	38.6	38.7	39.0	39.9	41.9
Shirley Road SPS	50.7	51.0	54.8	57.3	57.9
Total	**344.5**	**348.6**	**359.7**	**365.7**	**373.3**

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for Nigh Road Sewage Pumping Station:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 9.4 L/s + (113.8 ha × 0.286 L/s/ha)
= 41.9 L/s

I.3 Assessment of Wastewater Infrastructure (Existing and Future)

I.3.1 Treatment Plant Capacity

Figure 4.I.3 shows the projected future demands at the Crystal Beach Wastewater Treatment Plant. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.

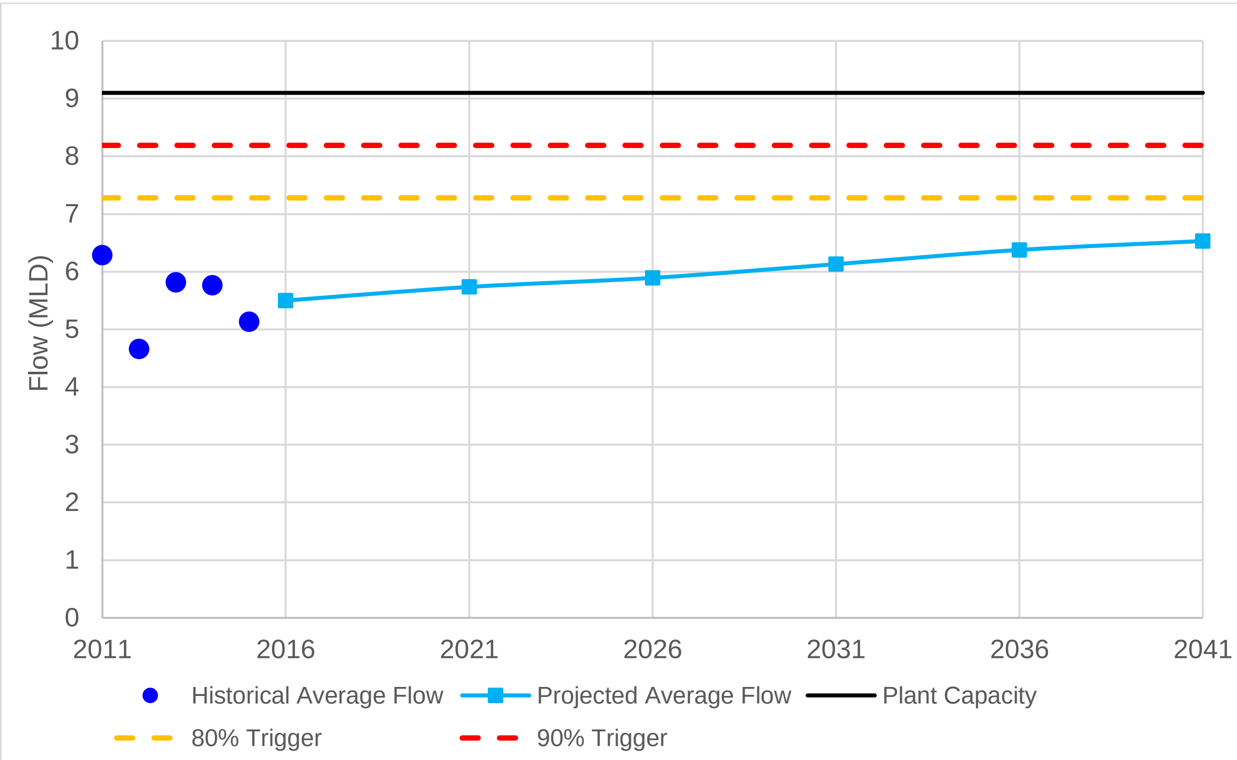


Figure 4.I.3 Projected future demands at Crystal Beach Wastewater Treatment Plant

I.3.2 Sewage Pumping Station

Table 4.I.12 highlights the sewage pumping station existing and projected capacity.

Table 4.I.12 System Sewage Pumping Station Performance

Sewage Pumping Station	Contributing Catchments	Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Nigh Road Sewage Pumping Station (SPS)	Nigh Road SPS	29.0	37.6	41.9	-12.9
Shirley Road SPS	Shirley Road SPS	29.0	51.5	57.9	-28.9
Erie Road SPS	Erie Road SPS	18.0	13.7	14.1	3.9

The following sewage pumping stations have projected pumping deficits:

- Nigh Road Sewage Pumping Station
- Shirley Road Sewage Pumping Station

I.3.3 Forcemain

Table 4.I.13 highlights the existing and projected forcemain performance.

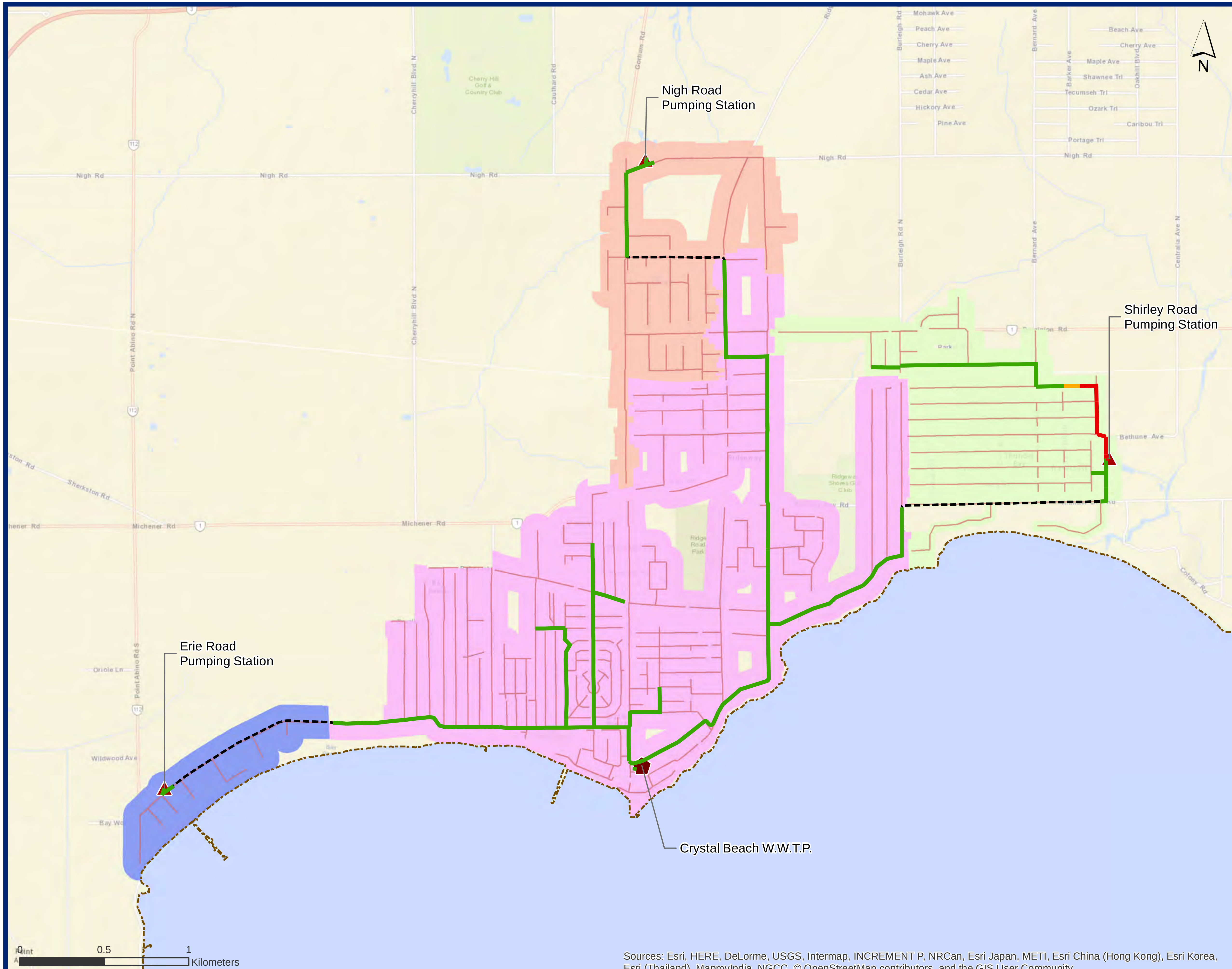
Table 4.I.13 Forcemain Performance

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Forcemain Capacity @ 2.5 m/s (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Nigh Road Sewage Pumping Station (SPS)	29.0	148.5	37.6	41.9	106.6
Shirley Road SPS	29.0	78.5	51.5	57.9	20.6
Erie Road SPS	18.0	44.2	13.7	14.1	30.1

All forcemains have a projected surplus capacity.

I.3.4 Trunk Sewer

Figure 4.I.4 and Figure 4.I.5 highlight the existing and projected peak wet weather flow, respectively. Trunk sewers in Shirley Road Sewage Pumping Station catchment are approaching capacity within the 2041 time horizon.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Crystal Beach W.W.T.P.
- Erie Road
- Nigh Road
- Shirley Road

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.I.4

Existing Peak Wet Weather Flow

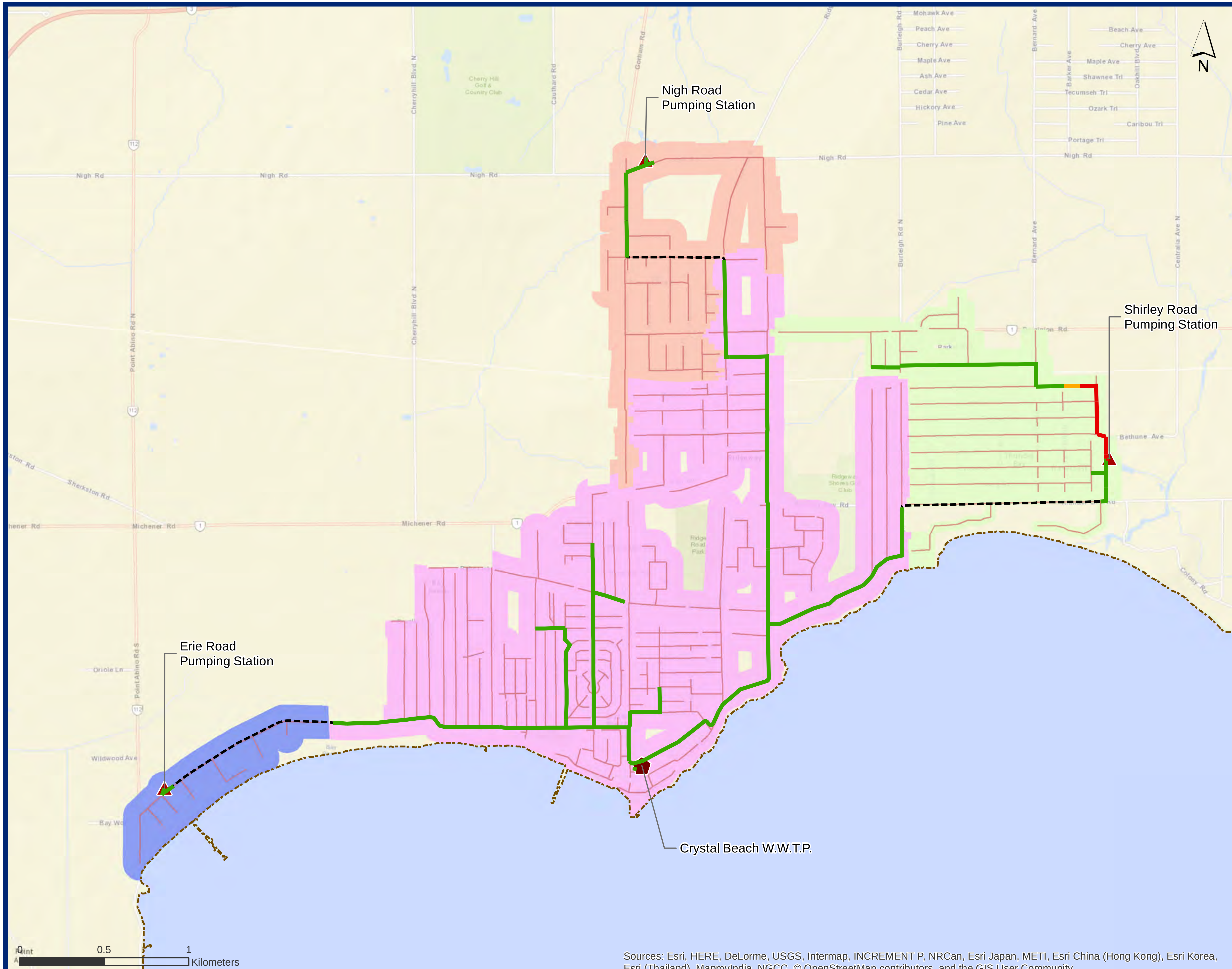
Crystal Beach WWTP

BluePlan

June 2017
715023-WW-4-Existing Wet Weather (CB)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN



Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Crystal Beach W.W.T.P.
- Erie Road
- Nigh Road
- Shirley Road

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.I.5

2041 Peak Wet Weather Flow

Crystal Beach WWTP

BluePlan

June 2017
715023-WW-5-2041 Wet Weather (CB)
NAD 1983 UTM Zone 17N

I.4 System Opportunities and Constraints

Figure 4.I.6 highlights the existing opportunities and constraints.

I.4.1 Crystal Beach Wastewater Treatment Plant

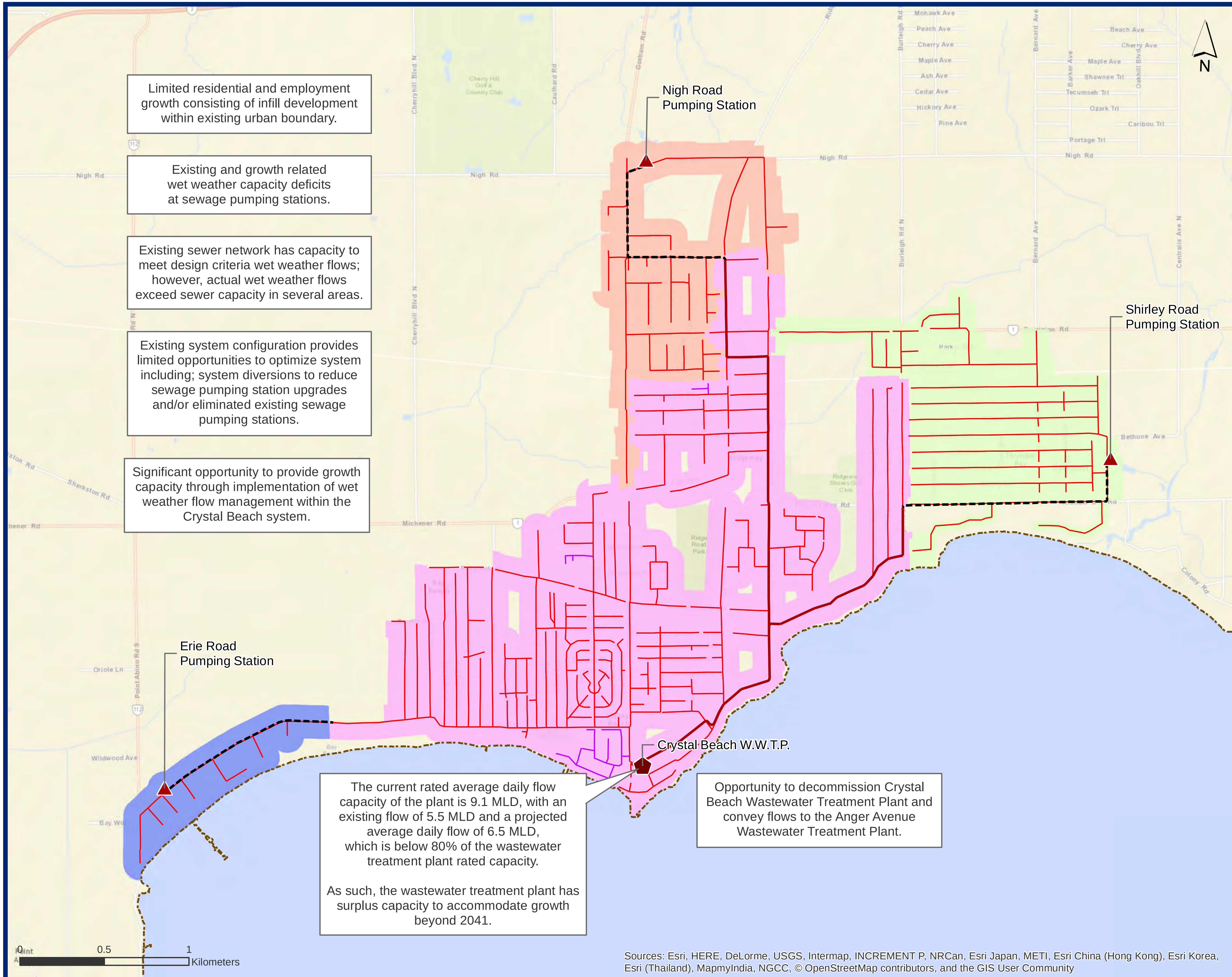
- The current rated average daily flow capacity of the plant is 9.1 MLD, with an existing flow of 5.5 MLD and a projected average daily flow of 6.5 MLD, which is below 80% of the wastewater treatment plant rated capacity. As such, the wastewater treatment plant has surplus capacity to accommodate growth beyond 2041.

I.4.2 Crystal Beach

- Limited residential and employment growth consisting of infill development within existing urban boundary.
- Existing and growth related wet weather capacity deficits at sewage pumping stations.
- Existing sewer network has capacity to meet design criteria wet weather flows; however, actual wet weather flows exceed sewer capacity in several areas.

I.4.3 System Optimization Opportunities

- Existing system configuration provides limited opportunities to optimize system including; system diversions to reduce sewage pumping station upgrades and/or eliminated existing sewage pumping stations.
- Opportunity to decommission Crystal Beach Wastewater Treatment Plant and convey flows to the Anger Avenue Wastewater Treatment Plant.
- Significant opportunity to provide growth capacity through implementation of wet weather flow management within the Crystal Beach system.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Crystal Beach W.W.T.P.
- Erie Road
- Nigh Road
- Shirley Road

Figure 4.I.6

System Opportunities and Constraints

Crystal Beach WWTP

BluePlan

June 2017
715023-WW-3-Opportunities and Constraints (CB)
NAD 1983 UTM Zone 17N

I.5 Assessment of Alternatives

The hybrid management strategy consists of:

- Providing capacity within Regional sewage pumping stations and trunk sewers to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Providing upstream flow management and peak flow management to address peak flows in systems where peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in potential basement flooding and overflow risks.

