Notice of Comments Received

Following Completion of the Public Review Period

The Regional Municipality of Niagara filed the 2021 Water and Wastewater Master Servicing Plan Update report for the 45-day public review period From Thursday June 22, 2023 to Monday August 7, 2023.

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 2021 Water and Wastewater Master Servicing Plan Update include the following:

Volume 3

Modifications to table headings for the Comparison of Alternatives including Table 3.A.12, Table 3.B12, Table 3.E.12, and Table 3.F.12 to identify the Preferred Alternative within the table heading.

Figure captions were updated to address numbering and naming inconsistencies.

Volume 4

Text updated in Section 4.1.6 to address formatting error.

Text updated in Part A: Figure 4.A.2, Table 4.A.3, Table 4.A.8, Table 4.A.9, Section A.6.2, Table 4.A.10, to update the operational firm capacity for Biggar Lagoon.

Text updated in Part A: Table 4.A.3 and Table 4.A.9 to revise the Smithville SPS forcemain diameter.

Text updated in Part B: Table 4.B.8 to revise the PDWF for Cole Farm SPS.

Figure captions were updated to address numbering and naming inconsistencies.

Volume 5

Record of consultation dates updated.

Contact list updated in Appendix B.

Regional Municipality of Niagara
2021 Water and Wastewater Master Servicing Plan Update
Public Review Period Consultation Summary and Records

Date Received (MM/DD/YYYY)	Contact Name / Organization	Comment	Response / Action	Response Date (MM/DD/YYYY)	Status	Related ESR Updates
6/1/2023	Newspaper Ads	Notice of Study Completion and Public Review ads appearing in newspapers.	- No action required	N/A	Complete	- Record of consultation provded in Volume 5
6/20/2023	Project Study Contact List	Notice of Study Completion sent by GM BluePlan on behalf of Niagara Region to project stakeholders (see Appendix V4.2 Contact List) using mass email newsletter.	- No action required	N/A	Complete	- Record of consultation provded in Volume 5
6/20/2023	Niagara Peninsula Energy	Niagara Peninsula Energy acknowledged receipt of Notice of Study Completion.	- No action required	N/A	Complete	- Record of consultation provded in Volume 5
6/22/2023	Indigenous Groups	Reminder email sent from GMBP to the following indigenous groups separate from mass email to notify them that the document is available for review from June 22 to August 7. - Haudenosaunee Development Institute (HDI) - Mississaugas of the Credit First Nations (MCFN) - Six Nations of the Grand River (SNGR)	- No action required	6/22/2023	Complete	- Record of consultation provded in Volume 5
6/27/2023	[redacted] (Resident)	**Resident brought up the following concerns:** - Potential underestimation of future sewage flow from Stevensville-Douglastown Lagoons, the new Spring Creek Estates development, and major commercial development in the Netherby and Townline Rd area of Fort Erie. - Sewage redirection from Stevensville-Douglastown lagoons being reconsidered after being identified as not practical or cost effective in the 2016 MSPU. **Resident inquired about the following:** - Is directing sewage from the Stevensville-Douglastown lagoons to the new SNF WWTP practical and cost effective or not? Resident provided estimate for amount of sewage projected to flow from the proposed commercial development in the Towline and Netherby roads area into the Stevensville-Douglastown sewage lagoons to assist in available capacity projections for the sewage lagoons.	- Region responded with information on growth projections, analysis and evaluation process for the Stevensville and Douglastown lagoons and the recommended projects to be undertaken as a result of the Master Servicing Plan	11/10/2023	Complete	- No further action required.
6/29/2023	[redacted] (Resident)	**Resident brought up the following concerns:** - Trouble accessing documents from project website for review.	- Project Manager (Ilija S.) was able to direct [redacted] (Resident) to download the appropriate document.	6/29/2023	Complete	- Record of consultation provded in Volume 5
7/7/2023	Mr. Moir (Urbantech)	Mr. Moir reached out via contact form on the project website and inquired about the northern reach property in the Town of Welland and wanted to speak about existing sewer capacity at area pump stations.	- Project Manager (Ilija S.) directed Mr. Moir to download and review the project web page and documents	7/10/2023	Complete	- No further action required.
7/31/2023	MECP Project Review Unit	The project team received detailed MECP Project Review Unit comments (see below)	- Documents were revised after the review period based on comments received. See notes below.	N/A	Complete	- See notes below
7/31/2023	MECP Project Review Unit Comment 1	**Volume 4 (Wastewater Master Servicing Plan Update) - Introduction, Section 4.1.6** -Grammatical errors where a space should be added in between the words in bold and the rest of the bullet point. For example, there should be a space between "Strategy and "Without" on the second bullet point of this section.	- Section 4.1.6 updated to address formatting concerns.	N/A	Complete	- Text updated in Section 4.1.6 to address formatting errors
7/31/2023	MECP Project Review Unit Comment 2	**Appendix V5-B (Public and Agency Consultion)** Shareholder Contact List in Volume 5 of the MSP should be revised to have the correct titles for stakeholders. In this case Joan Del Villar Cuicas of the MECP is mislabeled as 'Project Information Form - Online Submission" and should be revised to Regional Environmental Planner. The table should be reviewed to ensure there are no other errors.	- Contact list list updated in Volume 5, Appendix B.	N/A	Complete	- Contact list updated in Volume 5, Appendix B
7/31/2023	MECP Project Review Unit Comment 3	**Volume 3 (Comparison of Alternatives)** It is recommended that the identified preferred alternative is labeled on Tables 3.A.12, 3.B.12, 3.C.12, 3.D.12, 3.E.12, and 3.F.12 Comparison of Alternatives in Volume 3 of the MSP.	- Tables 3.A.12, 3.B.12, 3.E.12, and 3.F.12 updated to identify the preferred alternative.	N/A	Complete	- Tables 3.A.12, 3.B.12, 3.E.12, and 3.F.12 updated (Parts C and D do not have a Comparison of Alternatives table - text only)
7/31/2023	MECP Project Review Unit Comment 4	**Volume 5 (Indigenous Engagement)** The proponent should continue to document communication with all communities that have been engaged with as the Class EA proceeds.	- No further action required.	N/A	Complete	- Record of consultation provded in Volume 5
7/31/2023	MECP Project Review Unit Comment 5	Please note that it is the responsibility of the proponent to ensure that Species at Risk (SAR) are not killed, harmed, or harassed, and that their habitat is not damaged or destroyed through the proposed activities to be carried out on the site. If the proposed activities cannot avoid impacting protected species and their habitats, then the proponent will need to apply for an authorization under the Endangered Species Act (ESA). As is noted in the Report, if the proponent believes that their proposed activities are going to have an impact or are uncertain about the impacts, they should contact SAROntario@ontario.ca to undergo a formal review under the ESA.	- No further action required.	N/A	Complete	- Record of consultation provded in Volume 5
8/4/2023	Robert Babic (Crozier Consulting Engineers)	Crozier Consulting Engineers provided comments related to the Stevensville Secondary Plan area and the Douglas Town-Black Creek Secondary area plans servicing strategy and concerns and indicated this is a continued and ongoing effort to further discussion regarding development and servicing of these lands. The letter included a request to be included in updates and discussions related to recommendations and preferred strategies to be undertaken by the Region.	- Region responded noting reccomendation in the MSP Update were based on the best available planning information and that capacity needs will be reevaluated as new development application are projected. The Region noted Crozier requested to be included in updates and discussions related to recommendation and preferred strategies undertaken within the Stevensville Secondary Plan and Douglastown Black Creek Secondary Plan areas.	11/10/2023	Complete	- No further action required.

Date Received (MM/DD/YYYY)	Contact Name / Organization	Comment	Response / Action	Response Date (MM/DD/YYYY)	Status	Related ESR Updates
8/10/2023	Livia McEachern (City of Welland)	City of Welland provided comments from City staff requesting responses and supplemental information. 1) There are Regional projects identified in Welland's 2020 PPCP & MSP Update that were not identified in the Regional MSP Update. Those projects include: Dain City SPS Storage Optimization Woodlawn Trunk Sewer Upgrade Can staff provide some clarification as to why these projects were not identified in the Regional study? 2) The Ontario Rd Sewer upgrade identified in the City 2020 PPCP & MSP meets the requirements of a Regional Wastewater Trunk Main as identified in the Niagara Region's Development Charges Background Study Appendix E: Local Service Policy. Regional trunk mains are defined by having 170 l/s or more DWF. This upgrade was not identified in the Regional MSP. When investigated more closely though the City's Commercial Street MSP the following DWF were calculated for the Ontario Rd Sewer upgrade: - Ontario Rd – Southworth to Empress – 172 l/s - Ontario Rd – Empress to Ontario Rd SPS – 205 l/s Can staff provide some clarification as to why this project was not identified in the Regional study? 3) There were low pressures identified in the Hunter's Point Area. Can staff confirm if the water analysis incorporated the Hunter's Point Booster Station?	- Comprehensive response provided to address comments and will form part of the communication record. - Input was incorporated in final document preparation.	10/17/2023 and 11/10/2023	Complete	- Provided collaborative response that will form part of the communication document included in the final MSP.
8/16/2023	Mr. Moir (Urbantech)	Mr. Moir reached out to request a meeting to get clarification on items from the MSP as it relates to the towpath pump station (WW-SPS-037).	- Region provided clarification on question related to the towpath pump station site. - Region formally met with Urbantech to discuss the related questions.	9/18/2023	Complete	- No further action required.
9/6/2023	Project Team	Received comments regarding clarification around average and peak flows for the Cole Farm SPS.	- GMBP response provided to Region on 9/8/2023 indicating pump start/stop levels are causing an artificial increase in peak flows but the station wasn't flagged for any capacity issues.	N/A	Complete	- See below for adjustments made within the MSPU documentation
9/18/2023	Project Team	Received comments regarding Cole Farm SPS flows and Biggar Lagoon operational firm capacity Email from Ilija: Here, I have two corrections to incorporate: Cole Farm SPS – PDWF 14 L/s based on the upstream pipe segment. This is very similar to the flow numbers from Glenn; Biggar Lagoon – Operational firm capacity is 74 L/s instead of 54 L/s; If you know of any other correction that would prevent additional questions and confusion, please feel free to make it and let us know.	- Text updated in Part A: Figure 4.A.2, Table 4.A.3, Table 4.A.8, Table 4.A.9, Section A.6.2, Table 4.A.10, to update the operational firm capacity for Biggar Lagoon. - Text updated in Part A: Table 4.A.3 and Table 4.A.9 to revise the Smithville SPS forcemain diameter. - Text updated in Part B: Table 4.B.8 to revise the PDWF for Cole Farm SPS.	N/A	Complete	- Text updated in Part A: Figure 4.A.2, Table 4.A.3, Table 4.A.8, Table 4.A.9, Section A.6.2, Table 4.A.10, to update the operational firm capacity for Biggar Lagoon. - Text updated in Part A: Table 4.A.3 and Table 4.A.9 to revise the Smithville SPS forcemain diameter. - Text updated in Part B: Table 4.B.8 to revise the PDWF for Cole Farm SPS.

Niagara Region

2021 Water and Wastewater
Master Servicing Plan Update

Volume 3 – Water Master Servicing Plan Update

Final Report

December 5, 2023

Niagara Region is committed to reviewing its practices, processes and the built environment for barriers to access for persons with disabilities. If you require additional or other formats for communicating the details of the appendices in this attached report, please contact the project team at niagaramspu@niagararegion.ca

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TABLE OF CONTENTS

List of Figures

List of Tables

Volume 3 Parts

PART A	GRIMSBY WATER SYSTEM
PART B	DECEW WATER SYSTEM
PART C	NIAGARA FALLS WATER SYSTEM
PART D	FORT ERIE WATER SYSTEM
PART E	PORT COLBORNE WATER SYSTEM
PART F	WELLAND WATER SYSTEM

LIST OF ABBREVIATIONS

Acronym	Definition
2016 MSPU	2016 Water and Wastewater Master Servicing Plan Update
ANSI	Areas of Natural and Scientific Interest
BOD	Biochemical Oxygen Demand
BPS	Booster Pumping Station
CSO	Combined Sewer Overflow
CT	Contact Time
DFO	Department of Fisheries and Oceans Canada
EA(A)	Environmental Assessment (Act)
ECA	Environmental Compliance Assessment
ESR	Environmental Study Report
ET	Elevated Tank
FF	Fire Flow
GGH	Greater Golden Horseshoe
HADD	Harmful Alterations, Disruption, or Destruction of Fish Habitat
HCA	Hamilton Conservation Authority
HDI	Haudenosaunee Development Institute
HGL	Hydraulic Grade Line
I/I	Inflow and Infiltration
L/c/d	Litres per capita per day
L/e/d	Litres per employment per day
L/s/ha	Litres per second per hectare
LAM	Local Area Municipality
MCP	Master Community Plan
MCFN	Mississaugas of the Credit First Nation
MDD	Max Day Demand
MEA	Municipal Engineers Association
MECP	Ministry of the Environment, Conservation and Parks
MLD	Million Litres per Day
MMAH	Ministry of Municipal Affairs and Housing
MNRF	Ministry of Natural Resources and Forestry
MOE	Ministry of the Environment
MOECC	Ministry of the Environment and Climate Change
MSPU	Master Servicing Plan Update
NEP	Niagara Escarpment Plan
NOTL	Niagara-On-The-Lake

Acronym	Definition
NPCA	Niagara Peninsula Conservation Authority
NRW	Non-Revenue Water
OP	Official Plan
ORMCP	Oak Ridges Moraine Conservation Plan
PHD	Peak Hour Demand
PIC	Public Information Centre
PPCP	Pollution Prevention Control Plan
PPS	Provincial Policy Statement
PRV	Pressure Reducing Valves
PWC	Public Works Committee
PWWF	Peak Wet Weather Flow
QEW	Queen Elizabeth Way
SARA	Species at Risk Act
SCADA	Supervisory Control and Data Acquisition
SD	Stevensville-Douglastown
SNGR	Six Nations of the Grand River
SOGR	State of Good Repair
SPS	Sanitary Pumping Station
TAZ	Traffic Analysis Zones
TRC	Total Residual Chlorine
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

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, feedermains, 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 2051.

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 and sustainability with the protection and preservation of natural, environmental and heritage resources, Niagara Region initiated a Water and Wastewater Master Servicing Plan Update.

The 2021 Master Servicing Plan Update (MSPU) has completed a review, evaluation and development of growth-related water and wastewater servicing strategies, with consideration of sustainability requirements for the existing infrastructure, for all servicing within the urban areas of the Region. The 2021 MSPU uses updated population and employment growth forecasts based on a 2051 planning horizon, and accounts for changes in regulatory and legislative requirements. The 2021 MSPU addresses all Regional infrastructure within the urban areas for all Local Municipalities excluding the Township of Wainfleet.

Through this update of the Master Servicing Plan, the Region has highlighted the need to integrate the MSPU growth-related program with the Region's sustainability program intended to address the condition and performance of the existing infrastructure. The MSPU servicing strategies are based on the need to maintain appropriate levels of service throughout the systems and acknowledges that investment will be needed to support operations, maintenance, staff, and other resources related to maintaining the existing systems and facilities in a state of good repair and performance.

The 2021 MSPU builds on previous work undertaken as part of the 2016 Master Servicing Plan and previous long term infrastructure planning studies. The 2021 MSPU 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 2051, along with consideration for post-2051 growth.

The Study Area for the 2021 MSPU 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. The study area is presented in **Figure 1.1.**

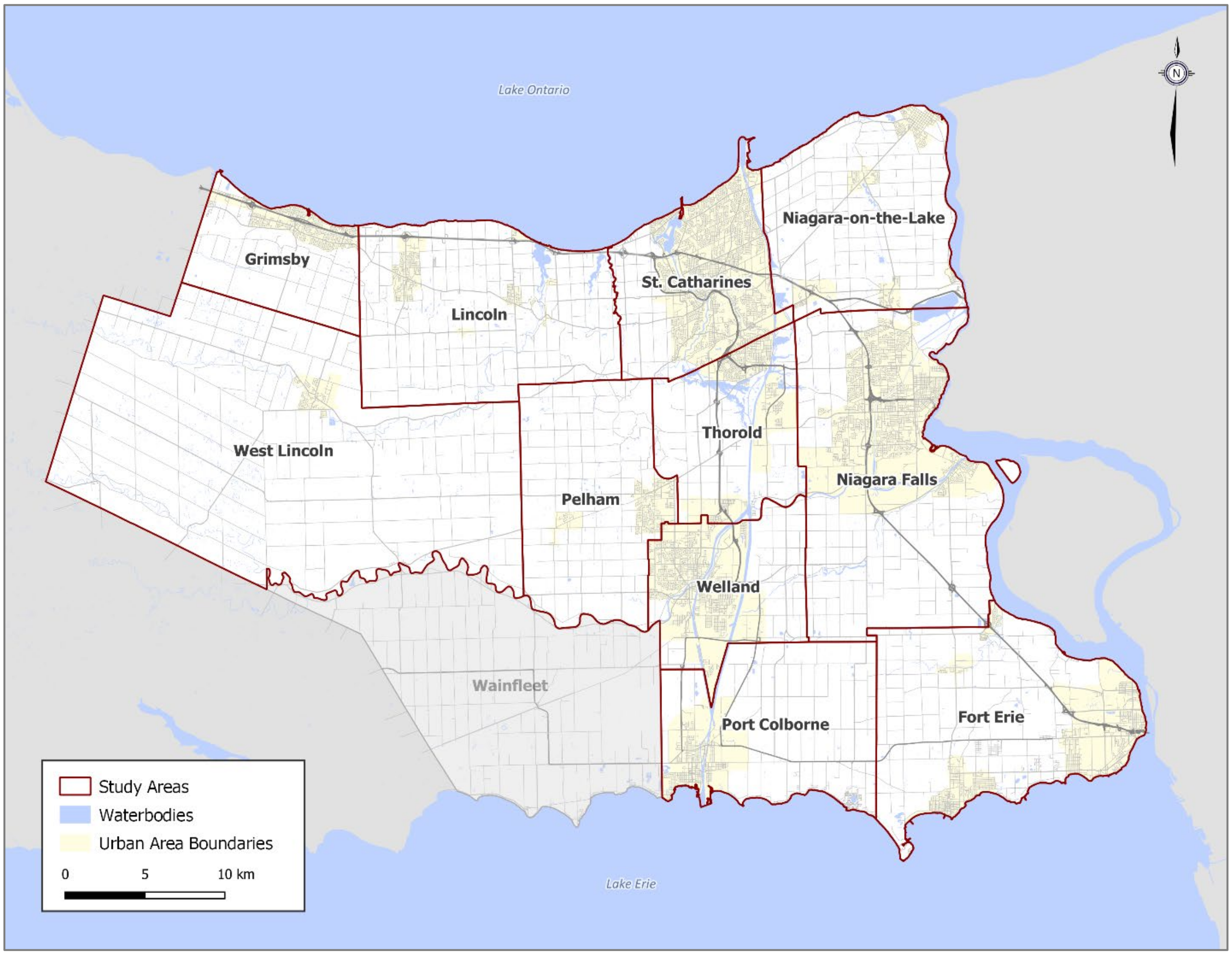


Figure 1.1 Study Area

Through this update of the Master Servicing Plan, the Region has highlighted the need to integrate the MSPU growth-related program with the Region's sustainability program intended to address the condition and performance of the existing infrastructure. The MSPU servicing strategies are based on the need to maintain appropriate levels of service throughout the systems and acknowledges that investment will be needed to support operations, maintenance, staff, and other resources related to maintaining the existing systems and facilities in a state of good repair and performance. The 2021 MSPU focuses on growth-related infrastructure needs and does not include a comprehensive assessment of the state of existing infrastructure. Details regarding asset management of existing water and wastewater infrastructure can be found in the Region’s Corporate Asset Management Plan 2021.

The 2021 MSPU builds on previous work undertaken as part of the 2016 Master Servicing Plan and previous long term infrastructure planning studies. The 2021 MSPU 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 2051, along with consideration for post-2051 growth.

1.2 Integrated Planning Process

The Niagara Region is proactively planning to facilitate the anticipated growth for a total of 694,000 people and 272,000 jobs by 2051 in an integrated process that includes the Niagara Official Plan, 2022 Development Charges Background Study and By-Law Update, and the 2021 Water and Wastewater Master Servicing Plan Update (2021 MSPU). These strategic projects are aligned and interconnected to collectively form the foundation to support and foster Niagara's anticipated growth.

1.2.1 Region Official Plan Update (2022)

As part of the Niagara Official Plan, the Region completed extensive background review, consultation, and supporting studies which resulted in policies and mapping to managing growth and the economy, protecting the natural environment, resources, and agricultural land, and providing infrastructure.

On November 4, 2022, the Minister of Municipal Affairs and Housing approved the Niagara Official Plan, with modifications. This approval helps the Niagara Region prepare for the anticipated population of 694,000 people and 272,000 jobs by 2051. Through the Niagara Official Plan and working with the local area municipalities, it helps provide more housing and jobs within the region.

The anticipated growth out to 2051 from the Niagara Official Plan process was utilized in the 2021 MSPU to determine the required water and wastewater growth capital projects.

1.2.2 Niagara Region's Development Charges Background Study and By-Law Update

The estimated capital costs of the recommended growth capital projects in the 2021 MSPU over the 30-year forecast period were included in the 2022 Development Charges Background Study and By-law. The 2022 Development Charges By-law was approved by Regional Council on August 25, 2022 and took effect on September 1, 2022.

1.2.3 Water and Wastewater Master Servicing Plan (MSP)

The 2021 MSPU is a critical component in the Region's planning for growth and provides the framework and vision for the water and wastewater servicing needs for the service areas of the Region to 2051. The 2021 MSPU evaluates the ability of the existing and planned water and wastewater infrastructure to continue to efficiently and effectively service the Region's existing users, service anticipated growth, and to evaluate and develop recommended strategies. This included having consideration for Regional water and wastewater infrastructure to be aligned with the urban expansion and intensification areas identified in the Niagara Official Plan review. Additionally, the potential impacts of estimated growth beyond 2051 was considered due to the longer useful life of some components of the water and wastewater infrastructure assets.

1.3 Master Servicing Plan Update Objectives

The 2021 MSPU comprehensively documents the development, evaluation, and selection of the preferred water and wastewater servicing strategies to meet the servicing needs of both existing users and future development to 2051.

The 2021 MSPU evaluates the ability of existing and planned water and wastewater infrastructure in Niagara Region to efficiently and effectively service the Region's existing users and anticipated growth, and to evaluate and develop recommended servicing strategies.

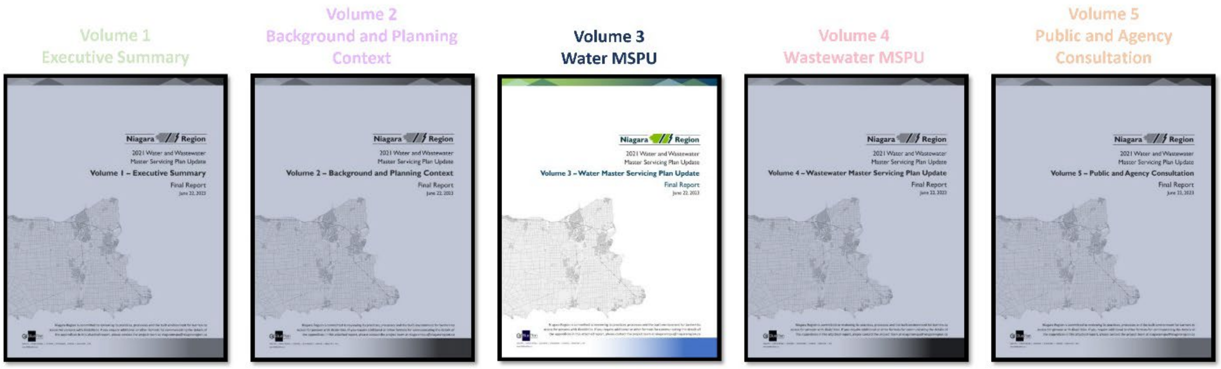
The key objectives of the 2021 MSPU are as follows:

- Review planning forecasts to 2051 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:
    - Maintaining appropriate level of service to existing users and providing the same level of service for approved growth
    - Operational flexibility, system security, and system 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 Update Report Outline

The 2021 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 2021 MSPU documentation is organized into five volumes as illustrated in the following Figure and as described below:



Volume 1
Executive Summary

Volume 2
Background and Planning Context

Volume 3
Water MSPU

Volume 4
Wastewater MSPU

Volume 5
Public and Agency Consultation

Figure 1.2 Master Servicing Plan Update Documentation

1.4.1 Volume 1 – Executive Summary

Volume 1 provides a brief overview of the 2021 MSPU. It summarizes the information contained in Volumes 2, 3, 4, and 5, including the 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).

1.4.2 Volume 2 – Background and Planning Context

Volume 2 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.

1.4.3 Volume 3 – Water Master Servicing Plan Update and Project File

Volume 3 is the principal document summarizing the study objectives, approach, methodologies, technical analyses, and 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 conceptual information on the projects and capital program associated with the preferred water servicing strategy.

1.4.4 Volume 4 – Wastewater Master Servicing Plan Update and Project File

Volume 4 is the principal document summarizing the study objectives, approach, methodologies, technical analyses, and 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 conceptual information on the projects and capital program associated with the preferred wastewater servicing strategy.

1.4.5 Volume 5 – Public and Agency Consultation

Volume 5 contains all relevant documentation of the public consultation process, including notices, comments, 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 3

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

This main section of Volume 3 has been organized into four sections outlining the general approach, methodologies, and technical analysis used to develop the preferred water servicing strategy.

This volume has been organized in four sections as described below:

1. Introduction
2. Analysis Methodology
3. Water Servicing Strategy
4. Water Capital Program

Six individual sub-parts A to F – one for each water system – are also included to summarize the technical analyses and evaluation of the preferred water servicing strategy for each system.

Each sub-part has been organized in eight sections as described below:

1. Existing System Overview
2. Basis for Analysis
3. System Performance
4. System Opportunities and Constraints
5. Assessment of Alternatives
6. Preferred Servicing Strategy
7. Capital Program
8. Project Implementation and Considerations

Volume 3 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 water system analysis establishes the following:

- Total equivalent population fed by each water treatment plant at the following time horizons: 2021, 2051, and post-2051
- Total equivalent population fed by each pumping station at each time horizon
- Total equivalent supported by each storage facility at each time horizon
- Maximum day demand for each pumping station at each time horizon
- Maximum day storage requirement for each pressure zone

The results of this analysis are used as inputs to this Master Servicing Plan, which identifies the water system problems and opportunities, then develops alternative solutions to address.

2.1 Project Assumptions

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

- Growth projections were based on the following two sources of information received from the Region:
  - Traffic Area Zone population projections to 2051 and post-2051 were used:
    - To estimate growth related demands within the water systems
    - To spatially allocate growth demands within the water systems, and
  - Parcel-specific population projections for known development locations throughout the Region;
- Institutional, industrial, and commercial growth flows were estimated using equivalent employment projections; and,
- Pumping station firm capacity is given in the latest Drinking Water Works Permit (DWWP) for each water system. System capacity analysis was completed using the lesser of the DWWP firm capacity or actual operational capacity, if provided by Regional operational staff
  - 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.
- That ongoing asset renewal programs will maintain the capacity and good working order of existing infrastructure

2.2 Demand Projections and Allocations

The study area consists of the existing service areas as well as the residential and industrial land supply within the existing urban boundary. The population and employment projections were provided in ten-year increments on a traffic area zone basis.

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

- A shapefile of known development locations was provided by the Region. This shapefile included the development type (planned, redevelopment, vacant), land use (employment, mixed, or residential), development timing (pre- or post-2051), and the equivalent population;
- Traffic survey zones and development locations were overlaid with the Region's parcels shapefile. The growth data was brought down to the most granular parcel level to maintain flexibility and transparency in the growth allocation process;
- 2051 growth allocation:
    - For traffic survey zones with no corresponding development locations, all growth was assumed to be proportionally applied across the serviced parcels within the traffic survey zone;
    - For traffic survey zones with corresponding development locations:
        - If the total equivalent population of all the corresponding development locations was **greater** than the traffic survey zone growth, the traffic survey zone growth value was utilized and spread across the development locations proportionally. This means that the development location growth was reduced proportionally to match the traffic survey zone projection.
        - If the total equivalent population from all the corresponding development locations was **less** than the traffic survey zone growth, the development location growth was first allocated to the development locations provided by the Region, then the remainder of the traffic survey zone growth was spread across the remaining serviced parcels within the traffic survey zone;
- Post-2051 growth allocation:
    - For traffic survey zones with no corresponding development locations, all growth was assumed to be proportionally applied across the serviced parcels within the traffic survey zone
    - For traffic survey zone with development locations:
        - If the total equivalent pre-2051 population of all the corresponding development locations was **greater** than the traffic survey zone growth, the equivalent population that was removed from 2051 growth was spread to their respective development locations. The post-2051 population equivalent from the development locations was spread to their respective development locations. The remainder of post-2051 growth from the traffic survey zone growth number was then spread across remaining serviced parcels within the TAZ.
        - If the total equivalent pre-2051 population from all the corresponding development locations was **less** than the traffic survey zone growth, the post-2051 development location growth was spread to their respective

development locations and the remainder of post-2051 traffic survey zone growth was spread across remaining serviced parcels within the TAZ;

- For traffic survey zones partially in the urban boundary, all growth was assumed to occur within the urban boundary;
- The total population growth serviced by water out to 2051 will be less than the total growth presented in **Table 3.1** as this includes unserviced areas outside the urban area boundary;
- The growth shapes were overlaid with the existing pressure zone boundary to assign growth to individual pressure zones;
- For unassigned growth shapes, a manual review of existing service network, topography, and existing natural and physical features was conducted, and growth was assigned to individual pressure zones based on likely service connection; and,
- For allocation to the InfoWater model, the growth area shapes were then allocated to the closest existing water system zone within the growth shape's previously assigned pressure zone:
    - Basic local watermain loops were drawn within large development areas and development growth was assigned to these placeholder local pipes. The alignments of these pipes are not based on draft plans and will be updated to reflect actual alignments within future model updates as the developments are built out.

Figure 3.3 provides an example of the process used to allocate system demands.

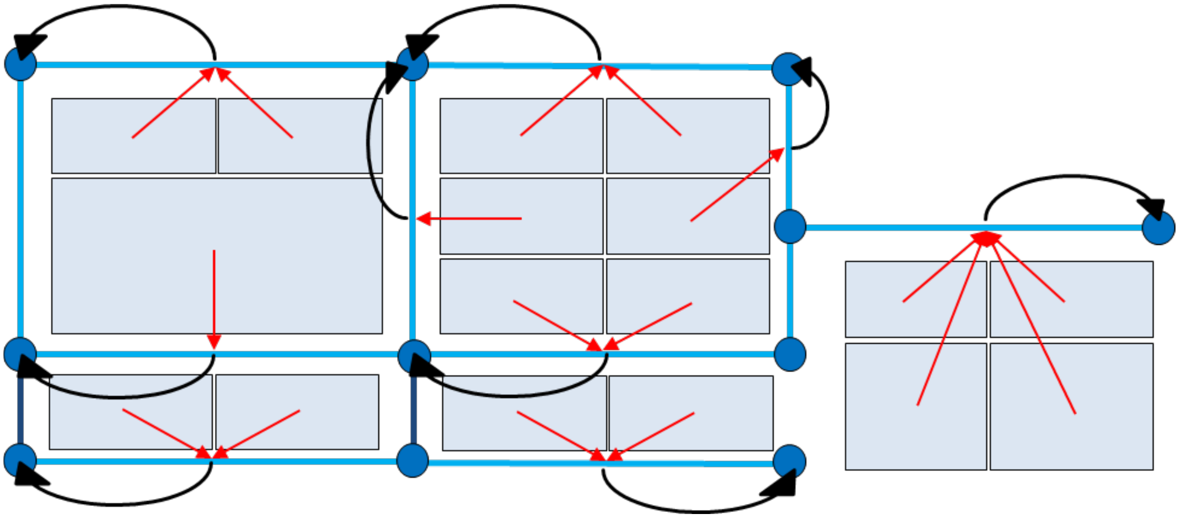


Figure 3.3 Process for Allocating System Demands

2.3 Study Area Population and Employment

Table 3.1 presents the projected residential population and employment population by municipality to 2051, as presented within the Region's Official Plan.

Table 3.1 Niagara Region 2021 Official Plan – 2051 Population and Employment Forecast Allocations by Local Municipality

Municipality	2051 Residential Population	2051 Employment Population
Fort Erie	48,050	18,430
Grimsby	37,000	14,960
Lincoln	45,660	15,220
Niagara Falls	141,650	58,110
Niagara-on-the-Lake	28,900	17,610
Pelham	28,830	7,140
Port Colborne	23,230	7,550
St. Catharines	171,890	79,350
Thorold	39,690	12,510
Wainfleet	7,730	1,830
Welland	83,000	28,790
West Lincoln	38,370	10,480
Niagara Region	**694,000**	**272,000**

Table 3.2 presents the existing and projected serviced residential and employment populations by municipality. Note that Wainfleet is not included in this table as it is not serviced by Regional water or wastewater infrastructure. The presented population and employment totals are based on the Region's 2021 allocation of Traffic Area Zones planning data and have been processed through the allocation methodology presented in **Section 2.2** to refine the data to include only serviced populations. As such, the population and employment total does not directly match the system totals using the Region's unprocessed planning data, or the Region's Official Plan populations.

Table 3.2 Existing and Projected Water Serviced Residential and Employment Population by Local Area Municipality

	2021		2051		Post-2051	
Municipality	**Residential**	**Employment**	**Residential**	**Employment**	**Residential**	**Employment**
Grimsby	29,806	9,889	37,139	14,522	48,672	19,338
Lincoln	25,168	10,181	44,195	14,527	51,883	19,258
St. Catharines	138,624	62,501	171,733	80,175	184,155	85,453
NOTL	20,272	12,278	29,577	17,177	33,841	21,566
Niagara Falls	94,437	37,781	139,340	58,790	160,477	62,768
Fort Erie	33,865	10,241	48,013	17,432	61,721	20,116
Port Colborne	17,356	5,083	21,496	7,040	36,769	11,246
Thorold	22,898	8,041	39,230	12,441	53,363	19,284
Welland	57,076	17,950	82,909	28,685	106,932	35,497
Pelham	18,377	4,329	27,965	6,824	29,999	7,073
West Lincoln	8,386	2,400	30,279	8,091	34,585	9,409
Total	**466,264**	**180,673**	**671,877**	**265,703**	**802,398**	**311,008**

2.4 Design Criteria

The 2021 MSPU has used the following design criteria to project water demands, determine capacity requirements, and establish the water infrastructure program:

- Residential Average Day Demand: 240 Lpcd
- Employment Average Day Demand: 270 Lped
- Maximum Day Factors: based on rolling average for each system from last 5 years
- Peak Hour Factors: based on diurnal curves developed for each system using historic SCADA data

2.4.1 Updated Per Capita Demand Criteria

The Region's 2016 Master Servicing Plan Update utilized 300 Lpcd for both residential and employment land uses to project growth average day demands. As part of this MSPU, the per capita demand criteria were analysed using data with a higher degree of granularity. This was necessary to ensure a reasonable factor of safety is maintained within the consumption criteria while avoiding over-conservatism, which ultimately impacts the capital projects that are triggered and when they are triggered.

Through this MSPU, a three-year period of record (2018 – 2020) for local billing meter records was provided by each local area municipality. **Table 3.3** presents the average per capita rate that was calculated for each local area municipality, categorized by residential and employment land uses.

The basis of the recommended per capita rates was the median per capita rate of all the local area municipalities, including a 25% non-revenue water (NRW) rate. The recommended residential per capita rate was 240 Lpcd, which is increased from the results of the historic data analysis (216 Lpcd), however, in consultation with the Region it was agreed that a more measured reduction in per capita rate should be completed. Further stepped reduction in the per capita rates can be revisited in the future if further analysis of current trends indicates that it is appropriate.