Further to the application of the opportunity to integrate the Crystal Beach service area into the Anger Avenue Wastewater Treatment Plant Catchment was reviewed; however, as shown in Figure 4.I.7, there is not sufficient additional capacity at Anger Avenue to support Crystal Beach flows. Therefore, the Anger Avenue Wastewater Treatment Plant would require a capacity upgrade in order to support growth and the Crystal Beach system flows. Due to the additional need of a new pumping station, forcemain, and conveyance upgrades that would be required to transfer flows to the Anger Avenue Wastewater Treatment Plant, this servicing alternative was not further reviewed.

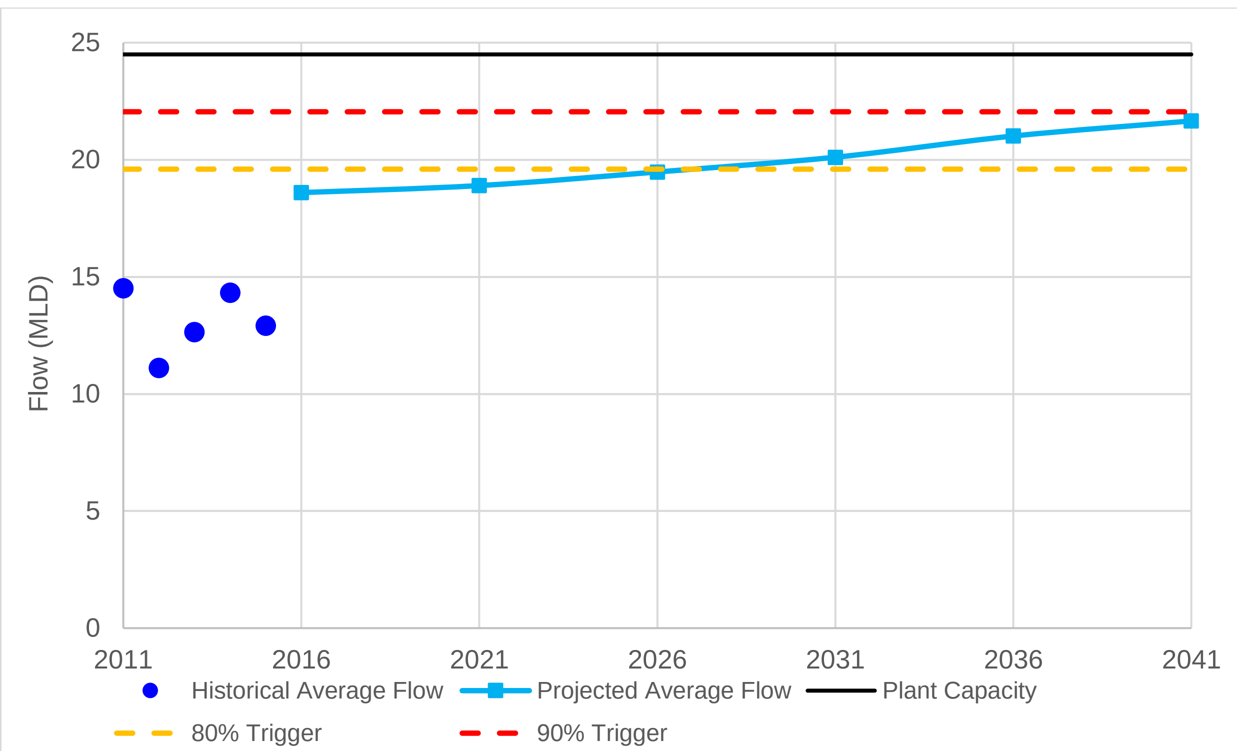


Figure 4.I.7 Projected Future Flows at Anger Avenue Wastewater Treatment Plant including Flows from Crystal Beach Wastewater Treatment Plant

I.6 Preferred Servicing Strategy

The following is a summary of the Crystal Beach wastewater servicing strategy:

- There is some projected growth to year 2041 in the service area. The Crystal Beach Wastewater Treatment Plant has sufficient capacity to support growth to year 2041.
- Existing and growth flows will require additional capacity at the Nigh Road Sewage Pumping Station and Shirley Road Sewage Pumping Station.
- Additional wet weather management in the core of the service area is recommended to minimize impact to existing infrastructure and support the growth to year 2041.

I.6.1 Pumping Stations

The following sewage pumping station capacity upgrades are required:

- Shirley Road Sewage Pumping Station upgrade: Increase capacity from 29 L/s to 63 L/s.
- Nigh Road Sewage Pumping Station upgrade: Increase capacity from 29 L/s to 45 L/s

I.6.2 Wet Weather

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts. These wet weather management programs will need to be a joint initiative between the Region and local municipalities.

For the Crystal Beach system, the following priority areas are identified:

- Crystal Beach Wastewater Treatment Plant catchment.

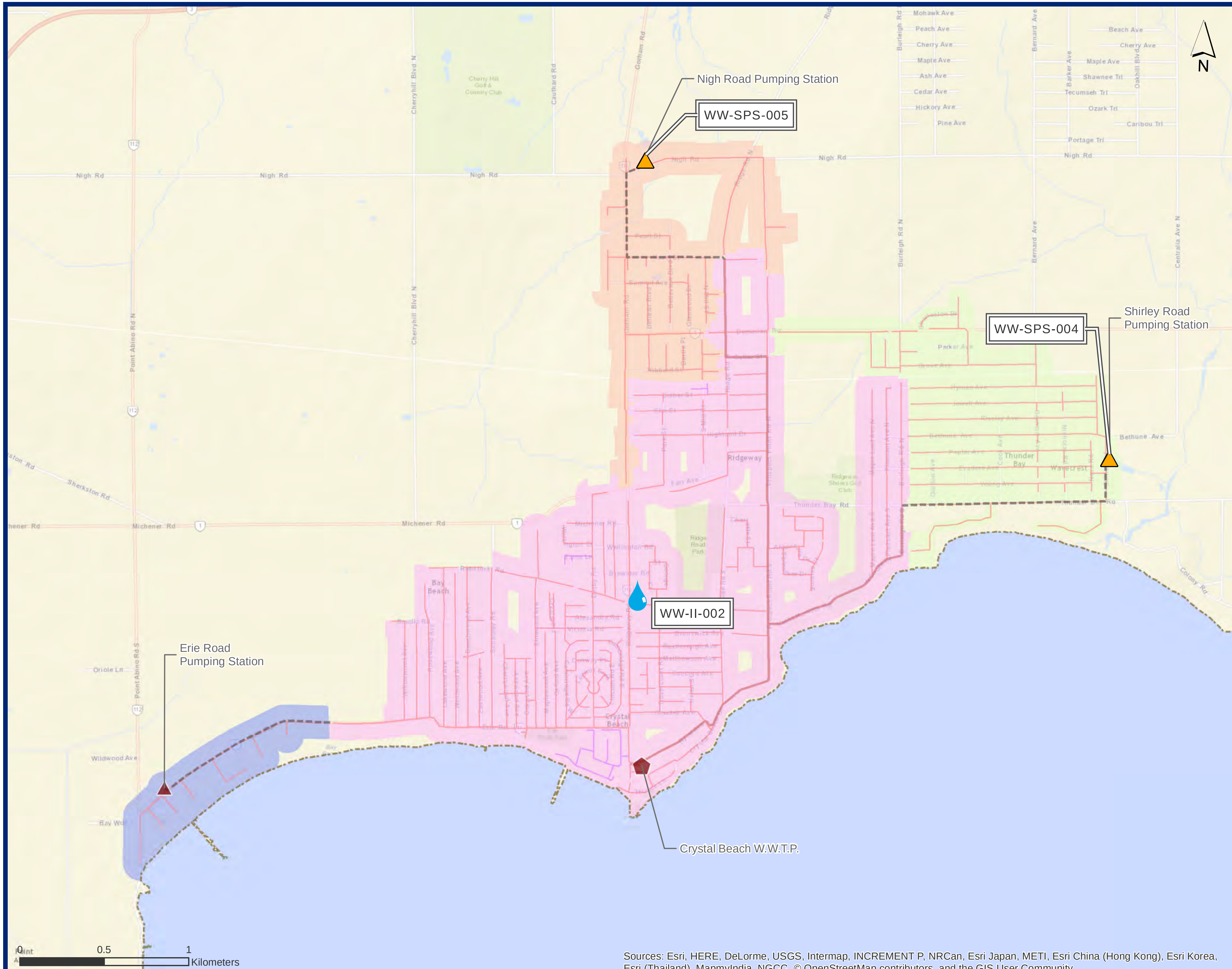
Further flow monitoring and area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, Preferred Servicing Strategy are needed to identify area specific strategies and projects required to achieve the wet weather flow reduction objectives. Following the outcomes of the further studies, targeted funding can be applied outside the priority areas if the projects are found to address capacity issues and support growth capacity needs.

I.7 Capital Program

Table 4.I.14 summarizes the recommended project costing, implementation schedule and Class EA requirements.

I.7.1 Schedule B Project Files

No Schedule B projects are anticipated for the Crystal Beach Wastewater Treatment Plant system.



Niagara Region

2016 MASTER SERVICING PLAN

MSP Wastewater Projects

- Treatment Plant
- Pumping Station
- Wet Weather Reduction
- Sanitary Sewer Projects
- Forcemain Projects

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Private
- Local
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Crystal Beach W.W.T.P.
- Erie Road
- Nigh Road
- Shirley Road

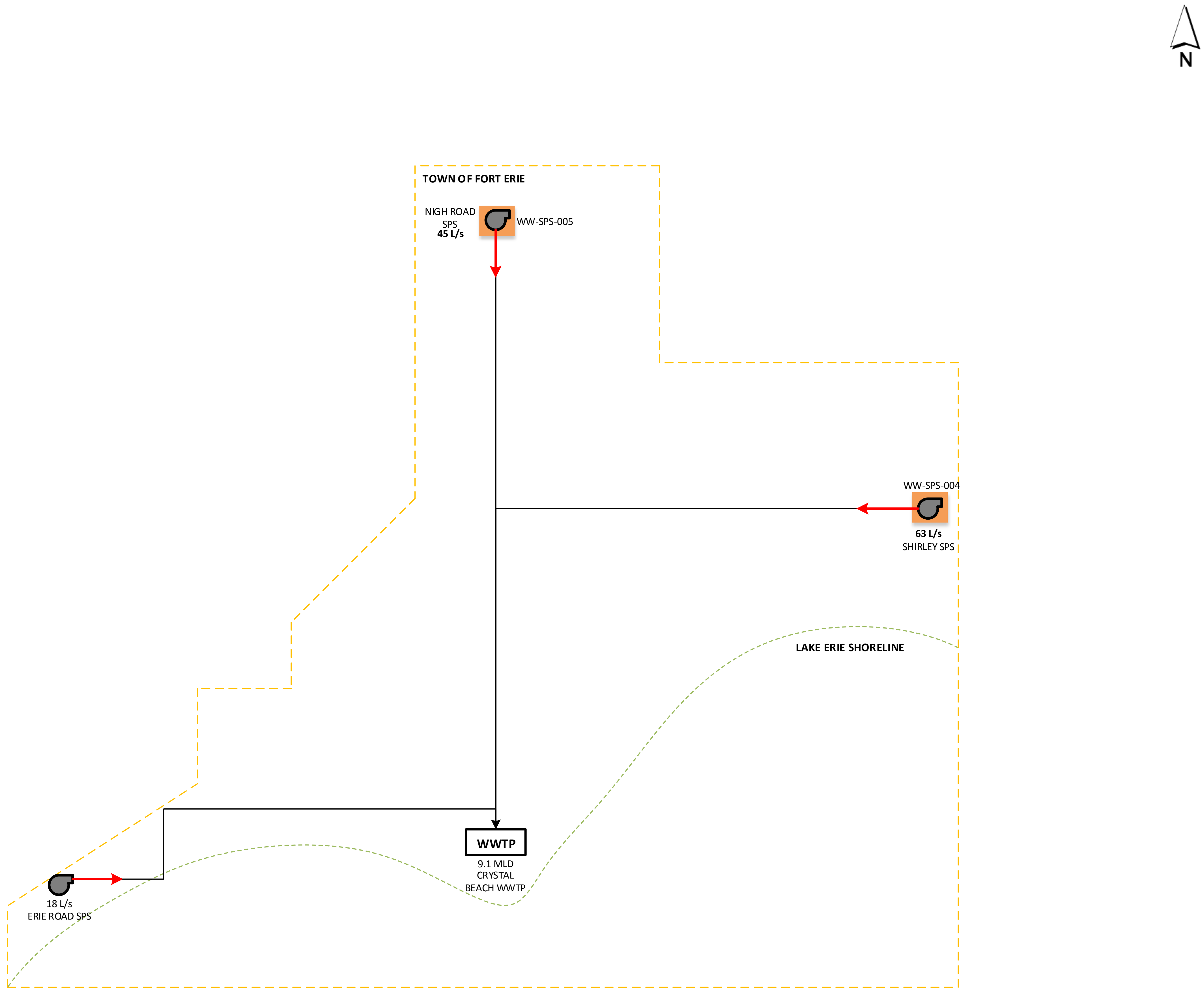
Figure 4.I.8

Preferred Wastewater Strategy

Crystal Beach WWTP

BluePlan ENGINEERING

June 2017
715023-WW-6-Capital Projects (Crystal Beach)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Crystal Beach WWTP

2041 COLLECTION SCHEMATIC

WWTP (RATED CAPACITY)	Wastewater Treatment Plant
FIRM CAPACITY	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP
	Facility Upgrade
	Upgrade Forcemain or Sewer
	New Forcemain or Sewer
	Decommission Project

June 2017
Figure 4.1.8
Not to Scale

GM BluePlan ENGINEERING

Table 4.I.14 Summary of Crystal Beach Wastewater Treatment Plant Capital Program

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-II-002	Wet weather reduction in Crystal Beach	Wet weather reduction in Crystal Beach	30 L/s reduction	2022-2031	Fort Erie	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$4,500,000
WW-SPS-004	Shirley Road Sewage Pumping Station (SPS) Upgrade - Crystal Beach	Increase station capacity from 29 L/s to 63 L/s; Also includes sustainability upgrades to the station	63 L/s	2032-2041	Fort Erie	A+	Satisfied	Pumping	$2,889,000
WW-SPS-005	Nigh Road SPS Pump Replacement - Crystal Beach	Increase station capacity from 29 L/s to 45 L/s. Use implementation plan prior to upgrade: Flow monitoring, validate wet weather flows, re-evaluate required upgrades"	45 L/s	2022-2031	Fort Erie	A+	Dependent on outcome of wet weather flow study	Pumping	$989,000
Total									**$8,378,000**

PART J
SEAWAY WASTEWATER SYSTEM

J. SEAWAY WASTEWATER TREATMENT PLANT

J.1 Existing System Overview

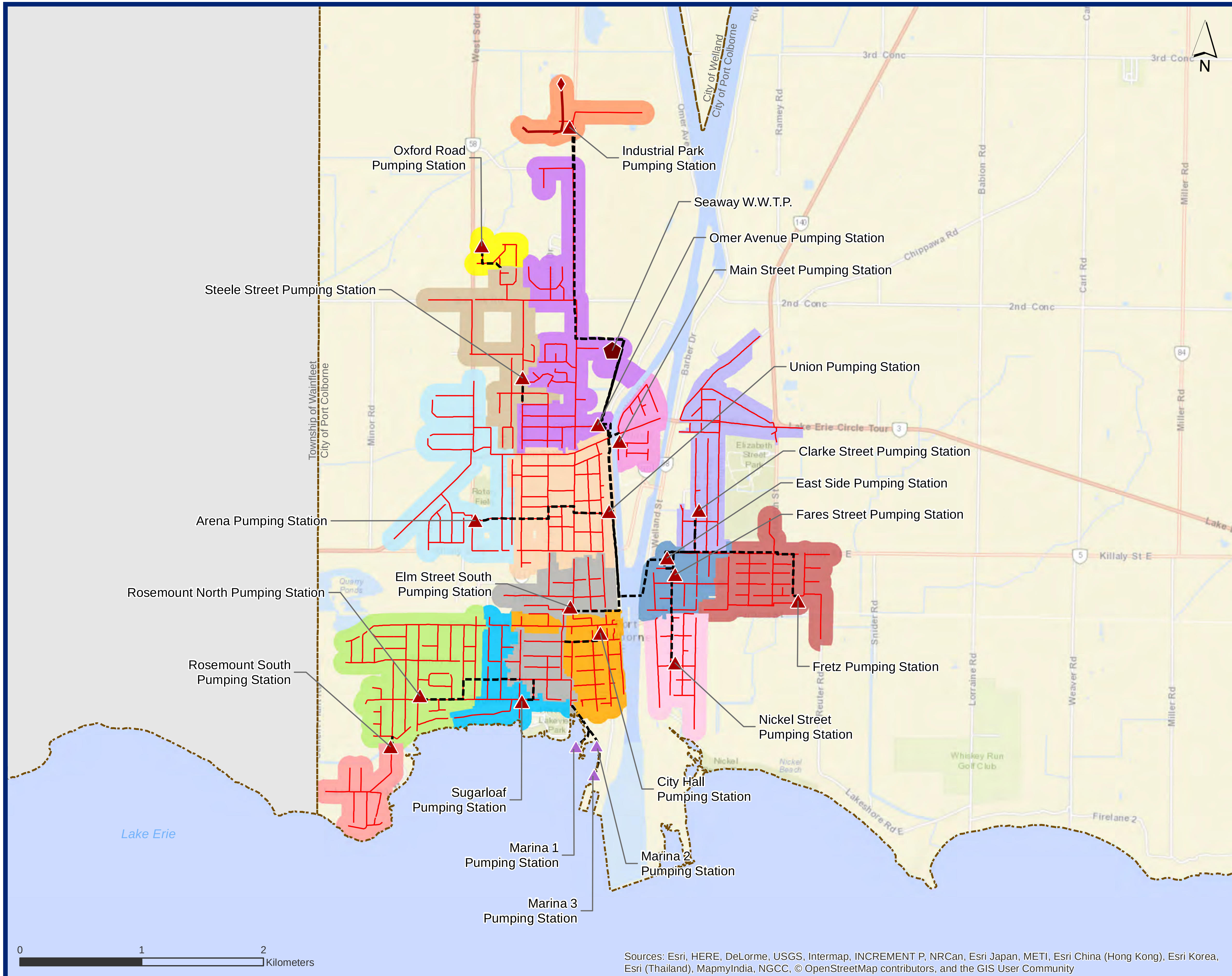
The Port Colborne wastewater system services the City of Port Colborne. The system services an existing population of 16,428 and 5,667 employees.[1]

The system is serviced by the Seaway Wastewater Treatment Plant, located on 30 Prosperity Avenue, Port Colborne. The Seaway Wastewater Treatment Plant is a modified conventional activated sludge facility with a current rated capacity of 19.6 MLD, and a peak flow capacity of 45.4 MLD. [2]

Figure 4.J.1 presents an overview of the wastewater system, and Figure 4.J.2 shows a schematic of the wastewater system.

[1] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*

[2] *Ministry of Environment, 25 February 2011. Ammeded Certificate of Approval. Number 8101-8BAPJ9*



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Arena
- City Hall
- Clarke Street
- East Side
- Elm Street
- Fares Street
- Fretz
- Industrial Park
- Main Street
- Nickel Street
- Omer Avenue
- Oxford Road
- Rosemount North
- Rosemount South
- Steele Street
- Sugarloaf
- Union

Figure 4.J.1

Existing Wastewater System

Seaway WWTP

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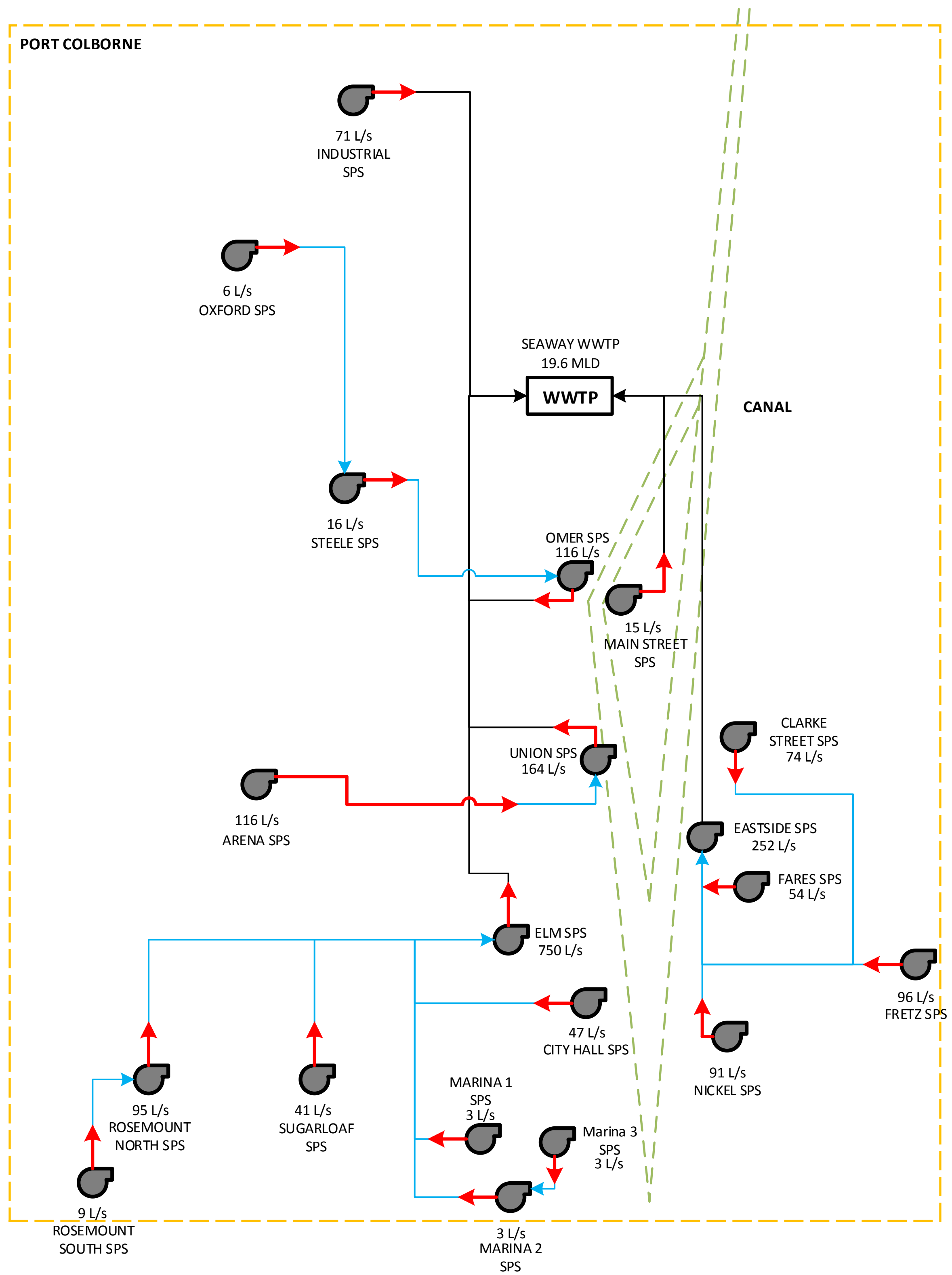
June 2017
715023-WW-2-Existing System (Port Colborne)
NAD 1983 UTM Zone 17N



N

Niagara Region

2016 Master Servicing Plan

Seaway WWTP

EXISTING COLLECTION SCHEMATIC

Legend

WWTP RATED CAPACITY	Wastewater Treatment Plant
FIRM CAPACITY	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP

June 2017
Figure 4.J.2
Not to Scale

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J.1.1 Service Area Overview

Table 4.J.1 provides a list of facility catchments and their areas. Refer to Figure 4.J.1 for the catchment areas of each facility

Table 4.J.1 Facilities and Catchment Areas

Facility	Catchments	Catchment Area (ha)
Seaway Wastewater Treatment Plant (WWTP)	**Seaway WWTP** (Including Sub Catchments) Industrial SPS Omer SPS Eastside SPS Main Street SPS Union SPS Elm SPS	935.6
	Seaway WWTP (Excluding Sub Catchments)	0.0
Industrial Sewage Pumping Station (SPS)	Industrial SPS	31.2
Omer SPS	**Omer SPS** (Including Sub Catchments) Steele SPS	194.0
	Omer SPS (Excluding Sub Catchments)	113.2
Steele SPS	**Steele SPS** (Including Sub Catchments)	80.9
	Steele SPS (Excluding Sub Catchments) Oxford SPS	65.6
Oxford SPS	Oxford SPS	15.3
Eastside SPS	**Eastside SPS** (Including Sub Catchments) Nickel SPS Fares SPS Fretz SPS Clarke Street SPS	219.4
	Eastside SPS (Excluding Sub Catchments)	0.0
Nickel SPS	Nickel SPS	45.4
Fares SPS	Fares SPS	32.2
Fretz SPS	Fretz SPS	72.0
Clarke Street SPS	Clarke St SPS	69.9

<table>
<tr><th>Facility</th><th>Catchments</th><th>Catchment Area (ha)</th></tr>
<tr><td>Main Street SPS</td><td>Main Street SPS</td><td>24.5</td></tr>
<tr><td>Union SPS</td><td>Union SPS</td><td>83.0</td></tr>
<tr><td rowspan="2">Elm SPS</td><td>Elm SPS
(Including Sub Catchments)
Arena SPS
City Hall SPS
Sugarloaf SPS
Rosemount North SPS</td><td>383.4</td></tr>
<tr><td>Elm SPS
(Excluding Sub Catchments)</td><td>62.0</td></tr>
<tr><td>Arena SPS</td><td>Arena SPS</td><td>100.1</td></tr>
<tr><td>City Hall SPS</td><td>City Hall SPS</td><td>45.1</td></tr>
<tr><td>Sugarloaf SPS</td><td>Sugarloaf SPS</td><td>35.1</td></tr>
<tr><td rowspan="2">Rosemount North SPS</td><td>Rosemount North SPS
(Including Sub Catchments)
Rosemount South SPS</td><td>141.1</td></tr>
<tr><td>Rosemount North SPS
(Excluding Sub Catchments)</td><td>106.4</td></tr>
<tr><td>Rosemount South SPS</td><td>Rosemount South SPS</td><td>34.8</td></tr>
<tr><td>Marina 1 SPS</td><td>Marina 1 SPS</td><td>Not Available</td></tr>
<tr><td>Marina 2 SPS</td><td>Marina 2 SPS</td><td>Not Available</td></tr>
<tr><td>Marina 3 SPS</td><td>Marina 3 SPS</td><td>Not Available</td></tr>
</table>

Note: Marina 1, 2, and 3 are owned by the City of Port Colborne; information was not available.

J.1.2 Facility Overview

Table 4.J.2 Wastewater Treatment Plant Overview

Plant Name	Port Colborne Wastewater Treatment Plant
Address	30 Prosperity Ave, Port Colborne, ON, L3K 5X9
Discharge Water	Welland Canal
Rated Capacity: Average Daily Flow	19.6 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	Not Available
Rated Capacity: Peak Flow Rate (Wet Weather)	45.4 MLD
Key Processes	• Conventional activated sludge treatment with screening • Grit removal • Mechanical aeration • Effluent disinfection • UV treatment of secondary effluent

Table 4.J.3 Wastewater Treatment Plant Effluent Objectives

Effluent Parameter	Objective Concentration[3]
$CBOD_5$	15.0 mg/L
TSS	15.0 mg/L
Total Phosphorus	0.5 mg/L
E. Coli	200 organisms/100 mL
Total Chlorine Residual	0.5 mg/L

[3] *Ministry of Environment, 25 February 2011. Ammeded Certificate of Approval. Number 8101-8BAPJ9*

Table 4.J.4 Pumping Station Overview

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Industrial Sewage Pumping Station (SPS)	1680 Elm Street, Port Colborne	2	80.0	71.2	22.0
Omer SPS	Omer Street, Port Colborne	3	107.2	116.3	14.6
Steele SPS	940 Steele Street, Port Colborne	2	35.0	16.0	13.4
Oxford SPS	16 Oxford Boulevard, Port Colborne	2	7.6	6.4	N/A
Eastside SPS	Killaly Street, Port Colborne	3	252.4	252.0	17.7
Nickel SPS	Nickel Street, Port Colborne	2	116.7	91.1	N/A
Fares SPS	Fares Street, Port Colborne	3	65.6	53.9	N/A
Fretz SPS	185 Johnson Street, Port Colborne	3	152.0	95.8	11.5
Clarke Street SPS	111 Clarke Street, Port Colborne	2	73.8	73.8	9.9
Main Street SPS	Main Street, Port Colborne	2	16.4	14.6	11.0
Union SPS	Union Street, Port Colborne	3	126.2	164.0	20.7
Elm SPS	137 Princess Street, Port Colborne	4	750.0	750.0	17.0
Arena SPS	N/A	N/A	N/A	116.3	N/A
City Hall SPS	City Hall, Port Colborne	3	69.4	47.4	11.58
Sugarloaf SPS	274 Sugarloaf Street, Port Colborne	2	36.0	41.3	5.2
Rosemount North SPS	101 Rosemount Avenue North, Port Colborne	2	95.0	95.0	7.5

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Rosemount South SPS	Bayview Lane, Port Colborne	2	N/A	9.0	N/A
Marina 1 SPS	Sugarloaf Harbour Marina, Port Colborne	2	3.0	3.0	N/A
Marina 2 SPS	Sugarloaf Harbour Marina, Port Colborne	2	3.0	3.0	N/A
Marina 3 SPS	Sugarloaf Harbour Marina, Port Colborne	2	3.0	3.0	N/A

Table 4.J.5 Forcemain Overview

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Length (m)	Diameter (mm)	Capacity @ 2.5 m/s (L/s)
Industrial Sewage Pumping Station (SPS)	71.2	2,279	350	240.5
Omer SPS	116.3	654	350	240.5
Steele SPS	16.0	225	200	78.5
Oxford SPS	6.4	335	100	19.6
Eastside SPS	252.0	2,754	350	240.5
Nickel SPS	91.1	962	500	490.9
Fares SPS	53.9	333	250	122.7
Fretz SPS	95.8	1,560	300	176.7
Clarke Street SPS	73.8	590	250	122.7
Main Street SPS	14.6	205	150	44.2
Union SPS	164.0	1,428	350	240.5
Elm SPS	750.0	2,641	500	490.9
Arena SPS	116.3	1,201	300	176.7
City Hall SPS	47.4	378	250	122.7
Sugarloaf SPS	41.3	284	200	78.5
Rosemount North SPS	95.0	1,000	400	314.2
Rosemount South SPS	9.0	92	150	44.2
Marina 1 SPS	3.0	180	65	8.3
Marina 2 SPS	3.0	414	65	8.3
Marina 3 SPS	3.0	270	65	8.3

J.1.3 Flows Overview

Table 4.J.6 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.J.7 shows the existing wastewater system flows by catchment.

Table 4.J.6 Historic Seaway Wastewater Treatment Plant Flows

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	L/s	MLD	L/s	MLD	L/s
2011	11.3	130.8	13.6	157.4	61.0	706.0
2012	9.3	107.6	10.6	122.7	44.9	519.7
2013	11.4	131.9	12.8	148.1	74.3	860.0
2014	11.5	133.1	12.1	140.0	52.8	611.1
2015	10.1	116.9	11.4	131.9	37.6	435.2
5 Year Average	10.7	123.8	12.1	140.0	54.1	626.2
5 Year Peak	11.5	133.1	13.6	157.4	74.3	860.0

Table 4.J.7 Existing Wastewater System Flows by Catchment

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Seaway Wastewater Treatment Plant (WWTP)	22,095	125.4	518.4	994.7	1455.0
Seaway WWTP	0	0.0	0.0	0.0	0.0
Industrial Sewage Pumping Station (SPS)	475	18.6	46.1	31.2	56.0
Omer Avenue SPS	3,371	7.4	70.3	416.0	578.0
Omer Avenue SPS	2,816	5.0	42.3	402.0	559.0
Steele Street SPS	555	2.4	28.0	14.0	19.0
Steele Street SPS	432	2.1	23.0	11.4	15.4
Oxford Road SPS	123	0.3	5.0	2.6	3.6
Eastside SPS	5,870	40.5	143.7	253.0	415.0

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Eastside SPS	0	0.0	0.0	0.0	0.0
Nickel Street SPS	1,144	2.8	18.6	41.0	54.0
Fares Street SPS	137	3.0	15.1	44.0	59.0
Fretz SPS	3,680	14.7	49.9	72.3	130.0
Clarke Street SPS	909	20.0	60.0	95.7	172.0
Main Street SPS	351	2.4	11.8	24.5	44.0
Union SPS	1,190	7.6	38.9	120.0	161.0
Elm SPS	10,838	49.0	207.6	150.0	201.0
Elm SPS	193	6.5	30.8	44.0	62.0
Arena SPS	3,887	5.0	38.6	70.0	100.1
City Hall SPS	3,529	16.4	45.7	79.0	105.0
Sugarloaf SPS	78	4.3	18.7	26.0	35.0
Rosemount North SPS	3,151	16.7	73.8	206.0	286.0
Rosemount North SPS	3,052	13.3	57.0	154.7	214.7
Rosemount South SPS	99	3.4	16.8	51.3	71.3

Note: Flow numbers may not sum due to rounding.

J.2 Growth Projections

J.2.1 Population Projections and Allocations

Table 4.J.8 and Table 4.J.9 outline the existing and projected serviced population and employment by catchment.

Table 4.J.8 Seaway Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Arena Sewage Pumping Station (SPS)	2,921	3,061	3,226	3,427	3,839	4,016	1,095
City Hall SPS	1,659	1,610	1,610	1,617	1,635	1,651	-8
Clarke Street SPS	614	575	644	724	741	783	169
Eastside SPS	0	0	0	0	0	0	0
Elm SPS	8	8	8	8	8	8	0
Fares Street SPS	54	55	56	58	59	59	5
Fretz SPS	3,259	3,104	3,230	3,396	3,462	3,720	462
Industrial SPS	0	0	0	0	0	0	0
Main Street SPS	351	406	407	410	415	419	68
Nickel Street SPS	868	878	886	898	908	918	51
Omer Avenue SPS	2,125	2,077	2,188	2,326	2,584	2,741	616
Oxford Road SPS	123	136	168	206	235	247	123
Rosemount North SPS	3,035	2,975	2,978	3,074	3,109	3,146	111
Rosemount South SPS	36	36	36	37	37	38	1
Steele Street SPS	432	457	552	662	746	762	331

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Sugarloaf SPS	66	65	65	67	68	69	2
Union SPS	876	874	876	881	894	903	28
Total	**16,428**	**16,317**	**16,929**	**17,792**	**18,741**	**19,481**	**3,053**

Note: Population numbers may not sum due to rounding.

Table 4.J.9 Seaway Wastewater Treatment Plant Existing and Projected Serviced Employment by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 – 41
Arena Sewage Pumping Station (SPS)	966	967	987	1,013	1,043	1,080	114
City Hall SPS	1,870	1,836	1,864	1,896	1,935	1,982	112
Clarke Street SPS	295	351	403	478	561	680	385
Eastside SPS	0	0	0	0	0	0	0
Elm SPS	185	182	184	188	191	196	11
Fares Street SPS	83	82	83	84	86	88	5
Fretz SPS	421	432	444	461	479	503	82
Industrial SPS	475	520	541	594	639	703	228
Main Street SPS	0	0	0	0	0	0	0
Nickel Street SPS	276	271	275	280	286	293	17
Omer Avenue SPS	690	726	748	800	846	910	219
Oxford Road SPS	0	0	0	0	0	0	0
Rosemount North SPS	17	17	17	17	17	18	1
Rosemount South SPS	62	61	62	63	64	66	4

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 – 41
Steele Street SPS	0	0	0	0	0	0	0
Sugarloaf SPS	12	12	12	12	12	13	1
Union SPS	314	309	313	319	325	333	19
Total	**5,667**	**5,765**	**5,934**	**6,206**	**6,487**	**6,864**	**1,197**

Note: Population numbers may not sum due to rounding.

J.2.2 Future Flow Projections

Table 4.J.10 and Table 4.J.11 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

Table 4.J.10 Projected Peak Dry Weather Flow by Catchment

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Arena Sewage Pumping Station (SPS)	11.5	13.4	15.8	20.3	22.4
City Hall SPS	31.9	32.2	32.6	33.2	33.9
Clarke Street SPS	40.2	41.7	43.5	44.7	46.5
Eastside SPS	0.0	0.0	0.0	0.0	0.0
Elm SPS	13.0	13.1	13.1	13.2	13.2
Fares Street SPS	5.9	5.9	6.0	6.0	6.1
Fretz SPS	27.8	29.3	31.2	32.1	35.1
Industrial SPS	37.8	38.0	38.7	39.3	40.0
Main Street SPS	5.5	5.5	5.5	5.6	5.6
Nickel Street SPS	5.7	5.8	6.0	6.2	6.4
Omer Avenue SPS	9.8	11.3	13.3	16.6	18.9
Oxford Road SPS	0.8	1.3	1.8	2.1	2.3
Rosemount North SPS	25.9	25.9	27.0	27.4	27.8
Rosemount South SPS	6.9	6.9	6.9	6.9	7.0
Steele Street SPS	4.5	5.7	7.1	8.1	8.3
Sugarloaf SPS	8.6	8.6	8.7	8.7	8.7
Union SPS	15.0	15.1	15.2	15.5	15.7
Total	**250.9**	**259.8**	**272.5**	**285.9**	**297.9**

The following presents an example calculation of projected peak dry weather flow.