The recommended residential and employment per capita rates represent a 20% reduction for the residential rate and a 10% reduction for the employment rate compared to the Region's previous rate of 300 Lpcd for both residential and employment land uses.

Table 3.3 Per Capita Water Demand by Local Area Municipality

Municipality	Residential Average (Lpcd)	Employment Average (Lped)
Grimsby	168	152
Lincoln	133	304
St Catharines	175	135
NOTL	198	266
Niagara Falls	180	395
Fort Erie	173	208
Port Colborne	144	398
Thorold	173	99
Welland	152	160
Pelham	175	156
West Lincoln	133	551
Median	173	208
Include 25% Non-Revenue Water	216	260
Recommended Per Capita Rate	**240**	**270**

2.4.2 Maximum Day Demand Peaking Factor

The starting point demand and maximum day peaking factors for each WTP were calculated using historic SCADA production data. Ten years of data (2011 to 2020) were reviewed to provide historical context and assess overall long-term trends, however, only the most recent five years of data was used to determine the maximum day demand peaking factor. **Table 3.4** presents the recommended peaking factor for each system. Further detail regarding historic demands within each system can be found in their respective Volume 3 sub-parts.

Table 3.4 Recommended Peaking Factor by WTP System

Water Treatment Plant	2021 MSPU MDD Peaking Factor
DeCew WTP	1.58
Port Colborne WTP	1.57
Niagara Falls WTP	1.60
Welland WTP	1.49
Grimsby WTP	1.66
Rosehill WTP	1.55

2.5 Demand Projection

2.5.1 Starting Point Methodology

Niagara Region provided daily demand at each water treatment plant for 2011 – 2020. Using this data, average day demand and maximum day demand peaking factors were calculated for each year.

The five-year rolling average of average day demands and maximum day peaking factor was used to establish baseline (2021) system average day demands and maximum day demands to assess water treatment plant capacity. The baseline demand scenario for system modelling and assessment of facility capacity by pressure zone was established using three years of historic local billing meter records from each local area municipality (discussed in **Section 2.4.1)** and Regional billing meter data to account for non-revenue water (discussed in **Section 2.5.2**).

2.5.2 Non-Revenue Water Methodology

Existing non-revenue water (NRW) was calculated for the existing system using the difference between local water billing meter and Regional billing meter data. NRW includes:

- Authorized and unauthorized NRW,
- Unbilled accounted for water (i.e., flushing program, fire department usage),
- Water theft,
- System loss/leakage, and
- Failure/breakdown of service water billing meters.

In some systems, the NRW was found to be extremely high (i.e., greater than 25%). The expected NRW due to unbilled account for water is 10 to 20%. **Table 3.5** presents the estimated unaudited non-revenue water (which includes both authorized and unauthorized uses) within each local area municipality.

Table 3.5 Non-Revenue Water by Local Area Municipality

Municipality	2018 – 2020 Average NRW
Grimsby	25%
Lincoln	9%
St Catharines	23%
NOTL	26%
Niagara Falls	18%
Fort Erie	35%
Port Colborne	41%
Thorold	27%
Welland	42%
Pelham	7%
West Lincoln	20%
Average	**25%**

It was recommended that the local municipalities and the Region work to decrease NRW as much as possible in the long-term. Through this MSPU, a new policy has been proposed for municipalities where existing NRW is greater than 25% to attempt to decrease the future NRW to a maximum of 25%, using local area municipality programs and initiatives. As such, the starting point NRW was reduced for systems that are currently greater than 25% NRW. For systems where the existing NRW is less than 25%, no adjustment was made. The future per capita demand criteria include NRW allowance.

2.5.3 Growth Demand Projections

Future system demands were developed using a starting point methodology and are presented in **Table 3.6.** Expected growth demands were added to the starting point demand to establish future demands. A sample calculation for the Fort Erie system is provided below.

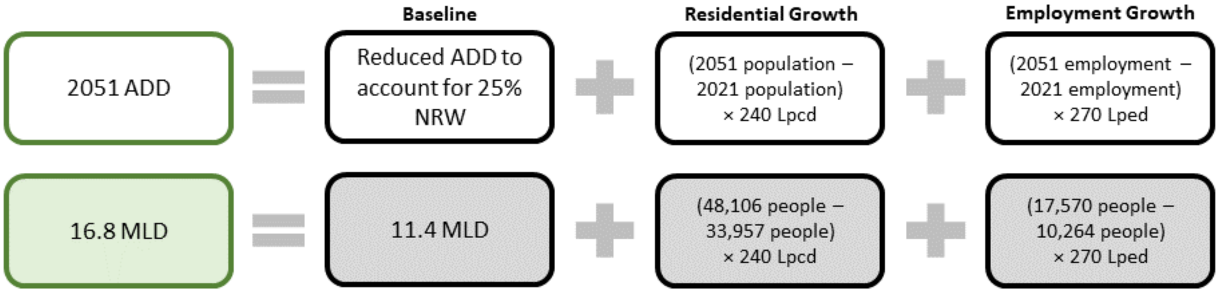


Figure 3.4 Sample Calculation of Expected Growth Demand

Table 3.6 Water Demand Projections

Water System	2021 – 2051 Growth *			2021 – Post-2051 Growth *			2021 Demands		2051 Demands		Post-2051	
	Growth Population	Growth Employment	Total Equivalent Growth	Growth Population	Growth Employment	Total Equivalent Growth	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)
Grimsby WTP	37,731	13,381	51,112	56,287	22,033	78,320	16.2	24.8	28.8	45.7	35.6	57.0
DeCew WTP	62,873	27,796	90,670	92,719	45,158	137,877	66.6	95.3	87.1	129.0	98.9	147.8
Niagara Falls WTP	45,051	21,095	66,146	67,961	25,111	93,072	43.0	64.5	59.5	90.9	66.1	101.4
Fort Erie WTP	14,149	7,305	21,454	27,857	9,989	37,846	12.6	17.3	16.8	24.4	20.8	30.6
Port Colborne WTP	4,140	1,956	6,097	19,413	6,163	25,576	8.2	11.2	8.3	12.1	13.1	19.8
Welland WTP	41,668	13,496	55,164	71,897	21,881	93,778	26.1	34.7	35.9	51.2	45.4	65.4

* Note: The 2021 MSPU has an established baseline condition of year 2021. 2021 represents the best available system information and system calibration data for the water and wastewater models at the time of study initiation. The 2021 MSPU has projected water demands from year 2021 to establish the 2051 infrastructure needs. The potential impacts of estimated growth beyond 2051 was considered due to the longer useful life of water and wastewater infrastructure assets.

2.6 Water Infrastructure Capacity

2.6.1 Sizing of Treatment Plant

Treatment plants are designed to treat the maximum day demand. 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, and
- 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 maximum day demands, assuming there is sufficient storage in the pressure zone. When storage in the pressure zone is not provided, the pumping requirement is for:

- Peak hour demands when there is insufficient balancing storage, or
- Maximum day plus equivalent fire storage deficit flow transfer.

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

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

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

2.6.3 Sizing of Storage

The capacity of the required storage was estimated using Typical Ministry of the Environment, Conservation, and Parks (MECP) criteria:

- Fire Storage component in accordance with the MECP Guideline for the Design of Water Distribution Systems, based on equivalent population (A),
- Equalization component at 25% of the maximum day demand (B), and
- Emergency storage component at 25% of equalization plus fire storage (C = 25% of A+B).

2.6.4 Sizing of Watermains

Feedermains are sized based on flow demands and pressure requirements, which include maintaining:

- Local system pressures between 40 and 100 psi,
- Preferred pressure target of 50 to 80 psi for Regional transmission mains:
    - Note that there are Regional watermains with pressure lower than 50 psi – in particular, the watermains that feed at-grade facilities, such as in-ground reservoirs, where low-pressures are expected and cannot be increased,
- Velocities in the pipe and headloss in the system have been considered, including:
    - Target headloss of 2.5 m/km or less to reduce pumping costs,
    - Target velocity less than 2.0 m/s under normal operating conditions, and
- Minimum fire flow target of 250 L/s at a residual pressure of 30 psi within Regional transmission mains which service local distribution watermain connections.

The water models have been utilized to assess the network and to run four main scenarios (minimum hour, maximum day, peak hour, and maximum day plus fire) to confirm transmission requirements.

Transmission watermain capacity expansions are based on service level (pressure, velocity, and headloss). Oversizing may be considered in areas with an excess of land supply to plan for future potential.

2.6.5 Water Treatment Plant Contact Time Volume Requirement

A conservative assumption has been made for the usable volume at all water treatment plant (WTP) reservoirs. Due to the contact time requirements from the MECP, the actual usable volume at the WTP reservoirs is calculated to be less than the total volume, as contact time volume cannot be used as system storage based on the MECP's CT requirement.

The methodology for determining required CT is outlined in the MECP's Procedure for Disinfection of Drinking Water in Ontario. This procedure states that the disinfection portion of the overall water treatment process must achieve at least 0.5-log removal or inactivation of Giardia cysts and 2-log removal or inactivation of viruses. The required CT for 0.5 log inactivation of Giardia cysts is the limiting factor compared to the 2-log inactivation of viruses.

The CT disinfection concept is a method of quantifying the capability of a chemical disinfection system to provide effective pathogen inactivation to the required level. CT is calculated by multiplying the disinfectant residual concentration in mg/L by the disinfectant contact time in minutes. The contact time used is T_{10} – the length of time during which no more than 10% of the influent water would pass through the process (i.e., 90% of the water will have a longer contact time). The required CT values are provided by the MECP under various combinations of temperatures, pH, and free chlorine residuals. **Table 3.7** presents the CT value of 49 which is utilized by the Region as presented within the Procedure for Disinfection of Drinking Water in Ontario.

Table 3.7 CT Requirement for 0.5 Log Inactivation of Giardia Cysts by Free Chlorine, 0.8 mg/L free chlorine

CT Required	pH 7.0	pH 7.5	pH 8.0
.5 Deg C	34	41	**49**
5.0 Deg C	24	29	35
10.0 Deg C	18	22	26

Using the required CT and the chlorine concentration of 0.8 mg/L (as assumed by the Region), the T_{10} value can be calculated.

$$T_{10} = \frac{CT}{C} = \frac{49}{0.8} = 61.25\, minutes$$

Subsequently, the required hydraulic detention time (T) can be calculated by dividing T_{10} by the reservoir baffle factor (BF), using the Welland WTP as an example.

$$T = \frac{T_{10}}{BF} = \frac{61.25\, minutes}{0.7} = 87.5\, minutes$$

The required amount of storage needed for CT (V) can then be determined by multiplying the plant flow rate (Q) by the required hydraulic detention time. It should be noted that the Region utilizes the MDWL capacity when calculating required CT volume and available system storage at WTP reservoirs. In discussions with the Region and through the MECP process, it was determined that a more appropriate methodology for calculating CT for the purposes of sizing the Region's storage infrastructure would be to utilize the corresponding projected MDD for each planning horizon (2051 and buildout). The sample calculation below presents the required CT volume under 2051 MDD at the Welland WTP.

$$V = Q \times T = 51.2\, MLD \times 87.5\, minutes\ = 3.1\, ML$$

Using the MECP methodology for CT volume calculations and the corresponding MDD for each planning horizon, the required CT volume at the Welland WTP reservoir is 3.1 ML under 2051 MDD, and 4.0 ML under buildout MDD. As such, the remaining usable volume for system storage utilization at the Welland WTP reservoir is 2.5 ML under 2051 MDD, and 1.6 ML under buildout MDD. As a conservative assumption the 2051 MDD volume was utilized for the existing system capacity utilization table.

Further, it should be noted that the Region applies a safety factor of 1.2 to all CT volume calculations as an additional buffer. However, it was determined that this safety factor would be removed for the purposes of storage sizing for the Region's MSPU, as all other parameters utilized within the CT calculation provide an inherent level of conservatism (i.e., temperature of 0.5 deg C and pH of 8). **Table 3.8** presents the available system storage for all WTP reservoirs under 2051 MDD and buildout MDD using the parameters that were agreed upon with the Region through the MSPU process.

Table 3.8 Usable Volume at Water Treatment Plant Reservoirs

	Total Volume (ML)	2051 Required CT Volume (ML)	2051 Available Volume (ML)	Post-2051 Required CT Volume (ML)	Post-2051 Available Volume (ML)
Grimsby Water Treatment Plant (WTP)	10.0	6.5	**3.5**	8.1	**1.9**
DeCew WTP	56.6	7.8	**48.8**	9.0	**47.6**
Niagara Falls WTP	14.0	7.7	**6.3**	8.6	**5.4**
Fort Erie WTP	11.7	2.1	**9.6**	2.6	**9.1**
Port Colborne WTP	3.8	0.7	**3.1**	1.2	**2.6**
Welland WTP	5.6	3.1	**2.5**	4.0	**1.6**

2.7 Summary of Flow Criteria, Performance, and Sizing Methodology

Table 3.9 presents a summary of the flow criteria, performance, and sizing methodology that was utilized.

Table 3.9 Flow Criteria, Performance, and Sizing Methodology

Description			Criteria
Flow Criteria	Water Demand	Residential	240 L/c/d
		Employment	270 L/e/d
	Peaking Factor	Maximum Day	Based on historic average of maximum day peaking factors from 2016 – 2020
		Peak Hour Factor	Based on system mass balance using hourly SCADA data from 2018 – 2020
	Existing System Demands		Starting Point Methodology • Based on local billing meter records and production records to establish existing system demands • Growth demands are added to the existing system baseline using design criteria
System Performance Criteria	System Pressures		Acceptable pressure range of 40 – 100 psi • Regional objective of maximizing areas within the preferred range of 50 – 80 psi on Regional watermains
	Fire Flow		250 L/s on Regional watermains at residual pressure of 30 psi
	Velocity	Average Day	Flag areas less than 0.6 m/s minimum velocity
		MDD+FF or PHD	Flag areas greater than 1.5 m/s Trigger upgrades greater than 2 m/s
Sizing and Triggers	Plant and Facility Upgrade Triggers		• 80% trigger for plant and facility planning process (time-based trigger on a case-by-base basis) • Complete plant and facility expansions before 90% capacity is reached
	Treatment Plant Sizing		Maximum day demand
	Pumping Station Sizing		Various potential demand scenarios: • Maximum day demand (MDD) • MDD + fire flow (250 L/s or MECP) • Peak Hour Demand (PHD)
	Watermain Sizing		Regional transmission main system for PHD and MDD + fire flow demands
	Storage Sizing		MECP methodology (A + B + C)

3 Water Servicing Strategy

3.1 Servicing Principles

Development of water and wastewater principles are integral to provide guidelines and direction to the 2021 MSPU process, as well as to the identification and evaluation of servicing strategies. Refer to **Volume 2** for more details regarding servicing principles.

Through the course of the 2021 MSPU, priority areas were reviewed from the previous 2016 MSPU and further refined for application under this 2021 MSPU including:

- Health and safety;
- System reliability and security of supply;
- 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; and
- Addressing issues related to the full lifecycle of water and wastewater services.

A comprehensive list of general, water, and wastewater principles 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 of supply 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 water and wastewater facilities with consideration to energy use;
- Niagara Region may consider levels of storage beyond MECP guidelines where appropriate in order to provide operational flexibility, energy management, and system security of supply. Further, system storage requirements should be exclusive of the volume required to achieve sufficient disinfection requirements at the Region’s water treatment plants;
- 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; and,

- Niagara Region will work to ensure that new developments do not increase wet weather flows and consider the potential for new developments to work collaboratively with the Region and local area municipalities to reduce I/I in upstream catchments in order to gain some capacity for new developments.

3.2 Evaluation Methodology

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

- Review of baseline conditions across each water 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 conceptual 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, and financial criteria.

4 Growth-Related Capital Program

4.1 Water System Recommendations Overview

A summary of the key aspects of the water servicing strategy is provided below.

4.1.1 Grimsby Water Treatment Plant Service Area

- Based on the forecasted level of growth on the system, the Grimsby Water Treatment Plant will require additional water treatment capacity prior to 2051
- The location of water storage to optimize pumping costs, maximize water quality and provide the required storage in the system has been addressed. A new storage facility to support the Grimsby and Smithville service areas has been established (Park Ridge Reservoir). The new location and size allows the Region to decommission the existing reservoir and pumping station
- To support the new storage location and to provide additional water transmission capacity through the Grimsby system, a new feedermain across Grimsby and a new feedermain from the Grimsby Water Treatment Plant to the Park Ridge Reservoir are required, as well as a new separate set of high lift pumps to support the higher head required within the dedicated reservoir feed to the new Park Ridge Reservoir
- The level of growth anticipated in the Smithville area will require additional storage, pumping, and feedermain capacity through the network
- A new transmission main between the new Park Ridge Reservoir in Grimsby and the Hixon Reservoir in Lincoln is recommended to improve security of supply to Lincoln, reduce overall pumping costs and maximize the use of existing storage capacity
- Baffle improvements at the Grimsby WTP Reservoir are recommended to maximize the use of existing infrastructure by increasing the efficiency of the disinfection process and allowing more volume to be used as system storage
- Additional storage capacity at the Hixon Reservoir is needed post-2051 to support growth beyond 2051

4.1.2 DeCew and Niagara Falls Water Treatment Plant Service Area

- Both the DeCew Water Treatment Plant and the Niagara Falls Water Treatment Plant have sufficient capacity to support growth to year 2051 and beyond.
- Additional feedermain capacity is required in Niagara-on-the-Lake to support water supply to the growth areas.
- A new feedermain from DeCew WTP to Townline Road East in Thorold is recommended to address security of supply concerns.
- Twinning of the Fourth Avenue transmission main from St. Catharines to Vineland is recommended to address security of supply to Lincoln
- Additional storage capacity in the following areas to support growth to 2051:
  - **Fifth Avenue Reservoir** – one additional cell at the existing site

  - **South Thorold Elevated Tank (ET)** – new tank with additional storage capacity, location to be determined through a separate study, existing tank would be decommissioned
  - **Virgil ET** – new tank (either replacement or twinned tank) to provide additional storage capacity, location to be determined through a separate study
  - **Lundy's Lane ET –** New tank location to be determined through a separate study, existing Lundy's Lane tank will be decommissioned; and
  - DeCew and Niagara Falls WTP Reservoir expansions recommended post-2051 to support post-2051 storage needs
- Due to the amount of growth in South Niagara Falls, a new feedermain will be required to support the growth demands
- Additional feedermain capacity is required in the Port Robinson East area due to growth and for system connectivity

4.1.3 Fort Erie Water Treatment Plant Service Area

- The Rosehill Water Treatment Plant has sufficient capacity to support growth beyond 2051
- The components of the Fort Erie water strategy are focused on providing additional storage for the growth in the area while optimizing the storage/pumping relationship to reduce long term lifecycle costs
- A new elevated tank will be provided in central Fort Erie to support the system growth and directly support the employment centre
- The new tank will allow for decommissioning of the existing Stevensville reservoir and pumping station as well as Central Avenue Fort Erie Elevated Tank
- Additional feedermain capacity is required to support security of supply to central Fort Erie

4.1.4 Port Colborne Water Treatment Plant Service Area

- The Port Colborne Water Treatment Plant has sufficient capacity to support growth beyond 2051
- The components of the Port Colborne water strategy are focused on providing additional storage for the growth in the area while optimizing the storage/pumping relationship to reduce long term lifecycle costs
- The Fielden Reservoir and Pumping Station will be decommissioned to address existing operational issues, reduce long-term life cycle costs, and maximize the use of surplus pumping and treatment capacity at the WTP
- Additional water feedermain will be provided crossing the Canal to support growth on the East and West side of Port Colborne
- New, or additional elevated storage post-2051 is recommended to support long-term growth needs – preferred location to be determined in a separate study

4.1.5 Welland Water Treatment Plant Service Area

- The Welland Water Treatment Plant has sufficient capacity to support growth beyond 2051, however, a sustainability upgrade for treatment is required
- The components of the Welland water strategy are focused on providing additional storage for the growth in the area while optimizing the storage/pumping relationship to reduce long term lifecycle costs
- A new larger ET is recommended in Welland to replace the existing Bemis ET. The operating strategy within the Welland zone will likely be adjusted, with the final preferred strategy being determined in the separate Bemis ET Schedule B EA. As part of the 2021 MSPU, placeholder projects have been assumed, with understanding that the Bemis ET EA will refine and recommend the preferred strategy. These projects include:
    - A new dedicated feedermain from the WTP to the new ET
    - Placing one 10 ML cell at the Shoalt's Drive Reservoir into standby for future re-commissioning when required
    - Both sets of pumps in the Shoalt's Drive pumping station for the higher and lower pressure zones will be upgraded to support growth; and
    - New pumps at the Welland WTP to support an increased HGL within the Welland system
- A new Pelham ET will replace the existing Pelham ET in a different location (as determined through the separate Pelham ET Schedule B EA). The new ET will have a larger volume and increased height to support growth and optimize system pressures and performance in the area
    - The Pelham ET EA also identified feedermain upgrades required to support the operations of the new ET
- Additional feedermain capacity is required to support growth and address security of supply in the following areas:
    - Port Robinson West
    - From the Welland WTP to northeast Welland
    - Connecting the east and west sides of the Recreational Canal along Humberstone Road, Thorold Townline Road, and Prince Charles Drive South
    - Across the canal from the Welland WTP to Aqueduct Street; and
    - On Niagara Street from Mill Street to Riverbank Street

4.2 Capital Program

A summary of the water servicing strategy capital program with details for each project is provided in **Table 3.10**.

Table 3.10 Water 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
W-D-001	Decommissioning of Central Ave (Fort Erie South) ET	New Fort Erie ET to replace the Central Ave ET and Stevensville Reservoir; Central Ave ET to be decommissioned	N/A	2027-2031	Fort Erie	A+	N/A	Storage	$823,000
W-D-002	Decommissioning of Stevensville Res + PS	New Fort Erie ET to replace the Central Ave ET and Stevensville Reservoir; Stevensville Reservoir and Pumping Station to be decommissioned	N/A	2027-2031	Fort Erie	A+	N/A	Storage	$1,611,000
W-D-003	Decommissioning of Park Road Res + PS	Decommissioning of Park Road Reservoir and Pumping Station, to be replaced by new Grimsby Reservoir and additional pumping capacity at the WTP. To be completed after completion of W-M-005.	N/A	2027-2031	Grimsby	A+	N/A	Storage	$1,611,000
W-D-004	Decommissioning of Lundy's Lane ET	Lundy's Lane ET to be decommissioned and replaced by new South Niagara Falls ET	N/A	2027-2031	Niagara Falls	A+	N/A	Storage	$823,000
W-D-005	Decommissioning of Pelham ET	Decommissioning of existing Pelham ET, to be replaced by a new ET	N/A	2027-2031	Pelham	A+	N/A	Storage	$1,290,000
W-D-007	Decommissioning of Fielden Ave Res + PS	Decommissioning of Fielden Avenue Reservoir and Pumping Station	N/A	2027-2031	Port Colborne	A+	N/A	Storage	$1,611,000
W-D-008	Decommissioning of Bemis Elevated Tank	Decommissioning of Bemis Elevated Tank to be replaced with a new elevated tank	N/A	2027-2031	Welland	A+	N/A	Storage	$823,000
W-D-009	Decommissioning of one Shoalt's Reservoir Cell	Decommissioning of one Shoalt's Reservoir Cell. Placeholder project - to be confirmed through Bemis Elevated Tank Environmental Assessment	N/A	2032-2041	Welland	A+	N/A	Storage	$512,000
W-D-010	Decommissioning of Smithville ET	Decommissioning of existing Smithville ET, to be replaced by a new ET	N/A	2042-2051	West Lincoln	A+	N/A	Storage	$1,290,000
W-D-012	Decommissioning of Thorold South ET	Decommissioning of existing Thorold South ET, to be replaced by a new ET	N/A	2032-2041	Thorold	A+	N/A	Storage	$1,290,000
W-F-001	Grimsby WTP Expansion	Provide an additional 22 MLD treatment	22 MLD	2022-2026	Grimsby	C	Ongoing (separate study)	Treatment	$73,904,000
W-F-003	Welland WTP Replacement	Replacement of existing Welland WTP with 73 MLD in approximately same location.	73 MLD	2027-2031	Welland	B	Satisfied (separate study)	Treatment	$160,000,000
W-M-001	New trunk main in Central Fort Erie	New trunk main in Central Fort Erie	450 mm	2022-2026	Fort Erie	A+	N/A	Watermain	$12,299,000
W-M-002	New trunk main to Port Colborne East side	New trunk main to East side of Port Colborne across canal	450 mm	2027-2031	Port Colborne	A+	N/A	Watermain	$12,251,000
W-M-004	Upgrade trunk main from Grimsby WTP to Park Road (Partially Completed)	Upgrade trunk main from Grimsby WTP to Park Road. Partially completed. Alignment to be completed is the section from Baker Road to Park Road.	750 mm	2022-2026	Grimsby	A+	N/A	Watermain	$6,157,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
W-M-005	New dedicated feedermain from Grimsby WTP to New Grimsby Reservoir	New trunk main from Grimsby WTP to New Grimsby Reservoir	750 mm	2022-2026	Grimsby	B	Ongoing (separate study)	Watermain	$54,668,000
W-M-006	New trunk main in Smithville (Phase 1)	New trunk main in Smithville (Phase 1 currently in design)	400 mm	2022-2026	West Lincoln	A+	Satisfied (Smithville Community Master Plan)	Watermain	$6,563,000
W-M-007	New trunk main from PRV to Port Robinson Chlorine BPS in Niagara Falls	New trunk main from PRV to Port Robinson Chlorine BPS in Niagara Falls	450 mm	2022-2026	Niagara Falls	A+	N/A	Watermain	$4,040,000
W-M-008	Secondary feed to Virgil ET (NOTL)	Trunk main from South NOTL to Virgil ET with PRV in NOTL to supply DeCew system from Niagara Falls system. Preliminary proposed alignment along Four Mile Creek.	600 mm	2032-2041	Niagara-on-the-Lake	A+	N/A	Watermain	$15,020,000
W-M-009	New Niagara Falls South trunk main to New Elevated Tank	New Niagara Falls South trunk main to provide additional supply to new growth areas. Placeholder project - subject to change based on preferred elevated tank location which is to be confirmed through the corresponding elevated tank EA	750 mm	2022-2026	Niagara Falls	A+	N/A	Watermain	$5,466,000
W-M-013	New trunk watermain from Grimsby to Lincoln	New trunk watermain from new Grimsby Reservoir to Hixon Reservoir in Lincoln. Preliminary alignment along Park Road, Elm Tree Road, Walker Road, Philp Road, Mountain Road, Edelheim Road. Alignment subject to change through Schedule B EA.	600 mm	2032-2041	Lincoln	B	Separate EA Required	Watermain	$32,080,000
W-M-014	New trunk main in southwest Welland	New trunk main on Humberstone Road and Prince Charles Drive. Allows for secondary connection for Dain City (significant projected growth) and closes the Region's trunk main loop across the canal. Include for coordination on potential Regional interconnection with City's planned new watermain on Canal Bank Street.	600 mm	2027-2031	Welland	A+	N/A	Watermain	$8,867,000
W-M-015	New trunk main in northwest Welland	New trunk main in northwest Welland to service growth areas. Watermain on Merritt Road and Merrittville Highway	450 mm	2032-2041	Welland	A+	N/A	Watermain	$6,520,000
W-M-016	Fourth Ave Watermain Twinning	Fourth Avenue watermain twinning from St. Catharines to Vineland to address security of supply to Vineland. Preliminary alignment along Fourth Avenue, Nineteenth Street, and along King Street. Alignment subject to change through Schedule B EA.	450 mm	2042-2051	Lincoln	B	Separate EA Required	Watermain	$19,187,000
W-M-017	New trunk main from Welland WTP to North	New trunk main from Welland WTP to North service area. Preliminary alignment along Ross Street, McMaster Avenue, Major Street, Atlas Avenue, Brown Road, Woodlawn Road	450 mm	2032-2041	Welland	A+	N/A	Watermain	$9,346,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
W-M-018	New trunk main in Smithville (Phase 2)	New trunk main in Smithville (Phase 2, further details to be provided through the Smithville Community Master Plan, alignment subject to change)	400 mm	2032-2041	West Lincoln	B	Satisfied (Smithville Community Master Plan)	Watermain	$14,382,000
W-M-019	New Niagara Falls South trunk main from Dorchester Road to Lyon's Creek Road	New Niagara Falls South trunk main to provide additional supply to new growth areas (W-M-009, W-M-019, W-M-020, W-M-021 form the loop). Preliminary alignment along Dorchester Road, across the Welland River, through South NF WWTP property, and Dell Road. Preferred alignment to be determined through EA process and depends on ET location.	600 mm	2032-2041	Niagara Falls	B	Separate EA Required	Watermain	$24,950,000
W-M-020	New Niagara Falls South trunk main along Lyon's Creek Road	New Niagara Falls South trunk main to provide additional supply to new growth areas (W-M-009, W-M-019, W-M-020, W-M-021 form the loop). Preliminary alignment along Lyon's Creek Road from Dell Road to Stanley Avenue. Preferred alignment to be determined through EA process and depends on ET location.	600 mm	2042-2051	Niagara Falls	B	Separate EA Required	Watermain	$6,982,000
W-M-021	New Niagara Falls South trunk main along Stanley Avenue	New Niagara Falls South trunk main to provide additional supply to new growth areas (W-M-009, W-M-019, W-M-020, W-M-021 form the loop). Preliminary alignment along Stanley Avenue from Lyon's Creek Road to existing Region 1050 mm watermain approximately 700 m south of Marineland Parkway. Preferred alignment to be determined through EA process and depends on ET location.	600 mm	2032-2041	Niagara Falls	B	Separate EA Required	Watermain	$16,048,000
W-M-022	New trunk main from DeCew WTP to Townline Road East in Thorold	New trunk main from DeCew WTP to Townline Road East in Thorold. Provides security of supply for City of Thorold through a secondary watermain feed. Routing and need for the project to be determined through ongoing EA.	750 mm	2022-2026	Thorold	B	Ongoing (separate study)	Watermain	$62,270,000
W-M-023	Twinning of transmission main across the Welland Canal at the Welland WTP	Construction of new 900mm HDPE watermain across Welland Canal to Merritt Street and Aqueduct Street.	900 mm	2022-2026	Welland	A+	N/A	Watermain	$6,848,000
W-M-024	New trunk main on Merritt Street from Aqueduct Street to Niagara Street	New trunk main on Merritt Street from Aqueduct Street to Niagara Street. Part of the Welland canal transmission main twinning project (W-M-023)	600 mm	2022-2026	Welland	A+	N/A	Watermain	$932,000
W-M-025	New trunk main on Niagara Street from Mill Street to Riverbank Street	New trunk main on Niagara Street from Mill Street to Riverbank Street. EA is undergoing with Transportation project to replace Niagara Street bridge over Welland River	600 mm	2022-2026	Welland	A+	N/A	Watermain	$832,000
W-M-026	New dedicated trunk main from Shoalt's HLPS to Pelham ET	New dedicated trunk main from Shoalt's HLPS to the new Pelham elevated tank. Alignment provided by the Region through the Pelham ET EA.	400 mm	2027-2031	Welland	A+	N/A	Watermain	$6,655,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
W-M-027	New trunk main from Pelham ET to Highway 20 and Haist Avenue	New trunk main from Pelham ET to Highway 20 and Haist Avenue. Alignment provided by the Region through the Pelham ET EA.	400 mm	2027-2031	Welland	A+	N/A	Watermain	$4,208,000
W-M-028	New dedicated feedermain from Welland WTP to existing Bemis ET	New dedicated feedermain from Welland WTP to existing Bemis ET. Placeholder project - preferred size and alignment to be determined through the Bemis ET EA.	400 mm	2027-2031	Welland	A+	N/A	Watermain	$4,466,000
W-P-001	Upgrade Shoalt's Drive LLPS	Replace existing 3 MLD low lift pumps with three 20.5 MLD pumps (41 MLD/474 L/s firm capacity to support 2051 required capacity in Welland, total station capacity of 61.5 MLD/712 L/s). Placeholder project - to be confirmed through Bemis Elevated Tank Environmental Assessment	475 L/s	2027-2031	Welland	A	N/A	Pumping	$6,868,000
W-P-002	Upgrade Shoalt's Drive HLPS	Replace all four 5.4 MLD high lift pumps with four 8 MLD pumps (24 MLD/278 L/s firm capacity to support MDD plus MECP fire flow for 2051 and post-2051, total station capacity of 32 MLD/370 L/s)	278 L/s	2027-2031	Welland	A	N/A	Pumping	$6,868,000
W-P-004	Upgrade Smithville Pumping Station	Replace one 4.32 MLD pump with 10.8 MLD pump (firm capacity of 32.4 MLD/375 L/s to support 2051 and post-2051 growth, total station capacity of 36.7 MLD/425 L/s)	300 L/s	2042-2051	West Lincoln	A	N/A	Pumping	$1,716,000
W-P-005	New HLP at Welland to support increased HGL	New separate set of high lift pumps at Welland WTP to support potential increase in hydraulic grade line (same capacity as existing pumps, but increased head). Placeholder project - to be confirmed through Bemis Elevated Tank Environmental Assessment	880 L/s	2027-2031	Welland	A+	N/A	Pumping	$13,620,000
W-P-006	New HLP at Grimsby for dedicated reservoir feed	New separate set of high lift pumps at Grimsby WTP to support dedicated feed to the new Grimsby Reservoir (48 MLD/556 L/s firm capacity to support 2051 MDD for the Grimsby system, total station capacity of 64 MLD/741 L/s).	556 L/s	2022-2026	Grimsby	A+	N/A	Pumping	$12,983,000
W-S-001	New Fort Erie ET	New Fort Erie ET to replace the Central Ave ET and Stevensville Reservoir	9.0 ML	2022-2026	Fort Erie	B	Satisfied (separate study)	Storage	$20,084,000
W-S-003	New Pelham ET	New Pelham ET to replace existing ET. Assuming property acquisition is required (5% for new site).	6.0 ML	2027-2031	Pelham	B	Satisfied (separate study)	Storage	$14,313,000
W-S-004	New South Niagara Falls ET	New South Niagara Falls ET to replace the Lundy's Lane ET and provide additional storage. Final preferred location to be determined through the EA process. Preliminary location shown on map. Assuming property acquisition is required (5% for new site).	12.0 ML	2022-2026	Niagara Falls	B	Ongoing (separate study)	Storage	$27,933,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost
W-S-005	New Grimsby Reservoir	New Grimsby Reservoir to provide additional storage – in construction Includes associated connection to existing Park Road facility and associated upgrades to Park Road pump station to support interim operational configuration	15.0 ML	2022-2026	Grimsby	B	Satisfied (separate study)	Storage	$24,921,000
W-S-006	Hixon Reservoir Expansion	Additional cell at Hixon to support post-2051 growth	5.0 ML	Post-2051	Lincoln	A+	N/A	Storage	$14,380,000
W-S-007	Fifth Avenue Reservoir Expansion	One additional cell to support 2051 and post-2051 growth	4.3 ML	2042-2051	Lincoln	A+	N/A	Storage	$12,542,000
W-S-008	New elevated tank in NOTL	New ET in Virgil to support 2051 growth. Assuming property acquisition is required (5% for new site).	4.5 ML	2042-2051	Niagara-on-the-Lake	B	Separate EA Required	Storage	$10,734,000
W-S-009	Replace Thorold South ET	New larger Thorold South ET to replace existing ET Assuming property acquisition is required (5% for new site).	11.0 ML	2027-2031	Thorold	B	Separate EA Required	Storage	$25,605,000
W-S-010	Replace Smithville Elevated Tank	Replace Smithville Elevated Tank with a larger tank to support 2051 and post-2051 growth. Assuming property acquisition is required (5% for new site).	9.0 ML	2042-2051	West Lincoln	B	Separate EA Required	Storage	$20,950,000
W-S-011	Replace Bemis Elevated Tank	Replace Bemis Elevated Tank - Sizing to be confirmed through Bemis Elevated Tank Environmental Assessment	12.0 ML	2027-2031	Welland	B	Ongoing (separate study)	Storage	$26,547,000
W-S-012	New Port Colborne Elevated tank	Twin existing Barrick Road ET to support post-2051 growth. Assuming property acquisition is required (5% for new site).	9.0 ML	Post-2051	Port Colborne	B	Separate EA Required	Storage	$20,950,000
W-S-014	In-ground Reservoir Expansion at Niagara Falls WTP	In-ground Reservoir Expansion at Niagara Falls WTP to support post-2051 growth and CT volume requirements. Also provides flexibility to support potential employment development in the QEW corridor. Assuming property acquisition is required (5% for new site).	10.0 ML	Post-2051	Niagara Falls	B	Separate EA Required	Storage	$23,278,000
W-S-015	Grimsby WTP Reservoir Baffle Improvements	Grimsby WTP Reservoir baffle improvements to increase baffle factor, allowing for more usable volume at the WTP. Current baffle factor is 0.3, target to increase to at least 0.5.	-	2022-2026	Grimsby	A	N/A	Storage	$2,500,000
W-S-016	In-ground Reservoir Expansion at DeCew WTP	In-ground Reservoir Expansion at DeCew WTP to support post-2051 growth and CT volume requirements.	5.0 ML	Post-2051	St. Catharines	A+	N/A	Storage	$11,352,000
W-ST-001	Region Wide WTP Reservoir Volume Study	Study to review WTP reservoir CT volume and overall system storage	N/A	2022-2026	Region-Wide	A+	N/A	Storage	$100,000
W-ST-002	Additional Studies	Water Master Servicing Plan and Water Servicing Study	N/A	2022 – 2051	Region-Wide	A+	N/A	N/A	$5,250,000
								Total	**$890,119,000**

4.3 Integration with the Sustainability Capital Plan

It is important to recognize that the 2021 MSPU servicing strategies identify new infrastructure to service the additional growth out to year 2051 but these strategies are built by extending infrastructure from the existing systems and leveraging the existing Region infrastructure in place. It is essential that the existing infrastructure is maintained in good condition and performance to support servicing growth.