2041 Peak Dry Weather Flow for Arena Sewage Pumping Station:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (5.0 L/s × 2.0) + (5,096 – 3,887 people) × 275 L/cap/day × 1 day/86400 s × 3.24
= 22.4 L/s

Table 4.J.11 Projected Peak Wet Weather Flow by Catchment

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Arena Sewage Pumping Station (SPS)	40.1	42.1	44.4	48.9	51.1
City Hall SPS	44.8	45.1	45.5	46.1	46.8
Clarke Street SPS	60.2	61.7	63.5	64.7	66.5
Eastside SPS	0.0	0.0	0.0	0.0	0.0
Elm Street South SPS (Port Colborne)	30.8	30.8	30.9	30.9	31.0
Fares Street SPS	15.1	15.2	15.2	15.2	15.3
Fretz SPS	48.4	49.9	51.8	52.7	55.7
Industrial Park SPS (Port Colborne)	46.7	47.0	47.6	48.2	49.0
Main Street SPS	12.5	12.5	12.5	12.6	12.7
Nickel Street SPS	18.6	18.8	19.0	19.2	19.4
Omer Avenue SPS	42.1	43.6	45.7	48.9	51.2
Oxford Road SPS	5.2	5.6	6.1	6.5	6.6
Rosemount North SPS	56.3	56.4	57.4	57.8	58.2
Rosemount South SPS	16.8	16.8	16.8	16.9	16.9
Steele Street SPS	23.3	24.5	25.9	26.9	27.1
Sugarloaf SPS	18.7	18.7	18.7	18.7	18.8
Union SPS	38.8	38.9	39.0	39.2	39.4
Total	**518.5**	**527.4**	**540.1**	**553.5**	**565.5**

Note: 25% of the growth catchment area was used in calculation for Fretz Sewage Pumping Station and Clarke Street Sewage Pumping Station design peak wet weather flow due to low equivalent population growth in the catchments.

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for Arena Sewage Pumping Station:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 22.4 L/s + (100.1 ha × 0.286 L/s/ha)
= 51.1 L/s

J.3 Assessment of Wastewater Infrastructure (Existing and Future)

J.3.1 Treatment Plant Capacity

Figure 4.J.3 shows the projected future demands at the Seaway Wastewater Treatment Plant. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.

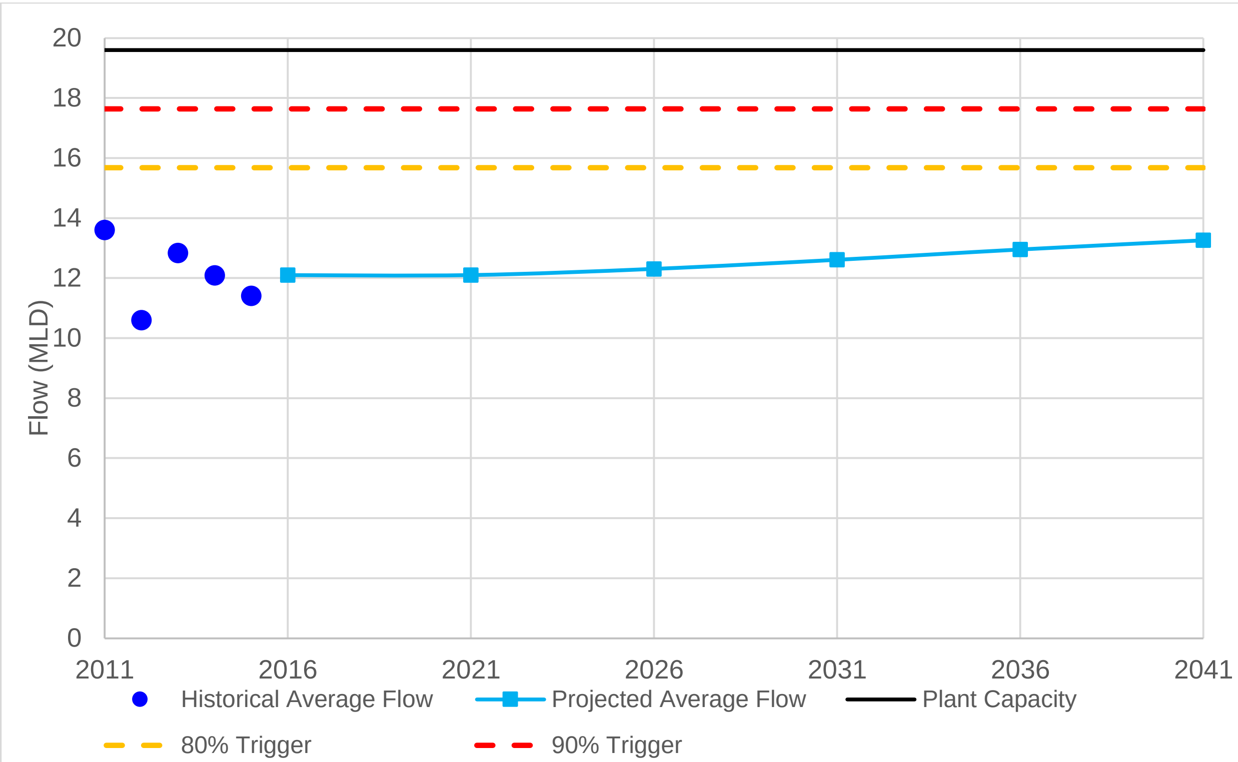


Figure 4.J.3 Projected future demands at Seaway Wastewater Treatment Plant

J.3.2 Sewage Pumping Station

Table 4.J.12 highlights the sewage pumping station existing and projected capacity.

Table 4.J.12 System Sewage Pumping Station Performance

Sewage Pumping Station	Contributing Catchments	Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Industrial SPS	Industrial SPS	71.2	46.1	49.0	22.2
Omer Avenue SPS	Omer SPS Steele SPS	116.3	70.3	83.7	32.6
Steele Street SPS	Steele SPS	16.0	28.0	33.5	-17.5
Oxford Road SPS	Oxford SPS	6.4	5.0	6.6	-0.2
Eastside SPS	Eastside SPS Nickel SPS Fares SPS Fretz SPS Clarke Street SPS	252.0	143.7	155.3	96.7
Nickel Street SPS	Nickel SPS	91.1	18.6	19.4	71.7
Fares Street SPS	Fares SPS	53.9	15.1	15.3	38.6
Fretz SPS	Fretz SPS	95.8	49.9	55.7	40.1
Clarke Street SPS	Clarke St SPS	73.8	60.0	66.5	7.3
Main Street SPS	Main Street SPS	14.6	11.8	12.7	1.9
Union SPS	Union SPS	164.0	38.9	39.4	124.6
Elm SPS	Elm SPS Arena SPS City Hall SPS Sugarloaf SPS Rosemount North SPS	750.0	207.6	220.8	529.2
Arena Sewage Pumping Station (SPS)	Arena SPS	116.3	38.6	51.1	65.2
City Hall SPS	City Hall SPS	47.4	45.7	46.8	0.6
Sugarloaf SPS	Sugarloaf SPS	41.3	18.7	18.8	22.5

Sewage Pumping Station	Contributing Catchments	Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Rosemount North SPS	Rosemount North SPS Rosemount South SPS	95.0	73.8	75.1	19.9
Rosemount South SPS	Rosemount South SPS	9.0	16.8	16.9	-7.9

The following sewage pumping stations have projected pumping deficits:

- Oxford Sewage Pumping Station
- Rosemount South Sewage Pumping Station
- Steele Street Sewage Pumping Station

J.3.3 Forcemain

Table 4.J.13 highlights the existing and projected forcemain performance.

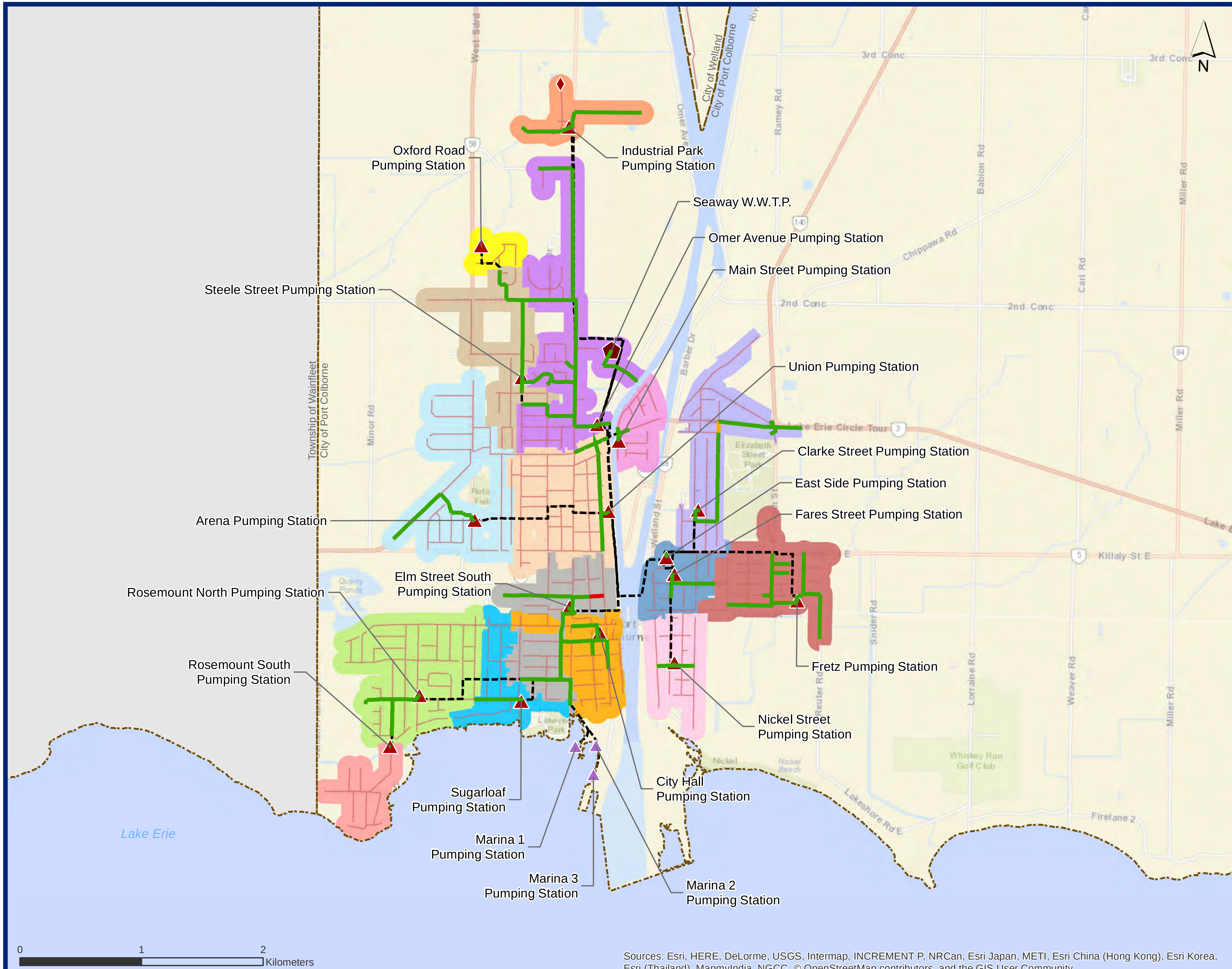
Table 4.J.13 Forcemain Performance

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Capacity @ 2.5 m/s (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus / Deficit (L/s)
Industrial SPS	71.2	240.5	46.1	49.0	191.5
Omer Avenue SPS	116.3	240.5	70.3	83.7	156.8
Steele Street SPS	16.0	78.5	28.0	33.5	45.0
Oxford Road SPS	6.4	19.6	5.0	6.6	13.0
Eastside SPS	252.0	240.5	143.7	155.3	85.2
Nickel Street SPS	91.1	490.9	18.6	19.4	471.5
Fares Street SPS	53.9	122.7	15.1	15.3	107.4
Fretz SPS	95.8	176.7	49.9	55.7	121.0
Clarke Street SPS	73.8	122.7	60.0	66.5	56.2
Main Street SPS	14.6	44.2	11.8	12.7	31.5
Union SPS	164.0	240.5	38.9	39.4	201.1
Elm SPS	750.0	490.9	207.6	220.8	270.1
Arena Sewage Pumping Station (SPS)	116.3	176.7	38.6	51.1	125.6
City Hall SPS	47.4	122.7	45.7	46.8	75.9
Sugarloaf SPS	41.3	78.5	18.7	18.8	59.7
Rosemount North SPS	95.0	314.2	73.8	75.1	239.1
Rosemount South SPS	9.0	44.2	16.8	16.9	27.3

All forcemains have a projected surplus capacity.

J.3.4 Trunk Sewer

Figure 4.J.4 and Figure 4.J.5 highlight the existing and projected peak wet weather flow, respectively. Trunk sewers in the Clarke Street Sewage Pumping Station and Fretz Sewage Pumping Station catchments are approaching capacity within the 2041 time horizon.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Arena
- City Hall
- Clarke Street
- East Side
- Elm Street
- Fares Street
- Fretz
- Industrial Park
- Main Street
- Nickel Street
- Omer Avenue
- Oxford Road
- Rosemount North
- Rosemount South
- Steele Street
- Sugarloaf
- Union

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

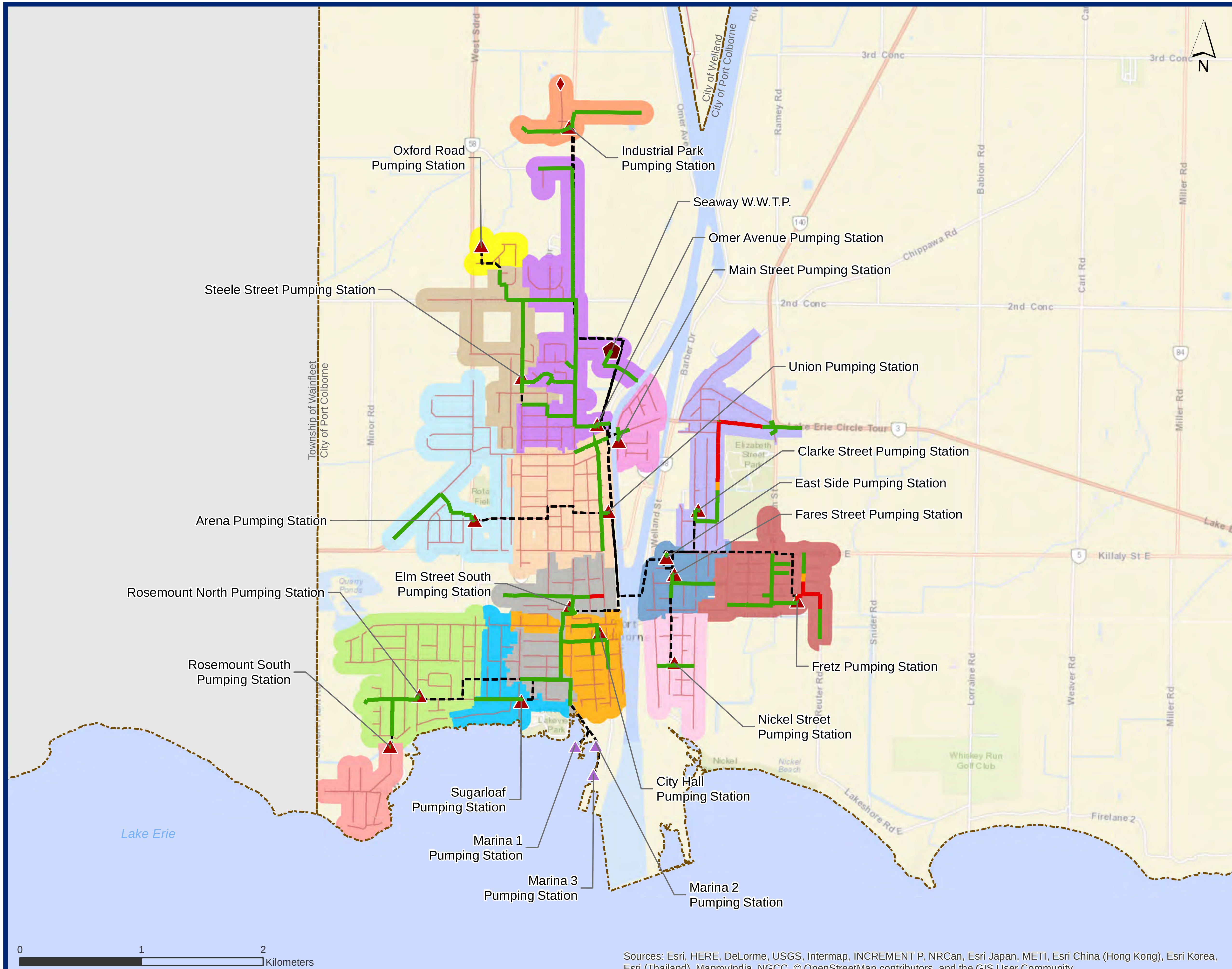
Figure 4.J.4

Existing Peak Wet Weather Flow

Seaway WWTP

BluePlan ENGINEERING

June 2017
715023-WW-4-Existing Wet Weather (PC)
NAD 1983 UTM Zone 17N



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Arena
- City Hall
- Clarke Street
- East Side
- Elm Street
- Fares Street
- Fretz
- Industrial Park
- Main Street
- Nickel Street
- Omer Avenue
- Oxford Road
- Rosemount North
- Rosemount South
- Steele Street
- Sugarloaf
- Union

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.J.5
2041 Peak Wet Weather Flow
Seaway WWTP

BluePlan

June 2017
715023-WW-5-2041 Wet Weather (PC)
NAD 1983 UTM Zone 17N

J.4 System Opportunities and Constraints

Figure 4.J.6 highlights the existing opportunities and constraints.

J.4.1 Seaway Wastewater Treatment Plant

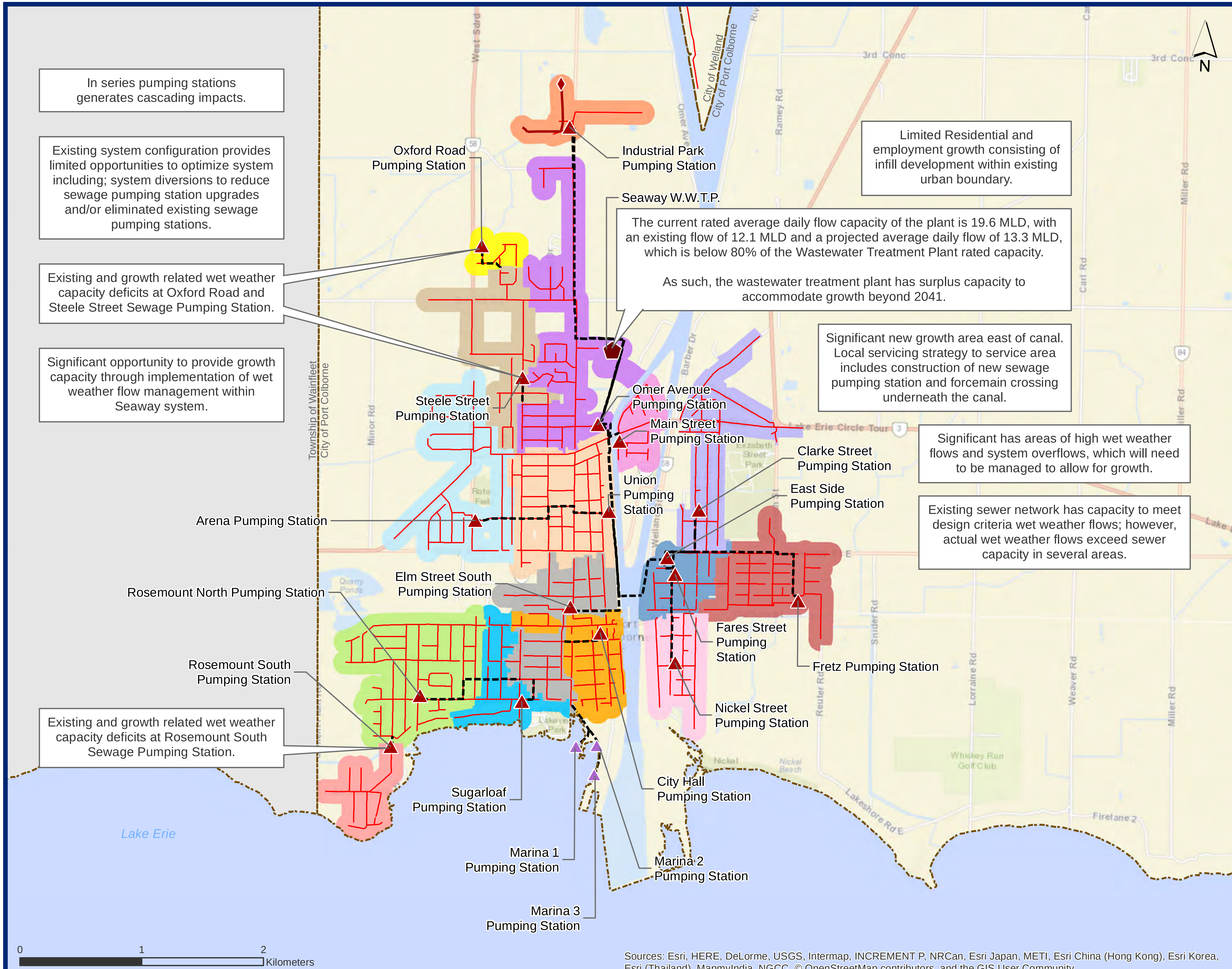
- The current rated average daily flow capacity of the plant is 19.6 MLD, with an existing flow of 12.1 MLD and a projected average daily flow of 13.3 MLD, which is below 80% of the Wastewater Treatment Plant rated capacity. As such, the wastewater treatment plant has surplus capacity to accommodate growth beyond 2041.

J.4.2 Port Colborne

- Limited residential and employment growth consisting of infill development within existing urban boundary.
- Existing and growth related wet weather capacity deficits at Oxford Road Sewage Pumping Station, Steele Street Sewage Pumping Station and Rosemount South Sewage Pumping Station.
- Significant new growth area east of canal. Local servicing strategy to service area includes construction of new sewage pumping station and forcemain crossing underneath the canal.
- Significant areas of high wet weather flows and system overflows, which will need to be managed to allow for growth.
- Existing sewer network has capacity to meet design criteria wet weather flows; however, actual wet weather flows exceed sewer capacity in several areas.

J.4.3 System Optimization Opportunities

- In series pumping stations generates cascading impacts.
- Existing system configuration provides limited opportunities to optimize system including; system diversions to reduce sewage pumping station upgrades and/or eliminated existing sewage pumping stations.
- Significant opportunity to provide growth capacity through implementation of wet weather flow management within Seaway system.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Arena
- City Hall
- Clarke Street
- East Side
- Elm Street
- Fares Street
- Fretz
- Industrial Park
- Main Street
- Nickel Street
- Omer Avenue
- Oxford Road
- Rosemount North
- Rosemount South
- Steele Street
- Sugarloaf
- Union

Figure 4.J.6

System Opportunities and Constraints

Seaway WWTP

BluePlan

June 2017
715023-WW-3-Opportunities and Constraints (PC)
NAD 1983 UTM Zone 17N

J.5 Assessment of Alternatives

No further alternative beyond application the hybrid management strategy below were identified.

- Providing capacity within Regional pumping stations and trunk sewers to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Provide upstream flow management and peak flow management to address peak flows in systems where peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in potential basement flooding and overflow risks.

J.6 Preferred Servicing Strategy

The following is a summary of the Seaway wastewater servicing strategy, presented in Figure 4.J.7 and Figure 4.J.8:

- The Seaway Wastewater Treatment Plant has sufficient capacity to support growth to year 2041.
- The projected growth will require pumping station capacity increases at Oxford Sewage Pumping Station, Steele Street Sewage Pumping Station and Rosemount South Sewage Pumping Station.
- Additional wet weather management, particularly on the east side of the Canal is recommended to minimize impact to existing infrastructure and support the growth to year 2041.

J.6.1 Pumping Stations

The following sewage pumping station upgrades are required:

- Rosemount South Sewage Pumping Station pump replacement: Increase capacity from 9 L/s to 17 L/s.
- Oxford Sewage Pumping Station pump replacement: Increase capacity from 7 L/s to 10 L/s.
- Steele Street Sewage Pumping Station pump replacement: Increase capacity from 16 L/s to 40 L/s.

J.6.2 Wet Weather

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts. These wet weather management programs will need to be a joint initiative between the Region and local municipalities.

For the Seaway system, the following priority areas are identified:

- Central Port Colborne area on the east and west sides of the Canal, consisting of the Fares Sewage Pumping Station and Elm Sewage Pumping Station catchments.

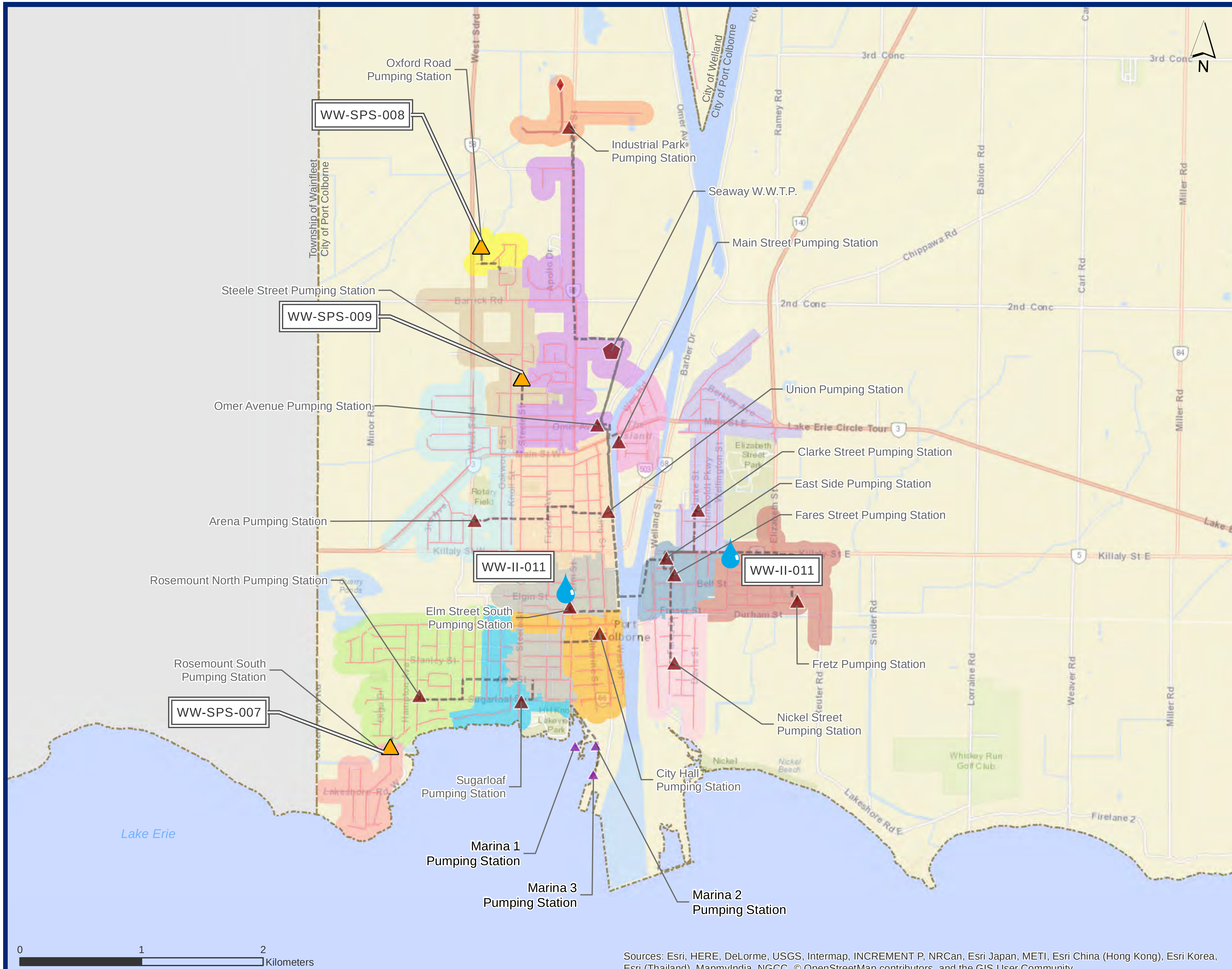
Further flow monitoring and area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, Preferred Servicing Strategy are needed to identify area specific strategies and projects required to achieve the wet weather flow reduction objectives. Following the outcomes of the further studies, targeted funding can be applied outside the priority areas if the projects are found to address capacity issues and support growth capacity needs.

J.7 Capital Program

Table 4.J.14 summarizes the recommended project costing, implementation schedule and Class EA requirements.

J.7.1 Schedule B Project Files

No Schedule B projects are anticipated for the Seaway Wastewater Treatment Plant system.



Niagara Region

2016 MASTER SERVICING PLAN

MSP Wastewater Projects

- Treatment Plant
- Pumping Station
- Wet Weather Reduction
- Sanitary Sewer Projects
- Forcemain Projects

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Private
- Local
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Arena
- City Hall
- Clarke Street
- East Side
- Elm Street
- Fares Street
- Fretz
- Industrial Park
- Main Street
- Nickel Street
- Omer Avenue
- Oxford Road
- Rosemount North
- Rosemount South
- Steele Street
- Sugarloaf
- Union

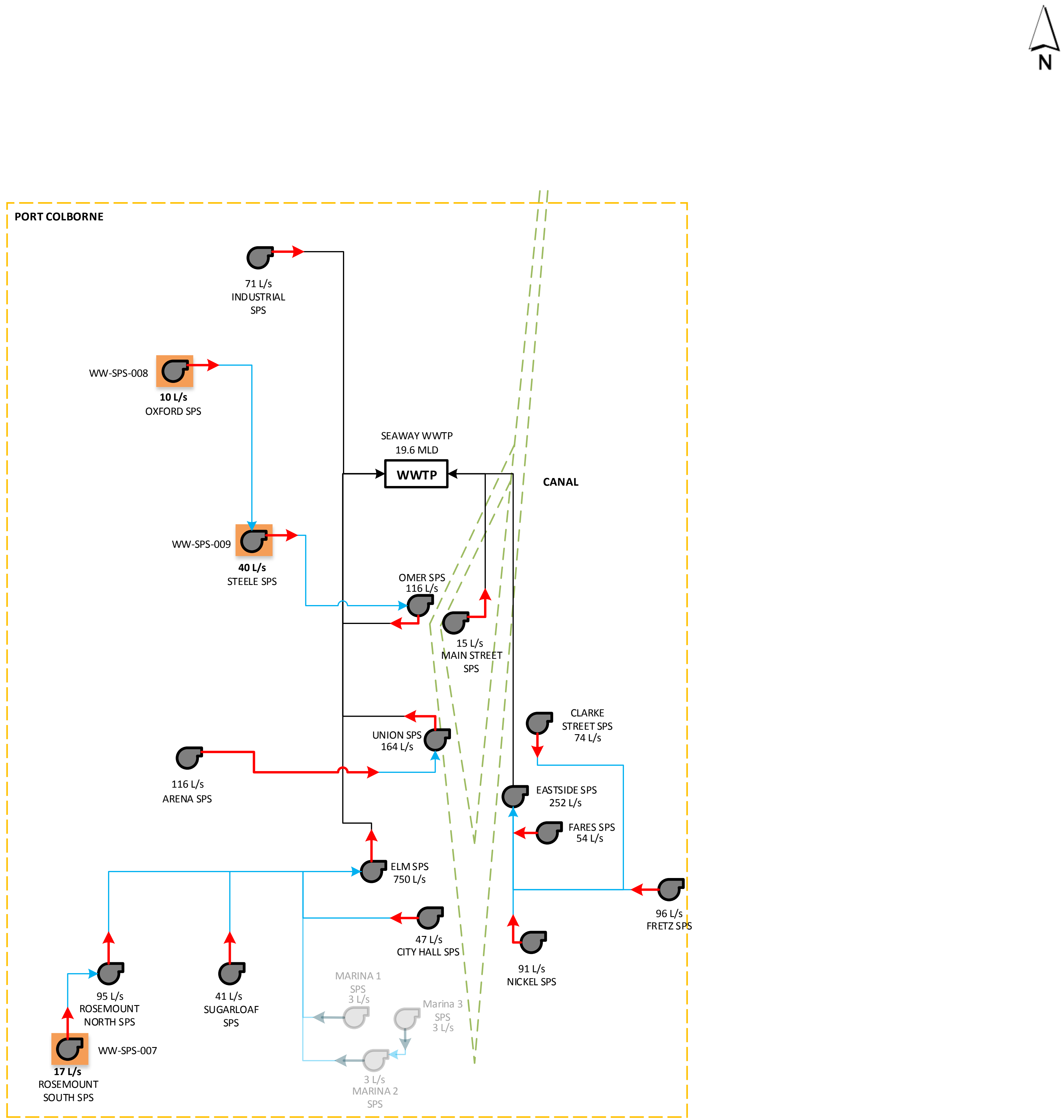
Figure 4.J.7

Preferred Wastewater Strategy

Seaway WWTP

BluePlan ENGINEERING

June 2017
715023-WW-6-Capital Projects (PC)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Seaway WWTP

2041 COLLECTION SCHEMATIC

WWTP — RATED CAPACITY — Wastewater Treatment Plant

FIRM CAPACITY — Sewage Pumping Station

Forcemain

Connection from SPS to SPS

Connection from SPS to WWTP

Facility Upgrade

Upgrade Forcemain or Sewer

New Forcemain or Sewer

Decommission Project

June 2017
Figure 4.J.8
Not to Scale

BluePlan ENGINEERING

Table 4.J.14 Summary of Seaway Wastewater Treatment Plant Capital Program

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-II-011	Wet weather reduction in Central Port Colborne	Wet weather reduction in Central Port Colborne	20 L/s reduction	2022-2031	Port Colborne	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$3,000,000
WW-SPS-007	Rosemount South Sewage Pumping Station (SPS) Pump Replacement - Seaway	Increase station capacity from 9 L/s to 17 L/s	17 L/s	2017-2021	Port Colborne	A+	Satisfied	Pumping	$665,000
WW-SPS-008	Oxford SPS Pump Replacement - Seaway	Increase station capacity from 7 L/s to 10 L/s	10 L/s	2032-2041	Port Colborne	A+	Satisfied	Pumping	$665,000
WW-SPS-009	Steele Street SPS Pump Replacement - Seaway	Increase station capacity from 16 L/s to 40 L/s	40 L/s	2032-2041	Port Colborne	A+	Satisfied	Pumping	$989,000
Total									**$5,319,000**

PART K
WELLAND WASTEWATER SYSTEM

K. WELLAND WASTEWATER TREATMENT PLANT

K.1 Existing System Overview

The Welland wastewater system services the City of Welland, Town of Pelham, and the Port Robinson area of City of Thorold. The system services an existing population of 68,722 residents and 27,380 employees[1].

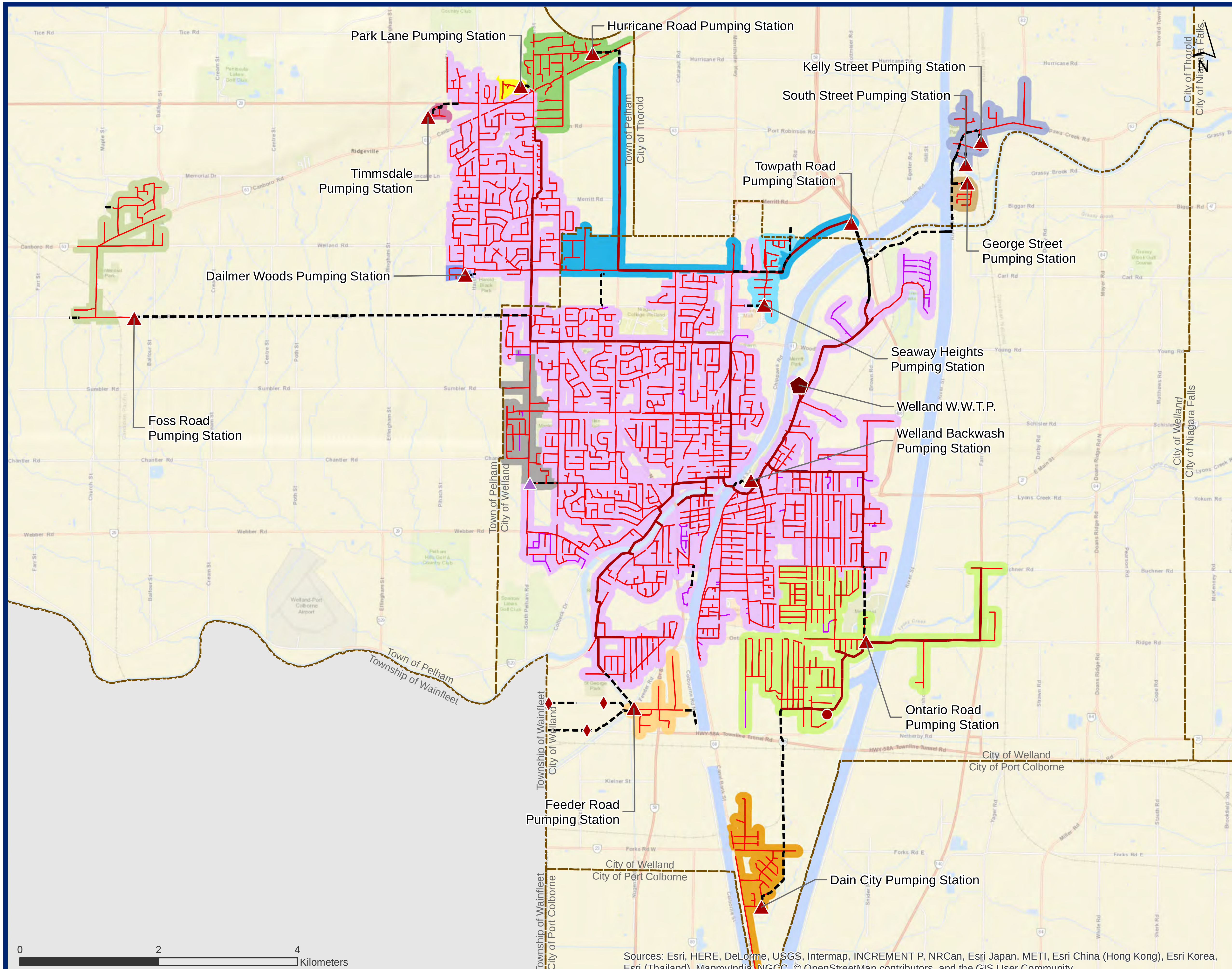
The system is serviced by the Welland Wastewater Treatment Plant, located on 505 River Road, R.R. #1, Welland City. The Welland Wastewater Treatment Plant has conventional activated sludge treatment, grit removal, effluent disinfection and tertiary filtration.