The Region continually establishes and implements a sustainability program that addresses priority projects to ensure the existing infrastructure is in a state-of-good-repair and continues to perform and meet the intended level of services.

Independent of the 2021 MSPU, the Region has completed a sustainability program analysis to identify the projects on a yearly basis, with focus on a 10 year program, to address the sustainability needs. This Sustainability Capital Plan is first developed to demonstrate the total investment needs and may identify a level of investment and implementation exceeding Region resources. The next steps for the Sustainability Capital Plan will be the development of the Financial Plan for existing Water and Wastewater assets which is anticipated to be completed in 2024. It should be noted that the Sustainability Capital Plan represents investment required over and above the growth-related 2021 MSPU program.

The 2021 MSPU undertook a process to review the Sustainability Program in conjunction with the growth-related program to eliminate duplicate projects and to align the timing of both growth and sustainability needs where appropriate in order to create efficiencies. This review was focused on the Sustainability Program for the next 10 years with the best information available at the time of this study.

The review process for integration of the MSPU program and the sustainability program was essential to demonstrate several key findings:

- There is opportunity to align growth and sustainability projects to bring efficiencies in costs and delivery;
- When planning and costing new infrastructure, lifecycle principles and costs must be considered. Existing and future infrastructure will have future service life replacements (i.e., pumps, electrical, roof, security upgrades at varying intervals from 5 – 40 years);
- Without maintenance of the existing infrastructure in a state of good repair and performance, there is risk that the growth-related program may not achieve desired capacities, timing, or level of service;
- There is also risk that implementing the growth-related program could have a negative impact on the level of service within the existing systems for the existing users; and,
- There are some major projects already considered under the sustainability program that are essential to the growth-related program such as the Welland WTP and WWTP.

Review of the needs based Sustainability Capital Plan for the next ten (10) years developed by the Region demonstrates a potential investment on average of $150M per year. When the Sustainability Capital Plan is integrated with the growth-related Water and Wastewater Capital Plans, the total investment approaches nearly $3B. The integrated potential 10-year program is shown in **Table 3.11**.

Table 3.11 Potential Growth-Related and Sustainability Program Summary

	DC Program Growth-Related Projects (2022 – 2031)	2021 MSPU 100% Sustainability/BTE Projects (2022 – 2031)	Additional Sustainability Projects (2022-2031)	Potential Integrated 10-Year Program (2022 – 2031)
Water	$463,010,000	$160,100,000	$487,237,000	**$1,110,347,000**
Wastewater	$786,399,000	$4,189,000	$1,048,099,500	**$1,838,687,500**
Total	**$1,249,409,000**	**$164,289,000**	**$1,535,336,500**	**$2,949,034,500**

This level of potential investment will require significant resourcing, implementation, and financial planning to establish a viable capital program to meet growth-related and sustainability requirements.

4.4 Project Implementation Flow Chart

The recommended design capacities within the capital program are based on the best available information at the time of analysis, including existing system demands, facility capacities, and projected growth. It is understood that this data is not static and often changes over the years between the regular updates of the Region's Master Plan. Design assumptions should be revisited before initiation of projects to reconfirm the appropriate design capacities, actual growth in demands and identification of any associated or dependent projects which can be combined or staged to optimize implementation efficiency and cost, and/or system operation.

To support the Region's process in implementing recommended 2021 MSPU capital projects, the following flow chart has been developed for the water system. This flow chart document is intended to be a reference resource for the Region and should be treated as a guideline to support existing internal Region processes in project implementation.

The water implementation flow chart is presented in the following two pages.

Niagara Region

WATER PROJECT IMPLEMENTATION

The intent of this document is to support the Region in confirming the scope of work for water infrastructure projects.

CONFIRM PROJECT SCOPE

To define Terms of Reference

☐ **What triggered this project?**
- Known development growth
- Forecasted growth
- Sustainability needs

☐ **Are there related or dependent projects that should be identified for streamlining opportunities or for project phasing?**
- Are there projects that need to be completed before this project?
- Are there projects within the same alignment or project area that could be combined (e.g., growth projects, wastewater, stormwater, corridor planning, sustainability projects, etc.)
- If there are related projects, could the project timing be adjusted to combine or stage projects more efficiently?

☐ **What is the project EA Schedule and status?**

☐ **Are there historic or ongoing operational issues in the project area?**
- Confirm with Regional and LAM operations and maintenance groups
- i.e. historic watermain breaks, water quality or pressure complaints, work order history, etc.

☐ **Are there any data gaps that should be incorporated into the Terms of Reference?**
- Refer to the Required Data section below for details
- How much does the project timeline and budget need to change to allow for the data collection?

☐ **Have the planning projections been updated to the best available information?**
- Consultation with Region and LAM planning groups to confirm planning projection
- Are projected needs for the project in place? Is actual growth in line with projected growth?)

☐ **Should the project be deferred until identified related works are completed?**

REQUIRED DATA

To support terms of reference and detailed design

☐ **Recently completed EA or servicing study**

(for growth triggered projects)

☐ **Historic demand records**
- Within the last 3 years
- Ideally one full year of SCADA records including facility demands, flow, and pressure records

☐ **Existing system hydrant testing or system pressure data to identify/verify existing system issues**

☐ **Asset inventory and condition assessment**
- All asset classes within the infrastructure type (watermain, storage, pumping, or treatment facility)
- Within the last 5 years
- Can be part of project scope if the data is not available and would not significantly alter project scope

☐ **Service area growth potential to confirm projected population and demands**
- Consultation with Region and LAM planning groups within the past year
- Growth information for 30-year horizon and beyond (maximum service area)
  - Population, jobs, land use, area
  - Current inventory of development areas with associated development status

IF THE REQUIRED DATA IS NOT AVAILABLE AND IF IT HAS THE POTENTIAL TO SIGNIFICANTLY ALTER SCOPE OF THE DESIGN, IT IS STRONGLY RECOMMENDED THAT THE APPROPRIATE DATA COLLECTION AND FIELD INVESTIGATION BE COMPLETED PRIOR TO PROCEEDING WITH DESIGN. ALTERNATIVELY, WHERE FEASIBLE, DATA COLLECTION SHOULD BE INCLUDED IN THE PROJECT SCOPE AND INTEGRATED INTO THE DESIGN PROCESS.

FLOW PROJECTIONS

To determine infrastructure capacity needs

EXISTING FLOWS

Average Day Demand (ADD)
- Historic SCADA to determine starting point average demand

Maximum Day Demand (MDD)
- Use peaking factors determined through MSPU to peak ADD
- There is a different peaking factor for each WTP system based on historic SCADA data

Peak Hour Demand (PHD)
- Diurnal curve based on historic data

Fire Flow (FF)
- MECP population-based

FUTURE FLOW PROJECTIONS

Existing Demand
- Scenarios depending on infrastructure type and design scenario (see next page

+

Growth Population Demand Contributions
- Residential, 240 L/c/d
- Employment, 270 L/e/d

The design criteria presented in this document are based on the 2021 Master Servicing Plan Update Study

BluePlan ENGINEERING

STORAGE AND PUMPING FACILITY CONSIDERATIONS

☐ What is the complete service area of the facility?
  - Some facilities support multiple pressure zones
  - Some pressure zones are supported by multiple facilities

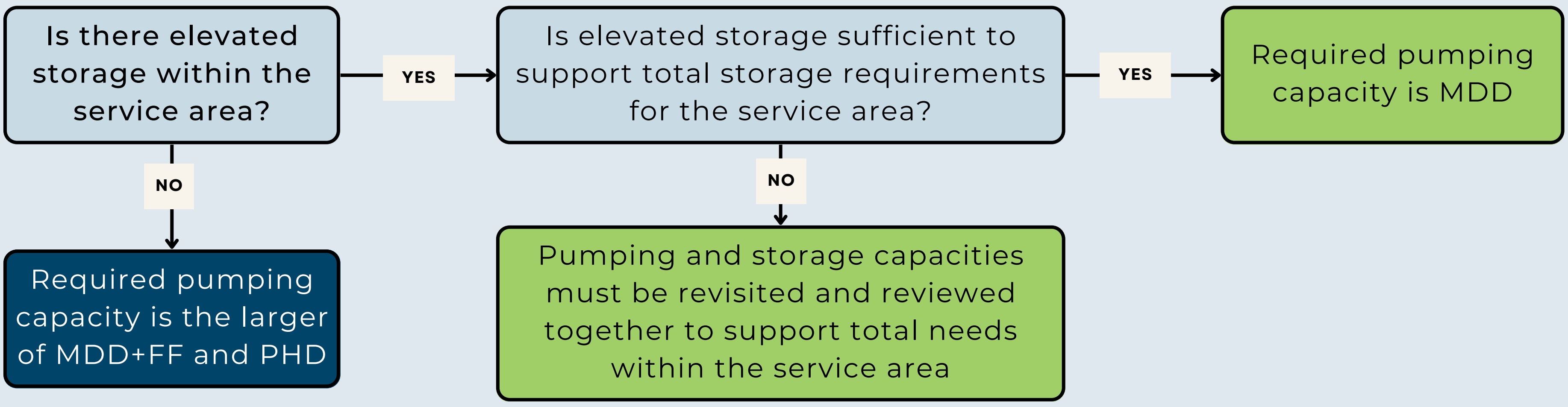
☐ If there are storage deficits, can they be supplemented through flow transfers?
  - Is it hydraulically and operationally feasible?

☐ Have storage and pumping facilites been reviewed in conjunction with one another?
  - Required pumping capacity varies based on available storage

☐ What is the optimal HGL target for pumping and elevated storage facilities?
  - Region strives to maximize areas within 50 - 80 psi for Regional watermains and minimum residual pressure of 30 psi at MECP population-based fire flow target

PUMPING STATION SIZING

To define design flow scenario (MDD, MDD+FF, PHD)


Is there elevated storage within the service area?

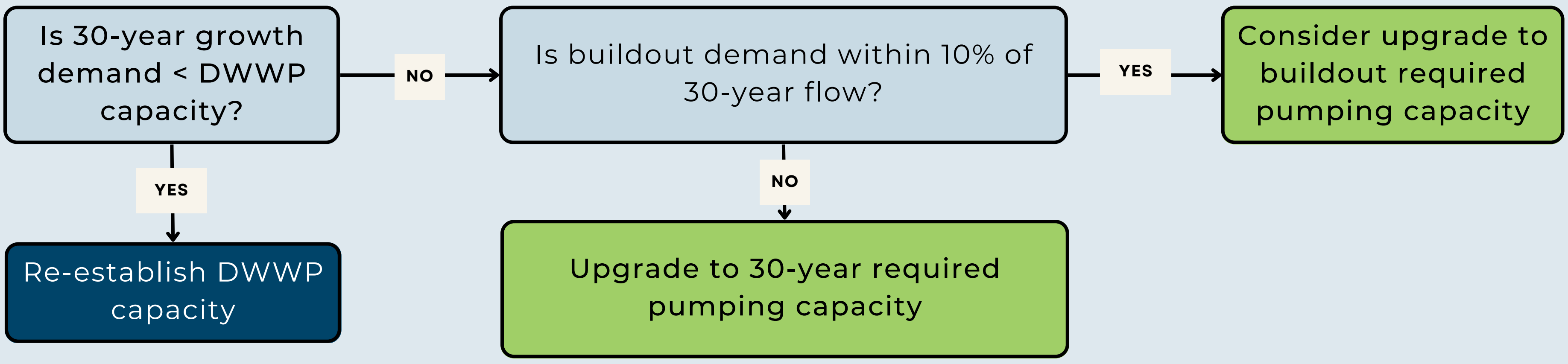
Is elevated storage sufficient to support total storage requirements for the service area?

Required pumping capacity is MDD

Required pumping capacity is the larger of MDD+FF and PHD

Pumping and storage capacities must be revisited and reviewed together to support total needs within the service area

To define design flow growth horizon (re-establish DWWP capacity, 30-year growth, buildout)


Is 30-year growth demand < DWWP capacity?

Is buildout demand within 10% of 30-year flow?

Consider upgrade to buildout required pumping capacity

Re-establish DWWP capacity

Upgrade to 30-year required pumping capacity

STORAGE SIZING

What are the system storage needs?
- System storage targets are based on MECP methodology, consistent with the 2021 Region MSPU
- Incorporate contact time storage needs at Water Treatment Plant Reservoirs
- Confirm fire flow storage strategy
- Review pumping capacity and impact on storage strategy

What timeline is considered for storage sizing?
- Is the storage sized at a minimum to support 30-year growth needs?
- What is the required storage sizing to support buildout needs?
- Is there a strategy to meet buildout needs?
- Is there opportunity for phased expansion?
- Is there a need for an alternative storage location?

TRUNK WATERMAIN SIZING

- Regional transmission mains should be sized to meet PHD and MDD+FF of maximum future service area (buildout) with a target velocity less than 1.5 m/s

A

Regional Municipality of Niagara

Part A

GRIMSBY WATER SYSTEM

TABLE OF CONTENTS

List of Figures

List of Tables

A. Grimsby Water Treatment Plant

A.1 Existing System Overview

The Grimsby water system services the areas of Grimsby, Beamsville in the Town of Lincoln, and the Smithville area in the Township of West Lincoln. The system services an existing population of 53,253 and 18,187 employees. Note that this population and employment total is based on the Region's 2021 allocation of Traffic Area Zones planning data and has been processed through the allocation methodology presented in **Volume 2** to refine the data to include only serviced populations. As such, the population and employment total may not directly match the system totals using the Region's unprocessed planning data.

The system is supplied by the Grimsby Water Treatment Plant, located on 300 North Service Road in Grimsby. The plant is a conventional surface water treatment plant with zebra mussel control, travelling screens, coagulation, flocculation, sedimentation, filtration, and disinfection processes. Lake Ontario serves as a source to the plant. The plant has a rated capacity of 44.0 MLD (509 L/s).

The system supplies local area municipalities via a watermain network, pumping stations, and storage reservoirs. The supply area is divided into nine pressure zones.

Figure 3.A.1 and **Figure 3.A.2** present an overview map of the water system and a water system schematic diagram, respectively.

Through this update of the Master Servicing Plan, the Region has highlighted the need to integrate the MSPU growth-related program with the Region's sustainability program intended to address the condition and performance of the existing infrastructure. The MSPU servicing strategies are based on the need to maintain appropriate levels of service throughout the systems and acknowledges that investment will be needed to support operations, maintenance, staff, and other resources related to maintaining the existing systems and facilities in a state of good repair and performance.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

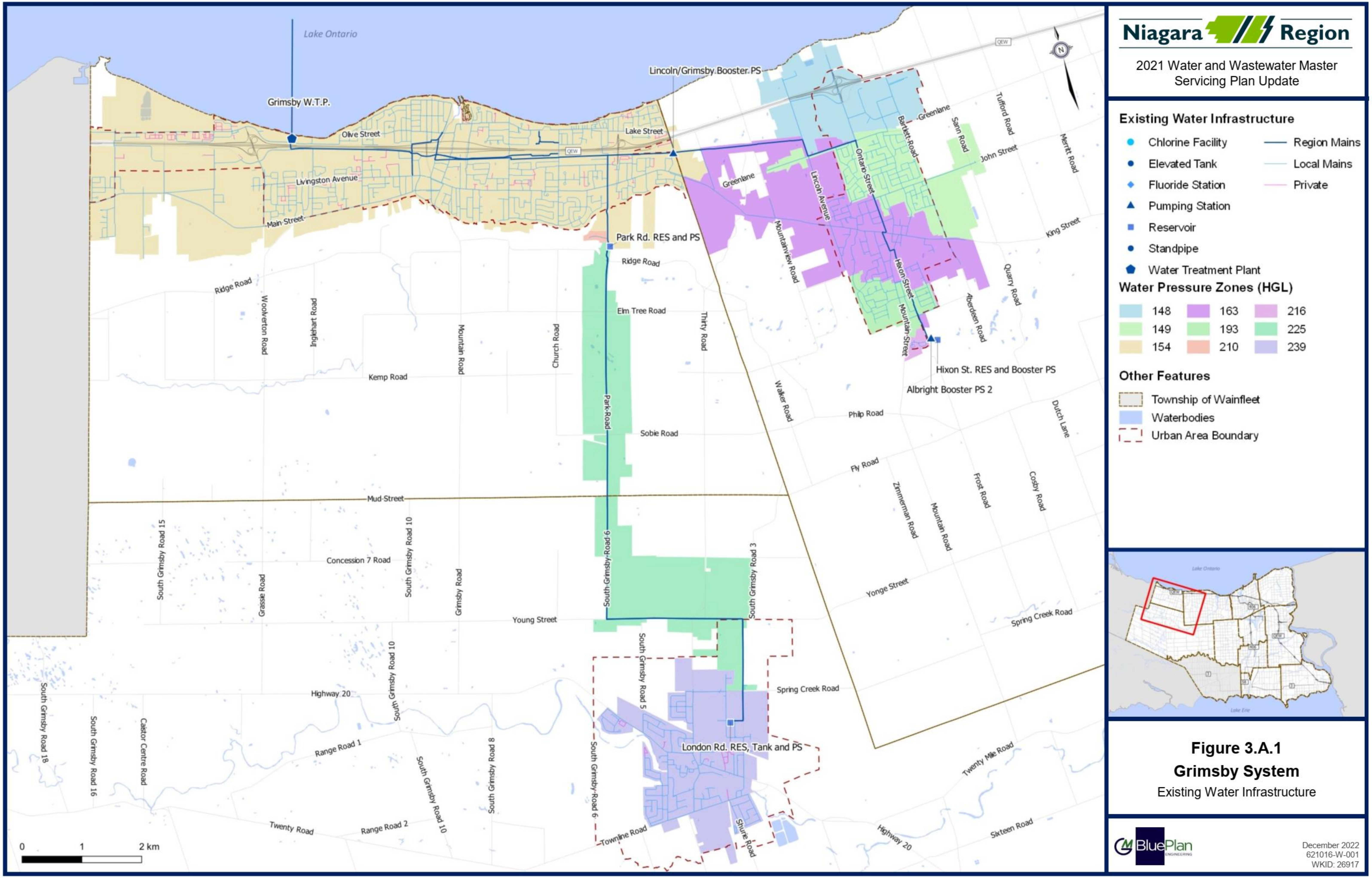


Figure 3.A.1

Grimsby System

Existing Water Infrastructure

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December 2022
621016-W-001
WKID: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

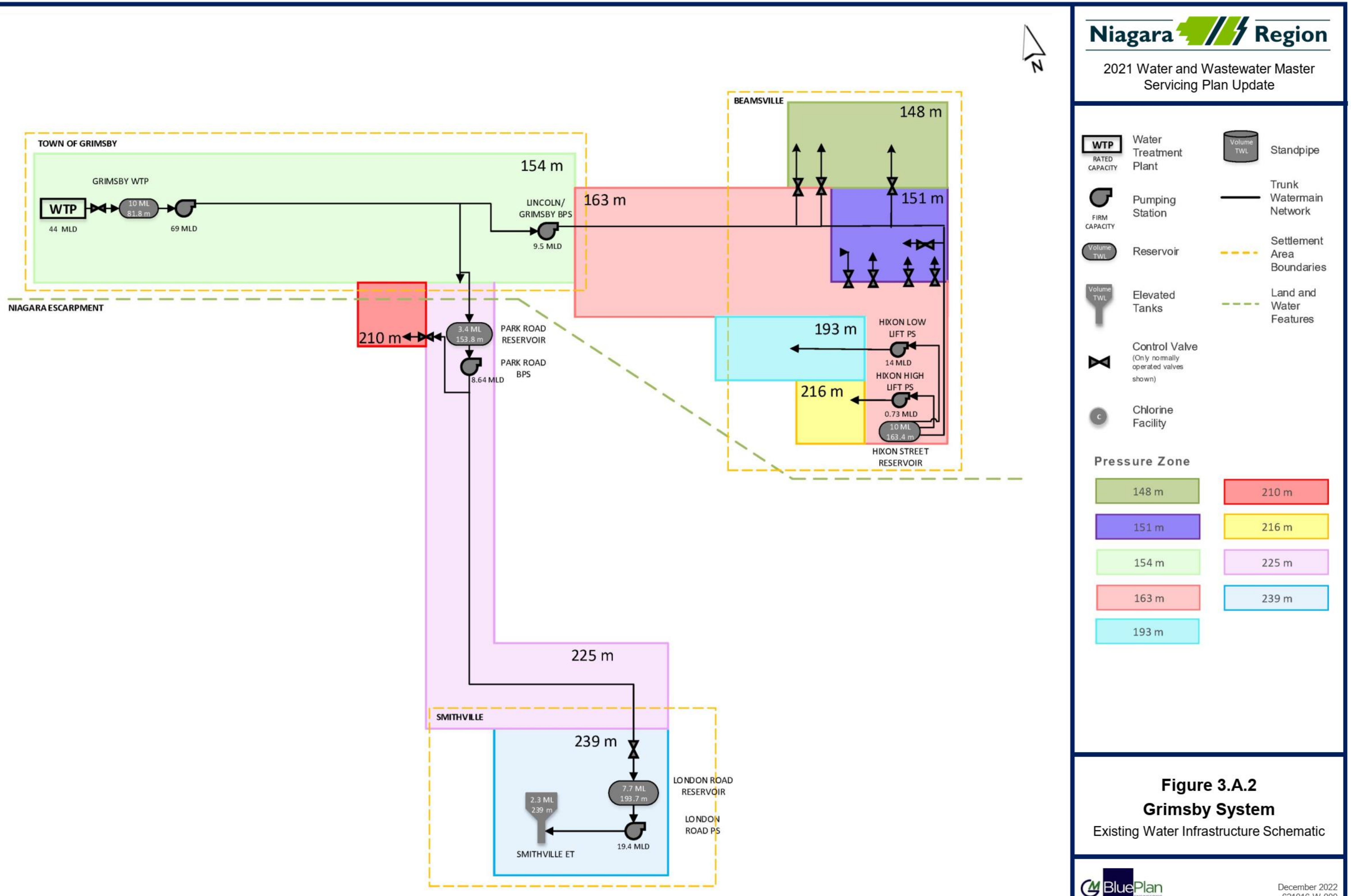

Figure 3.A.2
Grimsby System
Existing Water Infrastructure Schematic

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A.1.1 Facility Overview

Table 3.A.1 to **Table 3.A.4** present details regarding the existing water treatment plant (WTP), pump stations, and storage facilities.

Table 3.A.1 Water Treatment Plant Overview

Plant Name	Grimsby Water Treatment Plant
Drinking Water Works Permit	Permit Number: 007-205 Issue Number: 7 Issued August 2, 2019
Address	300 North Service Road, Grimsby, ON, L3M 4E8
Source Water	Lake Ontario
Rated Maximum Day Demand Capacity	44.0 MLD
Key Processes	• Zebra mussel control • Travelling screens • Coagulation • Flocculation • Sedimentation • Filtration • Disinfection

Table 3.A.2 Water Treatment Plant Water Quality Objectives

Parameters for Niagara Region Contact Time Calculation	
pH	8
Temperature (degrees C)	0.5
Required CT	49
Required Giardia Inactivation via Disinfection	0.5-log
Required Virus Inactivation via Disinfection	2-log
Minimum Free Chlorine	0.8 mg/L

* Refer to the Safe Drinking Water Act, Ontario Drinking Water Quality Standards for a comprehensive listing of water quality standards.

Table 3.A.3 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone and Facility)	Discharge (Pressure Zone)	Pressure Zones Supplied	Number of Pumps (Total/ Firm)	Installed Capacity (MLD)	Firm Capacity (MLD)	Total Dynamic Head (m)
Grimsby Water Treatment Plant (WTP) High Lift	300 North Service Road, Grimsby	WTP	154	All	6/5	88.6	68.6	81.0
Park Road Booster Pumping System (BPS)	83 Park Road, Grimsby	154	225	210, 225, 239	3/2	13.0	8.6	61.4
Smithville (London Rd.) Pumping Station (PS)	6247 London Road, Smithville	225	239	239	4/3	30.2	19.4	47.9
Lincoln/Grimsby BPS	10 Iroquois Trail, Grimsby	154	163	148, 163, 193, 216, 151	2/1	19.0	9.5	15.0
Hixon Street Low Lift Pumping Station (Town-owned)	3991 Hixon Street, Lincoln	163	193	193	4/2 (one fire pump)	22.2	9.3 14.0 (with fire pump)	30.0
Hixon Street High Lift Pumping Station	3991 Hixon Street, Lincoln	163	216	216	4/2 (one fire pump)	10.9	0.5 10.6 (with fire pump)	51.4

Table 3.A.4 Storage Facilities Overview

Storage Facility	Location	Storage Type	Volume (ML)	Top Water Level (m)	Fire Supply Zones	Maximum Day Demand Supply Zones
Grimsby Water Treatment Plant Reservoir[(1)]	300 North Service Road, Grimsby	Pumped Reservoir	10.0	81.8	154 Pumped	All
Park Road Reservoir	83 Park Road South, Grimsby	Pumped/ Floating Reservoir	3.4	153.8	154 Floating 210 Pumped 225 Pumped	154 Floating 210 Pumped 225 Pumped
London Road Reservoir	6247 London Road, Smithville	Pumped Reservoir	7.7	193.7	239 Pumped	239 Pumped
Smithville Elevated Tank	6247 London Road, Smithville	Elevated Tank	2.3	239.0	239 Floating	239 Floating
Hixon Street Reservoir	3991 Hixon Street, Beamsville	Pumped/ Floating Reservoir	10	163.4	148 Floating 151 Floating 163 Floating 193 Pumped 216 Pumped	148 Floating 151 Floating 163 Floating 193 Pumped 216 Pumped

(1) Total WTP storage volume is 10 ML, however, due to contact time requirements from the MECP, the actual usable volume at the Grimsby WTP is calculated to be 3.4 ML under 2051 MDD and 1.8 ML under post-2051 MDD, as contact time cannot be used as system storage based on the MECP's CT requirement. Refer to **Section A.2.2** and **Volume 3 - Introduction** for additional information.

A.2 Basis for Analysis

A.2.1 Flow Criteria, Performance, and Sizing Methodology

The Niagara Region Traffic Area Zone planning data was used to estimate growth related demands within the water system and to spatially allocate growth demands within each individual system. **Table 3.A.5** presents a summary of the flow criteria, performance, and sizing methodology that was utilized. Refer to **Volume 3 – Introduction** for additional information.

The Region's per capita water demand criteria was updated based on a historic review of the previous 3-year period local billing meter records. Given that more granular data was available to complete this analysis compared to previous master plan updates, the population and employment per capita rates were differentiated, and both were reduced compared to the Region's previous per capita rate to reflect existing usage trends more closely. Further detail regarding the per capita water demands is presented in **Volume 3 – Introduction.**

In some systems, the NRW was found to be extremely high (i.e. greater than 25%). The expected NRW due to unbilled account for water is 10 to 20%. It was recommended that the local municipalities and the Region work to decrease NRW as much as possible in the long-term. Through this 2021 MSPU, a new policy has been proposed for municipalities where existing NRW is greater than 25% to attempt to decrease the future NRW to a maximum of 25%, using local area municipality programs and initiatives. Existing non-revenue water rates within the Grimsby system are all at or below 25% (25% in Grimsby, 9% in Lincoln, and 20% in West Lincoln). As such, adjustment to the starting point NRW for future growth projections was not required for the Grimsby system. Further detail regarding the non-revenue water analysis is presented in **Volume 3 – Introduction.**

Table 3.A.5 Flow Criteria, Performance, and Sizing Methodology

Description			Criteria
Flow Criteria	Water Demand	Residential	240 L/c/d
		Employment	270 L/e/d
	Peaking Factor	Maximum Day	Based on historic average of maximum day peaking factors from 2016 – 2020
		Peak Hour Factor	Based on system mass balance using hourly SCADA data from 2018 – 2020
	Existing System Demands		Starting Point Methodology • Based on local billing meter records and production records to establish existing system demands • Growth demands are added to the existing system baseline using design criteria
System Performance Criteria	System Pressures		Acceptable pressure range of 40 – 100 psi • Regional objective of maximizing areas within the preferred range of 50 – 80 psi on Regional watermains
	Fire Flow		250 L/s on Regional watermains at residual pressure of 30 psi
	Velocity	Average Day	Flag areas less than 0.6 m/s minimum velocity
		MDD+FF or PHD	Flag areas greater than 1.5 m/s Trigger upgrades greater than 2 m/s
Sizing and Triggers	Plant and Facility Upgrade Triggers		• 80% trigger for plant and facility planning process (time based trigger on a case-by-base basis) • Complete plant and facility expansions before 90% capacity is reached
	Treatment Plant Sizing		Maximum day demand
	Pumping Station Sizing		Various potential demand scenarios: • Maximum day demand (MDD) • MDD + fire flow (250 L/s or MECP) • Peak Hour Demand (PHD) Appropriate design sizing scenario depends on the configuration of the service area for the pumping station. Refer to **Volume 3 - Introduction** for further discussion.
	Watermain Sizing		Regional transmission main system for PHD and MDD + fire flow demands
	Storage Sizing		MECP methodology (A + B + C) • Refer to **Section A.2.2** for discussion regarding contact time (CT) volume requirement at WTP reservoirs

A.2.2 Water Treatment Plant Reservoir Contact Time Volume Requirement

Due to the contact time requirements from the MECP, the actual usable volume at the Grimsby WTP reservoir is calculated to be less than the full volume of 10 ML, as contact time volume cannot be used as system storage based on the MECP’s CT requirement. System storage capacity is presented and discussed in **Section A.3.4**.

A conservative assumption has been made for the usable volume at all water treatment plant reservoirs. The methodology for determining required CT is outlined in the MECP’s Procedure for Disinfection of Drinking Water in Ontario. Detailed methodology and sample calculations for determining the required CT volume is presented in **Volume 3 – Introduction.**

Further, it should be noted that the Region applies a safety factor of 1.2 to all CT volume calculations as an additional buffer. However, it was determined that this safety factor would be removed for the purposes of storage sizing for the 2021 MSPU, as all other parameters utilized within the CT calculation provide an inherent level of conservatism (i.e. temperature of 0.5 deg C and pH of 8).

A.2.3 Growth Population Projections and Allocations

Table 3.A.6 outlines the existing and projected serviced population and employment by pressure zone.

Table 3.A.6 Grimsby Water Treatment Plant Existing and Projected Serviced Population and Employment by Pressure Zone

Pressure Zone	2021 Population & Employment			2051 Population & Employment			Post 2051 Population & Employment			2021-2051 Growth		
	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population Growth	Employment Growth	Total Growth
148	379	2,194	2,574	4,078	3,779	7,857	4,668	4,521	9,188	3,698	1,585	5,283
151	6,023	1,067	7,089	7,204	1,655	8,859	7,779	2,306	10,085	1,181	588	1,769
154	29,775	9,886	39,662	37,108	14,519	51,627	48,641	19,335	67,976	7,333	4,633	11,966
163	6,199	2,216	8,415	8,476	2,985	11,460	9,845	4,092	13,936	2,277	769	3,046
193	2,365	349	2,714	3,339	463	3,802	3,477	481	3,958	975	113	1,088
210	31	3	33	31	3	34	31	3	34	0	0	0
216	96	73	168	469	73	542	515	74	589	374	0	374
225	67	50	116	67	388	455	67	499	566	0	338	338
239	8,319	2,350	10,669	30,213	7,703	37,916	34,518	8,910	43,428	21,894	5,353	27,247
Total	**53,253**	**18,187**	**71,440**	**90,984**	**31,568**	**122,552**	**109,540**	**40,220**	**149,760**	**37,731**	**13,381**	**51,112**

Note: Population numbers may not sum due to rounding.

A.3 Existing System Performance

A.3.1 Starting Point Demands and Performance

The starting point demand and maximum day peaking factor for the Grimsby WTP was calculated using historic SCADA production data. Ten years of data (2011 to 2020) was reviewed to provide historical context and assess overall long-term trends, however, the most recent five years of data was used to determine the maximum day demand peaking factor. **Table 3.A.7** presents the historic water demand and water system maximum day peaking analysis. Based on the historic analysis, the Grimsby WTP system has an existing average demand of 15.0 MLD and system peaking factor of 1.66.

Table 3.A.7 Historic Water Demand

Year	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Maximum Day Demand Peaking Factor
2011	14.0	30.1	2.15
2012	14.5	27.7	1.91
2013	14.1	23.5	1.66
2014	15.1	21.1	1.40
2015	17.0	27.1	1.60
5-Year Average	*14.9*	*25.9*	*1.7*
5-Year Peak	*17.0*	*30.1*	*2.1*
2016	15.8	27.4	1.74
2017	14.0	21.8	1.56
2018	15.7	27.3	1.74
2019	14.0	20.7	1.48
2020	15.7	27.8	1.77
5-Year Average	**15.0**	**25.0**	**1.66**
5-Year Peak	*15.8*	*27.8*	*1.77*
10-Year Average	*15.0*	*25.5*	*1.70*
10-Year Peak	*17.0*	*30.1*	*2.15*
MECP Peaking Factor (Existing)	**1.75**		
MECP Peaking Factor (2051)	**1.65**		

Local billing meter records were provided by the local area municipalities for the years of 2018 – 2020. Using this more granular data, along with Region billing meter data, system non-revenue water was calculated for each municipality, as well as system demands for each pressure zone. To estimate future system demands, the projected residential and employment growth populations were then converted to expected flows using the criteria presented in **Table 3.A.5**. Existing and future water system demands by pressure zone are presented in **Table 3.A.8**.