Welland Wastewater Treatment Plant has a current rated capacity of 54.6 MLD and a peak flow capacity of 136.2 MLD[2].

Figure 4.K.1 and Figure 4.K.2 present an overview of the wastewater system and a wastewater system schematic diagram, respectively.

[1] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*

[2] *Ministry of Environment and Climate Change, 30 July 2015. Ammeded Environmental Compliance Approval. Number 5599-9VTGG2*



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Welland W.W.T.P.
- Dailmer Woods
- Dain City
- Feeder Road
- Foss Road
- George Street
- Hurricane Road
- Kelly Street
- Ontario Road
- Park Lane
- Seaway Heights
- Timmsdale
- Towpath Road
- 283000012 (Private)

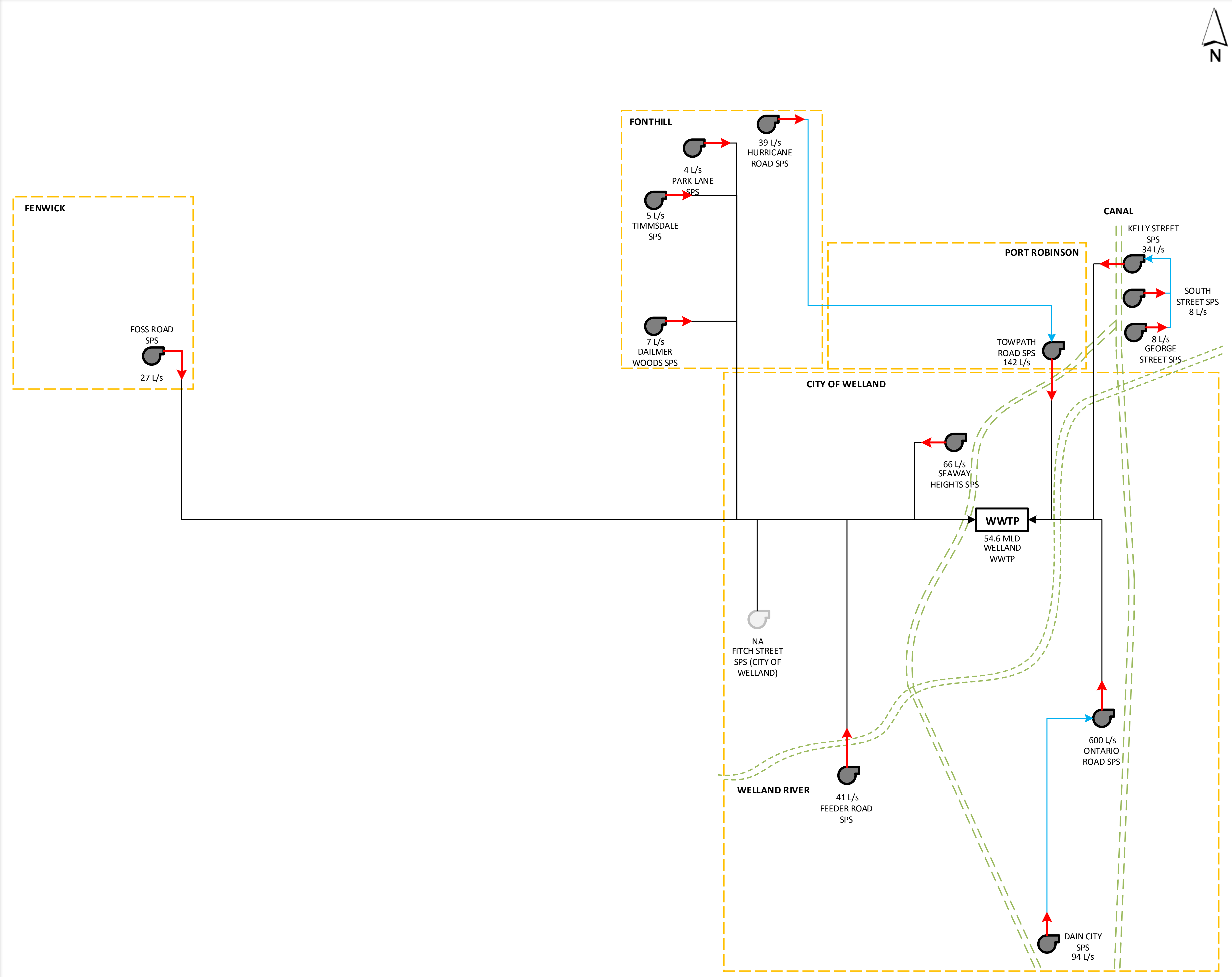
Figure 4.K.1

Existing Wastewater System

Welland WWTP

BluePlan

June 2017
715023-WW-2-Existing System (Welland)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Welland WWTP

EXISTING COLLECTION SCHEMATIC

Legend

WWTP (RATED CAPACITY)	Wastewater Treatment Plant
(FIRM CAPACITY)	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP

June 2017
Figure 4.K.2
Not to Scale

BluePlan ENGINEERING

K.1.1 Service Area Overview

Table 4.K.1 provides a list of facility catchments and their areas. Refer to Figure 4.K.1 for the catchment areas of each facility.

Table 4.K.1 Facilities and Catchment Areas

Facility	Catchments	Catchment Area (ha)
Welland Wastewater Treatment Plant (WWTP)	**Welland WWTP** (including sub catchments) Towpath Road SPS Foss Road SPS Feeder Road SPS Seaway Heights SPS Ontario Road SPS Kelly Street SPS Park Lane SPS Dailmer Woods SPS	3,550.9
	Welland WWTP (excluding sub catchments)	2,408.4
Timmsdale Sewage Pumping Station (SPS)	Timmsdale SPS	6.7
Towpath Road SPS	**Towpath Road SPS** (including sub catchments) Hurricane Road SPS	289.3
	Towpath Road SPS (excluding sub catchments)	172.7
Hurricane Road SPS	Hurricane Road SPS	116.6
Foss Road SPS	Foss Road SPS	125.0
Feeder Road SPS	Feeder Road SPS	55.8
Seaway Heights SPS	Seaway Heights SPS	46.2
Ontario Road SPS	**Ontario Road SPS** (including sub catchments) Dain City SPS	503.8
	Ontario Road SPS (excluding sub catchments)	400.5
Dain City SPS	Dain City SPS	103.3
Kelly Street SPS	**Kelly Street SPS** (including sub catchments) George Street SPS South Street SPS	99.5
	Kelly Street SPS (excluding sub catchments)	81.1

Facility	Catchments	Catchment Area (ha)
George Street SPS	George Street SPS	18.4
South Street SPS	South Street SPS	0.0
Park Lane SPS	Park Lane SPS	9.3
Dailmer Woods SPS	Dailmer Woods SPS	6.9

K.1.2 Facility Overview

Table 4.K.2 Wastewater Treatment Plant Overview

Plant Name	Welland Wastewater Treatment Plant
Address	505 River Road, R.R. #1, Welland
Discharge Water	Welland River
Rated Capacity: Average Daily Flow	54.6 MLD
Rated Capacity: Peak Flow Rate (Dry Weather)	Not available
Rated Capacity: Peak Flow Rate (Wet Weather)	136.2 MLD
Key Processes	• Conventional activated sludge treatment with screening • Grit removal • Effluent disinfection • Tertiary filtration

Table 4.K.3 Wastewater Treatment Plant Effluent Objectives

Effluent Parameter	Objective Concentration[3]
$CBOD_5$	15.0 mg/L
TSS	15.0 mg/L
Total Phosphorus	0.4 mg/L
Total Ammonia Nitrogen *November – April* *May – December*	 10 mg/L 5 mg/L
E. Coli	100 organisms/100 mL
Total Chlorine Residual	Non-detect

[3] *Ministry of Environment and Climate Change, 30 July 2015. Ammeded Environmental Compliance Approval. Number 5599-9VTGG2*

Table 4.K.4 Pumping Station Overview

Sewage Pumping Station	Location	Number of Pumps	ECA Firm Capacity (L/s)	Operational Firm Capacity (L/s)	Total Dynamic Head (m)
Timmsdale Sewage Pumping Station (SPS)	Timmsdale Estates, Pelham	2	4.4	5.0	20.0
Towpath Road SPS	Towpath Road, Thorold	2	150.0	141.7	25.0
Hurricane Road SPS	92 Hurricane Road, Pelham	2	39.4	39.0	N/A
Foss Road SPS	736 Foss Road, Pelham	2	27.0	26.6	23.0
Feeder Road SPS	Feeder Road, Welland	2	44.0	41.0	N/A
Seaway Heights SPS	Lancaster Drive, Welland	2	60.0	65.7	11.9
Ontario Road SPS	1200 Ontario Road, Welland	3	600.0	600.0	21.6
Dain City SPS	144 Logan Avenue, Welland	2	192.0	94.0	43.0
Kelly Street SPS	51 Kelly Street, Thorold	2	24.6	34.4	16.2
George Street SPS	George Street, Thorold	2	8.2	8.0	13.1
South Street SPS	South Street, Thorold	2	8.2	8.1	10.0
Park Lane SPS	Park Lane, Pelham	2	5.3	4.0	N/A
Dailmer Woods SPS	Haist Street, Pelham	2	9.2	7.4	6.6

Table 4.K.5 Forcemain Overview

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Length (m)	Diameter (mm)	Capacity @ 2.5 m/s (L/s)
Timmsdale Sewage Pumping Station (SPS)	5.0	573	100	19.6
Towpath Road SPS	141.7	647	400	1,021.0
Hurricane Road SPS	39.0	670	250	122.7
Foss Road SPS	26.6	5,718	200	78.5
Feeder Road SPS	41.0	677	250	122.7
Seaway Heights SPS	65.7	291	300	176.7
Ontario Road SPS	600.0	1,122	600	706.9
Dain City SPS	94.0	3,030	250	122.7
Kelly Street SPS	34.4	3,813	200	78.5
George Street SPS	8.0	643	100	19.6
South Street SPS	8.1	180	100	19.6
Park Lane SPS	4.0	165	100	19.6
Dailmer Woods SPS	7.4	176	100	19.6

K.1.3 Flows Overview

Table 4.K.6 shows the historical system flows obtained from wastewater treatment plant production data for 2011 to 2015. Table 4.K.7 shows the existing wastewater system flows by catchment.

Table 4.K.6 Historic Welland Wastewater Treatment Plant Flows

Year	Average Dry Weather Flow		Average Daily Flow		Peak Daily Flow	
	MLD	**L/s**	**MLD**	**L/s**	**MLD**	**L/s**
2011	30.0	347.2	41.7	482.6	111.7	1,292.8
2012	28.4	328.7	35.5	410.9	111.2	1,287.0
2013	33.8	391.2	40.6	469.9	144.6	1,673.6
2014	28.7	332.2	35.1	406.3	105.7	1,223.4
2015	23.0	266.2	24.9	288.2	81.9	947.9
5 Year Average	28.8	333.3	35.6	412.0	111.0	1,284.7
5 Year Peak	33.8	391.2	41.7	482.6	144.6	1,673.6

Table 4.K.7 Existing Wastewater System Flows by Catchment

Catchment	Total Service Equivalent Population	Existing Average Dry Weather Flow (L/s)	Existing Design Peak Wet Weather Flow (L/s)	Existing 2-Year Flow (L/s)	Existing 5-Year Flow (L/s)
Welland Wastewater Treatment Plant (WWTP)	94,351	325.8	1,667.1	2,713.2	3,582.9
Welland WWTP	64,810	244.4	1,177.7	1,980.0	2,725.0
Timmsdale Sewage Pumping Station (SPS)	28	0.6	3.1	8.1	10.4
Towpath Road SPS	7,555	14.5	111.7	150.0	180.7
Towpath Road SPS	5,133	8.4	66.1	111.0	143.0
Hurricane Road SPS	2,422	6.1	45.6	85.0	113.0
Foss Road SPS	4,748	3.8	43.3	24.0	32.0
Feeder Road SPS	2,563	3.3	22.6	71.0	95.0
Seaway Heights SPS	2,704	2.8	18.8	98.0	131.0
Ontario Road SPS	11,812	53.2	250.6	413.0	534.0
Ontario Road SPS	11,455	49.2	212.9	320.0	440.0
Dain City SPS and Detention Facility	357	4.1	37.7	93.0	124.0
Kelly Street SPS	0	2.3	33.1	39.0	52.0
Kelly Street SPS	0	1.9	27.0	31.8	42.4
George Street SPS	0	0.4	6.1	7.2	9.6
South Street SPS	0	0.0	0.0	0.0	0.0
Park Lane SPS	0	0.2	3.0	4.1	5.2
Dailmer Woods SPS	132	0.7	3.3	4.4	5.5

Note: Flow numbers may not sum due to rounding.

K.2 Growth Projections

K.2.1 Population Projections and Allocations

Table 4.K.8 and Table 4.K.9 outline the existing and projected serviced population and employment by catchment.

Table 4.K.8 Welland Wastewater Treatment Plant Existing and Projected Serviced Population by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Welland Wastewater Treatment Plant	48,303	49,550	51,614	54,283	56,556	58,299	9,996
Dailmer Woods Sewage Pumping Station (SPS)	115	112	113	114	115	115	-1
Dain City SPS and Detention Facility	341	801	922	1,077	2,041	3,211	2,869
Feeder Road SPS	1,078	1,069	1,071	1,079	1,106	1,132	54
Foss Road SPS	3,894	4,003	4,311	4,726	5,188	5,768	1,875
George Street SPS	0	0	0	0	0	0	0
Hurricane Road SPS	1,543	1,502	1,502	1,513	1,577	1,580	37
Kelly Street SPS and Storage Facility	0	0	0	0	0	0	0
Ontario Road SPS	7,924	7,890	8,148	8,483	9,160	9,405	1,482
Park Lane SPS	0	0	0	0	0	0	0
Seaway Heights SPS	1,165	1,273	1,445	1,577	1,619	1,756	591
South Street SPS	0	0	0	0	0	0	0
Timmsdale SPS	0	0	0	0	0	0	0

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Towpath Road SPS	3,085	4,467	6,444	8,694	9,965	11,229	8,144
Total	**68,722**	**72,027**	**76,987**	**83,038**	**88,853**	**94,050**	**25,328**

Note: Population numbers may not sum due to rounding.

Table 4.K.9 Welland Wastewater Treatment Plant Existing and Projected Serviced Employment by Catchment

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
Welland Wastewater Treatment Plant	16,507	17,151	17,515	17,941	18,459	19,106	2,598
Dailmer Woods Sewage Pumping Station (SPS)	16	17	18	18	19	20	4
Dain City SPS and Detention Facility	15	47	65	103	151	210	194
Feeder Road SPS	1,486	1,573	1,613	1,675	1,737	1,826	340
Foss Road SPS	855	970	1,042	1,153	1,265	1,406	551
George Street SPS	0	0	0	0	0	0	0
Hurricane Road SPS	879	981	1,048	1,152	1,257	1,387	508
Kelly Street SPS and Storage Facility	0	0	0	0	0	0	0
Ontario Road SPS	3,531	4,233	4,498	5,020	5,427	6,104	2,573
Park Lane SPS	0	0	0	0	0	0	0
Seaway Heights SPS	1,539	1,581	1,604	1,628	1,658	1,697	158

Catchment	2014	2021	2026	2031	2036	2041	Growth 2014 - 41
South Street SPS	0	0	0	0	0	0	0
Timmsdale SPS	28	29	30	32	33	35	7
Towpath Road SPS	2,048	2,337	2,505	2,811	3,130	3,544	1,496
Total	**27,380**	**29,408**	**30,434**	**32,035**	**33,650**	**35,859**	**8,479**

Note: Population numbers may not sum due to rounding.

K.2.2 Future Flow Projections

Table 4.K.10 and Table 4.K.11 summarize the projected peak dry weather flow and peak wet weather flow by catchment.

Table 4.K.10 Projected Dry Weather Daily Flow by Catchment

Catchment	2021 Design Peak Dry Weather Flow (L/s)	2026 Design Peak Dry Weather Flow (L/s)	2031 Design Peak Dry Weather Flow (L/s)	2036 Design Peak Dry Weather Flow (L/s)	2041 Design Peak Dry Weather Flow (L/s)
Welland Wastewater Treatment Plant	501.8	518.2	538.9	557.3	572.8
Dailmer Woods Sewage Pumping Station (SPS)	1.3	1.3	1.4	1.4	1.4
Dain City SPS and Detention Facility	14.1	15.7	17.9	28.9	41.2
Feeder Road SPS	7.5	7.9	8.7	9.7	10.9
Foss Road SPS	9.9	13.8	19.0	24.6	31.5
George Street SPS	0.8	0.8	0.8	0.8	0.8
Hurricane Road SPS	12.9	13.6	14.9	16.7	18.2
Kelly Street SPS and Storage Facility	3.8	3.8	3.8	3.8	3.8
Ontario Road SPS	104.5	109.2	116.8	126.2	134.0
Park Lane SPS	0.3	0.3	0.3	0.3	0.3
Seaway Heights SPS	7.2	9.4	11.0	11.8	13.7
South Street SPS	0.0	0.0	0.0	0.0	0.0
Timmsdale Sewage Pumping Station	1.2	1.3	1.3	1.3	1.3
Towpath Road SPS	33.3	53.2	75.4	88.6	102.2
Total	**698.7**	**748.6**	**810.3**	**871.4**	**932.1**

2041 Peak Dry Weather Flow for Seaway Heights Sewage Pumping Station:
= (2014 Average Dry Weather Flow × Peaking Factor) +
(2041 Equivalent Population – 2014 Equivalent Population) × 275 L/cap/day ×
1 day/86400 s × Harmon Peaking Factor for Growth Population
= (2.79 L/s × 2.0) + (3,453 – 2,704 people) × 275 L/cap/day × 1 day/86400 s × 3.39
= 13.7 L/s

Table 4.K.11 Projected Peak Wet Weather Flow by Catchment

Catchment	2021 Design Peak Wet Weather Flow (L/s)	2026 Design Peak Wet Weather Flow (L/s)	2031 Design Peak Wet Weather Flow (L/s)	2036 Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)
Welland Wastewater Treatment Plant	1,190.6	1,207.0	1,227.7	1,246.1	1,261.6
Dailmer Woods Sewage Pumping Station (SPS)	3.3	3.3	3.3	3.4	3.4
Dain City SPS and Detention Facility	43.7	45.3	47.5	58.4	70.7
Feeder Road SPS	23.4	23.9	24.7	25.6	26.9
Foss Road SPS	45.7	49.5	54.8	60.4	67.3
George Street SPS	6.1	6.1	6.1	6.1	6.1
Hurricane Road SPS	46.2	47.0	48.3	50.1	51.5
Kelly Street SPS and Storage Facility	27.0	27.0	27.0	27.0	27.0
Ontario Road SPS	219.0	223.7	231.3	240.7	248.6
Park Lane SPS	3.0	3.0	3.0	3.0	3.0
Seaway Heights SPS	20.5	22.6	24.3	25.0	26.9
South Street SPS	0.0	0.0	0.0	0.0	0.0
Timmsdale Sewage Pumping Station	3.1	3.2	3.2	3.2	3.2
Towpath Road SPS	82.7	102.6	124.8	138.0	151.5
Total	**1,714.3**	**1,764.1**	**1,825.8**	**1,887.0**	**1,947.7**

Note: 25% of the growth catchment area was used in calculation for Feeder Road Sewage Pumping Station design peak wet weather flow due to low equivalent population growth in the catchment.

The following presents an example calculation of projected peak wet weather flow.

2041 Peak Wet Weather Flow for Seaway Heights Sewage Pumping Station:
= 2041 Peak Dry Weather Flow + 2041 Design RDII
= 2041 Peak Dry Weather Flow + (2041 Catchment Area × 0.286 L/s/ha)
= 13.7 L/s + (46.2 ha × 0.286 L/s/ha)
= 26.9 L/s

K.3 Assessment of Wastewater Infrastructure (Existing and Future)

K.3.1 Treatment Plant Capacity

Figure 4.K.3 shows the projected future demands at the Welland Wastewater Treatment Plant. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.

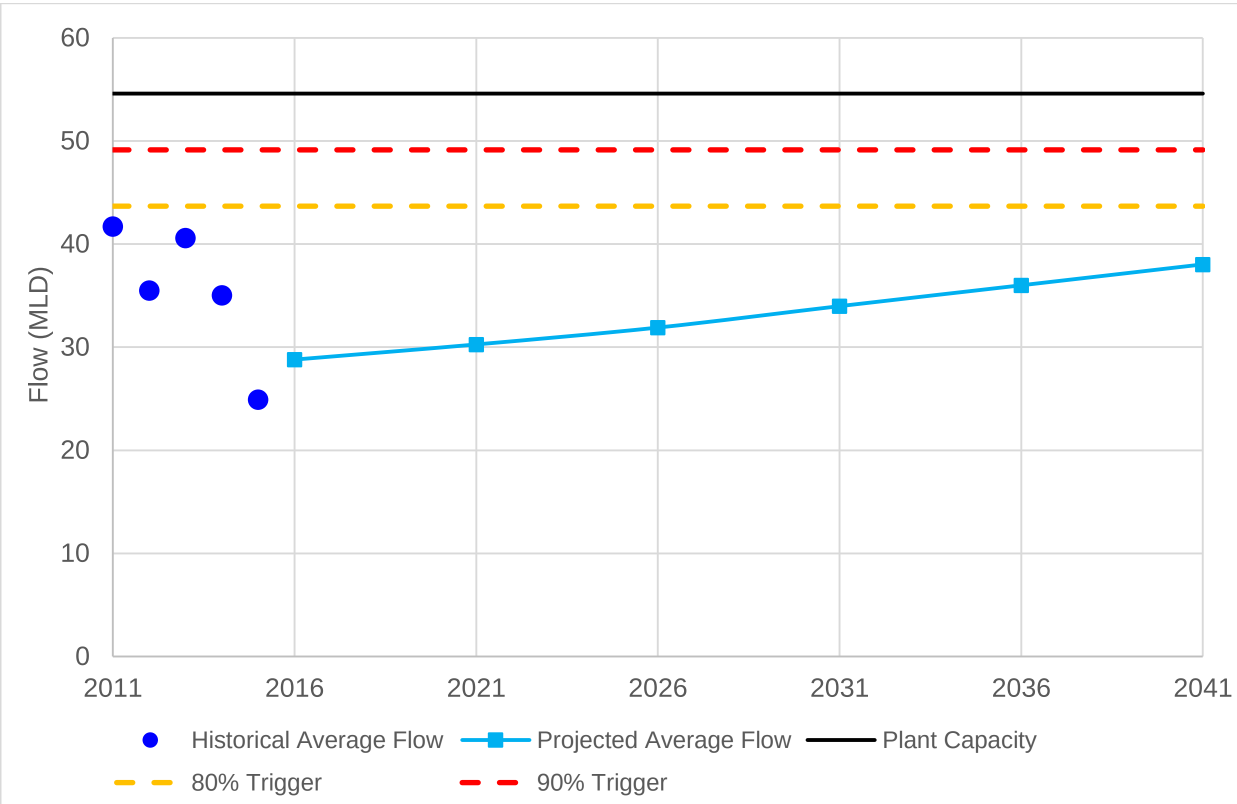


Figure 4.K.3 Projected future demands at Welland Wastewater Treatment Plant

K.3.2 Sewage Pumping Station

Table 4.K.12 highlights the sewage pumping station existing and projected capacity.

Table 4.K.12 System Sewage Pumping Station Performance

Sewage Pumping Station	Contributing Catchments	Facility Operational Capacity (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Timmsdale Sewage Pumping Station (SPS)	Timmsdale SPS	5.0	3.1	3.2	1.8
Towpath Road SPS	Towpath Road SPS	141.7	111.7	199.3	-57.6
Hurricane Road SPS	Hurricane Road SPS	39.0	45.6	51.5	-12.5
Foss Road SPS	Foss Road SPS	26.6	43.3	67.3	-40.7
Feeder Road SPS	Feeder Road SPS	41.0	22.6	26.9	14.1
Seaway Heights SPS	Seaway Heights SPS	65.7	18.8	26.9	38.8
Ontario Road SPS	Ontario Road SPS Dain City SPS	600.0	250.6	311.2	288.8
Dain City SPS	Dain City SPS	94.0	37.7	70.7	23.3
Kelly Street SPS	Kelly Street SPS George Street SPS South Street SPS	34.4	33.1	33.1	1.3
George Street SPS	George Street SPS	8.0	6.1	6.1	1.9
South Street SPS	South Street SPS	8.1	0.0	0.0	8.1
Park Lane SPS	Park Lane SPS	4.0	3.0	3.0	1.0
Dailmer Woods SPS	Dailmer Woods SPS	7.4	3.3	3.4	4.0

The following sewage pumping stations have projected pumping deficits:

- Towpath Road Sewage Pumping Station
- Hurricane Road Sewage Pumping Station
- Foss Road Sewage Pumping Station

K.3.3 Forcemain

Table 4.K.13 highlights the existing and projected forcemain performance.

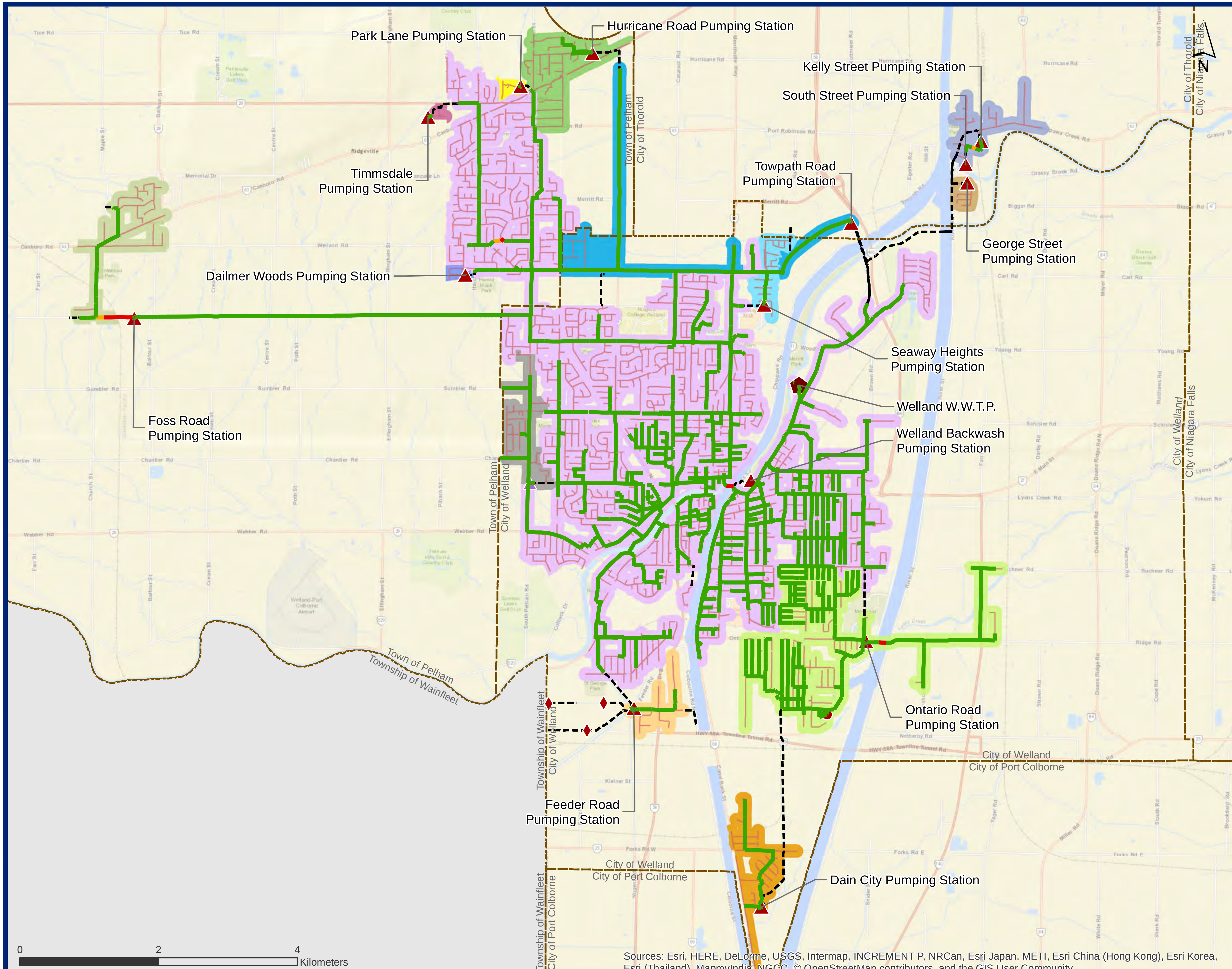
Table 4.K.13 Forcemain Performance

Sewage Pumping Station	Pump Station Operational Capacity (L/s)	Capacity @ 2.5 m/s (L/s)	Existing Design Peak Wet Weather Flow (L/s)	2041 Design Peak Wet Weather Flow (L/s)	2041 Surplus/ Deficit (L/s)
Timmsdale Sewage Pumping Station (SPS)	5.0	19.6	3.1	3.2	16.4
Towpath Road SPS	141.7	1,021.0	111.7	199.3	821.7
Hurricane Road SPS	39.0	122.7	45.6	51.5	71.2
Foss Road SPS	26.6	78.5	43.3	67.3	11.2
Feeder Road SPS	41.0	122.7	22.6	26.9	95.8
Seaway Heights SPS	65.7	176.7	18.8	26.9	149.8
Ontario Road SPS	600.0	706.9	250.6	311.2	395.7
Dain City SPS	94.0	122.7	37.7	70.7	52.0
Kelly Street SPS	34.4	78.5	33.1	33.1	45.4
George Street SPS	8.0	19.6	6.1	6.1	13.5
South Street SPS	8.1	19.6	0.0	0.0	19.6
Park Lane SPS	4.0	19.6	3.0	3.0	16.6
Dailmer Woods SPS	7.4	19.6	3.3	3.4	16.2

All forcemains have a projected surplus capacity.

K.3.4 Trunk Sewer

Figure 4.K.4 and Figure 4.K.5 highlight the existing and projected peak wet weather flow, respectively. Trunk sewers upstream of Foss Road Sewage Pumping Station ad Towpath Road Sewage Pumping Station are approaching capacity within the 2041 time horizon.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Welland W.W.T.P.
- Dailmer Woods
- Dain City
- Feeder Road
- Foss Road
- George Street
- Hurricane Road
- Kelly Street
- Ontario Road
- Park Lane
- Seaway Heights
- Timmsdale
- Towpath Road
- 283000012 (Private)

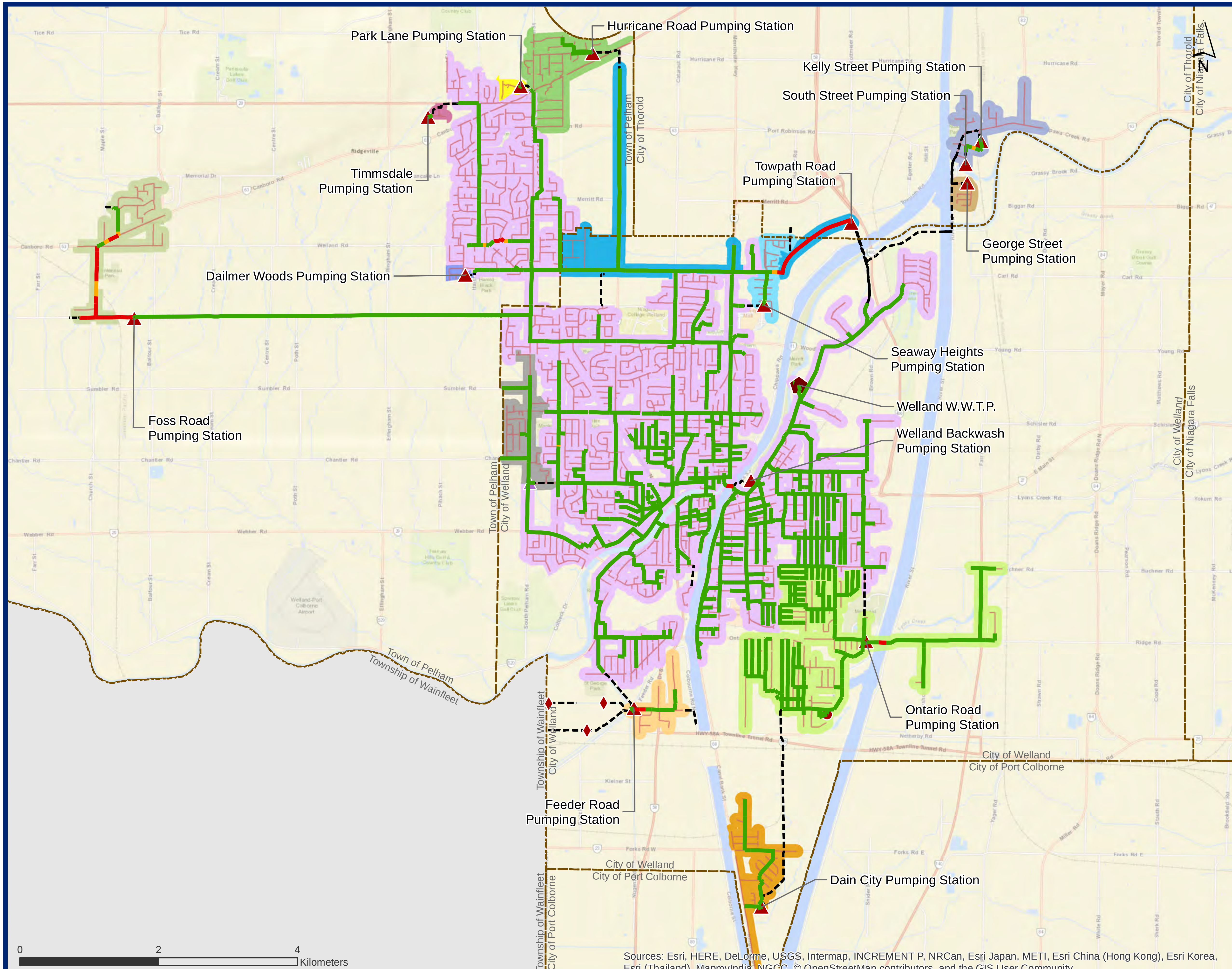
Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.K.4
Existing Peak Wet Weather Flow
Welland WWTP

GM BluePlan ENGINEERING

June 2017
715023-WW-4-Existing Wet Weather (Welland)
NAD 1983 UTM Zone 17N



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Sanitary Sewers
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Welland W.W.T.P.
- Dailmer Woods
- Dain City
- Feeder Road
- Foss Road
- George Street
- Hurricane Road
- Kelly Street
- Ontario Road
- Park Lane
- Seaway Heights
- Timmsdale
- Towpath Road
- 283000012 (Private)

Capacity (d/D)

- < 0.85
- 0.85 - 0.99
- > 1.00

Figure 4.K.5
2041 Peak Wet Weather Flow
Welland WWTP

GM BluePlan Engineering

June 2017
715023-WW-5-2041 Wet Weather (Welland)
NAD 1983 UTM Zone 17N

K.4 System Opportunities and Constraints

Figure 4.K.6 highlights the existing opportunities and constraints.

K.4.1 Welland Wastewater Treatment Plant

- The current rated average daily flow capacity of the plant is 54.6 MLD, with an existing flow of 28.8 MLD and a projected average daily flow of 37.9 MLD, which is at 80% of the wastewater treatment plant rated capacity. The wastewater treatment plant has surplus capacity to accommodate growth to 2041.

K.4.2 Welland

- Significant residential and employment growth consisting of infill and greenfield development within existing urban boundary.
- Growth related and wet weather capacity deficits at Towpath Sewage Pumping Station.
- Significant areas of high wet weather flows and system overflows, which will need to be managed to allow for growth.
- Majority of existing sewer network has capacity to meet design criteria wet weather flows; however, actual wet weather flows exceed sewer capacity in several areas.
- Welland River and Welland Canal siphon crossing present ongoing operational issues
- Additional trunk capacity on Quaker Road to support existing and growth flows from Pelham system.