Table 3.A.8 Existing and Future Water System Demands by Pressure Zone

Pressure Zone	2021 Demand		2021 to 2051 Growth Demand		2051 Demand (Existing + Growth)		2051 Demand With NRW Reduction (Existing + Growth) (1)		Post 2051 Demand (Existing + Growth)		Post 2051 Demand With NRW Reduction (Existing + Growth)(1)	
	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)
148	1.1	1.8	1.3	2.2	2.4	4.0	2.4	4.0	2.7	4.5	2.7	4.5
151	1.6	2.5	0.4	0.7	2.0	3.2	2.0	3.2	2.3	3.8	2.3	3.8
154	8.9	13.4	3.0	5.0	11.9	18.4	11.9	18.4	16.0	25.1	16.0	25.1
163	1.2	1.9	0.8	1.2	2.0	3.2	2.0	3.2	2.6	4.2	2.6	4.2
193	0.5	0.8	0.3	0.4	0.8	1.2	0.8	1.2	0.8	1.3	0.8	1.3
210	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2
225	0.0	0.0	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2
239	2.8	4.3	6.7	11.1	9.5	15.4	9.5	15.4	10.9	17.7	10.9	17.7
Total	**16.2**	**24.8**	**12.7**	**21.0**	**28.8**	**45.7**	**28.8**	**45.7**	**35.6**	**57.0**	**35.6**	**57.0**

(1)Non-revenue water (NRW) adjustments were made within systems where existing NRW was higher than 25%. Assumption was made that the starting point NRW would be reduced to less than 25% for those systems when analysing 2051 and post-2051 scenarios. No adjustment was required for the Grimsby system.

A.3.2 Treatment Plant Capacity

Figure 3.A.3 shows the projected future demands at the Grimsby Water Treatment Plant. The plant is approaching capacity, reaching the 80% planning trigger by 2035, and will require an upgrade within the 2051 time horizon.

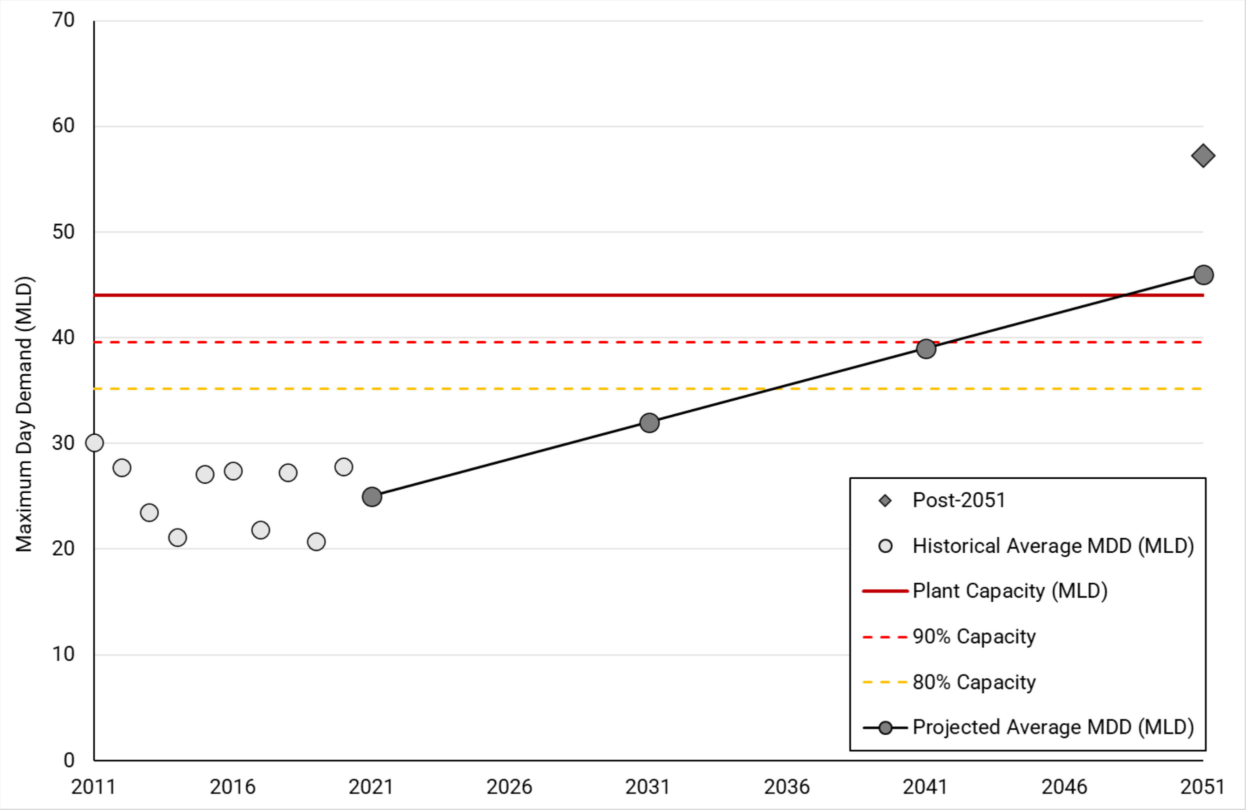

Figure 3.A.3 Projected Maximum Day Demand at Grimsby Water Treatment Plant

A.3.3 Pumping Capacity

Table 3.A.9 highlights the existing and projected capacity of the pumping station. As presented in **Section A.2.1**, there are various potential demand scenarios for pumping station capacity sizing depending on system configuration and available storage type and volume. As such, the design condition has been specified in the table below (i.e. maximum day demand, peak hour demand, or maximum day demand + fire flow), along with the 2021, 2051, and post-2051 design flows which correspond to the design condition for each respective pump station.

The Smithville pumping station and the Lincoln/Grimsby pumping station are projected to have a future pumping deficit.

The Park Road BPS also has a future pumping deficit, however, the Park Road BPS is anticipated to be decommissioned before 2051 as part of the updated operating strategy for the Grimsby and West Lincoln systems recommended through the 2016 Master Servicing Plan Update. This strategy will be carried forward through this update and includes the new Park Ridge Reservoir, a new dedicated feedermain from the Grimsby WTP to the new Park Ridge Reservoir, and a new separate set of high lift pumps at the Grimsby WTP to support the new dedicated feedermain

Table 3.A.9 System Pumping Station Performance

Pump Station	Firm Capacity (MLD)	Pressure Zones Supplied	Design Condition	2021 Maximum Day Demand (MLD)	2021 Design Flow (MLD)	2021 Surplus/ Deficit (MLD)	2051 Maximum Day Demand (MLD)	2051 Design Flow (MLD)	2051 Surplus/ Deficit (MLD)	Post 2051 Maximum Day Demand (MLD)	Post 2051 Design Flow (MLD)	Post 2051 Surplus/ Deficit (MLD)
Grimsby Water Treatment Plant/ High Lift PS	68.6	All	Maximum Day Demand	24.8	24.8	43.8	45.7	45.7	22.9	57.0	57.0	11.6
Park Road BPS	8.6	210, 225, 239	Maximum Day Demand	4.3	4.3	4.3	15.6	15.6	-7.0	17.9	17.9	-9.3
Smithville PS	19.4	239	Peak Hour Demand	4.3	6.5	13.0	15.4	23.1	-3.7	17.7	26.5	-7.0
Lincoln/ Grimsby PS	9.5	148, 163, 193, 216, 151	Maximum Day Demand	7.0	7.0	2.5	11.8	11.8	-2.3	14.0	14.0	-4.5
Hixon Street High Lift PS	10.1(1)	216	Maximum Day Demand + Fire	0.0	3.3	6.8	0.2	3.4	6.7	0.2	3.5	6.6
Hixon Street Low Lift **PS**	17.6(1)	193	Maximum Day Demand + Fire	0.8	9.0	8.5	1.2	10.7	6.8	1.3	10.8	6.7

(1) Firm Capacity plus fire pump due to design condition

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A.3.4 Storage Capacity

Using the MECP methodology for CT volume calculations and the corresponding MDD for each planning horizon, the required CT volume at the Grimsby WTP reservoir is 6.48 ML under 2051 MDD and 8.08 ML under post-2051 MDD. As such, the remaining usable volume for system storage utilization at the Grimsby WTP reservoir is 3.52 ML under 2051 MDD and 1.92 ML under post-2051 MDD. As a conservative assumption, the 2051 MDD volume was utilized for the existing system capacity utilization table. **Table 3.A.10** presents the available system storage at the Grimsby WTP under various demand scenarios.

Table 3.A.10 Available System Storage at the Grimsby WTP under 2051 MDD, Post-2051 MDD, and at MDWL Capacity

Grimsby WTP	2051 MDD	Post-2051 MDD	At MDWL Capacity
Minimum Reservoir Out/Treated Free Chlorine (mg/L)	0.8	0.8	0.8
Maximum Ph	8	8	8
Minimum Temperature (deg. C)	0.5	0.5	0.5
Reservoir Volume (ML)	10	10	10
Reservoir Baffle Factor	0.3	0.3	0.3
MDD (ML/D)	45.7	57.0	44
$CT_{required}$	49	49	49
Safety Factor	**1**	**1**	**1**
CT_{actual}	49	49	49
T_{10}	61.25	61.25	61.25
Reservoir Retention Time (min)	204.2	204.2	204.2
Min Volume Needed (ML)	6.48	8.08	6.24
Minimum Reservoir Level (%)	0.65	0.81	0.62
Storage Volume Available (ML)	**3.52**	**1.92**	**3.76**

Table 3.A.11 highlights the storage existing and projected capacity. The Region has initiated the construction of the 15 ML Park Ridge Reservoir (to be commissioned by 2023), the new reservoir has been incorporated into the storage analysis.

The 154, 210, and 225 pressure zones have an existing storage deficit, which will addressed by the addition of the new Park Ridge Reservoir, resulting in surplus storage projected for 2051. There is a small post-2051 deficit within this area. The 239 pressure zone (Smithville) and the Hixon Street Reservoir (servicing all pressure zones in Lincoln Beamsville) have future storage deficits (2051 and post-2051).

Table 3.A.11 System Storage Capacities

Storage	Fire Supply Zones	MDD Supply Zones	2021 Rated Capacity (ML)	2051 Rated Capacity (ML)	Post 2051 Rated Capacity (ML)	2021 Total Available Storage (ML)	2021 Required Storage	2021 Surplus/ Deficit (ML)	2051 Total Available Storage (ML)	2051 Required Storage (ML)	2051 Surplus/ Deficit (ML)	Post 2051 Total Available Storage (ML)	Post 2051 Required Storage (ML)	Post 2051 Surplus/ Deficit (ML)
Grimsby WTP Reservoir[(1)]	154 Pumped	All	3.52[(4)]	3.52	1.92	6.92	14.3	-7.4	18.5	16.0	2.5	16.9	18.1	-1.2
Park Road Reservoir**[(2)]**	154 Floating, 210 Pumped, 225 Pumped	154, 210, 225	3.4	N/A	N/A									
New Park Ridge **Reservoir[(3)]**	154 Floating	154	N/A	15	15									
London Road Reservoir	239 Pumped	239	7.7	7.7	7.7	10.0	4.0	6.0	10.0	14.3	-4.3	10.0	15.7	-5.8
Smithville Elevated Tank	239 Floating	239	2.27	2.27	2.27									
Hixon Street Reservoir	148 Floating, 151 Floating, 163 Floating, 193 Pumped, 216 Pumped	148, 151, 163, 193, 216	10	10	10	10.0	7.7	2.3	10.0	11.4	-1.4	10.0	13.8	-3.8

(1)Refer to **Section A.2.2** for discussion on contact time volume requirements at the WTP reservoir

(2)To be decommissioned before 2051, volume not included in 2051 or Post-2051 available storage

(3)To be commissioned shortly after 2021, volume not included in 2021 available storage

(4)2051 MDD volume was utilized for the existing system capacity utilization table (conservative assumption)

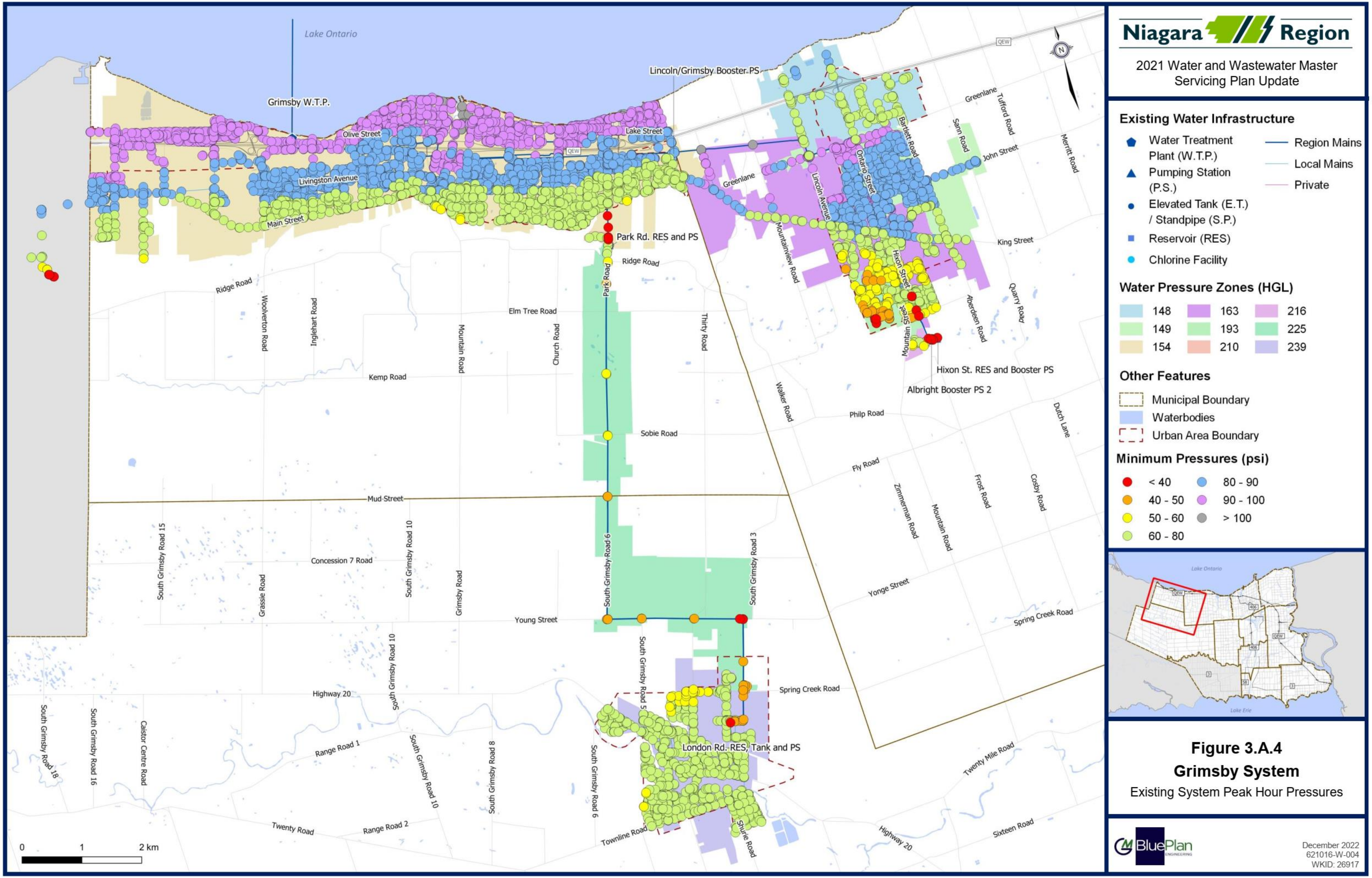
A.3.5 System Pressures and Fire Flows

Figure 3.A.4 and **Figure 3.A.5** present the existing system performance, based on existing system configuration and capacities.

In general, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. Higher pressures, exceeding 100 psi under average days demands, are experienced in areas closer to Lake Ontario. Addressing large high-pressure areas was outside of the scope of the Region's 2021 MSPU, but they can be assessed at the local area municipality level, with potential options including do nothing, optimize the HGL for the entire zone, or the creation of new subzones. Low pressure below 40 psi are experienced in Grimsby on Park Road south of Bell Avenue to the existing Park Road Reservoir, as well as in Lincoln Beamsville along Hixon Street on the Regional watermain south of Douglas Street to the Hixon Reservoir. These low-pressure areas are expected as the watermains feed the inground reservoirs which service Grimsby and Lincoln and do not directly service residents or businesses.

The Region's target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for critical system areas. The fire flow target is not met on the transmission main from the existing Park Road Reservoir to Smithville, however, this area is outside of the urban area boundary and does not provide fire service to local residents or businesses. The fire flow target is not met on the Regional transmission main in Lincoln (Beamsville) from pressure zone 193 to Hixon Reservoir, however this is to be expected as it is a low pressure watermain filling the reservoir. Fire flow is provided to pressure zones 193 and 216 by separate fire pumps at the Hixon Reservoir high and low lift pumping stations.

It is noted that the Smithville system does not have a Regional feedermain supplying the local distribution system. The fire flow capacity within the local Smithville system is below the land use based fire flow targets and are further reduced when growth demands are applied to the system.



Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

▨ 148	▨ 163	▨ 216
▨ 149	▨ 193	▨ 225
▨ 154	▨ 210	▨ 239

Other Features

- ▭ Municipal Boundary
- ▭ Waterbodies
- ▭ Urban Area Boundary

Minimum Pressures (psi)

● < 40	● 80 - 90
● 40 - 50	● 90 - 100
● 50 - 60	● > 100
● 60 - 80	

Figure 3.A.4

Grimsby System

Existing System Peak Hour Pressures

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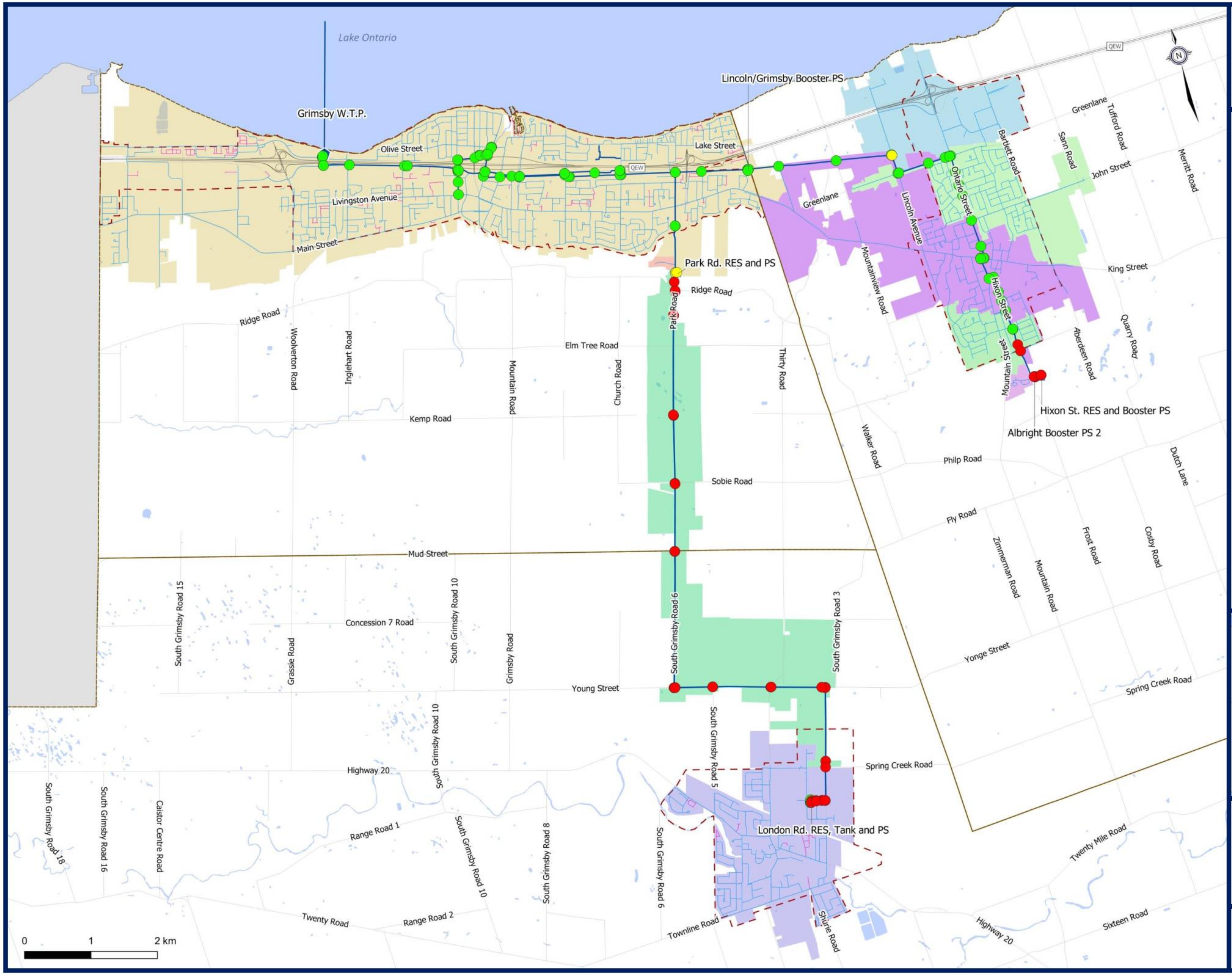

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

148	163	216
149	193	225
154	210	239

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Regional Mains Available Fire Flow (L/s) - 30 psi Residual Pressure

- 🟥 < 125
- 🟩 > 250
- 🟨 125 - 250

Figure 3.A.5
Grimsby System
Existing System Fire Flows

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A.3.6 Water Age and Watermain Velocity

Using the baseline system model, water age scenarios were created to identify average system water age. Using the Drinking Water Works Permits for each system, the locations of re-chlorination facilities were identified. Water age was reset to zero at these facilities for the water age model scenario. Water age is typically used as a proxy indicator for water quality, however the exact correlation between water age and water quality can be highly variable depending on the source water quality, the distribution system material, and the secondary disinfectant used. A common threshold used within water system age is to flag areas where water age is greater than 7 days.

Figure 3.A.6 presents the existing system water age. Watermain velocities less than 0.6 m/s or greater than 1.5 m/s have been flagged and are shown in **Figure 3.A.7**.

In general, maximum water age is less than 7 days within the Grimsby water system, except for the following areas:

- The partially constructed transmission main in Grimsby where water age will be reduced once the full alignment is completed and looped within the system;
- The transmission main from Park Road Reservoir to Smithville, where the increased water age is due to the volume of water to turnover. Re-chlorination facilities in Smithville address any potential water quality concerns; and,
- Minor local dead-end watermains.

In general, watermain velocity is less than 2 m/s, however there are many Regional watermains which experience velocities less than 0.6 m/s.

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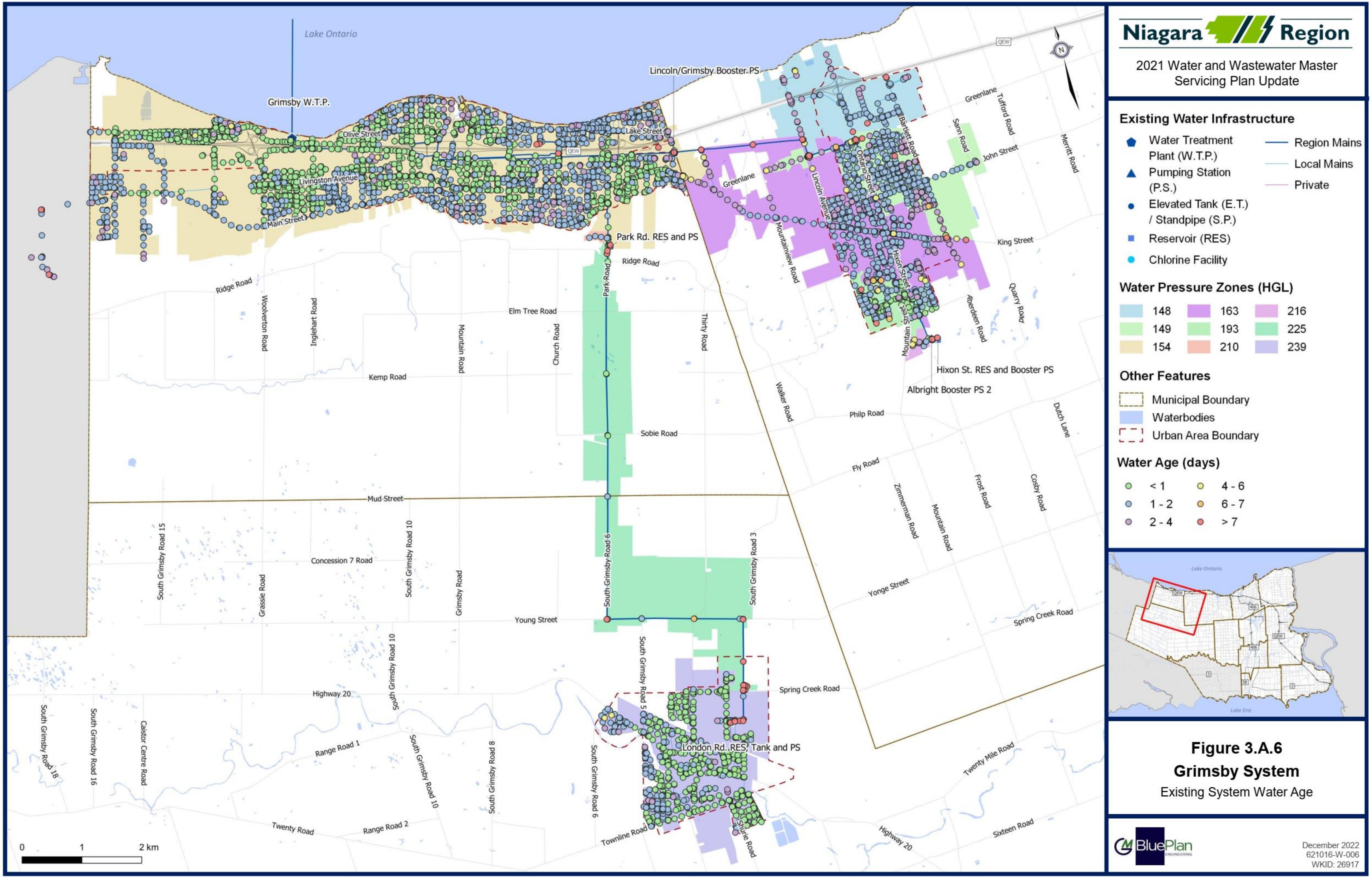

Figure 3.A.6

Grimsby System

Existing System Water Age

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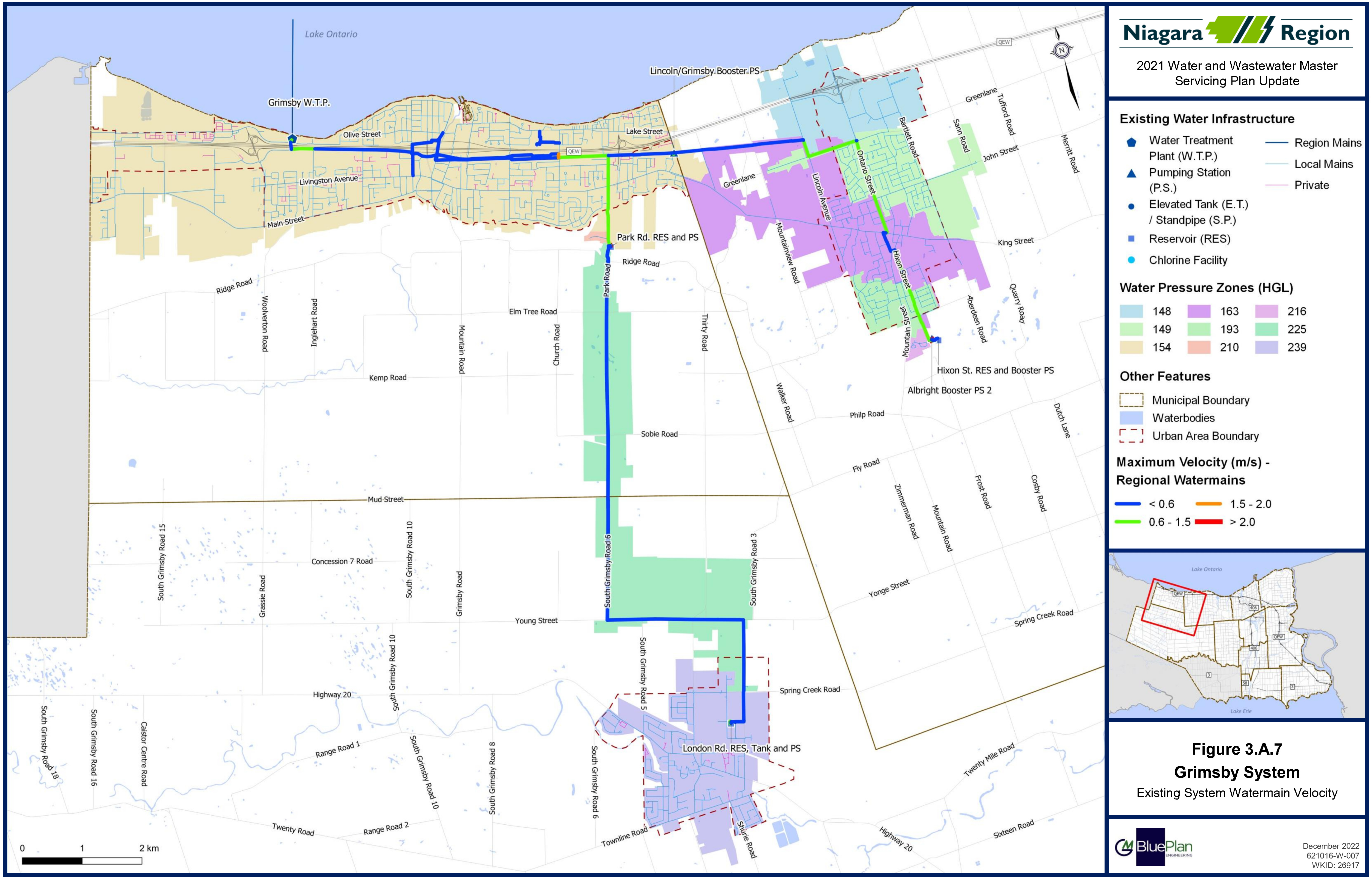

Figure 3.A.7
Grimsby System
Existing System Watermain Velocity

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A.4 System Opportunities and Constraints

Figure 3.A.8 highlights the existing opportunities and constraints.

A.4.1 Grimsby Water Treatment Plant

- The current rated MDD capacity of the plant is 44.0 MLD, with an existing demand of 25.0 MLD. The plant has limited capacity in the future, with treatment capacity upgrades required to support future projected flows.
- The 2051 projected MDD is 45.7 MLD, while the post-2051 projected MDD is 57.0 MLD.

A.4.2 Grimsby System

- Grimsby has an existing storage deficit of 7.4 MLD, however the New Park Ridge Reservoir which is currently being constructed will address existing and projected storage needs.
- There is sufficient storage capacity within the zone to support 2051 growth within Grimsby, however, there will be a slight post-2051 storage deficit.
- Significant portions of the Grimsby system experience high pressures (>100 psi), near Lake Ontario (minimum hour pressures).

A.4.3 Smithville System

- Smithville has sufficient existing pumping and storage capacity within the zone, as well as adequate fire flow and pressure capacity.
- Additional pumping, storage, and conveyance is required to support growth.
- Smithville has no feedermain loop, which results local fire flow capacity below the typical land use based criteria.

A.4.4 Lincoln System

- Projected 2051 growth is expected to exceed the Lincoln/Grimsby Booster Pumping Station capacity.
- Additional storage is required to support 2051 and post-2051 growth within Lincoln.
- Portions of the Beamsville system experience high pressures (>100 psi), near Lake Ontario (minimum hour pressures).

A.4.5 System Security of Supply & Interconnections

- The Park Road Booster Pumping Station, which transfers water from Grimsby to Smithville, does not have sufficient capacity to support 2051 growth flows. Further, the new Park Ridge Reservoir, and new interim operational configuration, is expected to further increase demands on the Park Road Booster Pumping Station.
- The Grimsby water system consists of a single spine watermain with a single feedermain watermain interconnecting all major components of the water system.
- There is a single feed watermain which supports Lincoln from Grimsby.

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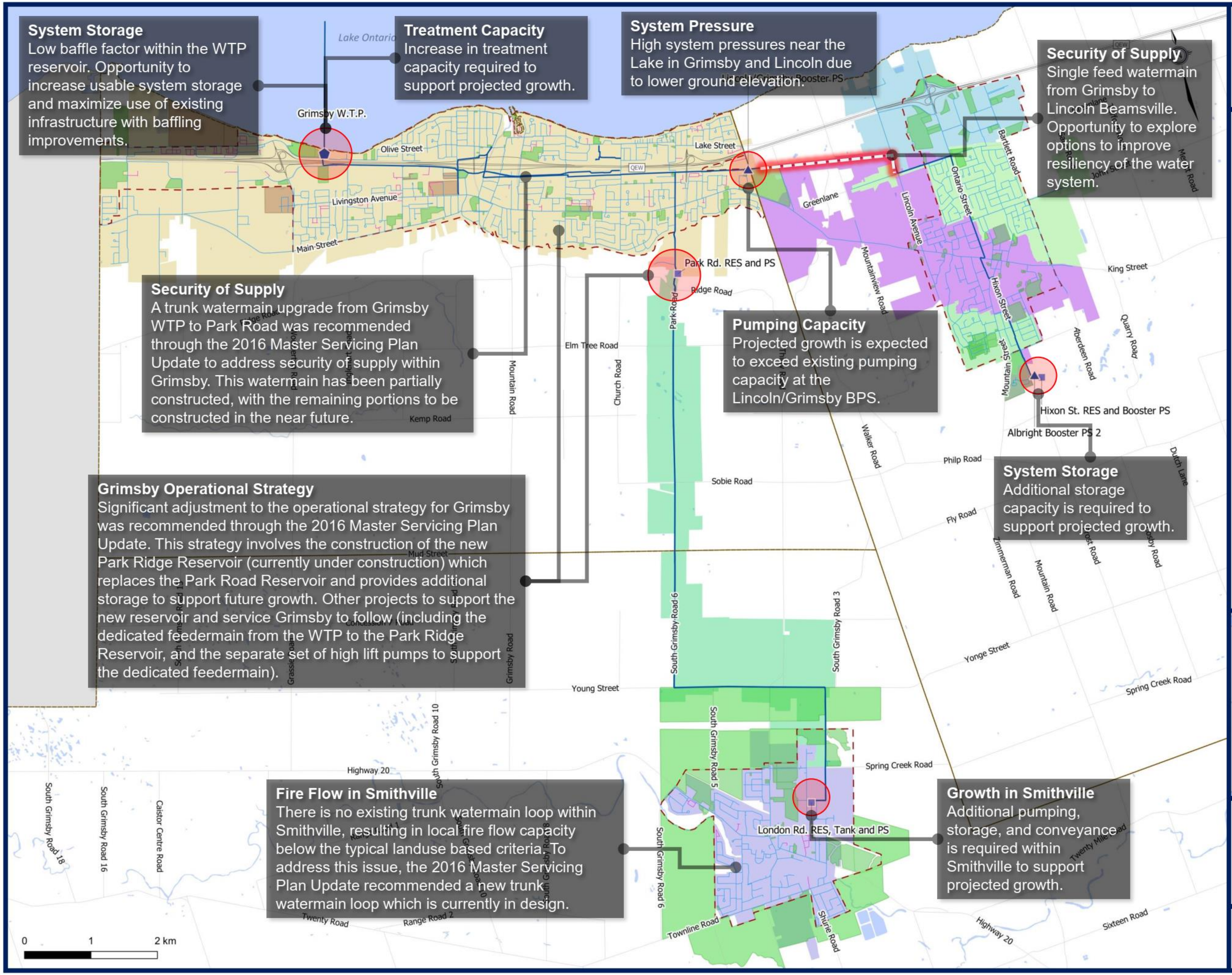

System Storage
Low baffle factor within the WTP reservoir. Opportunity to increase usable system storage and maximize use of existing infrastructure with baffling improvements.

Treatment Capacity
Increase in treatment capacity required to support projected growth.

System Pressure
High system pressures near the Lake in Grimsby and Lincoln due to lower ground elevation.

Security of Supply
Single feed watermain from Grimsby to Lincoln Beamsville. Opportunity to explore options to improve resiliency of the water system.

Security of Supply
A trunk watermain upgrade from Grimsby WTP to Park Road was recommended through the 2016 Master Servicing Plan Update to address security of supply within Grimsby. This watermain has been partially constructed, with the remaining portions to be constructed in the near future.

Pumping Capacity
Projected growth is expected to exceed existing pumping capacity at the Lincoln/Grimsby BPS.

System Storage
Additional storage capacity is required to support projected growth.

Grimsby Operational Strategy
Significant adjustment to the operational strategy for Grimsby was recommended through the 2016 Master Servicing Plan Update. This strategy involves the construction of the new Park Ridge Reservoir (currently under construction) which replaces the Park Road Reservoir and provides additional storage to support future growth. Other projects to support the new reservoir and service Grimsby to follow (including the dedicated feedermain from the WTP to the Park Ridge Reservoir, and the separate set of high lift pumps to support the dedicated feedermain).

Fire Flow in Smithville
There is no existing trunk watermain loop within Smithville, resulting in local fire flow capacity below the typical landuse based criteria. To address this issue, the 2016 Master Servicing Plan Update recommended a new trunk watermain loop which is currently in design.

Growth in Smithville
Additional pumping, storage, and conveyance is required within Smithville to support projected growth.

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

148	163	216
149	193	225
154	210	239

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Development Locations

- Pre-2051
- Post-2051

Figure 3.A.8
Grimsby System
System Opportunities and Constraints

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A.5 Assessment of Alternatives

Significant adjustments to the operational strategy for Grimsby was recommended through the 2016 Master Servicing Plan Update. This strategy involves the construction of the new Park Ridge Reservoir which replaces the Park Road Reservoir and provides additional storage to support future growth. Along with this reservoir, a dedicated feedermain from the WTP to the new Park Ridge Reservoir was recommended to fill the reservoir. It was determined that this strategy should continue to be implemented and associated projects would thus be carried forward through the 2021 MSPU, as listed below:

- Grimsby WTP treatment capacity upgrades;
- Construction of the new Park Ridge Reservoir and supporting transmission main and PRV to support back feed to the Grimsby system;
- Transmission main upgrade from Grimsby WTP to Park Road;
- New dedicated feedermain from Grimsby WTP to New Park Ridge Reservoir;
- New separate set of high lift pumps at Grimsby WTP to support dedicated feed to the new Park Ridge Reservoir;
- Decommissioning of the existing Park Road Reservoir and Pumping Station; and,
- New feedermain in Smithville to support growth to the north, east, and south of Smithville.

Some projects such as the new Park Ridge Reservoir are under construction and nearing completion at the time of this study and others such as the transmission main upgrade from Grimsby WTP to Park Road are in the EA stage.

To address the broader existing and growth-related capacity needs, the following servicing concepts were evaluated:

- Baseline (No Changes),
- Storage Expansion and Watermain Twinning,
- Storage Expansion to Address Security of Supply, and
- New Grimsby/Lincoln Connection.

Identified high pressure issues can be addressed through changes within the local distribution system through either the creation of new pressure zones, adjustments to existing zone boundaries, or adjustments to Region infrastructure pressure settings (i.e. PRV settings). While the local capacity constraints will be addressed through localized capacity upgrades.

A.5.1 System Alternative 1 – Storage Expansion and Watermain Twinning

System Alternative 1, highlighted in **Figure 3.A.9** generally maintains the existing system configuration with upgrades to existing facilities as required to support growth, as well as transmission main twinning of the existing single feed watermain from Grimsby to Lincoln, and a new Smithville feedermain loop. There are various potential sub-options depending on the length of watermain twinning, with the shortest length (A) providing the least security of supply benefit, the medium length (B) providing moderate security of supply benefit, and the full-length twinning (C) providing full redundancy of the transmission main through Beamsville to the Hixon Reservoir. Under this configuration, the existing single transmission main network would be maintained. This alternative would address future storage and pumping deficiencies, and address security of supply to Beamsville to varying degrees, depending on the twinning length sub-option.

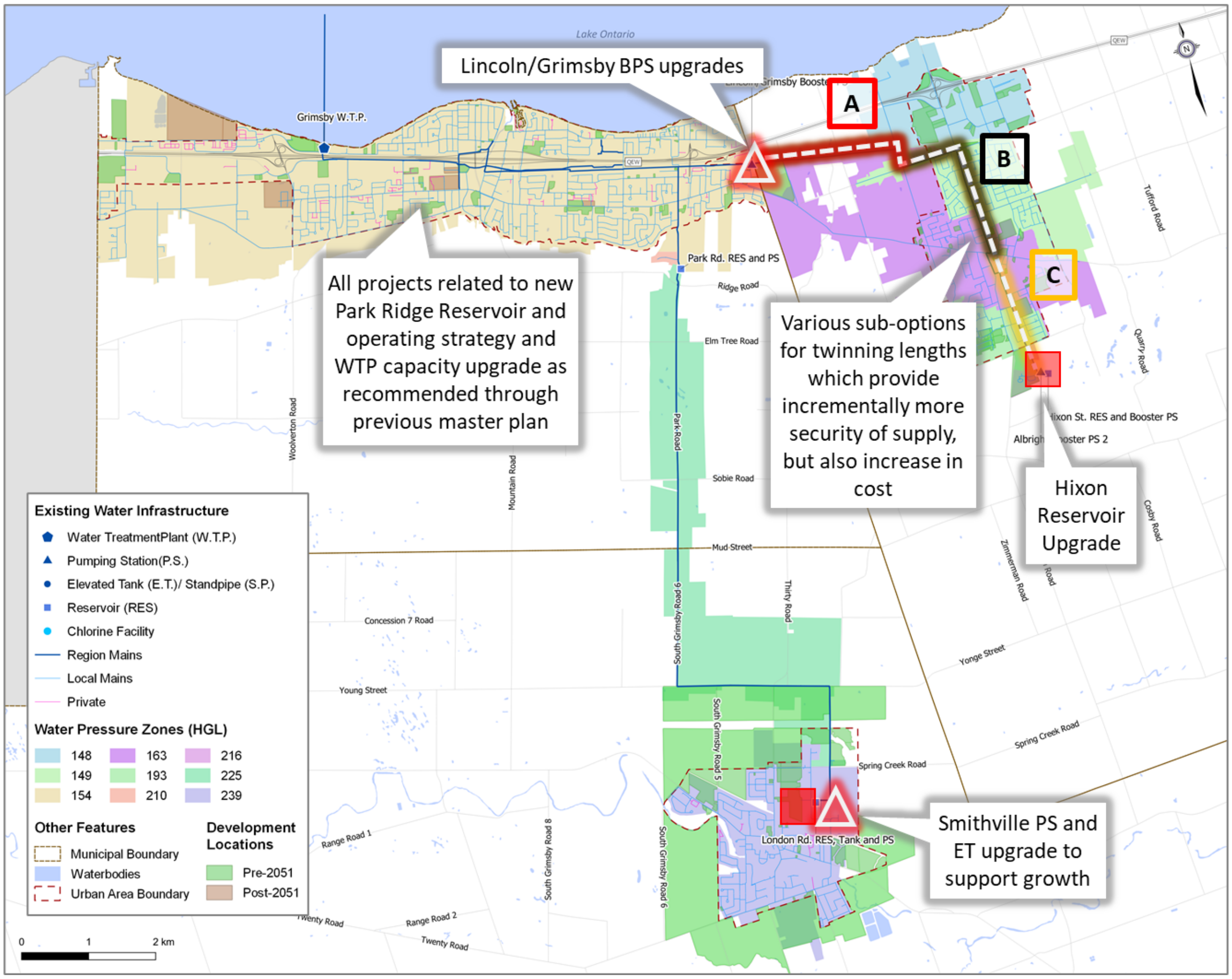
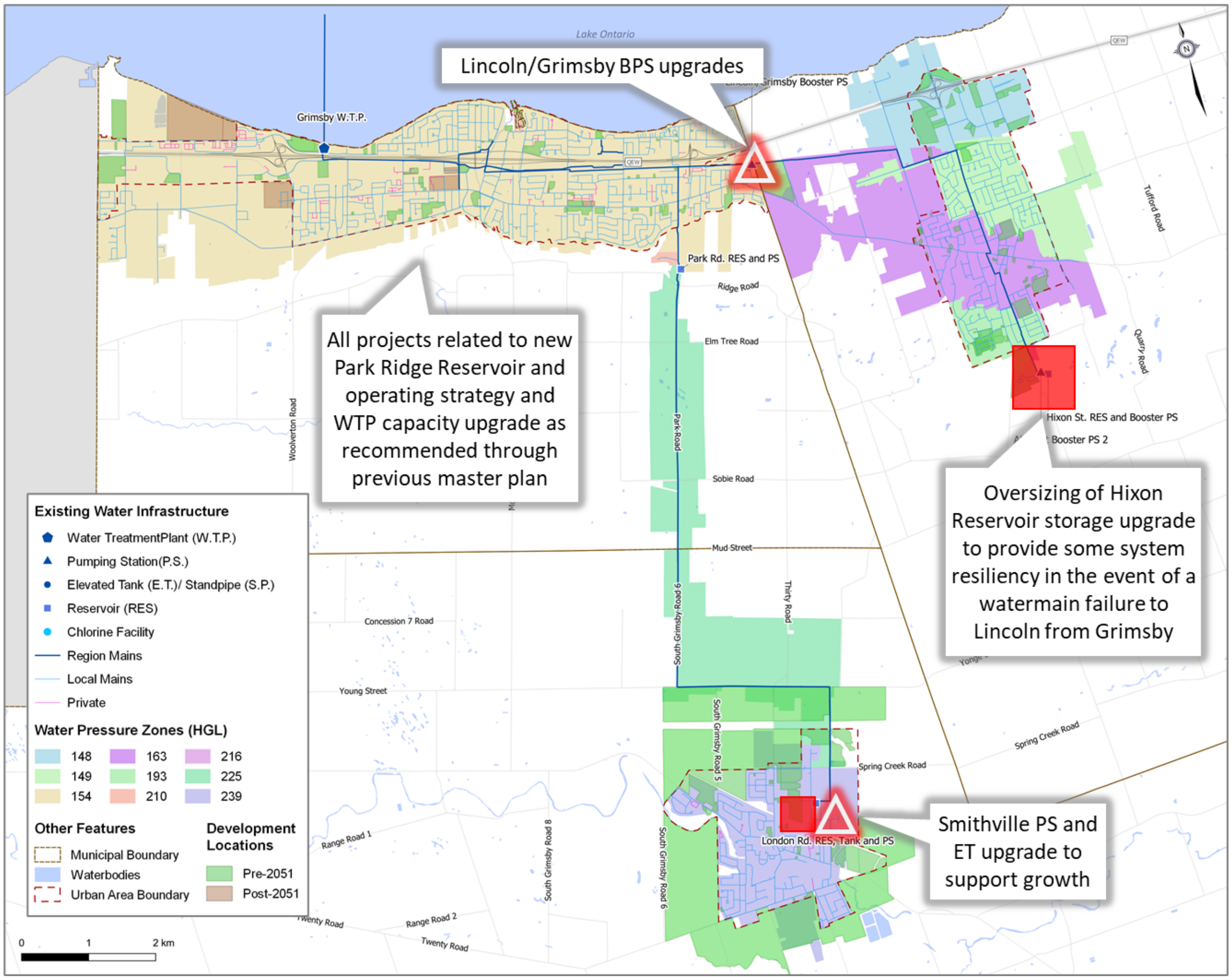


Figure 3.A.9 Alternative 1 – Storage Expansion and Watermain Twinning

A.5.2 System Alternative 2 – Storage Expansion to Address Security of Supply

System Alternative 2, highlighted in **Figure 3.A.10** generally maintains the existing system configuration, with upgrades to existing facilities as required to support growth, new Smithville feedermain loop, and includes an oversized storage expansion at Hixon Reservoir to address future storage deficiency and provide some security of supply in the event of a single feed watermain break. Based on existing site size at Hixon Reservoir and realistic oversizing, the increased reservoir size could provide up to 1.4 days of MDD storage under post-2051 projected demands. This alternative addresses future storage and pumping needs and provides some mitigation of security of supply concerns from Grimsby to Beamsville.



Lincoln/Grimsby BPS upgrades

All projects related to new Park Ridge Reservoir and operating strategy and WTP capacity upgrade as recommended through previous master plan

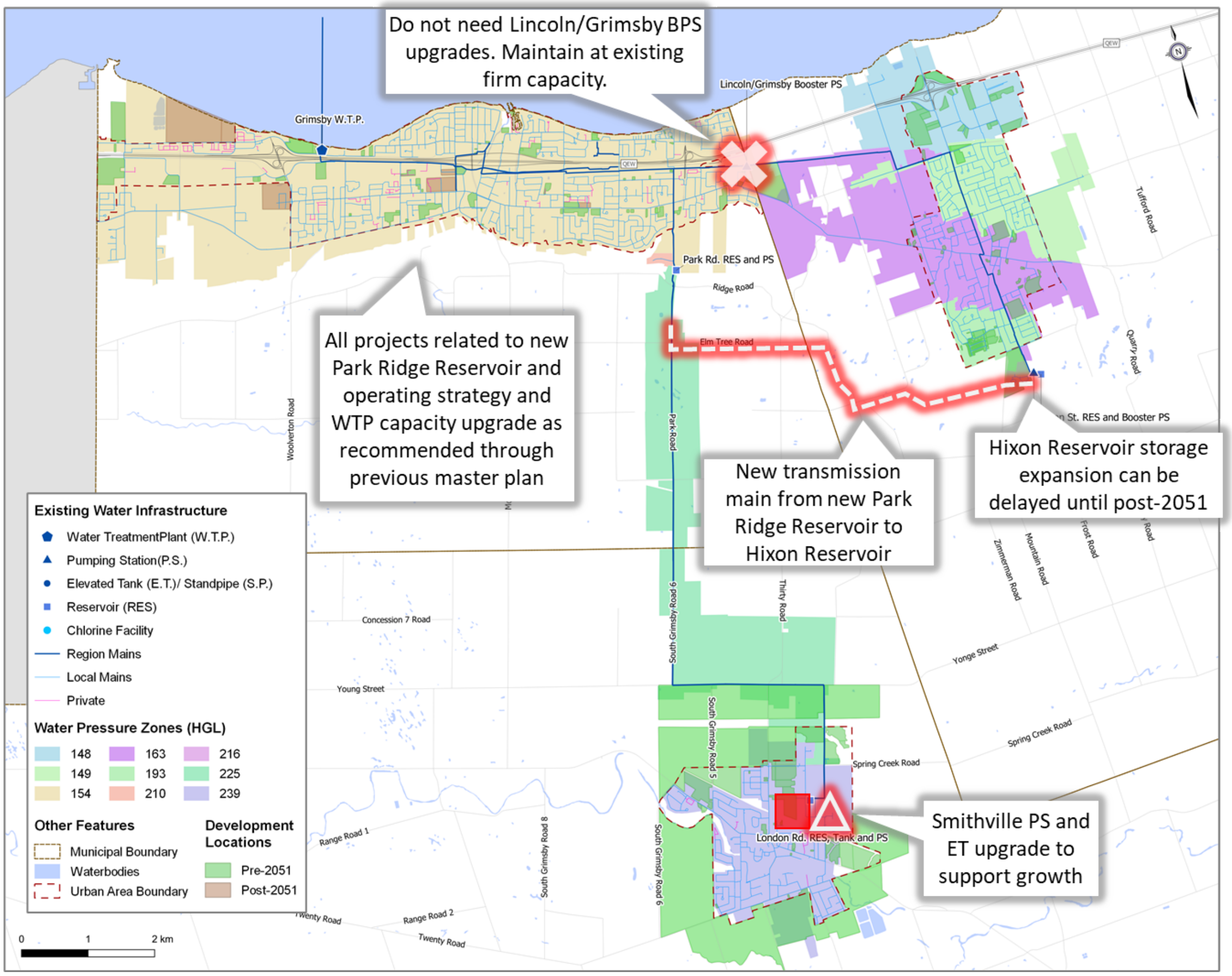
Oversizing of Hixon Reservoir storage upgrade to provide some system resiliency in the event of a watermain failure to Lincoln from Grimsby

Smithville PS and ET upgrade to support growth

Figure 3.A.10 Alternative 2 – Storage Expansion to Address Security of Supply

A.5.3 System Alternative 3 – New Grimsby/Lincoln Connection

Alternative 3, highlighted in **Figure 3.A.11** consists of upgrades to existing facilities as required to support growth, new Smithville feedermain loop, and a new transmission main from the new Park Ridge reservoir to the Hixon Reservoir to address security of supply and storage deficiency at Hixon. The top water level of the new Park Ridge reservoir will be 201 m, and the existing top water level of the Hixon Reservoir is 163.4 m, which is sufficient head difference to support a feed from the new Park Ridge reservoir to the Hixon Reservoir, with a new control valve at the Hixon Reservoir to control fill cycles. Upgrades to the Lincoln/Grimsby BPS would not be required under this alternative and the BPS can be maintained at its existing pumping capacity to act as a secondary feed. Further, this alternative allows surplus storage capacity at the new Park Ridge reservoir to be utilized within Lincoln, delaying the need for storage upgrades at Hixon Reservoir until after 2051. This alternative addresses future storage and pumping needs as well as security of supply concerns from Grimsby to Beamsville.


Do not need Lincoln/Grimsby BPS upgrades. Maintain at existing firm capacity.

All projects related to new Park Ridge Reservoir and operating strategy and WTP capacity upgrade as recommended through previous master plan

New transmission main from new Park Ridge Reservoir to Hixon Reservoir

Hixon Reservoir storage expansion can be delayed until post-2051

Smithville PS and ET upgrade to support growth

Figure 3.A.11 Alternative 3 – New Lincoln/Grimsby Connection

A.5.4 Alternatives Evaluation

Table 3.A.12 presents the various alternatives along with their advantages and disadvantages.

As determined through discussion with regional staff and based on the relative advantages and disadvantages of the alternatives, Alternative 3 – New Grimsby/Lincoln Connection is the preferred servicing strategy as:

- The baseline strategy does not satisfy future servicing needs of the water system.
- Alternative 3 allows for:
    - A more efficient operation of the overall system;
    - Increased security of transmission within the system, with the creation of a new alternate connection between Grimsby and Lincoln;
    - Improved turnover rate within the new Park Ridge Reservoir leading to improved water quality within the system;
    - Delays the timing for storage expansion needs at the Hixon Reservoir and maximizes the use of existing storage within the system; and,
    - Avoids the need for increase of pumping capacity at the Lincoln/Grimsby BPS.

Table 3.A.12 Comparison of Alternatives

Category	Alternative 1	Alternative 2	Alternative 3 (Preferred)
Description	Storage expansion and WM twinning	Storage expansion to address security of supply	New Grimsby/Lincoln connection
Upgrades	• All 2016 MSPU recommended projects o Including Park Ridge Reservoir and associated new set of pumps and watermains o Pumping upgrade at Lincoln/Grimsby BPS o New Smithville feedermain loop • Smithville PS and Reservoir upgrades to support growth o Upgrade Smithville ET to 8.2 ML (Fire) o Additional 7 MLD at Smithville PS (new firm capacity 26.5 MLD to support PHD) • One additional cell at Hixon (5 ML) • Pumping upgrade at Lincoln/Grimsby BPS • Optional 2.5, 5 km, or 9 km watermain twin from Grimsby to Lincoln (500 mm)	• All 2016 MSPU recommended projects o Including Park Ridge Reservoir and associated new set of pumps and watermains o Pumping upgrade at Lincoln/Grimsby BPSN o New Smithville feedermain loop • Smithville PS and Reservoir upgrades to support growth o Upgrade Smithville ET to 8.2 ML (Fire) o Additional 7 MLD at Smithville PS (new firm capacity 26.5 MLD to support PHD) • Including Park Ridge Reservoir and associated new set of pumps and watermains • Pumping upgrade at Lincoln/Grimsby BPS • Two additional cells at Hixon (10 ML)	• All 2016 MSPU recommended projects except for Lincoln/Grimsby BPS upgrade o Including Park Ridge Reservoir and associated new set of pumps and watermains o Pumping upgrade at Lincoln/Grimsby BPSN o New Smithville feedermain loop • Smithville PS and Reservoir upgrades to support growth o Upgrade Smithville ET to 8.2 ML (Fire) o Additional 7 MLD at Smithville PS (new firm capacity 26.5 MLD to support PHD) • 6.7 km of new watermain from new Grimsby Reservoir to Hixon Reservoir • Hixon Reservoir storage upgrade delayed to post-2051
Advantages	• Addresses future deficiencies	• Addresses future deficiencies	• Addresses future deficiencies • Maximizes use of existing storage infrastructure • Addresses of security of supply concerns to Lincoln Beamsville (full redundancy provided with new transmission main) • Upgrades to Lincoln/Grimsby BPS not required • Delays need for storage upgrade at Hixon Reservoir to post-2051 • Improved turnover of the Park Ridge and Hixon Reservoir
Disadvantages	• Security of supply to Lincoln Beamsville not fully mitigated due to single point of failure at Lincoln/Grimsby BPS facility • Security of supply mitigation to Lincoln Beamsville depends on chosen length of watermain twinning • Hixon Reservoir storage upgrade required pre-2051 • Higher water age in Beamsville system	• Significant Hixon Reservoir storage upgrade required pre-2051 • Potential for water quality/water turnover issues in 20 ML reservoir • May need more property at Hixon Reservoir • Security of supply to Lincoln Beamsville not fully mitigated due to single point of failure at Lincoln/Grimsby BPS facility • Additional storage at Hixon does not provide full redundancy of supply to Lincoln Beamsville	• EA required for new watermain from Grimsby to Lincoln, feasibility of alignment is uncertain, will likely need property acquisition

A.6 Preferred Servicing Strategy

The following is a summary of the Grimsby water servicing strategy as recommended through the 2016 Master Servicing Plan Update and carried forward through this update:

- Based on the level of growth projected for the system, the Grimsby Water Treatment Plant will require additional water treatment capacity;
- The new Park Ridge reservoir will support the Grimsby and Smithville service areas, with plans to decommission the existing Park Road Reservoir and Pumping Station;
    - Opportunity to optimize Grimsby system pressures through adjustment of the PRV from the Park Ridge Reservoir which will feed Grimsby.
- To support the new Park Ridge reservoir, a new dedicated feedermain from Grimsby WTP to the new Park Ridge reservoir will be required, as well as a new feedermain across Grimsby to provide additional water transmission capacity; and,
- The level of growth in the Smithville area requires additional feedermain capacity through the network.

The following is a summary of the additional enhancements to the Grimsby water servicing strategy (Alternative 3) to support growth to 2051 and beyond, and improve security of supply:

- Baffle improvements at the Grimsby WTP Reservoir to maximize the use of existing infrastructure by increasing usable volume;
- New transmission main between the new Park Ridge Reservoir and the Hixon Reservoir to improve security of supply between Grimsby and Lincoln and maximize the use of existing storage capacity;
- Additional storage and pumping capacity in Smithville to support growth to 2051 and beyond; and,
- Additional storage capacity at Hixon Reservoir post-2051 to support growth.

Figure 3.A.16 and **Figure 3.A.17** show the preferred servicing strategy, consisting of the works described in the following sections.

A.6.1 Treatment Plant Works

- Provide an additional 22 MLD of treatment capacity at the water treatment plant;
- New separate set of high lift pumps to support the dedicated feed to the new Park Ridge reservoir; and,
- Baffle improvements at the WTP reservoir to increase usable volume and maximum use of existing infrastructure.

A.6.2 Storage

- The new 15 ML Park Ridge Reservoir has been built on Park Road South, south of Ridge Road and the existing Park Road Reservoir and Booster Pumping Station to support growth and provide a benefit to existing. Includes:
    - Prior to the construction of the new watermains from the Grimsby WTP to the new reservoir, temporary upgrades to the Park Road Booster Pumping Station are required to support interim operation of the Reservoir, and
    - New 750 mm transmission main from the new reservoir to the new PRV located at the existing 500 mm watermain (upstream of the existing Park Road Reservoir);
- Replacement of the Smithville Elevated Tank with a larger 9 ML tank to support 2051 and post-2051 growth; and,
- Expansion of the Hixon Reservoir with the addition of one new 5 ML cell (post-2051 project to support growth beyond 2051).

A.6.3 Pumping

- Pumping upgrades at the Smithville Pumping Station to support 2051 and post-2051 growth (replace one 4.3 MLD pump with a 10.8 MLD pump); and,
- As described in **Section A.6.1** , a new separate set of high lift pumps to support the dedicated feed to the new Park Ridge reservoir.

A.6.4 Decommissioning of Existing Facilities

- Decommissioning of the existing Park Road Reservoir and Booster Pumping Station once all projects supporting the new Grimsby operational strategy are completed (i.e. new Grimsby transmission main, new dedicated transmission main from the WTP to the new Park Ridge reservoir, new separate set of high lift pumps at the WTP to support the new dedicated transmission main); and,
- Decommissioning of the existing Smithville ET after the replacement ET has been completed.

A.6.5 Regional Watermains

- New backfeed transmission main from new Park Ridge reservoir to existing Park Road Reservoir and Booster Pumping Station (constructed with the new Park Ridge Reservoir);
- Upgrade feedermain watermain to 750 mm from Grimsby WTP to Park Road (partially complete) with Baker Road to Park Road yet to be completed;
- New dedicated 750 mm transmission main from Grimsby WTP to new Park Ridge Reservoir;
- New 400 mm feedermain in Smithville; and,
- New 600 mm transmission main from new Park Ridge Reservoir in Grimsby to Hixon Reservoir in Lincoln.

A.6.6 Studies and Programs

- Region-wide WTP reservoir volume study to review CT volume and overall system storage.

A.6.7 Future System Performance

Figure 3.A.12 to **Figure 3.A.15** present the future system performance, based on the preferred servicing strategy configuration and capacities.

In general, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. Higher pressures, exceeding 100 psi under average days demands, are experienced in areas closer to Lake Ontario. Addressing large high-pressure areas was outside of the scope of the Region's 2021 MSPU, but they can be assessed at the local area municipality level, with potential options including do nothing, optimize the HGL for the entire zone, or the creation of new subzones. Low pressure below 40 psi are experienced in Grimsby on Park Road south of Bell Avenue to the London Road Reservoir, as well as in Lincoln Beamsville along Hixon Street on the Regional watermain south of Douglas Street to the Hixon Reservoir. These low-pressure areas are expected as the watermains feed the inground reservoirs which service Grimsby, Lincoln, and West Lincoln and do not directly service residents or businesses.

The Region's target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for critical system areas. The fire flow target is not met on the transmission main from the existing Park Road Reservoir to Smithville, however, this area is outside of the urban area boundary and does not provide fire service to local residents or businesses. The fire flow target is not met on the Regional transmission main in Lincoln (Beamsville) from pressure zone 193 to Hixon Reservoir, however this is to be expected as it is a low pressure watermain filling the reservoir. Fire flow is provided to pressure zones 193 and 216 by separate fire pumps at the Hixon Reservoir high and low lift pumping stations.

In general, maximum water age is less than 7 days within the Grimsby water system, except for the following areas:

- The transmission main from Park Road Reservoir to Smithville, where the increased water age is due to the volume of water to turnover. Re-chlorination facilities in Smithville address any potential water quality concerns; and,
- Minor local dead-end watermains.

In general, watermain velocity is less than 2 m/s, however there are many Regional watermains which experience velocities less than 0.6 m/s.

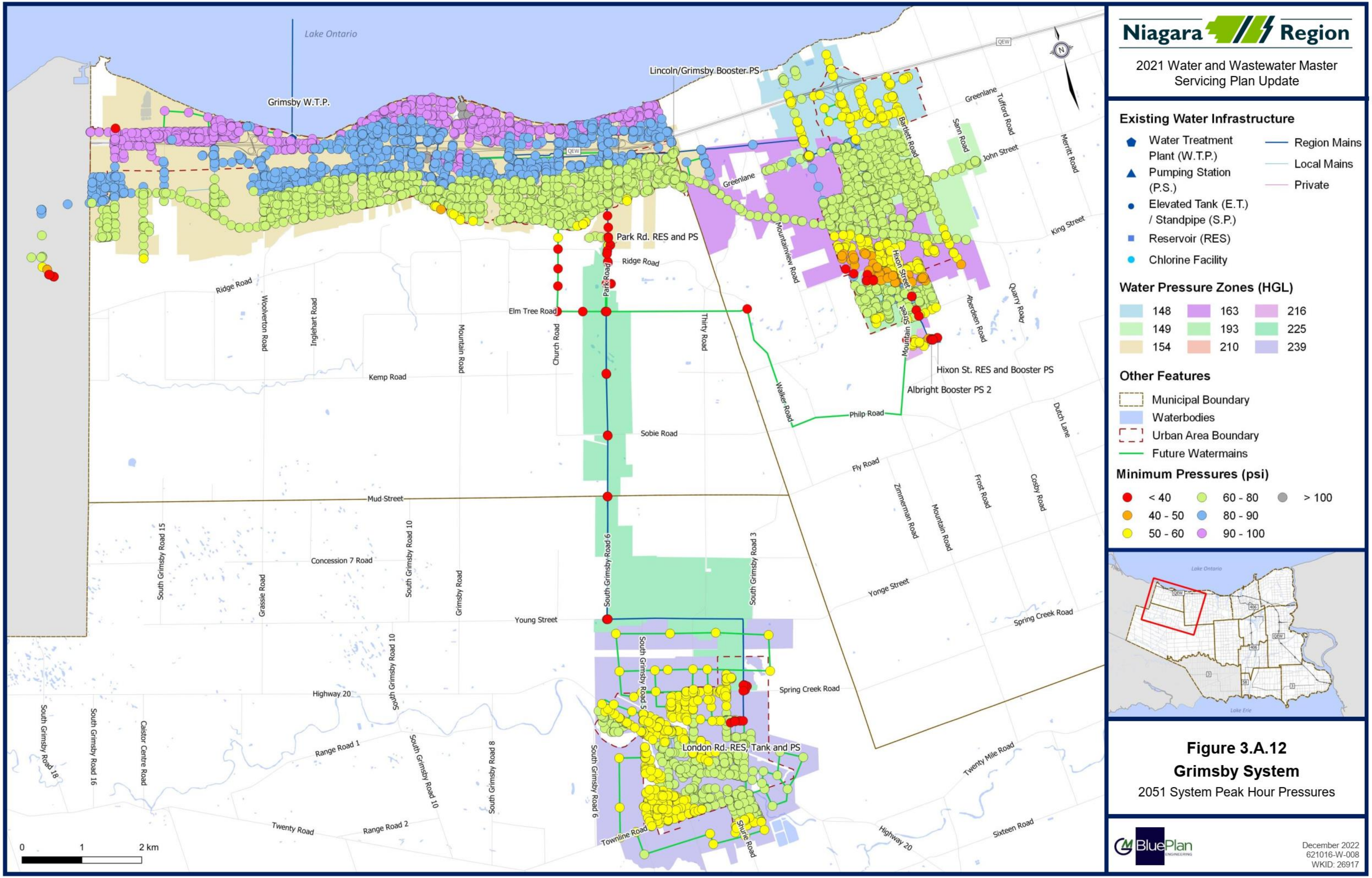


Figure 3.A.12
Grimsby System
2051 System Peak Hour Pressures

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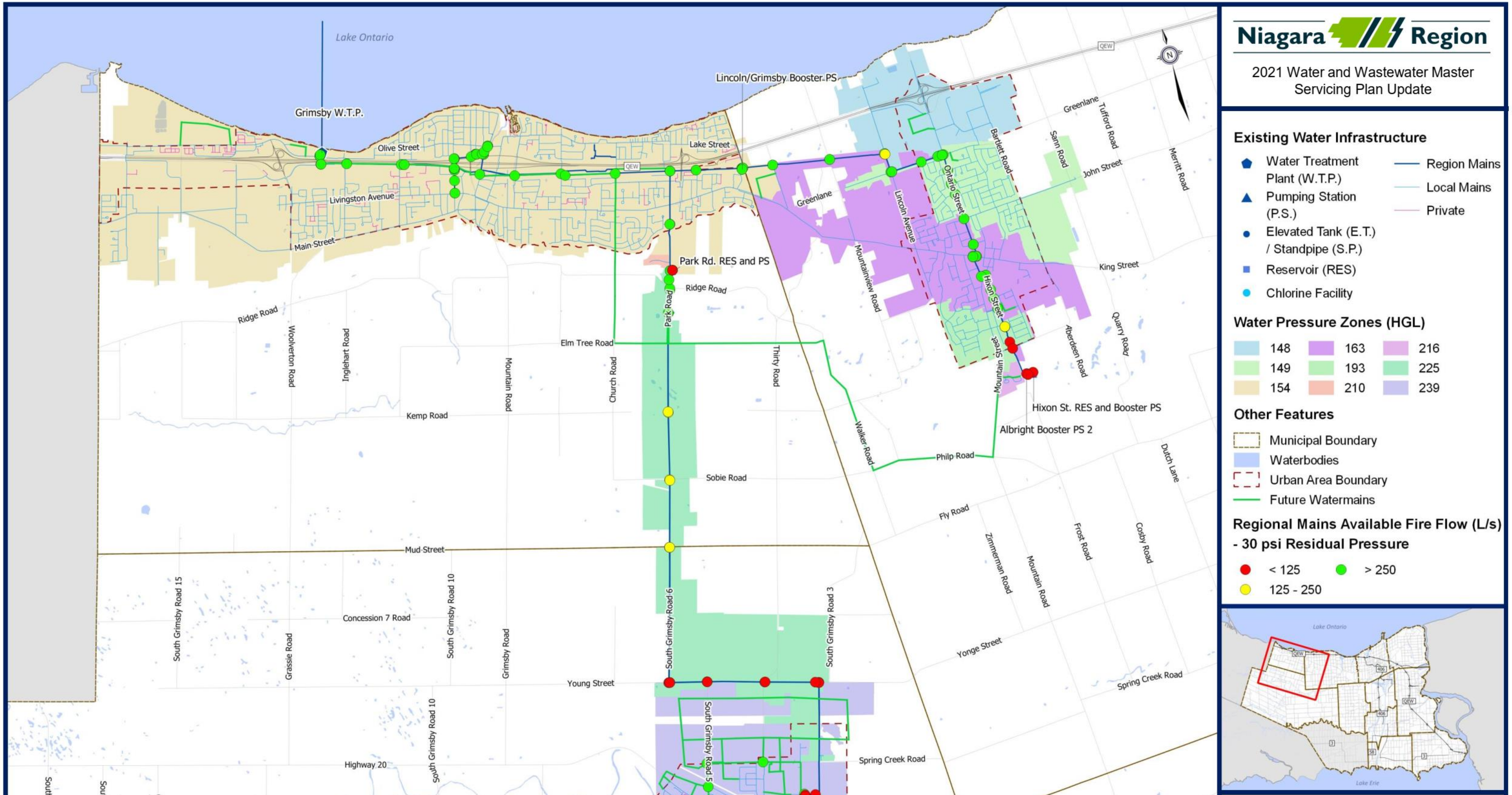