K.4.3 Pelham

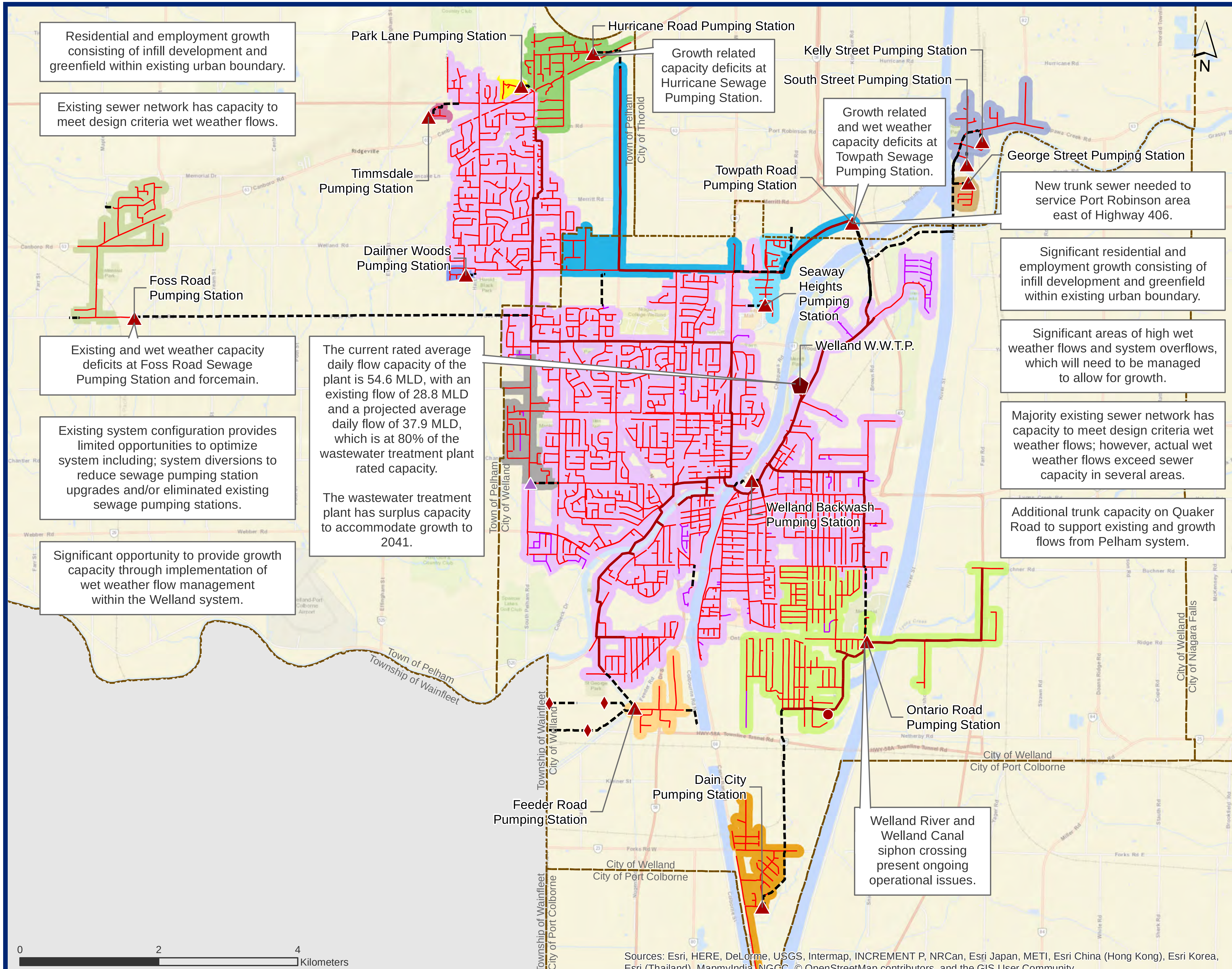
- Residential and employment growth consisting of infill and greenfield development within existing urban boundary.
- Growth related capacity deficits at Hurricane Sewage Pumping Station.
- Existing and wet weather capacity deficits at Foss Road Sewage Pumping Station and forcemain.
- Existing sewer network has capacity to meet design criteria wet weather flows.

K.4.4 Port Robinson – Thorold System

- Significant residential and employment growth consisting of infill and greenfield development within the Port Robinson area.
- New trunk sewer under Highway 406 required to service the Port Robinson growth area.
- Growth related and wet weather capacity deficits at Towpath Sewage Pumping Station.

K.4.5 System Optimization Opportunities

- Existing system configuration provides limited opportunities to optimize system including; system diversions to reduce sewage pumping station upgrades and/or eliminated existing sewage pumping stations.
- Significant opportunity to provide growth capacity through implementation of wet weather flow management within Welland system.



Niagara Region

2016 MASTER SERVICING PLAN

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations

- Regional
- Municipal
- Private

Wastewater Network

- Regional
- Local
- Private
- Forcemain

Wastewater Catchments*

*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Welland W.W.T.P.
- Dailmer Woods
- Dain City
- Feeder Road
- Foss Road
- George Street
- Hurricane Road
- Kelly Street
- Ontario Road
- Park Lane
- Seaway Heights
- Timmsdale
- Towpath Road
- 283000012 (Private)

Figure 4.K.6

System Opportunities and Constraints

Welland WWTP

GM BluePlan ENGINEERING

June 2017

715023-WW-3-Opportunities and Constraints (Welland)

NAD 1983 UTM Zone 17N

K.5 Assessment of Alternatives

No further alternative beyond application the hybrid management strategy below were identified.

- Providing capacity within Regional pumping stations and trunk sewers to convey peak wet weather flows up to the design criteria of 0.286 L/s/ha.
- Provide upstream flow management and peak flow management to address peak flows in systems where peak wet weather flows exceed the design criteria of 0.286 L/s/ha resulting in potential basement flooding and overflow risks.

K.6 Preferred Servicing Strategy

The following is a summary of the Welland wastewater servicing strategy, presented in Figure 4.K.7 and Figure 4.K.8:

- The Welland Wastewater Treatment Plant has sufficient capacity to support growth to year 2041.
- Due to the projected growth in the Fenwick area, additional pumping station and forcemain capacity is required.
- Additional capacity is required at the Hurricane Road Sewage Pumping Station and Towpath Sewage Pumping Station.
- Additional conveyance capacity under Highway 406 at the Towpath Sewage Pumping Station is required to support growth.
- The wet weather management program within the core areas of Welland and within the combined sewer systems is required to support growth and minimize infrastructure costs within the built boundary.

K.6.1 Pumping Stations

The following sewage pumping station upgrades are required:

- Foss Road Sewage Pumping Station upgrade: Increase capacity from 27 L/s to 76 L/s, and forcemain upgrade to 250 mm.
- Towpath Sewage Pumping Station pump replacement: Increase capacity from 150 L/s to 300 L/s.
- Hurricane Road Sewage Pumping Station upgrade: Increase capacity from 39 L/s to 52 L/s.

K.6.2 Trunk Sewers

The following trunk sewers are required:

- Highway 406 from Towpath Sewage Pumping Station to south end of Kottmeier Road in Thorold – 600 mm
- Quaker Road between Pelham Street and Rice Road – 600 mm

K.6.3 Wet Weather

A significant element of the Niagara Region wastewater servicing strategy is the wet weather management program. The program is intended to deal with existing capacity constraints, and to provide for growth-related capacity without expanding/upgrading existing trunk infrastructure, or by minimizing the required expansion/upgrade.

The wet weather management program currently identifies overall preliminary priority, staging of location and target amount of inflow and infiltration reduction across all systems. This program provides for a proactive and targeted approach to addressing wet weather impacts. These wet weather management programs will need to be a joint initiative between the Region and local municipalities.

For the Welland system, the following priority areas are identified:

- Central Welland on the east and west sides of the Welland River within the Welland Wastewater Treatment Plant catchment.

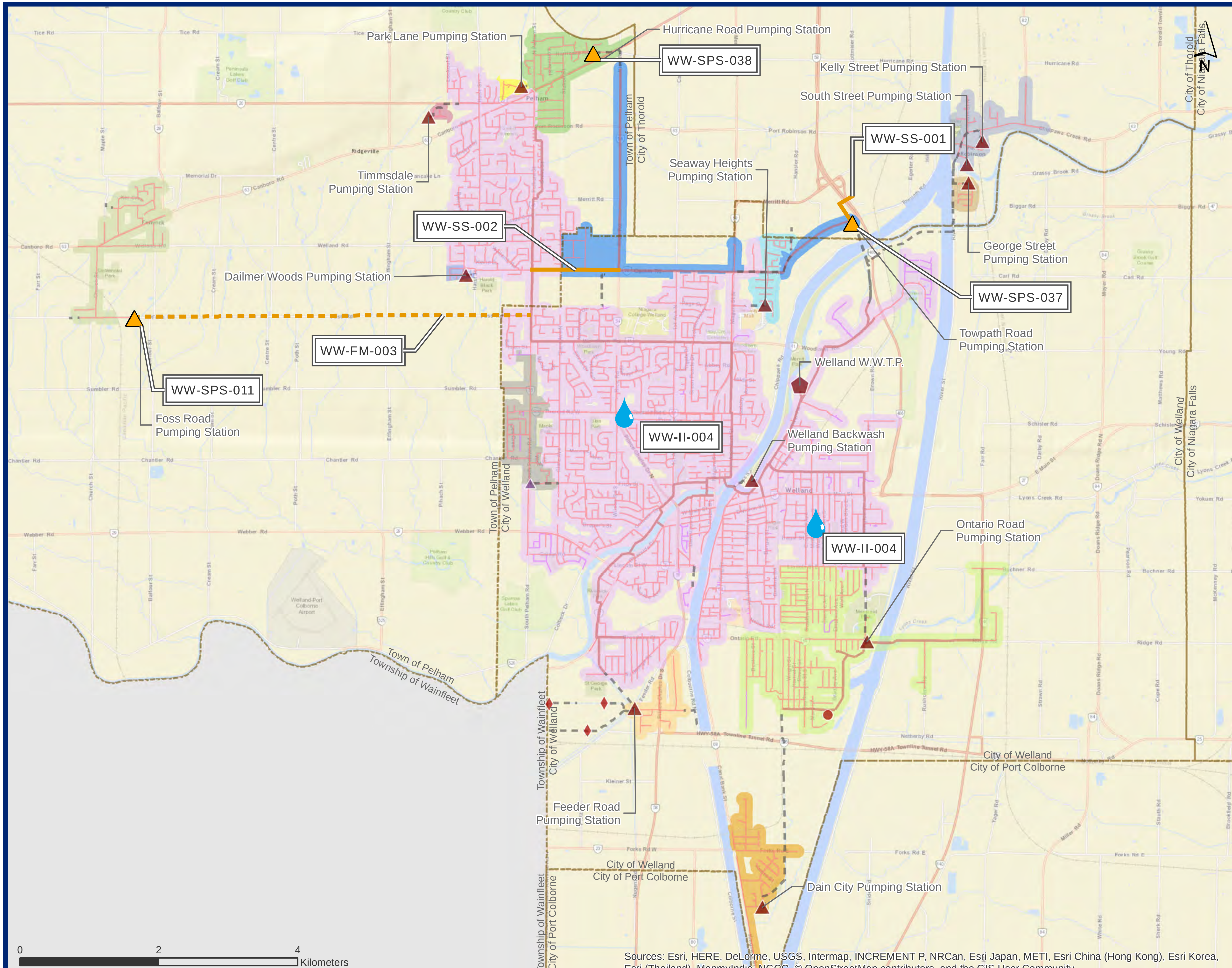
Further flow monitoring and area-specific wet weather flow studies, including Pollution Prevention Control Plan, Inflow and Infiltration Study, Intensification Studies, Preferred Servicing Strategy are needed to identify area specific strategies and projects required to achieve the wet weather flow reduction objectives. Following the outcomes of the further studies, targeted funding can be applied outside the priority areas if the projects are found to address capacity issues and support growth capacity needs.

K.7 Capital Program

Table 4.K.14 summarizes the recommended project costing, implementation schedule and Class EA requirements.

K.7.1 Schedule B Project Files

Project files for Municipal Class Schedule B Environmental Assessment are attached in Appendix 1.



Niagara Region

2016 MASTER SERVICING PLAN

MSP Wastewater Projects

- Treatment Plant
- Pumping Station
- Wet Weather Reduction
- Sanitary Sewer Projects
- Forcemain Projects

Wastewater Facilities

- Wastewater Treatment Plant
- Combined Sewage Detention Facility
- Lagoon
- Odour Control Facility
- Leachate Pumping Station

Pumping Stations
- Regional
- Municipal
- Private

Wastewater Network
- Regional
- Private
- Local
- Forcemain

Wastewater Catchments*

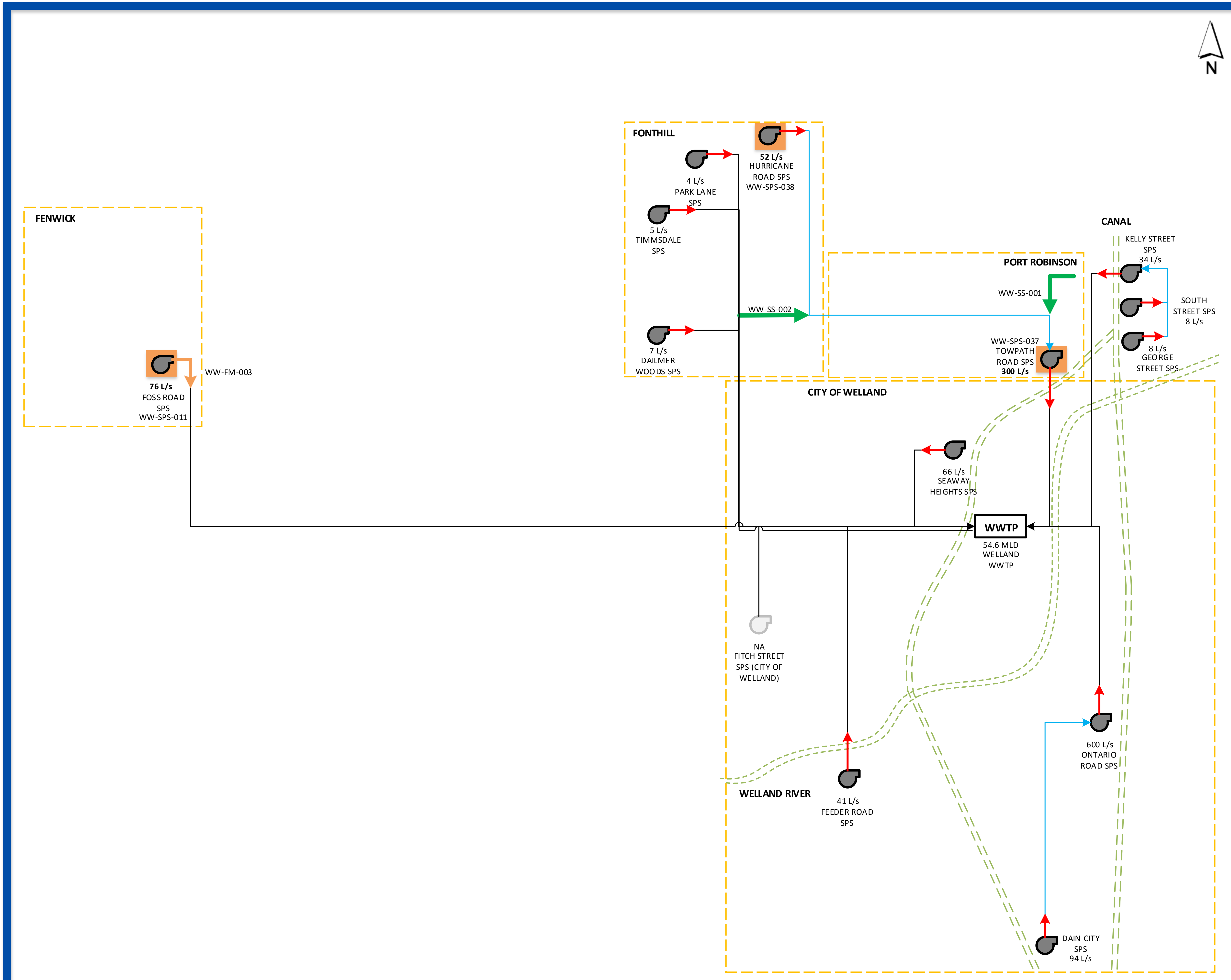
*Catchment limits are shown based on property boundaries and are within 100 m of sewers.

- Welland W.W.T.P.
- Dailmer Woods
- Dain City
- Feeder Road
- Foss Road
- George Street
- Hurricane Road
- Kelly Street
- Ontario Road
- Park Lane
- Seaway Heights
- Timmsdale
- Towpath Road
- 283000012 (Private)

Figure 4.K.7
Preferred Wastewater Strategy
Welland WWTP

GM BluePlan ENGINEERING

June 2017
715023-WW-6-Capital Projects (Welland)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Welland WWTP

2041 COLLECTION SCHEMATIC

WWTP RATED CAPACITY	Wastewater Treatment Plant
FIRM CAPACITY	Sewage Pumping Station
	Forcemain
	Connection from SPS to SPS
	Connection from SPS to WWTP
	Facility Upgrade
	New Facility
	Upgrade Forcemain or Sewer
	New Forcemain or Sewer
	Decommission Project

June 2017
Figure 4.K.8
Not to Scale

BluePlan ENGINEERING

Table 4.K.14 Summary of Welland Wastewater Capital Program

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
WW-FM-003	Upgrade Foss Road Sewage Pumping Station (SPS) Forcemain	Upgrade Foss Road SPS Forcemain in Welland	250 mm	2022-2031	Pelham	A+	Satisfied	Forcemain	$4,500,000
WW-II-004	Wet weather reduction in Central Welland	Wet weather reduction in Central Welland	200 L/s reduction	2022-2031	Welland	N/A	Dependent on outcome of wet weather flow study	Wet Weather Reduction	$30,000,000
WW-SPS-011	Foss Road SPS Upgrade - Welland	Increase station capacity from 27 L/s to 76 L/s	76 L/s	2022-2031	Pelham	B	Satisfied	Pumping	$1,866,000
WW-SPS-037	Towpath SPS Pump Replacement - Welland	Increase station capacity from 150 L/s to 300 L/s with addition of a third 150 L/s pump.	300 L/s	2022-2031	Thorold	A+	Satisfied	Pumping	$834,000
WW-SPS-038	Huricane Road SPS Pump Replacement - Welland	Increase station capacity from 39 L/s to 52 L/s	52 L/s	2022-2031	Pelham	A+	Satisfied	Pumping	$1,250,000
WW-SS-001	Highway 406 Trunk Sewer Crossing	New trunk sewer crossing of HWY 406 between Merritt Rd and recreational waterway in Thorold to support development of the Port Robinson West area.	600 mm	2017-2021	Thorold	A+	Satisfied	Pumping	$1,450,000
WW-SS-002	Quaker Road Trunk Sewer	New sewer on Quaker Rd. between Pelham Street trunk and Rice Road trunk sewers.	600 mm	2022-2031	Welland	A+	Satisfied	Pumping	$1,725,000
Total									**$41,625,000**