Figure 3.A.13
Grimsby System
2051 System Fire Flows

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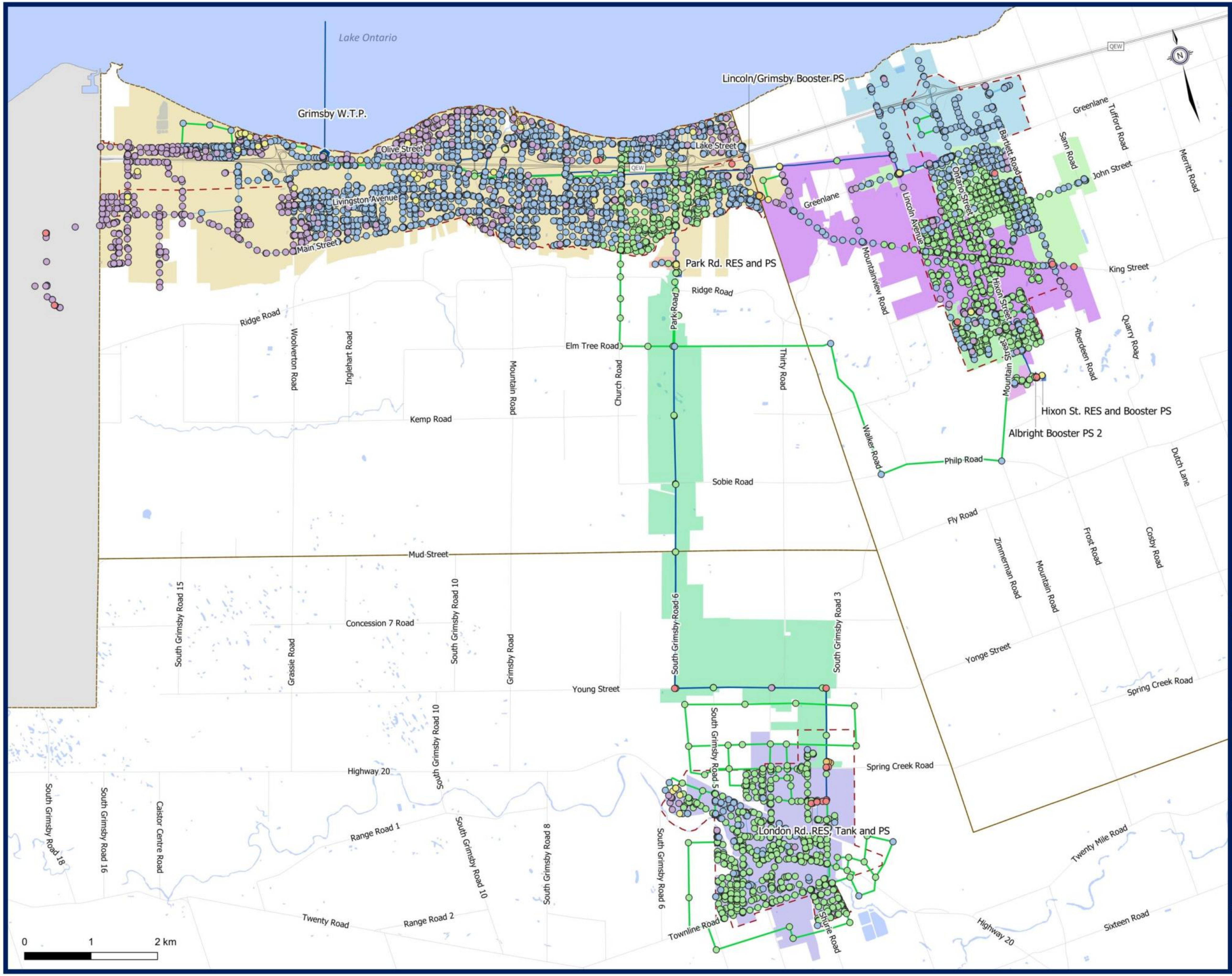

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Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

▨	148	▨	163	▨	216
▨	149	▨	193	▨	225
▨	154	▨	210	▨	239

Other Features

- ▭ Municipal Boundary
- ▨ Waterbodies
- ▭ Urban Area Boundary
- — Future Watermains

Water Age (days)

●	< 1	●	4 - 6
●	1 - 2	●	6 - 7
●	2 - 4	●	> 7

Figure 3.A.14
Grimsby System
2051 System Water Age

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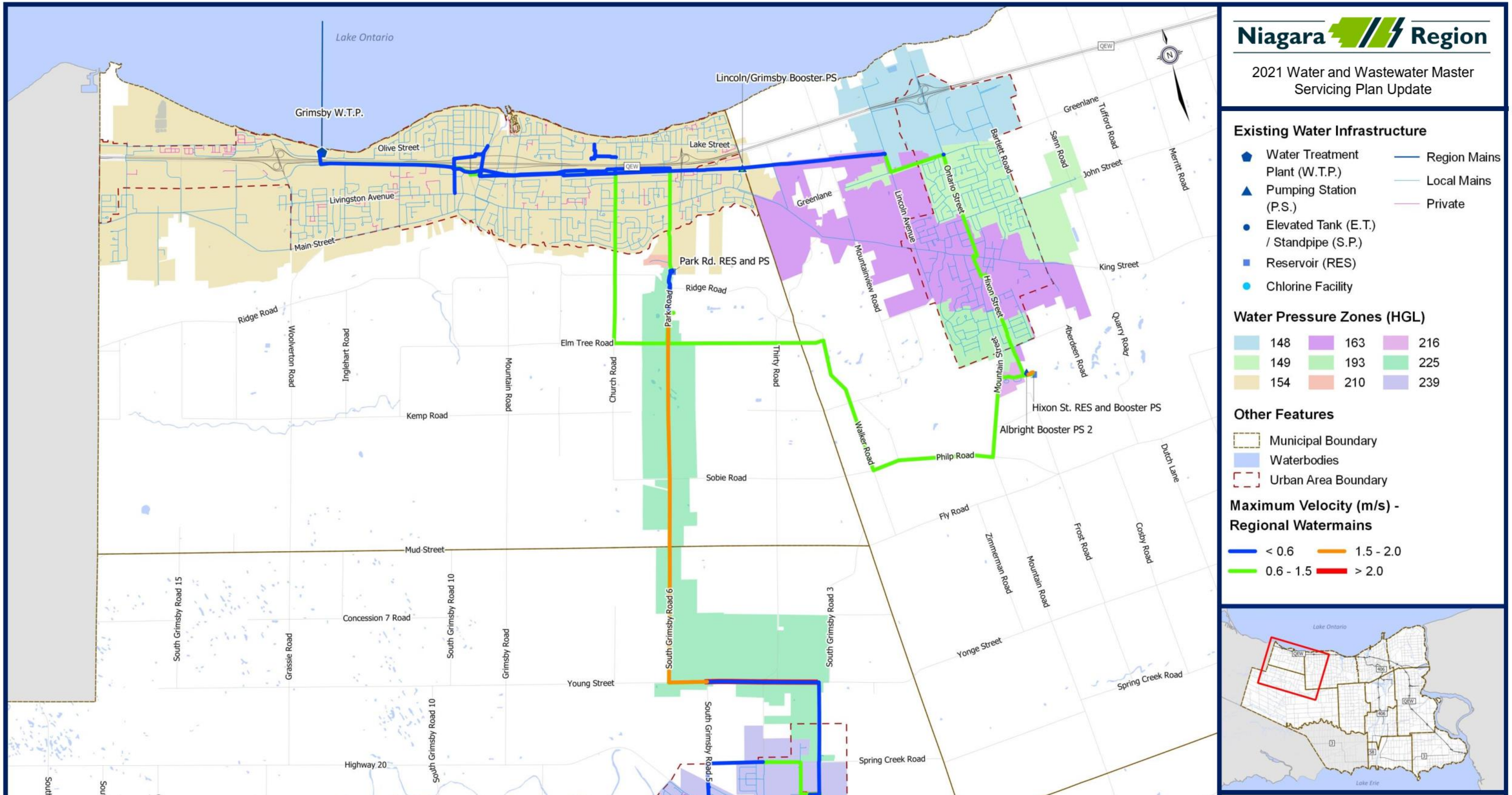

Figure 3.A.15
Grimsby System
2051 System Watermain Velocity

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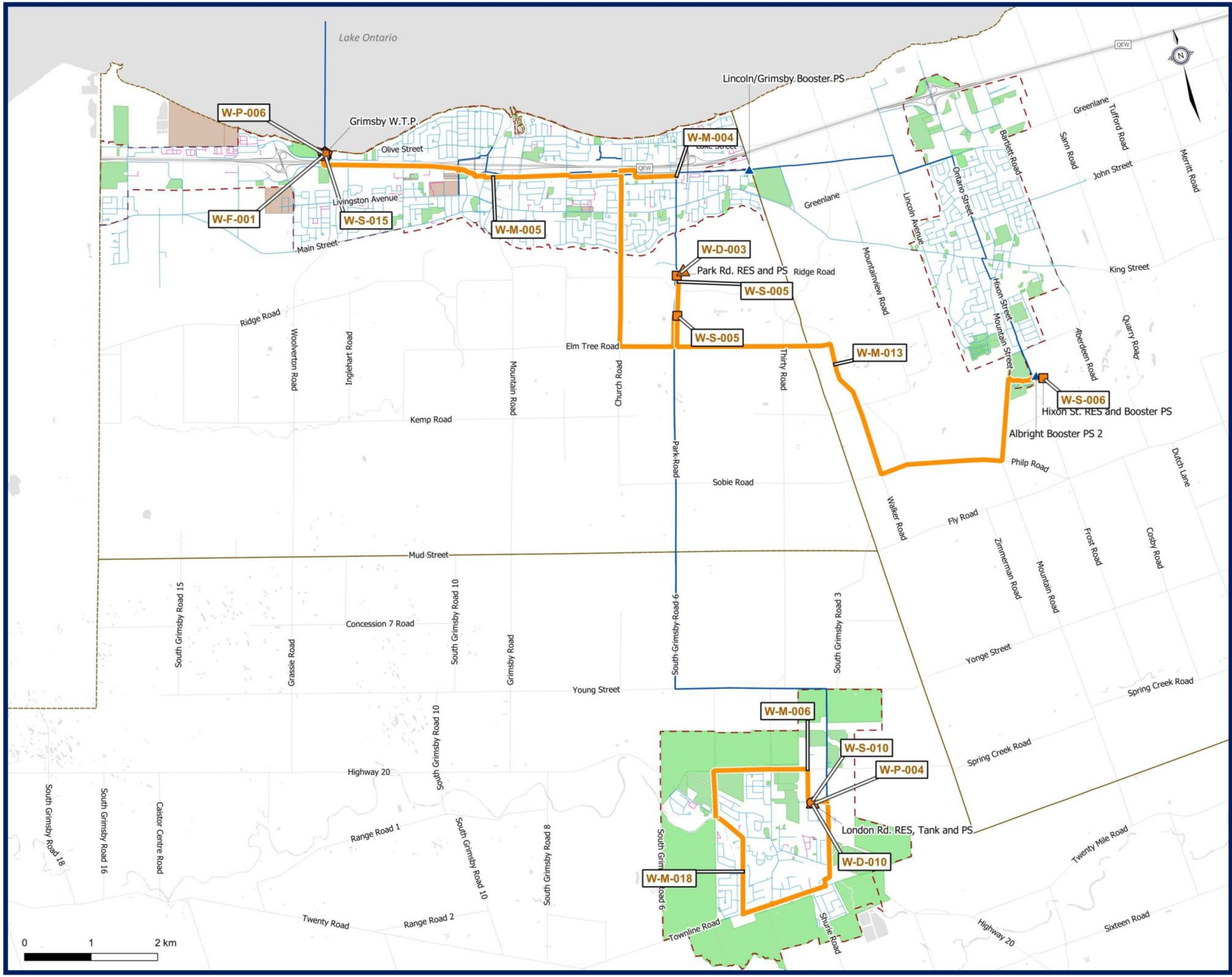
A.7 Capital Program

Figure 3.A.16 and **Figure 3.A.17** present the preferred servicing strategy map and schematic. **Table 3.A.13** summarizes the recommended project costing, timing, and Class EA requirements. Individual detailed project costing sheets are presented in **Section A.8.6**.



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Capital Program

- ⬟ Water Treatment Plant
- ▲ Pumping Station
- ■ Reservoir
- ● Elevated Tank
- ▬ Watermains

Existing Water Infrastructure

- ⬟ Water Treatment Plant
- ■ Reservoir
- ▲ Pumping Station
- ● Elevated Tank / Standpipe
- — Region Mains
- — Local Mains
- — Private

Other Features

- ▭ Township of Wainfleet
- ▭ Waterbodies
- ▭ Urban Area Boundary

Development Locations

- ▨ Post-2051
- 🟩 Pre-2051

***Note that additional growth in existing built areas is anticipated**

***Project alignments are preliminary and will be refined through subsequent projects (EA and/or detailed design)**

Figure 3.A.16

Grimsby System

Preferred Water Servicing Strategy

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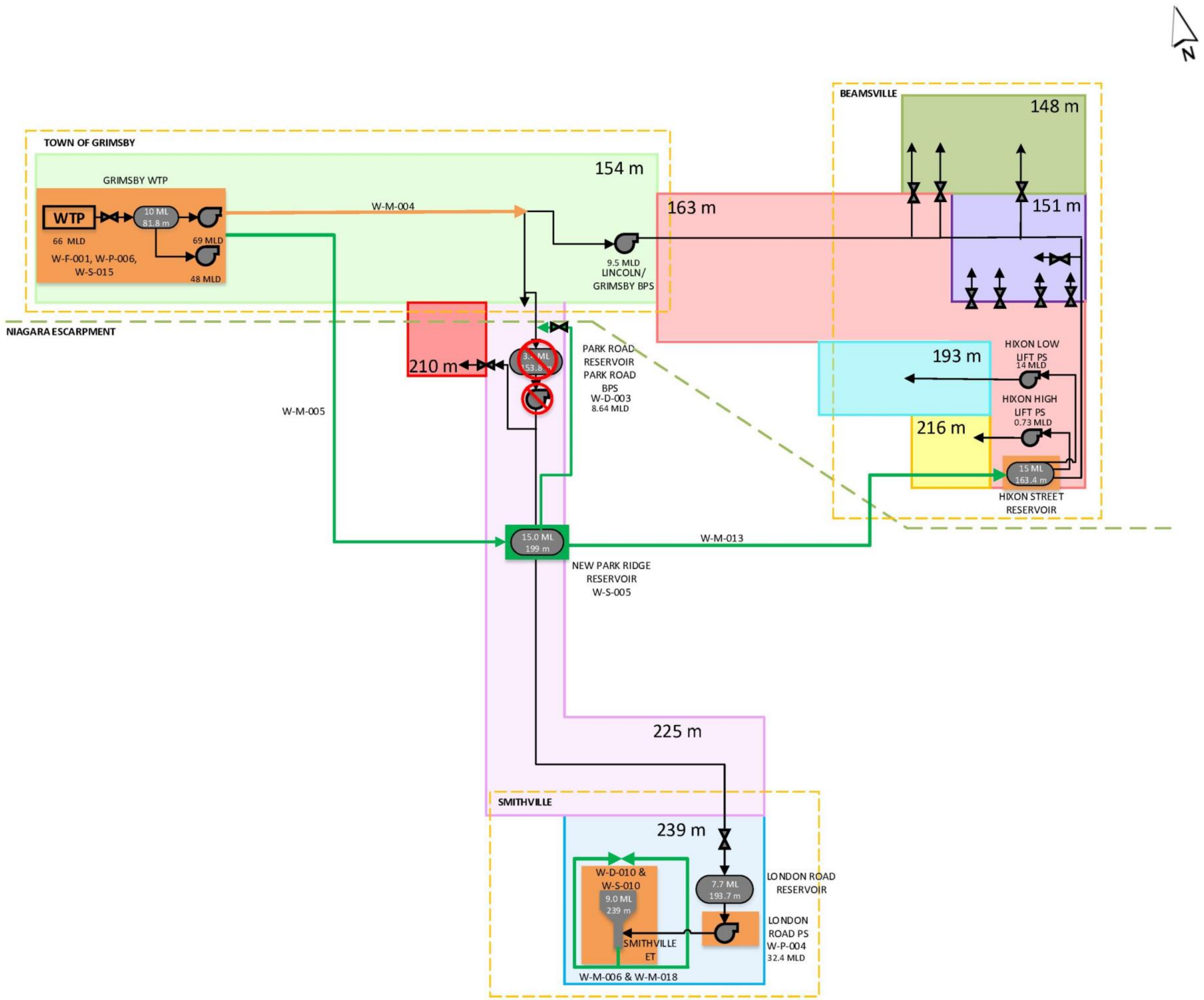

WTP Water Treatment Plant (RATED CAPACITY)

Standpipe (Volume TWL)

Pumping Station (FIRM CAPACITY)

Trunk Watermain Network

Reservoir (Volume TWL)

Settlement Area Boundaries

Elevated Tanks (Volume TWL)

Land and Water Features

Control Valve (Only normally operated valves shown)

New Watermain

Chlorine Facility

Upgrade Watermain

Facility Upgrade

Decommission Project

New Facility

Pressure Zone

148 m
210 m
151 m
216 m
154 m
225 m
163 m
239 m
193 m

Figure 3.A.17
Grimsby System
Future Water Infrastructure Schematic

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WKID: 26917

Table 3.A.13 Summary of Grimsby Water 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 ($)
W-D-003	Decommissioning of Park Road Reservoir + PS	Decommissioning of Park Road Reservoir and Pumping Station, to be replaced by new Park Ridge Reservoir and additional pumping capacity at the WTP. To be completed after completion of W-M-005.	N/A	2027-2031	Grimsby	A+	N/A	Storage	$1,611,000
W-D-010	Decommissioning of Smithville ET	Decommissioning of existing Smithville ET, to be replaced by a new ET	N/A	2042-2051	West Lincoln	A+	N/A	Storage	$1,290,000
W-F-001	Grimsby WTP Expansion	Provide an additional 22 MLD treatment	22 MLD	2022-2026	Grimsby	C	Ongoing (separate study)	Treatment	$73,904,000
W-M-004	Upgrade transmission main from Grimsby WTP to Park Road (Partially Completed)	Upgrade transmission main from Grimsby WTP to Park Road. Partially completed. Alignment to be completed is the section from Baker Road to Park Road.	750 mm	2022-2026	Grimsby	A+	N/A	Watermain	$6,157,000
W-M-005	New dedicated transmission main from Grimsby WTP to New Park Ridge Reservoir	New transmission main from Grimsby WTP to New Park Ridge Reservoir	750 mm	2022-2026	Grimsby	B	Ongoing (separate study)	Watermain	$54,668,000
W-M-006	New feedermain in Smithville (Phase 1)	New feedermain in Smithville	400 mm	2022-2026	West Lincoln	A+	Satisfied (separate study)	Watermain	$6,563,000
W-M-013	New transmission main from Grimsby to Lincoln	New transmission main from new Park Ridge Reservoir to Hixon Reservoir in Lincoln.	600 mm	2032-2041	Lincoln	B	Separate EA Required	Watermain	$32,080,000
W-M-018	New feedermain in Smithville (Phase 2)	New feedermain in Smithville	400 mm	2032-2041	West Lincoln	B	Satisfied (separate study)	Watermain	$14,382,000
W-P-004	Upgrade Smithville Pumping Station	Replace one 4.32 MLD pump with 10.8 MLD pump	300 L/s	2042-2051	West Lincoln	A	N/A	Pumping	$1,716,000
W-P-006	New HLP at Grimsby for dedicated reservoir feed	New separate set of high lift pumps at Grimsby WTP to support dedicated feed to the new Park Ridge Reservoir	556 L/s	2022-2026	Grimsby	A+	N/A	Pumping	$12,983,000
W-S-005	New Grimsby Reservoir	New Grimsby Reservoir to provide additional storage – in construction Includes associated connection to existing Park Road facility and associated upgrades to Park Road pump station to support interim operational configuration	15.0 ML	2022-2026	Grimsby	B	Satisfied (separate study)	Storage	$24,921,000
W-S-006	Hixon Reservoir Expansion	Additional cell at Hixon to support post 2051 growth	5.0 ML	Post-2051	Lincoln	A+	N/A	Storage	$14,380,000
W-S-010	Replace Smithville Elevated Tank	Replace Smithville Elevated Tank with a larger tank to support post 2051 growth.	9.0 ML	2042-2051	West Lincoln	B	Separate EA Required	Storage	$20,950,000
W-S-015	Grimsby WTP Reservoir Baffle Improvements	Grimsby WTP Reservoir baffle improvements to increase baffle factor, allowing for more usable volume at the WTP.	-	2022-2026	Grimsby	A	N/A	Storage	$2,500,000
W-ST-001(1)	Region Wide WTP Reservoir Volume Study	Study to review WTP reservoir CT volume and overall system storage	-	2022-2026	Region-Wide	A+	N/A	Storage	-
								Total	**$268,105,000**

(1) Project cost not included in subtotal as it is a Region-wide project

A.8 Project Implementation and Considerations

A.8.1 10-Year Program Sequencing

The recommended year in service for the capital projects is presented in **Section A.7**. Special project implementation and considerations for the preferred servicing strategy consist of:

- Timing of the new watermain from the Grimsby WTP to the new Park Ridge Reservoir needs to be coordinated with the proposed Grimsby WTP upgrades, as the separate set of high lift pumps at the WTP is needed to support the use of the new watermain;
- Review of phasing for the several projects recommended at the Grimsby WTP (i.e. the new separate set of high lift pumps, baffle improvements within the reservoir, treatment capacity upgrades). Efficiencies may be gained by completing work concurrently, or phasing may be required to complete the works;
- Decommissioning of the Park Road Reservoir and Pumping Station can only be completed once dependent projects to adjust the operating strategy of the Grimsby system are completed (i.e. the new Park Ridge Reservoir and associated works, the new dedicated feedermain from the WTP to the Park Ridge Reservoir, the new separate set of high lift pumps at the Grimsby WTP); and,
- Storage expansion at the Hixon Reservoir is not expected to be required until post-2051 but has been included in the capital program for informational and planning purposes.

It is understood that the timing for the recommended projects may be subject to change due to a variety of external factors, such as, overall balancing of the Region's capital budget, changes to growth projections, and other unforeseen circumstances. As such, **Table 3.A.14** presents the preferred priority of the projects within the first 10-years of the capital program.

Table 3.A.14 First 10-Years Project Sequencing

Master Plan ID	Name	In Service Period	Project Sequencing
W-S-005	New Grimsby Reservoir	2022-2026	1
W-M-004	Upgrade transmission main from Grimsby WTP to Park Road (Partially Completed)	2022-2026	2
W-M-006	New feedermain in Smithville (Phase 1)	2022-2026	3
W-P-006	New HLP at Grimsby for dedicated reservoir feed	2022-2026	4
W-F-001	Grimsby WTP Expansion	2022-2026	4
W-S-015	Grimsby WTP Reservoir Baffle Improvements	2022-2026	4
W-M-005	New dedicated transmission main from Grimsby WTP to New Grimsby Reservoir	2022-2026	5
W-D-003	Decommissioning of Park Road Res + PS	2027-2031	6

A.8.2 EA Requirements and Studies

The following summarizes the status of EA requirements for recommended capital projects which will require Schedule B or C EAs.

- **EA has been satisfied through previous projects:**
    - W-S-005 (New Park Ridge Reservoir) Schedule B
- **Currently ongoing separate EA studies:**
    - W-M-018 (New feedermain in Smithville – Phase 2) Schedule B
    - W-F-001 (Grimsby WTP expansion) Schedule C
    - W-M-005 (New dedicated feedermain from Grimsby WTP to new Park Ridge Reservoir) Schedule B
- **EA studies to be completed through separate studies:**
    - W-M-013 (New transmission main from Grimsby to Lincoln) Schedule B
    - W-S-010 (Replace Smithville ET) Schedule B

A.8.3 Region-Wide Projects and Collaboration with Local Area Municipalities

As part of the recommended capital program, it is recommended that the Region complete a WTP reservoir volume study across all WTP facilities to review CT volume and overall system storage. The intent of this study is to gain a clearer understanding of storage limitations at WTP facilities and how much usable volume can be accounted for within the system storage calculations.

Acknowledging that the overall water systems are jointly owned and operated by the Region and local area municipalities (LAM), the continued operation and expansion of the water systems to support existing users and accommodate projected growth relies upon the cooperation of the upper and lower tier municipalities. Major updates and adjustments to planning projections should be continued to be communicated as this may affect project details, such as trigger timelines and design capacities, which is discussed further in **Section A.8.5**.

One initiative that will be predominately driven by the LAMs is NRW reduction. While NRW reduction programs should be completed in all municipalities, this 2021 MSPU assumes that the municipalities currently experiencing NRW rates greater than 25% will put specific focus on reducing NRW.

Existing non-revenue water rates within the Grimsby system are all at or below 25% (25% in Grimsby, 9% in Lincoln, and 20% in West Lincoln) and as such, NRW reduction was not identified as a priority recommendation, however municipality-specific targets can be reviewed by the LAMs. NRW reduction program activities may include but are not limited to:

- Enhancement to the water metering program including:
    - Meter replacement program
    - Re-time monitoring of large water users
- Leak detection program for watermains,
- Watermain replacement program,
- Improved tracking of unbilled authorized users and development of demand reduction strategies:
    - Fire department
    - Watermain flushing
    - Facility usage,
- Development of bulk water user strategy and potential construction of additional bulk water station, and
- Improved monitoring and enforcement of new construction water uses.

A.8.4 Sustainability Projects

It is important to recognize that the 2021 MSPU servicing strategies identify new infrastructure to service the additional growth out to year 2051 but these strategies are built by extending infrastructure from the existing systems and leveraging the existing Region infrastructure in place. It is essential that the existing infrastructure is maintained in good condition and performance to support servicing growth.

The Region continually establishes and implements a sustainability program that addresses priority projects to ensure the existing infrastructure is in a state-of-good-repair and continues to perform and meet the intended level of services.

Independent of the 2021 MSPU, the Region has completed a sustainability program analysis to identify the projects on a yearly basis, with focus on a 10 year program, to address the sustainability needs. This Sustainability Capital Plan is first developed to demonstrate the total investment needs and may identify a level of investment and implementation exceeding Region resources. The next steps for the Sustainability Capital Plan will be the development of the Financial Plan for existing Water and Wastewater assets which is anticipated to be completed in 2024. It should be noted that the Sustainability Capital Plan represents investment required over and above the growth-related 2021 MSPU program.

The 2021 MSPU undertook a process to review the Sustainability Program in conjunction with the growth-related program to eliminate duplicate projects and to align the timing of both growth and sustainability needs where appropriate in order to create efficiencies. This review was focused on the Sustainability Program for the next 10 years with the best information available at the time of this study.

The review process for integration of the MSPU program and the sustainability program was essential to demonstrate several key findings:

- There is opportunity to align growth and sustainability projects to bring efficiencies in costs and delivery;
- When planning and costing new infrastructure, lifecycle principles and costs must be considered. Existing and future infrastructure will have future service life replacements (i.e., pumps, electrical, roof, security upgrades at varying intervals from 5 – 40 years);
- Without maintenance of the existing infrastructure in a state of good repair and performance, there is risk that the growth-related program may not achieve desired capacities, timing, or level of service;
- There is also risk that implementing the growth-related program could have a negative impact on the level of service within the existing systems for the existing users; and,
- There are some major projects already considered under the sustainability program that are essential to the growth-related program such as the Welland WTP and WWTP.

The 2021 MSPU growth capital program focuses on the infrastructure needs to support growth and all the projects build upon the Region's existing water systems. It is imperative that the Region's sustainability capital program continues to be completed as needed alongside the recommended 2021 MSPU growth capital program to ensure that the existing system is operating at expected capacities and reliability such that it can support the recommended growth projects.

The sustainability projects consist of Region-wide projects and programs including but not limited to: replacement programs for boilers, water valves, generators, watermains, master meters, GAC, process piping, process electrical, and process instrumentation. Grimsby system specific projects include:

- Grimsby Plant 1 WTP Sustainability,
- Grimsby WTP New Outfall,
- Grimsby WTP Process to Waste System, and
- Ontario Street Watermain Replacement.

A.8.5 Project Implementation Flow Chart

The recommended design capacities within the capital program are based on the best available information at the time of analysis, including existing system demands, facility capacities, and projected growth. It is understood that this data is not static and often changes over the years between the regular updates of the Region’s Master Plan. Design assumptions should be revisited before initiation of projects to reconfirm the appropriate design capacities, along with identification of any associated or dependent projects which can be combined or staged to optimize implementation efficiency and cost, and/or system operation.

To support the Region’s process in implementing all recommended 2021 MSPU capital projects, the following flow chart has been developed for the water system. This flow chart document is intended to be a reference resource for the Region and should be treated as a guideline to support existing internal Region processes in project implementation, as shown in **Figure 3.A.18.**

Niagara Region

WATER PROJECT IMPLEMENTATION

The intent of this document is to support the Region in confirming the scope of work for water infrastructure projects.

CONFIRM PROJECT SCOPE

To define Terms of Reference

☐ **What triggered this project?**
- Known development growth
- Forecasted growth
- Sustainability needs

☐ **Are there related or dependent projects that should be identified for streamlining opportunities or for project phasing?**
- Are there projects that need to be completed before this project?
- Are there projects within the same alignment or project area that could be combined (e.g., growth projects, wastewater, stormwater, corridor planning, sustainability projects, etc.)
- If there are related projects, could the project timing be adjusted to combine or stage projects more efficiently?

☐ **What is the project EA Schedule and status?**

☐ **Are there historic or ongoing operational issues in the project area?**
- Confirm with Regional and LAM operations and maintenance groups
- i.e. historic watermain breaks, water quality or pressure complaints, work order history, etc.

☐ **Are there any data gaps that should be incorporated into the Terms of Reference?**
- Refer to the Required Data section below for details
- How much does the project timeline and budget need to change to allow for the data collection?

☐ **Have the planning projections been updated to the best available information?**
- Consultation with Region and LAM planning groups to confirm planning projection
- Are projected needs for the project in place? Is actual growth in line with projected growth?)

☐ **Should the project be deferred until identified related works are completed?**

REQUIRED DATA

To support terms of reference and detailed design

☐ **Recently completed EA or servicing study**

(for growth triggered projects)

☐ **Historic demand records**
- Within the last 3 years
- Ideally one full year of SCADA records including facility demands, flow, and pressure records

☐ **Existing system hydrant testing or system pressure data to identify/verify existing system issues**

☐ **Asset inventory and condition assessment**
- All asset classes within the infrastructure type (watermain, storage, pumping, or treatment facility)
- Within the last 5 years
- Can be part of project scope if the data is not available and would not significantly alter project scope

☐ **Service area growth potential to confirm projected population and demands**
- Consultation with Region and LAM planning groups within the past year
- Growth information for 30-year horizon and beyond (maximum service area)
  - Population, jobs, land use, area
  - Current inventory of development areas with associated development status

IF THE REQUIRED DATA IS NOT AVAILABLE AND IF IT HAS THE POTENTIAL TO SIGNIFICANTLY ALTER SCOPE OF THE DESIGN, IT IS STRONGLY RECOMMENDED THAT THE APPROPRIATE DATA COLLECTION AND FIELD INVESTIGATION BE COMPLETED PRIOR TO PROCEEDING WITH DESIGN. ALTERNATIVELY, WHERE FEASIBLE, DATA COLLECTION SHOULD BE INCLUDED IN THE PROJECT SCOPE AND INTEGRATED INTO THE DESIGN PROCESS.

FLOW PROJECTIONS

To determine infrastructure capacity needs

EXISTING FLOWS

Average Day Demand (ADD)
- Historic SCADA to determine starting point average demand

Maximum Day Demand (MDD)
- Use peaking factors determined through MSPU to peak ADD
- There is a different peaking factor for each WTP system based on historic SCADA data

Peak Hour Demand (PHD)
- Diurnal curve based on historic data

Fire Flow (FF)
- MECP population-based

FUTURE FLOW PROJECTIONS

Existing Demand
- Scenarios depending on infrastructure type and design scenario (see next page

+

Growth Population Demand Contributions
- Residential, 240 L/c/d
- Employment, 270 L/e/d

The design criteria presented in this document are based on the 2021 Master Servicing Plan Update Study

BluePlan ENGINEERING

STORAGE AND PUMPING FACILITY CONSIDERATIONS

☐ **What is the complete service area of the facility?**
  - Some facilities support multiple pressure zones
  - Some pressure zones are supported by multiple facilities

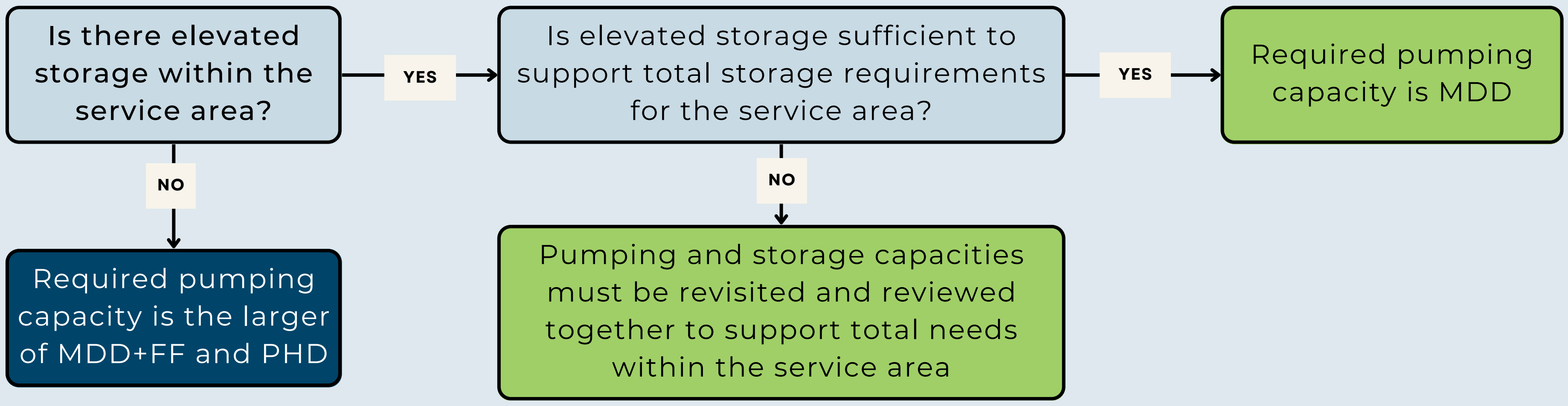
☐ **If there are storage deficits, can they be supplemented through flow transfers?**
  - Is it hydraulically and operationally feasible?

☐ **Have storage and pumping facilites been reviewed in conjunction with one another?**
  - Required pumping capacity varies based on available storage

☐ **What is the optimal HGL target for pumping and elevated storage facilities?**
  - Region strives to maximize areas within 50 - 80 psi for Regional watermains and minimum residual pressure of 30 psi at MECP population-based fire flow target

PUMPING STATION SIZING

To define design flow scenario (MDD, MDD+FF, PHD)



Is there elevated storage within the service area?

YES

Is elevated storage sufficient to support total storage requirements for the service area?

YES

Required pumping capacity is MDD

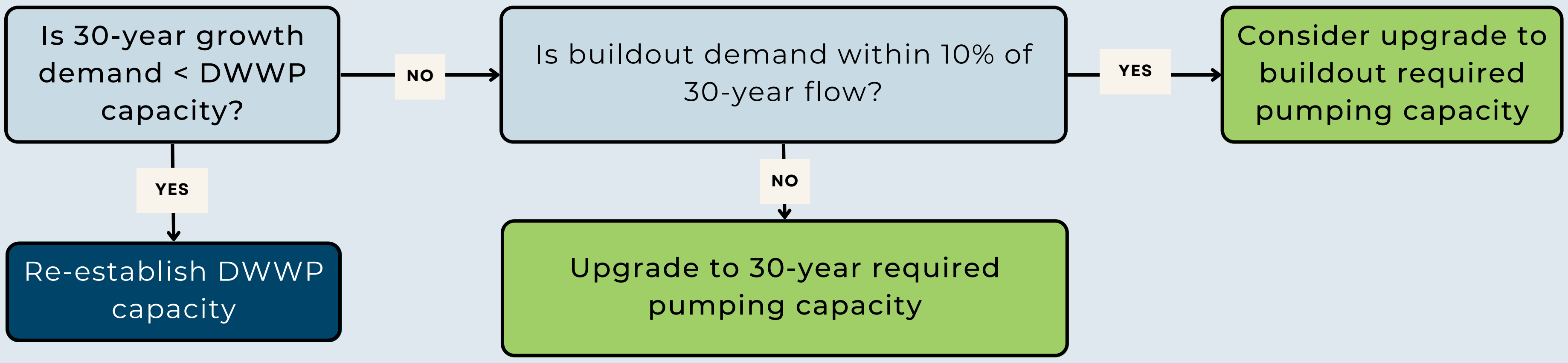
NO

Required pumping capacity is the larger of MDD+FF and PHD

NO

Pumping and storage capacities must be revisited and reviewed together to support total needs within the service area

To define design flow growth horizon (re-establish DWWP capacity, 30-year growth, buildout)



Is 30-year growth demand < DWWP capacity?

NO

Is buildout demand within 10% of 30-year flow?

YES

Consider upgrade to buildout required pumping capacity

YES

Re-establish DWWP capacity

NO

Upgrade to 30-year required pumping capacity

STORAGE SIZING

What are the system storage needs?
- System storage targets are based on MECP methodology, consistent with the 2021 Region MSPU
- Incorporate contact time storage needs at Water Treatment Plant Reservoirs
- Confirm fire flow storage strategy
- Review pumping capacity and impact on storage strategy

What timeline is considered for storage sizing?
- Is the storage sized at a minimum to support 30-year growth needs?
- What is the required storage sizing to support buildout needs?
- Is there a strategy to meet buildout needs?
- Is there opportunity for phased expansion?
- Is there a need for an alternative storage location?

TRUNK WATERMAIN SIZING

- Regional transmission mains should be sized to meet PHD and MDD+FF of maximum future service area (buildout) with a target velocity less than 1.5 m/s

A.8.6 Detailed Project Costing Sheets

The detailed project costing sheets for the recommended 2021 MSPU capital projects within the Grimsby system are presented below.

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-D-003**
PROJECT NAME:	**Decommissioning of Park Road Res + PS**
PROJECT DESCRIPTION:	Decommissioning of Park Road Reservoir and Pumping Station, to be replaced by new Grimsby Reservoir and additional pumping capacity at the WTP. To be completed after completion of W-M-005.

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

Class Estimate Type:	Class 3	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	20%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Decommissioning						$1,000,000	2016 lump sum inflated
Additional Construction Costs	10%		ea.			$100,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$110,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$1,210,000**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 181,500	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$181,500**	
In House Labour/Engineering/Wages/CA	4%					$ 48,400	
In-house Labour/Wages Sub-Total						**$48,400**	
Project Contingency	10%					$144,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$144,000**	
Non-Refundable HST	1.76%					$27,000	
Non-Refundable HST Sub-Total						**$27,000**	
Total (2022 Dollars)						**$1,611,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$1,611,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$32,220		
Design	Design fees, Region fees for design, contract admin	13%	$209,430		
Construction	Region fees, base costs and project contingency	85%	$1,369,350		
TOTAL			**$1,611,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-D-010
PROJECT NAME: **Decommissioning of Smithville ET**
PROJECT DESCRIPTION: Decommissioning of existing Smithville ET, to be replaced by a new ET

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

Class Estimate Type:	Class 3	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	20%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Decommissioning						$800,000	
Additional Construction Costs	10%		ea.			$80,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$88,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$968,000**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 145,200	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$145,200**	
In House Labour/Engineering/Wages/CA	4%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$115,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$115,000**	
Non-Refundable HST	1.76%					$21,600	
Non-Refundable HST Sub-Total						**$21,600**	
Total (2022 Dollars)						**$1,290,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$1,290,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$25,800		
Design	Design fees, Region fees for design, contract admin	13%	$167,700		
Construction	Region fees, base costs and project contingency	85%	$1,096,500		
TOTAL			**$1,290,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-F-001
PROJECT NAME: Grimsby WTP Expansion
PROJECT DESCRIPTION: Provide an additional 22 MLD treatment

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

= Field has drop down
= Field must be manually populated
= Field auto-filled based on project details

PROPOSED CAPACITY	22 MLD

CLASS EA REQUIREMENTS:	C
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			MLD	22 MLD	$2,000,000	$44,000,000	15 MLD needed, but WTP capacity is 44 MLD with 2 treatment trains, so upgrade should happen in 22 MLD
Related Works (Electrical, MCC, Generators, etc)	30%					$0	
Additional Construction Costs	15%		ea.			$6,600,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$5,060,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$55,660,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$556,600	
Geotechnical Sub-Total Cost						**$556,600**	
Property Requirements	1.5%						Confirm existing site can accommodate expansion
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	10%					$ 5,566,000	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$5,566,000**	
In House Labour/Engineering/Wages/CA	3%					$ 1,391,500	
In-house Labour/Wages Sub-Total						**$1,391,500**	
Project Contingency	15%					$9,476,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$9,476,000**	
Non-Refundable HST	1.76%					$1,254,200	
Non-Refundable HST Sub-Total						**$1,254,200**	
Total (2022 Dollars)						**$73,904,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$73,904,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$1,478,080		
Design	Design fees, Region fees for design, contract admin	13%	$9,607,520		
Construction	Region fees, base costs and project contingency	85%	$62,818,400		
TOTAL			**$73,904,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-004**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**Upgrade trunk main from Grimsby WTP to Park Road (Partially Completed)**	**VERSION:**	
PROJECT DESCRIPTION:	Upgrade trunk main from Grimsby WTP to Park Road. Partially completed. Alignment to be completed is the section from Baker Road to Park Road.	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	High	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	50%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	750 mm	
TOTAL LENGTH:	1120 m	
Tunnelled		0%
Open Cut	1120 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	1120 m	$1,730	$1,937,651	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	30%					$581,295	
Minor Creek Crossings			ea.	0	$296,000	$0	
Major Creek Crossings			ea.	0	$1,115,000	$0	
Road Crossings			ea.	0	$548,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,115,000	$0	
Utility Crossings			ea.	0	$548,000	$0	
Valve and Chamber			ea.	5	$85,000	$425,000	Major pipe crossings
Updated Soils Regulation Uplift	2%					$38,753	
Additional Construction Costs	20%		ea.			$596,540	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$357,924	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$3,937,000**	
Geotechnical / Hydrogeological / Materials	2.0%					$78,700	
Geotechnical Sub-Total Cost						**$78,700**	
Property Requirements	2.0%					$ 78,700	
Property Requirements Sub-Total						**$78,700**	
Consultant Engineering/Design	15%					$ 590,600	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$590,600**	
In House Labour/Engineering/Wages/CA	4%					$ 157,480	
In-house Labour/Wages Sub-Total						**$157,480**	
Project Contingency	25%					$1,211,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,211,000**	
Non-Refundable HST	1.76%					$103,800	
Non-Refundable HST Sub-Total						**$103,800**	
Total (2022 Dollars)						**$6,157,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$6,157,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$123,140		
Design	Design fees, Region fees for design, contract admin	13%	$800,410		
Construction	Region fees, base costs and project contingency	85%	$5,233,450		
TOTAL			**$6,157,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-005**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New dedicated feedermain from Grimsby WTP to New Grimsby Reservoir**	**VERSION:**	
PROJECT DESCRIPTION:	New trunk main from Grimsby WTP to New Grimsby Reservoir	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	High	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	50%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	750 mm	
TOTAL LENGTH:	9070 m	
Tunnelled	1000 m	11%
Open Cut	8070 m	89%

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	8070 m	$1,730	$13,961,469	Existing road ROW
Pipe Construction - Tunneling			m	1000 m	$6,300	$6,300,000	Related to escarpment construction
Pipe Construction Uplift (Based on Area Conditions)	20%					$2,792,293.76	
Minor Creek Crossings			ea.	0	$296,000	$0	
Major Creek Crossings			ea.	2	$1,115,000	$2,230,000	Christie Street and Escarpment
Road Crossings			ea.	0	$548,000	$0	
Major Road Crossings (Highway)			ea.	1	$1,115,000	$1,115,000	QEW
Utility Crossings			ea.	0	$548,000	$0	
Valve and Chamber			ea.	8	$85,000	$680,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$405,229	
Additional Construction Costs	20%		ea.			$5,496,798	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$3,298,079	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$36,279,000**	
Geotechnical / Hydrogeological / Materials	2.0%					$725,600	
Geotechnical Sub-Total Cost						**$725,600**	
Property Requirements	2.0%					$ 725,600	
Property Requirements Sub-Total						**$725,600**	
Consultant Engineering/Design	12%					$ 4,353,500	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$4,353,500**	
In House Labour/Engineering/Wages/CA	3%					$ 906,975	
In-house Labour/Wages Sub-Total						**$906,975**	
Project Contingency	25%					$10,748,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$10,748,000**	
Non-Refundable HST	1.76%					$929,800	
Non-Refundable HST Sub-Total						**$929,800**	
Total (2022 Dollars)						**$54,668,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$54,668,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$1,093,360		
Design	Design fees, Region fees for design, contract admin	13%	$7,106,840		
Construction	Region fees, base costs and project contingency	85%	$46,467,800		
TOTAL			**$54,668,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-M-006
PROJECT NAME: New trunk main in Smithville (Phase 1)
PROJECT DESCRIPTION: New trunk main in Smithville (Phase 1 currently in design)

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

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

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:		400 mm	
TOTAL LENGTH:		2860 m	
	Tunnelled		0%
	Open Cut	2860 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	2860 m	$970	$2,773,614	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	20%					$554,723	
Minor Creek Crossings			ea.	0	$196,000	$0	
Major Creek Crossings			ea.	0	$1,015,000	$0	
Road Crossings			ea.	0	$448,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,015,000	$0	
Utility Crossings			ea.	1	$448,000	$448,000	Rail
Valve and Chamber			ea.	5	$35,000	$175,000	3 major pipe connections
Updated Soils Regulation Uplift	2%					$55,472	
Additional Construction Costs	10%		ea.			$400,681	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$440,749	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$4,848,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$48,500	
Geotechnical Sub-Total Cost						**$48,500**	
Property Requirements	1.0%					$ 48,500	
Property Requirements Sub-Total						**$48,500**	
Consultant Engineering/Design	15%					$ 727,200	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$727,200**	
In House Labour/Engineering/Wages/CA	4%					$ 193,920	
In-house Labour/Wages Sub-Total						**$193,920**	
Project Contingency	10%					$587,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$587,000**	
Non-Refundable HST	1.76%					$110,200	
Non-Refundable HST Sub-Total						**$110,200**	
Total (2022 Dollars)						**$6,563,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$6,563,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$131,260		
Design	Design fees, Region fees for design, contract admin	13%	$853,190		
Construction	Region fees, base costs and project contingency	85%	$5,578,550		
TOTAL			**$6,563,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-013**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New trunk watermain from Grimsby to Lincoln**	**VERSION:**	
PROJECT DESCRIPTION:	New trunk watermain from new Grimsby Reservoir to Hixon Reservoir in Lincoln. Preliminary alignment along Park Road, Elm Tree Road, Walker Road, Philp Road, Mountain Road, Edelheim Road. Alignment subject to change through Schedule B EA.	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Rural	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	600 mm	
TOTAL LENGTH:	8700 m	
Tunnelled	1000 m	11%
Open Cut	7700 m	89%

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	7700 m	$1,439	$11,078,553	Existing road ROW
Pipe Construction - Tunneling			m	1000 m	$6,300	$6,300,000	Related to escarpment
Pipe Construction Uplift (Based on Area Conditions)	0%					$0	
Minor Creek Crossings			ea.	2	$236,000	$472,000	Two minor creeks between Thirty Road and Park Rd S
Major Creek Crossings			ea.	0	$1,055,000	$0	
Road Crossings			ea.	0	$488,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,055,000	$0	
Utility Crossings			ea.	0	$488,000	$0	
Valve and Chamber			ea.	6	$55,000	$330,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$347,571	
Additional Construction Costs	15%		ea.			$2,779,219	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$2,130,734	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$23,438,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$234,400	
Geotechnical Sub-Total Cost						**$234,400**	
Property Requirements	1.5%					$ 351,600	
Property Requirements Sub-Total						**$351,600**	
Consultant Engineering/Design	12%					$ 2,812,600	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$2,812,600**	
In House Labour/Engineering/Wages/CA	3%					$ 585,950	
In-house Labour/Wages Sub-Total						**$585,950**	
Project Contingency	15%					$4,113,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$4,113,000**	
Non-Refundable HST	1.76%					$544,700	
Non-Refundable HST Sub-Total						**$544,700**	
Total (2022 Dollars)						**$32,080,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$32,080,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$641,600		
Design	Design fees, Region fees for design, contract admin	13%	$4,170,400		
Construction	Region fees, base costs and project contingency	85%	$27,268,000		
TOTAL			$32,080,000		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-018**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New trunk main in Smithville (Phase 2)**	**VERSION:**	
PROJECT DESCRIPTION:	New trunk main in Smithville (Phase 2, further details to be provided through the Smithville Community Master Plan, alignment subject to change)	**DATE UPDATED:**	
		UPDATED BY:	

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

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	400 mm	
TOTAL LENGTH:	5000 m	*Based on Region comment
Tunnelled		0%
Open Cut	5000 m	100%

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	5000 m	$970	$4,848,975	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	20%					$969,795	
Minor Creek Crossings			ea.	1	$196,000	$196,000	
Major Creek Crossings			ea.	2	$1,015,000	$2,030,000	
Road Crossings			ea.	0	$448,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,015,000	$0	
Utility Crossings			ea.	1	$448,000	$448,000	Rail
Valve and Chamber			ea.	14	$35,000	$490,000	6 major pipe connections
Updated Soils Regulation Uplift	2%					$96,979	
Additional Construction Costs	10%		ea.			$907,975	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$998,772	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$10,986,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$109,900	
Geotechnical Sub-Total Cost						**$109,900**	
Property Requirements	1.0%					$ 109,900	
Property Requirements Sub-Total						**$109,900**	
Consultant Engineering/Design	12%					$ 1,318,300	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,318,300**	
In House Labour/Engineering/Wages/CA	3%					$ 329,580	
In-house Labour/Wages Sub-Total						**$329,580**	
Project Contingency	10%					$1,285,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,285,000**	
Non-Refundable HST	1.76%					$243,000	
Non-Refundable HST Sub-Total						**$243,000**	
Total (2022 Dollars)						**$14,382,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$14,382,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$287,640		
Design	Design fees, Region fees for design, contract admin	13%	$1,869,660		
Construction	Region fees, base costs and project contingency	85%	$12,224,700		
TOTAL			**$14,382,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-P-004
PROJECT NAME: Upgrade Smithville Pumping Station
PROJECT DESCRIPTION: Replace one 4.32 MLD pump with 10.8 MLD pump (firm capacity of 32.4 MLD/375 L/s to support 2051 and post-2051 growth, total station capacity of 36.7 MLD/425 L/s)

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED FIRM CAPACITY	300 L/s	
2051 Required Capacity	23.1 MLD	PHD
Post-2051 Required Capacity	26.5 MLD	PHD

CLASS EA REQUIREMENTS:	A
CONSTRUCTION ASSUMPTION:	Other

Existing Rated Capacity (MLD) 19.44

Pump	Existing (MLD)	Future (MLD)
1	10.8	10.8
2	10.8	10.8
3	4.32	10.8
4	4.32	4.32

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	300 L/s	$15,816	$750,000	750K per pump (using existing pump bays)
Related Works (Electrical, MCC, Generators, etc)	30%					$225,000	
Additional Construction Costs	15%		ea.			$146,250	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$112,125	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$1,233,000**	
Geotechnical / Hydrogeological / Materials	1.0%						Existing site
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.5%						Pump upgrades within existing station
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 185,000	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$185,000**	
In House Labour/Engineering/Wages/CA	4%					$ 49,320	
In-house Labour/Wages Sub-Total						**$49,320**	
Project Contingency	15%					$220,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$220,000**	
Non-Refundable HST	1.76%					$28,800	
Non-Refundable HST Sub-Total						**$28,800**	
Total (2022 Dollars)						**$1,716,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$1,716,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$34,320		
Design	Design fees, Region fees for design, contract admin	13%	$223,080		
Construction	Region fees, base costs and project contingency	85%	$1,458,600		
TOTAL			**$1,716,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-P-006**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New HLP at Grimsby for dedicated reservoir feed**	**VERSION:**	
PROJECT DESCRIPTION:	New separate set of high lift pumps at Grimsby WTP to support dedicated feed to the new Grimsby Reservoir (48 MLD/556 L/s firm capacity to support 2051 MDD for the Grimsby system, totatl station capacity of 64 MLD/741 L/s).	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED FIRM CAPACITY	556 L/s	
2051 Required Capacity	45.7 MLD	MDD (Grimsby sytem)
Post-2051 Required Capacity	57.0 MLD	MDD (Grimsby sytem)

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

Existing Rated Capacity (MLD) 0.00

Pump	Existing (MLD)	Future (MLD)
1		16
2		16
3		16
4		16

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	556 L/s	$13,383	$7,435,101	New pumps for Grimsby dedicated reservoir feed. Used lower pump unit rate to reflect staged works with treatment plant expansion.
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$1,115,265	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$855,037	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$9,405,000**	
Geotechnical / Hydrogeological / Materials	1.0%						Existing site
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.5%						Existing site
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 1,410,800	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,410,800**	
In House Labour/Engineering/Wages/CA	3%					$ 282,150	
In-house Labour/Wages Sub-Total						**$282,150**	
Project Contingency	15%					$1,665,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,665,000**	
Non-Refundable HST	1.76%					$219,700	
Non-Refundable HST Sub-Total						**$219,700**	
Total (2022 Dollars)						**$12,983,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$12,983,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$259,660		
Design	Design fees, Region fees for design, contract admin	13%	$1,687,790		
Construction	Region fees, base costs and project contingency	85%	$11,035,550		
TOTAL			**$12,983,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-S-005

PROJECT NAME: New Grimsby Reservoir

PROJECT DESCRIPTION: New Grimsby Reservoir to provide additional storage - already designed
Includes associated connection to existing Park Road facilitiy and associated upgrades to Park Road pump station to support interm operational configuration

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	15 ML

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	15 ML	$1,300,000	$19,500,000	
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$2,925,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$2,242,500	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$17,797,000**	**Override construction cost based on Region info**
Geotechnical / Hydrogeological / Materials	1.0%					$178,000	
Geotechnical Sub-Total Cost						**$178,000**	
Property Requirements	5.0%					$ 889,900	
Property Requirements Sub-Total						**$889,900**	
Consultant Engineering/Design	12%					$ 2,135,600	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$2,135,600**	
In House Labour/Engineering/Wages/CA	2.0%					$ 300,000	
In-house Labour/Wages Sub-Total						**$300,000**	
Project Contingency	15%					$3,195,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$3,195,000**	
Non-Refundable HST	1.76%					$425,800	
Non-Refundable HST Sub-Total						**$425,800**	
Total (2022 Dollars)						**$24,921,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$24,921,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$498,420		
Design	Design fees, Region fees for design, contract admin	13%	$3,239,730		
Construction	Region fees, base costs and project contingency	85%	$21,182,850		
TOTAL			**$24,921,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: **W-S-006**

PROJECT NAME: **Hixon Reservoir Expansion**

PROJECT DESCRIPTION: Additional cell at Hixon to support post-2051 growth

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	5 ML

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	5 ML	$1,300,000	$6,500,000	
Related Works (Electrical, MCC, Generators, etc)	30%					$1,950,000	
Additional Construction Costs	15%		ea.			$1,267,500	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$971,750	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$10,689,000**	
Geotechnical / Hydrogeological / Materials	1.0%						existing site
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.5%						Existing site has room for expansion
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	12%					$ 1,282,700	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,282,700**	
In House Labour/Engineering/Wages/CA	3%					$ 320,670	
In-house Labour/Wages Sub-Total						**$320,670**	
Project Contingency	15%					$1,844,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,844,000**	
Non-Refundable HST	1.76%					$243,200	
Non-Refundable HST Sub-Total						**$243,200**	
Total (2022 Dollars)						**$14,380,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$14,380,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$287,600		
Design	Design fees, Region fees for design, contract admin	13%	$1,869,400		
Construction	Region fees, base costs and project contingency	85%	$12,223,000		
TOTAL			**$14,380,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: **W-S-010**

PROJECT NAME: **Replace Smithville Elevated Tank**

PROJECT DESCRIPTION: Replace Smithville Elevated Tank with a larger tank to support 2051 and post-2051 growth. Assuming property acquisition is required (5% for new site).

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	9.0 ML

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	9.0 ML	$1,300,000	$11,700,000	
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$1,755,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,345,500	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$14,801,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$148,010	New site
Geotechnical Sub-Total Cost						**$148,010**	
Property Requirements	5.0%					$ 740,050	New site
Property Requirements Sub-Total						**$740,050**	
Consultant Engineering/Design	12%					$ 1,776,100	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,776,100**	
In House Labour/Engineering/Wages/CA	3%					$ 444,030	
In-house Labour/Wages Sub-Total						**$444,030**	
Project Contingency	15%					$2,686,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$2,686,000**	
Non-Refundable HST	1.76%					$354,700	
Non-Refundable HST Sub-Total						**$354,700**	
Total (2022 Dollars)						**$20,950,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$20,950,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$419,000		
Design	Design fees, Region fees for design, contract admin	13%	$2,723,500		
Construction	Region fees, base costs and project contingency	85%	$17,807,500		
TOTAL			**$20,950,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-S-015

PROJECT NAME: Grimsby WTP Reservoir Baffle Improvements

PROJECT DESCRIPTION: Grimsby WTP Reservoir baffle improvements to increase baffle factor, allowing for more usable volume at the WTP. Current baffle factor is 0.3, target to increase to at least 0.5.

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	0.0 ML

CLASS EA REQUIREMENTS:	A
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	0.0 ML	$1,300,000	$0	
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$0	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$0	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$0**	
Geotechnical / Hydrogeological / Materials	1.0%					$ -	
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	5.0%					$ -	
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ -	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$0**	
In House Labour/Engineering/Wages/CA	4%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	15%					$6,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$6,000**	
Non-Refundable HST	1.76%					$100	
Non-Refundable HST Sub-Total						**$100**	
Total (2022 Dollars)						**$46,000**	Rounded to nearest $1,000
Other Estimate						**$2,500,000**	
Chosen Estimate						**$2,500,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$50,000		
Design	Design fees, Region fees for design, contract admin	13%	$325,000		
Construction	Region fees, base costs and project contingency	85%	$2,125,000		
TOTAL			**$2,500,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-ST-001
PROJECT NAME: **Region Wide WTP Reservoir Volume Study**
PROJECT DESCRIPTION: Study to review WTP reservoir CT volume and overall system storage

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

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

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Grimsby WTP Reservoir							
Decew WTP Reservoir							
Niagara Falls WTP Reservoir							
Welland WTP Reservoir							
Port Colborne WTP Reservoir							
Rosehill (Fort Erie) WTP Reservoir							
Additional Construction Costs	10%		ea.			$0	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$0	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$0**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ -	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$0**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$4,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$4,000**	
Non-Refundable HST	1.76%					$100	
Non-Refundable HST Sub-Total						**$100**	
Total (2022 Dollars)						**$44,000**	Rounded to nearest $1,000
Other Estimate						**$100,000**	
Chosen Estimate						**$100,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$2,000		
Design	Design fees, Region fees for design, contract admin	13%	$13,000		
Construction	Region fees, base costs and project contingency	85%	$85,000		
TOTAL			**$100,000**		

B

Regional Municipality of Niagara

Part B

DECEW WATER SYSTEM

TABLE OF CONTENTS

List of Figures

List of Tables

B. DeCew Water Treatment Plant

B.1 Existing System Overview

The DeCew water system services the City of St. Catharines, the parts of Thorold, the Vineland area in Lincoln, and Niagara-on-the-Lake. The system is interconnected with the Niagara Falls water system. The system services an existing population of 188,172 and 86,173 employees. Note that this population and employment total is based on the Region's 2021 allocation of Traffic Area Zones planning data and has been processed through the allocation methodology presented in **Volume 2** to refine the data to include only serviced populations. As such, the population and employment total may not directly match the system totals using the Region's unprocessed planning data.

The system is supplied by the DeCew Water Treatment Plant, located on 2700 DeCew Road in St. Catharines. The plant is a conventional surface water treatment plant with zebra mussel control, travelling screens, coagulation, flocculation, sedimentation, filtration, and disinfection processes within a process consisting of three separate treatment trains. Lake Erie (via the Welland Canal) serves as a source to the plant, with Lake Gibson serving as an alternate source. The plant has a rated capacity of 227.3 MLD (2,631 L/s).

The system supplies local area municipalities via a watermain network, pumping stations, and storage reservoirs. The supply area is divided into 11 pressure zones.

Figure 3.B.1 and **Figure 3.B.2** present an overview of the water system and a water system schematic diagram, respectively.

Through this update of the Master Servicing Plan, the Region has highlighted the need to integrate the MSPU growth-related program with the Region's sustainability program intended to address the condition and performance of the existing infrastructure. The MSPU servicing strategies are based on the need to maintain appropriate levels of service throughout the systems and acknowledges that investment will be needed to support operations, maintenance, staff, and other resources related to maintaining the existing systems and facilities in a state of good repair and performance.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

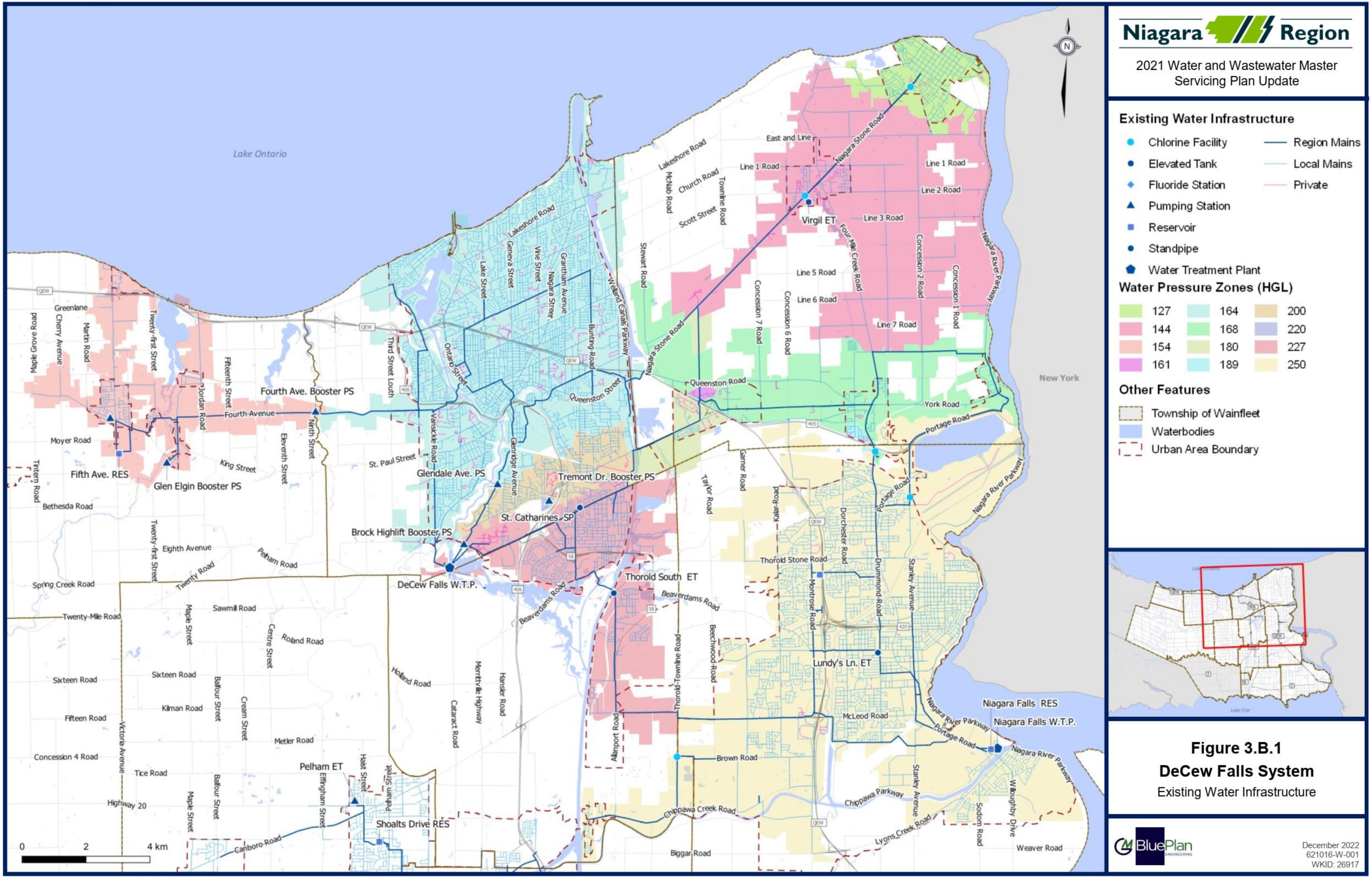


Figure 3.B.1

DeCew Falls System

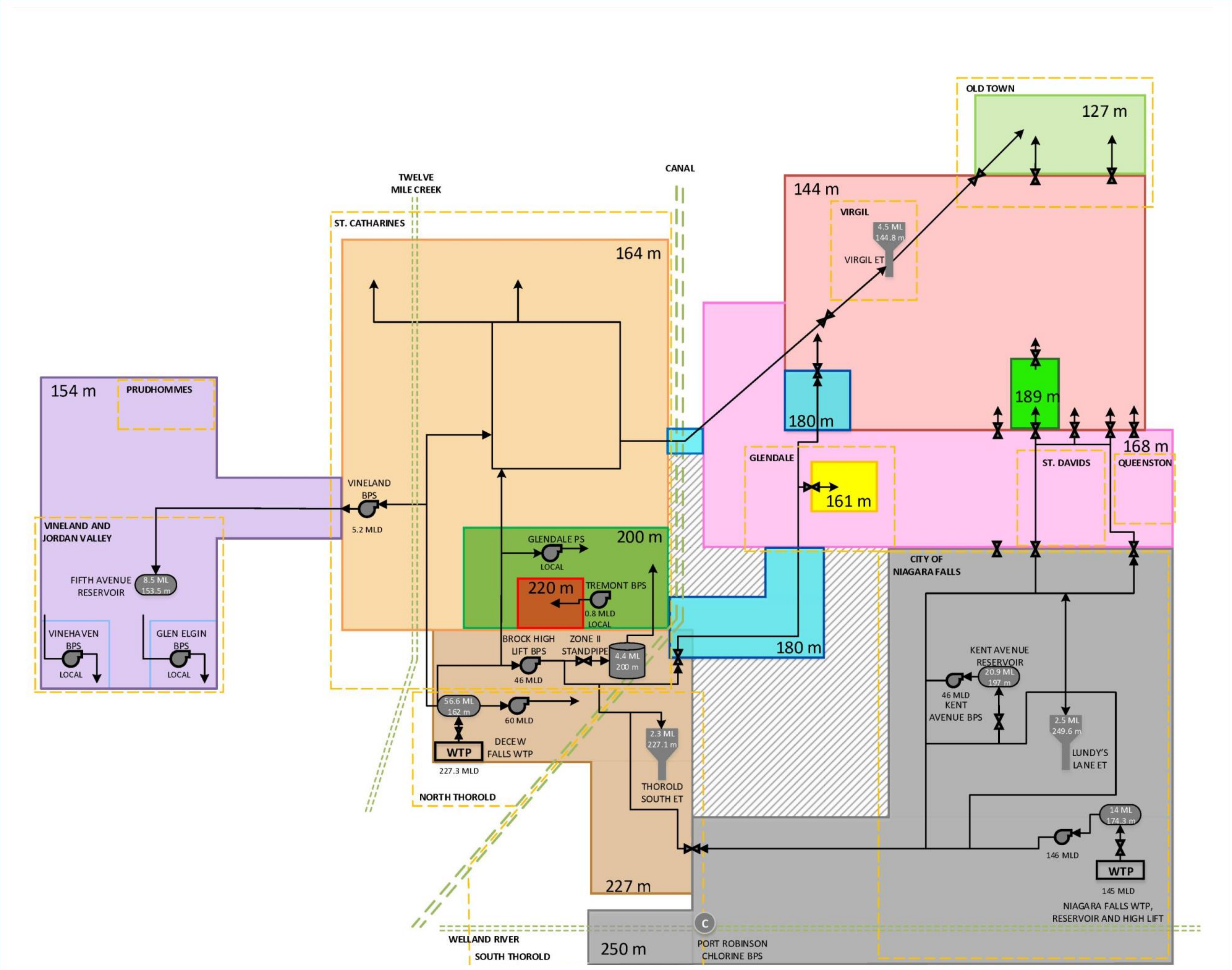
Existing Water Infrastructure

BluePlan ENGINEERING

December 2022
621016-W-001
WKID: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update



WTP RATED CAPACITY	Water Treatment Plant	Volume TWL	Standpipe
FIRM CAPACITY	Pumping Station		Trunk Watermain Network
Volume TWL	Reservoir		Settlement Area Boundaries
Volume TWL	Elevated Tanks		Land and Water Features
⋈	Control Valve (Only normally operated valves shown)		
c	Chlorine Facility		

Pressure Zone

127 m	189 m
144 m	200 m
154 m	220 m
161 m	227 m
164 m	250 m
168 m	180 m

Figure 3.B.2

DeCew Falls System

Existing Water Infrastructure Schematic

BluePlan ENGINEERING

December 2022
621016-W-000
WKID: 26917

B.1.1 Facility Overview

Table 3.B.1 to **Table 3.B.4** present details regarding the existing water treatment plant (WTP), pump stations, and storage facilities.

Table 3.B.1 Water Treatment Plant Overview

Plant Name	DeCew Water Treatment Plant
Drinking Water Works Permit	Permit Number: 007-202 Issue Number: 9 Issued August 2, 2019
Address	2700 DeCew Road, St. Catharines
Source Water	Lake Erie via Welland Canal
Rated Maximum Day Demand Capacity	227.3 MLD
Key Processes	• Zebra mussel control • Travelling screens • Coagulation • Flocculation • Sedimentation • Filtration • Disinfection

Table 3.B.2 Water Treatment Plant Water Quality Objectives

Parameters for Niagara Region Contact Time Calculation	
pH	8
Temperature (degrees C)	0.5
Required CT	49
Required Giardia Inactivation via Disinfection	0.5-log
Required Virus Inactivation via Disinfection	2-log
Minimum Free Chlorine	0.8 mg/L

* Refer to the Safe Drinking Water Act, Ontario Drinking Water Quality Standards for a comprehensive listing of water quality standards.

Table 3.B.3 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone and Facility)	Discharge (Pressure Zone)	Pressure Zones Supplied	Number of Pumps (Total/ Firm)	Installed Capacity (MLD)	Firm Capacity (MLD)	Total Dynamic Head (m)
DeCew Water Treatment Plant (WTP) High Lift Pumps	2700 DeCew Road, St. Catharines	WTP	227	161, 168, 180, 189, 200, 220, 227	4/3	90.0	60.0	76.2
DeCew Water Treatment Plant Gravity Feed(1)		WTP	164	127, 144, 154, 164, 189, 200, 220	N/A	N/A	109.9	N/A
Brock High Lift Booster Pumping Station	500 Glenridge Avenue, St. Catharines	DeCew WTP High Lift	164	161, 168, 180, 189, 200, 220, 227	3/2	69.0	46.0	67.0
Vineland Booster Pumping Station	1855 Fourth Avenue, St. Catharines	DeCew WTP High Lift	154	154	2/1	10.4	5.2	52.0

(1) Capacity based on 2 m/s watermain velocity.

Table 3.B.4 Storage Facilities Overview

Storage Facility	Location	Storage Type	Volume (ML)	Top Water Level (m)	Fire Supply Zones	Maximum Day Demand Supply Zones
DeCew Water Treatment Plant Reservoir 1(1)	2700 DeCew Road, St. Catharines	Floating/ Gravity Reservoir	18.6	162.0	164 Floating	164 Floating
DeCew Water Treatment Plant Reservoir 2(1)	2700 DeCew Road, St. Catharines	Reservoir	38.0	162.0	164 Floating	164 Floating
Fifth Avenue Reservoir	3390 Fifth Avenue, Vineland	Pumped Reservoir	8.5	153.5	154 Floating	154 Floating
Thorold South Elevated Tank	105 Allanburg Road, Thorold	Elevated Tank	2.3	227.1	161 Floating 180 Floating 227 Floating	161 Floating 180 Floating 227 Floating
Zone 2 Standpipe	5 Allanburg Road, Thorold	Standpipe	4.4	200.3	200 Floating 220 Pumped	200 Floating 220 Pumped
Virgil Elevated Tank	11 Walker Street, Virgil	Elevated Tank	4.5	144.8	127 Floating 144 Floating	127 Floating 144 Floating

(1) Total WTP storage volume is 57 ML (Two reservoirs at 18.6 ML and 38 ML); however, due to contact time requirements from the MECP, the actual usable volume at the DeCew WTP is calculated to be 49.2 ML under 2051 MDD and 48.0 ML under post-2051 MDD, as contact time cannot be used as system storage based on the MECP's CT requirement. Refer to **Section B.2.2** and **Volume 3 - Introduction** for additional information.

B.2 Basis for Analysis

B.2.1 Flow Criteria, Performance, and Sizing Methodology

The Niagara Region Traffic Area Zone planning data was used to estimate growth related demands within the water system and to spatially allocate growth demands within each individual system. **Table 3.B.5** presents a summary of the flow criteria, performance, and sizing methodology that was utilized. Refer to **Volume 3 – Introduction** for additional information.

The Region's per capita water demand criteria was updated based on a historic review of the previous 3-year period local billing meter records. Given that more granular data was available to complete this analysis compared to previous master plan updates, the population and employment per capita rates were differentiated, and both were reduced compared to the Region's previous per capita rate to reflect existing usage trends more closely. Further detail regarding the per capita water demands is presented in **Volume 3 – Introduction.**

In some systems, the NRW was found to be extremely high (i.e., greater than 25%). The expected NRW due to unbilled account for water is 10 to 20%. It was recommended that the local municipalities and the Region work to decrease NRW as much as possible in the long-term. Through this MSPU, a new policy has been proposed for municipalities where existing NRW is greater than 25% to attempt to decrease the future NRW to a maximum of 25%, using local area municipality programs and initiatives. The overall existing non-revenue water rate within the DeCew system is above 25% (9% in Lincoln, 23% in St. Catharines, 26% in Niagara-on-the-Lake, 27% in Thorold). When projecting future 2051 and buildout flows, the existing 2021 starting point NRW was reduced to 25% of existing billed demands. Further detail regarding the non-revenue water analysis is presented in **Volume 3 – Introduction.**

Table 3.B.5 Flow Criteria and Sizing Methodology

Description			Criteria
Flow Criteria	Water Demand	Residential	240 L/c/d
		Employment	270 L/e/d
	Peaking Factor	Maximum Day	Based on historic average of maximum day peaking factors from 2016 – 2020
		Peak Hour Factor	Based on system mass balance using hourly SCADA data from 2018 – 2020
	Existing System Demands		Starting Point Methodology • Based on local billing meter records and production records to establish existing system demands • Growth demands are added to the existing system baseline using design criteria
System Performance Criteria	System Pressures		Acceptable pressure range of 40 – 100 psi • Regional objective of maximizing areas within the preferred range of 50 – 80 psi on Regional watermains
	Fire Flow		250 L/s on Regional watermains at residual pressure of 30 psi
	Velocity	Average Day	Flag areas less than 0.6 m/s minimum velocity
		MDD+FF or PHD	Flag areas greater than 1.5 m/s Trigger upgrades greater than 2 m/s
Sizing and Triggers	Plant and Facility Upgrade Triggers		• 80% trigger for plant and facility planning process (time-based trigger on a case-by-base basis) • Complete plant and facility expansions before 90% capacity is reached
	Treatment Plant Sizing		Maximum day demand
	Pumping Station Sizing		Various potential demand scenarios: • Maximum day demand (MDD) • MDD + fire flow (250 L/s or MECP) • Peak Hour Demand (PHD) Appropriate design sizing scenario depends on the configuration of the service area for the pumping station. Refer to **Volume 3 - Introduction** for further discussion.
	Watermain Sizing		Regional transmission main system for PHD and MDD + fire flow demands
	Storage Sizing		MECP methodology (A + B + C) • Refer to Section B.2.2 for discussion regarding contact time (CT) volume requirement at WTP reservoirs

B.2.2 Water Treatment Plant Reservoir Contact Time Volume Requirement

Due to the contact time requirements from the MECP, the actual usable volume at the DeCew WTP reservoir is calculated to be less than the full volume of 57 ML, as contact time volume cannot be used as system storage based on the MECP's CT requirement. System storage capacity is presented and discussed in **Section B.3.4**.

A conservative assumption has been made for the usable volume at all water treatment plant reservoirs. The methodology for determining required CT is outlined in the MECP's Procedure for Disinfection of Drinking Water in Ontario. Detailed methodology and sample calculations for determining the required CT volume is presented in **Volume 3 – Introduction.**

Further, it should be noted that the Region applies a safety factor of 1.2 to all CT volume calculations as an additional buffer. However, it was determined that this safety factor would be removed for the purposes of storage sizing for the Region's MSPU, as all other parameters utilized within the CT calculation provide an inherent level of conservatism (i.e., temperature of 0.5 deg C and pH of 8).

B.2.3 Population Projections and Allocations

Table 3.B.6 outlines the existing and projected serviced population and employment by pressure zone.

Table 3.B.6 DeCew Water Treatment Plant Existing and Projected Serviced Population and Employment by Pressure Zone

Pressure Zone	2021 Population & Employment			2051 Population & Employment			Post 2051 Population & Employment			2021-2051 Growth		
	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Total
127	6,035	3,162	9,197	6,958	3,827	10,785	7,502	3,949	11,451	923	665	1,588
144	7,061	2,465	9,526	8,209	3,846	12,054	8,860	4,038	12,898	1,148	1,381	2,529
154	10,107	4,282	14,389	20,629	5,573	26,202	25,601	7,785	33,386	10,522	1,291	11,813
161	16	93	109	25	187	212	38	580	618	9	94	103
164	125,968	52,811	178,779	155,801	68,704	224,505	166,296	72,590	238,886	29,833	15,893	45,726
168	4,207	2,652	6,858	7,078	4,644	11,721	8,301	7,687	15,988	2,871	1,992	4,863
180	1,162	5,330	6,492	6,077	6,225	12,303	6,255	6,830	13,086	4,915	896	5,811
189	656	143	798	986	147	1,133	986	187	1,174	331	4	335
200	10,630	4,781	15,411	12,652	5,836	18,488	13,541	6,070	19,610	2,023	1,055	3,078
220	280	232	512	302	277	579	1,268	394	1,662	22	45	67
227	22,051	10,224	32,275	32,327	14,705	47,032	42,244	21,221	63,465	10,276	4,481	14,757
Total	**188,172**	**86,173**	**274,346**	**251,046**	**113,970**	**365,015**	**280,891**	**131,331**	**412,223**	**62,873**	**27,796**	**90,670**

Note: Population numbers may not sum due to rounding.

B.3 Existing System Performance

B.3.1 Starting Point Demands and Performance

The starting point demand and maximum day peaking factor for the DeCew WTP was calculated using historic SCADA production data. Ten years of data (2011 to 2020) was reviewed to provide historical context and assess overall long-term trends; however, the most recent five years of data was used to determine the maximum day demand peaking factor. **Table 3.B.7** presents the historic water demand and water system maximum day peaking analysis. Based on the historic analysis, the DeCew WTP system has an existing average demand of 52.9 MLD and system peaking factor of 1.50.

Table 3.B.7 Historic Water Demand

Year	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Maximum Day Demand Peaking Factor
2011	53.2	93.3	1.75
2012	52.8	89.6	1.70
2013	54.5	80.2	1.47
2014	53.8	70.6	1.31
2015	54.4	81.1	1.49
5 Year Average	*53.7*	*82.9*	*1.50*
5 Year Peak	*54.5*	*93.3*	*1.80*
2016	54.9	88.0	1.60
2017	47.3	73.1	1.55
2018	55.8	94.9	1.70
2019	53.2	75.0	1.41
2020	53.4	88.4	1.66
5-year average	**52.9**	**83.9**	**1.58**
5-year peak	*55.8*	*94.9*	*1.70*
10-year average	*53.3*	*83.4*	*1.56*
10-year peak	*55.8*	*94.9*	*1.75*
MECP Peaking Factor (Existing)	**1.50**		
MECP Peaking Factor (2051)	**1.50**		

Local billing meter records were provided by the local area municipalities for the years of 2018 – 2020. Using this more granular data, along with Region billing meter data, system non-revenue water was calculated for each municipality, as well as system demands for each pressure zone. To estimate future system demands, the projected residential and employment growth populations were then converted to expected flows using the criteria presented in **Table 3.B.5**. Existing and future water system demands by pressure zone are presented in **Table 3.B.8**.

Table 3.B.8 Existing and Future Water System Demands by Pressure Zone

Pressure Zone	2021 Demand		2021 to 2051 Growth Demand		2051 Demand (Existing + Growth)		2051 Demand With NRW Reduction (Existing + Growth) (1)		Post 2051 Demand (Existing + Growth)		Post 2051 Demand With NRW Reduction (Existing + Growth)(1)	
	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)
127	3.4	4.8	0.4	0.6	3.8	5.5	3.7	5.4	3.9	5.7	3.9	5.7
144	2.9	4.2	0.6	1.0	3.6	5.2	3.6	5.2	3.8	5.6	3.8	5.6
154	2.9	4.4	2.9	4.6	5.7	9.0	5.7	9.0	7.5	11.8	7.5	11.8
161	0.1	0.1	0.0	0.0	0.1	0.2	0.1	0.2	0.2	0.3	0.2	0.3
164	41.9	59.6	11.5	18.1	53.4	77.7	51.8	76.1	56.9	83.4	55.4	81.8
168	1.9	2.8	1.2	1.9	3.2	4.8	3.2	4.8	4.3	6.5	4.3	6.5
180	1.2	1.9	1.4	2.3	2.7	4.1	2.7	4.1	2.9	4.4	2.9	4.4
189	0.2	0.3	0.1	0.1	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4
200	4.1	5.7	0.8	1.2	4.9	7.0	4.5	6.5	5.2	7.4	4.7	7.0
220	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.3	0.5	0.3	0.5
227	7.8	11.4	3.7	5.8	11.5	17.2	11.5	17.2	15.7	23.8	15.7	23.8
Total	**66.6**	**95.3**	**22.6**	**35.8**	**89.2**	**131.1**	**87.1**	**129.0**	**101.0**	**149.9**	**98.9**	**147.8**

(1) Non-revenue water (NRW) adjustments were made within systems where existing NRW was higher than 25%. Assumption was made that the starting point NRW would be reduced to less than 25% for those systems when analysing 2051 and post-2051 scenarios.

B.3.2 Treatment Plant Capacity

Figure 3.B.3 shows the projected future demands at the DeCew Water Treatment Plant. The plant has surplus capacity to support growth and will not reach 80% capacity within the 2051 time horizon.

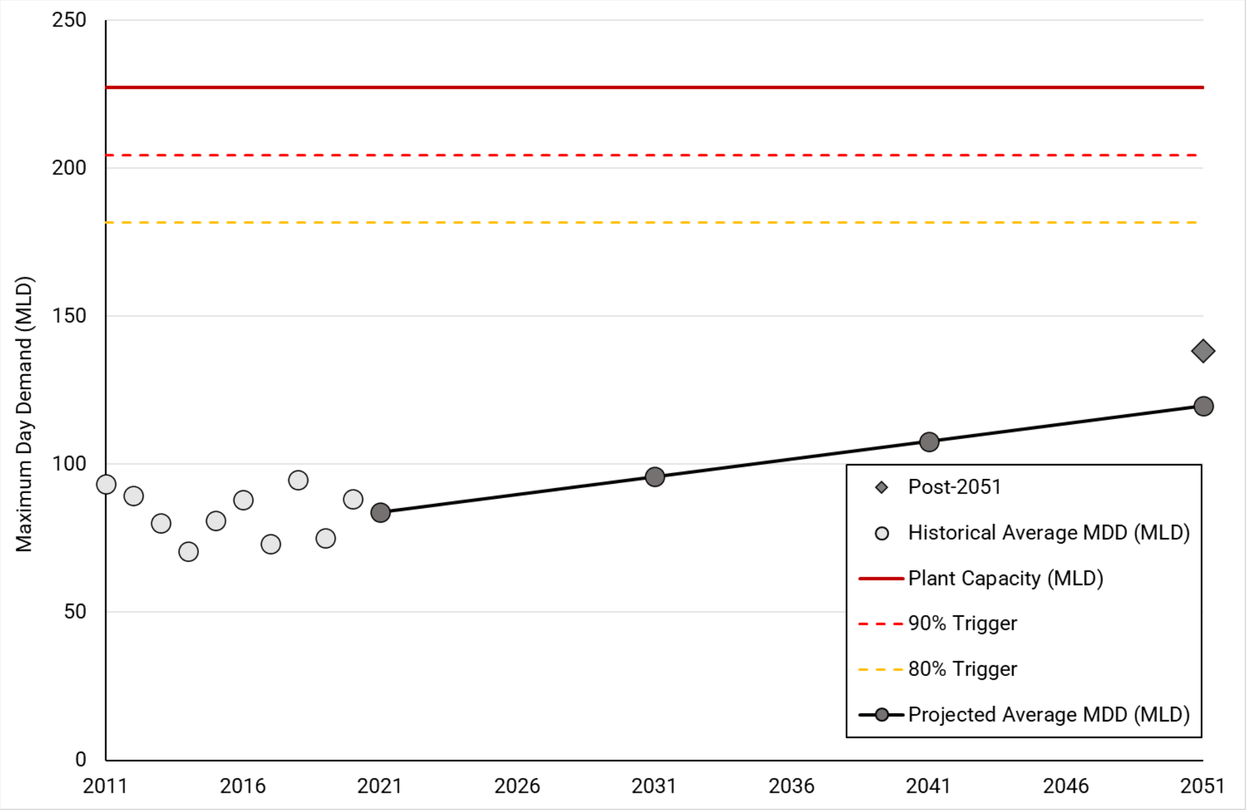


Figure 3.B.3 Projected Maximum Day Demand at DeCew Water Treatment Plant

B.3.3 Pumping Capacity

Table 3.B.9 highlights the pumping station existing and projected capacity. As presented in **Section B.2.1**, there are various potential demand scenarios for pumping station capacity sizing depending on system configuration and available storage type and volume. As such, the design condition has been specified in the table below (i.e., maximum day demand, peak hour demand, or maximum day demand + fire flow), along with the 2021, 2051, and post-2051 design flows which correspond to the design condition for each respective pump station.

The DeCew system has surplus existing and future pumping capacity projected to 2051.

Table 3.B.9 System Pumping Station Performance

Pump Station	Firm Capacity (MLD)	Pressure Zones Supplied	Design Condition	2021 Maximum Day Demand (MLD)	2021 Design Flow (MLD)	2021 Surplus/ Deficit (MLD)	2051 Maximum Day Demand (MLD)	2051 Design Flow (MLD)	2051 Surplus/ Deficit (MLD)	Post 2051 Maximum Day Demand (MLD)	Post 2051 Design Flow (MLD)	Post 2051 Surplus/ Deficit (MLD)
DeCew Water Treatment Plant Gravity Feed[(1)]	109.9	127, 144, 154, 164, 200, 220	MDD	78.8	78.8	31.1	102.4	102.4	7.6	112.3	112.3	-2.4
DeCew Water Treatment Plant High Lift	60	161, 168, 180, 200, 220, 227	MDD + Fire (MECP)	22.0	54.6	51.5	32.8	65.5	40.6	42.5	75.2	30.9
Brock High Lift Booster Pumping Station	46.09	161, 168, 180, 200, 220, 227										
Vineland Booster Pumping Station	13.3	154	MDD	4.4	4.4	8.9	9.0	9.0	4.3	11.8	11.8	1.5

(1) Capacity based on 2 m/s watermain velocity in the 900 mm gravity feed.

B.3.4 Storage Capacity

Using the MECP methodology for CT volume calculations and the corresponding MDD for each planning horizon, the required CT volume at the DeCew WTP reservoir is 7.9 ML under 2051 MDD, and 9.1 ML under post-2051 MDD. As such, the remaining usable volume for system storage utilization at the DeCew WTP reservoir is 48.7 ML under 2051 MDD, and 47.5 ML under post-2051 MDD. As a conservative assumption the 2051 MDD volume was utilized for the existing system capacity utilization table. **Table 3.B.10** presents the available system storage at the DeCew WTP under various demand scenarios. **Table 3.B.11** highlights the storage existing and projected capacity.

When reviewed on individual zone-by-zone basis, portions of the DeCew system appear to have storage deficiencies. However, when reviewed on a system basis, the system as whole has sufficient storage under the existing scenario, provided there is sufficient capacity to transfer surplus storage capacity to deficient zones. Under the growth scenarios to 2051 and post-2051, the overall storage for the entire system is in deficit, indicating that an adjustment in the recommended strategy is likely required in addition to maximizing existing storage infrastructure through system transfers.

Table 3.B.10 Available System Storage at the DeCew WTP under 2051 MDD, Buildout MDD, and at MDWL Capacity

DeCew WTP	2051 MDD		Buildout MDD		At MDWL Capacity	
	18 ML Reservoir	38 ML Reservoir	18 ML Reservoir	38 ML Reservoir	18 ML Reservoir	38 ML Reservoir
Minimum Reservoir Out/Treated Free Chlorine (mg/L)	0.8	0.8	0.8	0.8	0.8	0.8
Maximum Ph	8	8	8	8	8	8
Minimum Temperature (deg. C)	0.5	0.5	0.5	0.5	0.5	0.5
Reservoir Volume (ML)	19	38	19	38	19	38
Reservoir Baffle Factor	0.7	0.7	0.7	0.7	0.7	0.7
MDD (ML/D)	41.5	87.5	47.5	100.3	159.1	159.1
$CT_{required}$	49	49	49	49	49	49
Safety Factor	1	1	1	1	1	1
CT_{actual}	49	49	49	49	49	49
T_{10}	61.3	61.3	61.3	61.3	61.3	61.3
Reservoir Retention Time (min)	87.5	87.5	87.5	87.5	87.5	87.5
Min Volume Needed (ML)	2.5	5.3	2.9	6.1	9.7	9.7
Minimum Reservoir Level (%)	0.1	0.1	0.2	0.2	0.5	0.3
Storage Volume Available (ML)	**16.1**	**32.7**	**15.7**	**31.9**	**8.9**	**28.3**
Total DeCew WTP Reservoirs – Storage Volume Available (ML)	**48.8**		**47.6**		**37.3**	

Table 3.B.11 System Storage Capacities

Storage	Fire Supply Zones	MDD Supply Zones	2021 Rated Capacity (ML)	2051 Rated Capacity (ML)	Post 2051 Rated Capacity (ML)	2021 Total Available Storage (ML)	Existing Required Storage	Existing Surplus/ Deficit (ML)	2051 Total Available Storage (ML)	2051 Required Storage (ML)	2051 Surplus/ Deficit (ML)	Post 2051 Total Available Storage (ML)	Post 2051 Required Storage (ML)	Post 2051 Surplus/ Deficit (ML)
DeCew Water Treatment Plant Reservoir 1	164 Floating	164	16.1(2)	16.1	15.7	48.8	28.8	19.9	48.8	34.0	14.8	47.6	35.8	11.9
DeCew Water Treatment Plant Reservoir 2	164 Floating	164	32.7	32.7	31.9									
Zone 2 Standpipe	200 Floating, 220 Floating	200, 220	4.4	4.4	4.4	4.4	5.9	-1.5	4.4	7.1	-2.7	4.4	8.0	-3.6
Virgil Elevated Tank	127 Floating, 144 Floating	127, 144	4.5	4.5	4.5	4.5	7.8	-3.2	4.5	9.4	-4.8	4.5	10.0	-5.4
Fifth Avenue Reservoir	154 Floating	154	8.5	8.5	8.5	8.5	4.9	3.6	8.5	9.7	-1.2	8.5	11.7	-3.2
Thorold South Elevated Tank	161 Floating, 180 Floating, 227 Floating	161, 180, 227	2.3	2.3	2.3	2.3	14.0	-11.7	2.3	16.9	-14.6	2.3	19.1	-16.8
Overall Storage (including Fifth Avenue Reservoir)(1)						**Overall Existing Storage Surplus**		**3.5**	**Overall 2051 Storage Deficit**		**-7.4**	**Overall Post 2051 Storage Deficit**		**-14.0**

(1)Excluding the Fifth Avenue Reservoir, as storage from the Fifth Avenue Reservoir cannot be used to support the remainder of the DeCew system due to elevation.

(2)2051 MDD volume was utilized for the existing system capacity utilization table (conservative assumption)

B.3.5 System Pressures and Fire Flows

Figure 3.B.4 to **Figure 3.B.5** present the existing system performance, based on existing system configuration and capacities.

For the majority of the system, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. Higher pressures exceeding 100 psi under average days demands are experienced in areas closer to Lake Ontario. Addressing large high-pressure areas was outside of the scope of the Region’s MSPU, but they can be assessed at the local area municipality level, with potential options including do nothing, optimize the HGL for the entire zone, or the creation of new subzones. Low pressure below 40 psi are experienced in Lincoln Vineland near the Fifth Avenue Reservoir, which is expected as the watermains feed the inground reservoir which service Vineland and does not directly servicing residents or businesses. Further, low pressure below 40 psi is experienced in two small areas near the Zone 2 Standpipe in St. Catharines and on Glen Road in Vineland, which is also expected due to the high ground elevation.

The Region’s target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for critical system areas. The fire flow target is not met on the transmission main on Portage Road from Niagara Falls pressure zone 250 to Niagara-on-the-Lake pressure zone 164, however, this area is outside of the urban area boundary and does not provide fire service to local residents or businesses. The fire flow target is not met on the Regional transmission main in Lincoln Vineland near the Fifth Avenue Reservoir, however this is to be expected as it is a low pressure watermain filling the reservoir.

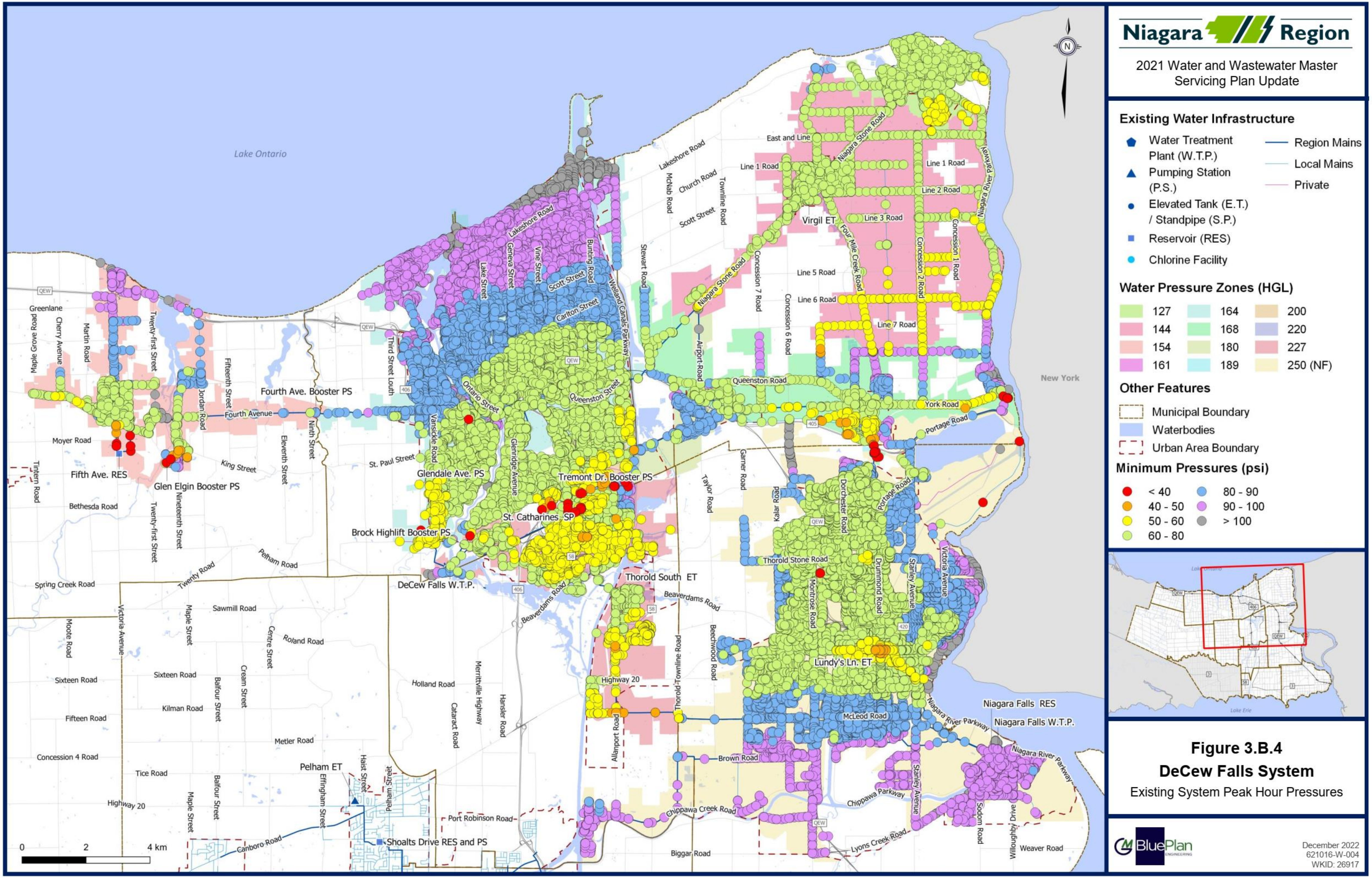


Figure 3.B.4

DeCew Falls System

Existing System Peak Hour Pressures

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621016-W-004
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Niagara Region

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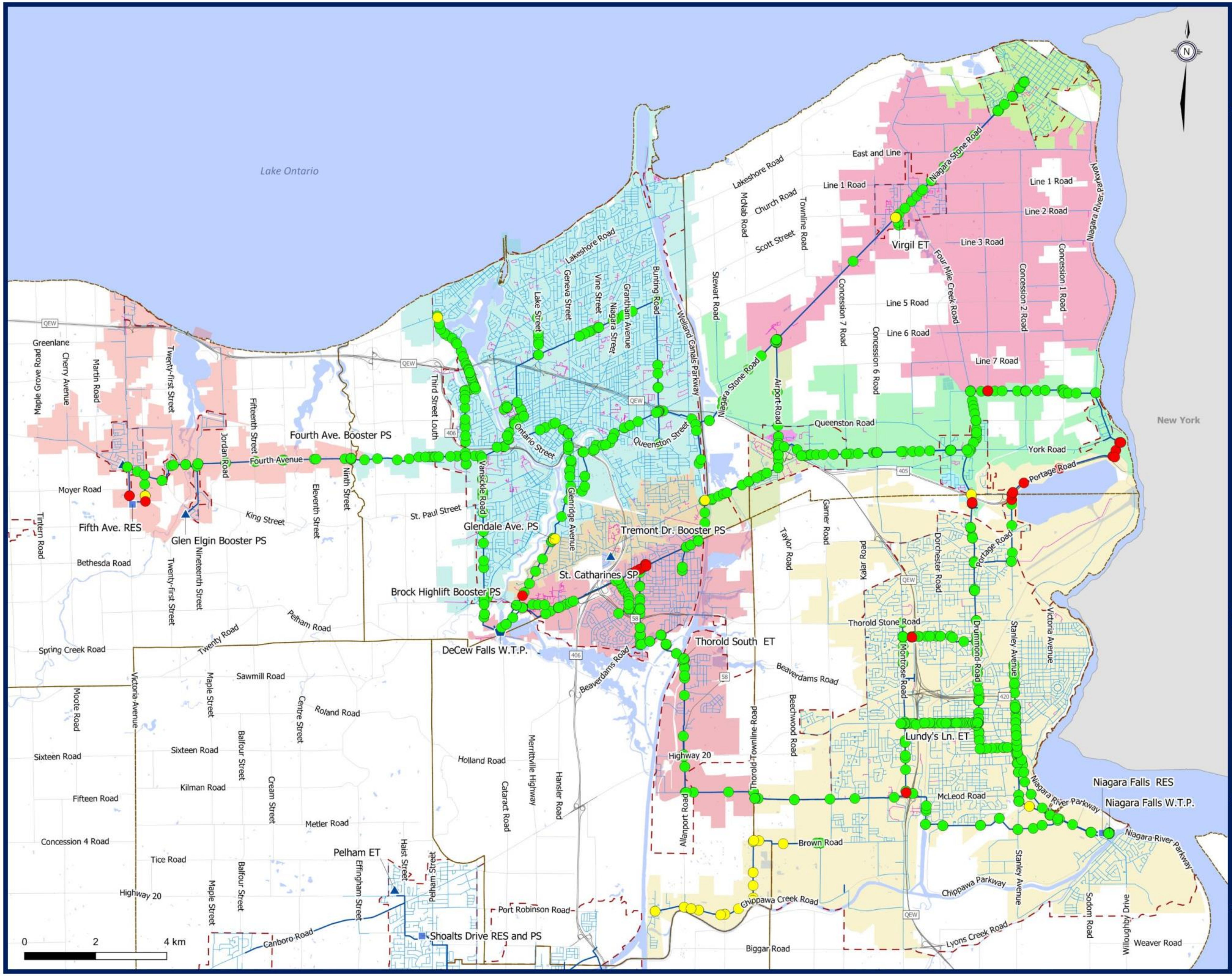

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- Region Mains
- Local Mains
- Private

Water Pressure Zones (HGL)

127	164	200
144	168	220
154	180	227
161	189	250

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Regional Mains Available Fire Flow (L/s) - 30 psi Residual Pressure

- 🔴 < 125
- 🟢 > 250
- 🟡 125 - 250

Figure 3.B.5
DeCew Falls System

Existing System Fire Flows

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B.3.6 Water Age and Watermain Capacity

Using the baseline system model, water age scenarios were created to identify average system water age. Using the Drinking Water Works Permits for each system, the locations of re-chlorination facilities were identified. Water age was reset to zero at these facilities for the water age model scenario. Water age is typically used as a proxy indicator for water quality, however, the exact correlation between water age and water quality can be highly variable depending on the source water quality, the distribution system material, and the secondary disinfectant that is used. A common threshold that is used within water system age is to flag areas where water age is greater than 7 days.

Figure 3.B.6 presents the existing system water age. Watermain velocities less than 0.6 m/s or greater than 1.5 m/s have been flagged and are shown in **Figure 3.B.7**.

In general, maximum water age is less than 7 days within the DeCew water system, except for minor local dead-end watermains.

In general, watermain velocity is less than 2 m/s, however there are many Regional watermains which experience velocities less than 0.6 m/s.

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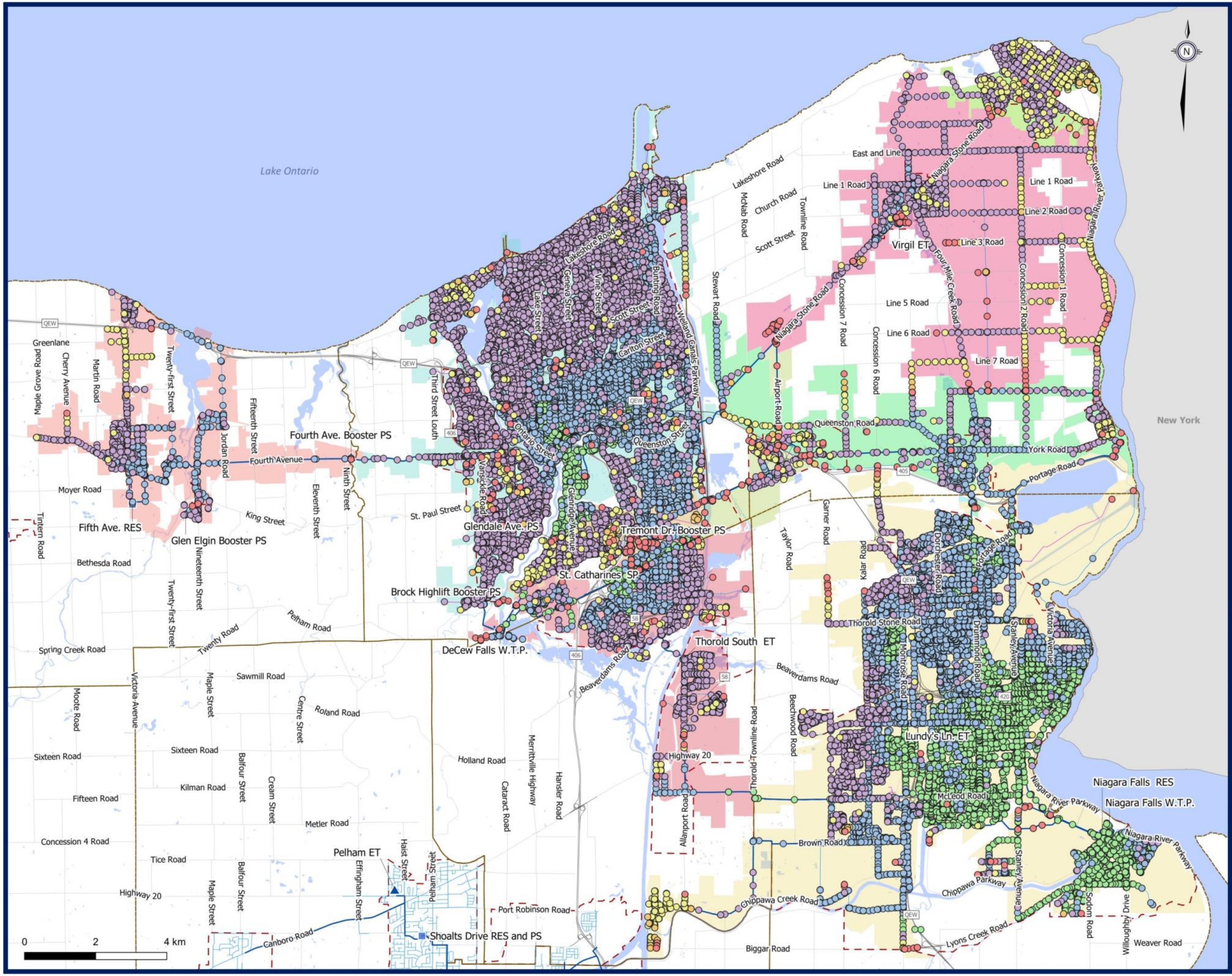

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- Region Mains
- Local Mains
- Private

Water Pressure Zones (HGL)

127	164	200
144	168	220
154	180	227
161	189	250 (NF)

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Water Age (days)

● < 1	● 4 - 6
● 1 - 2	● 6 - 7
● 2 - 4	● > 7

Figure 3.B.6
DeCew Falls System
Existing System Water Age

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621016-W-006
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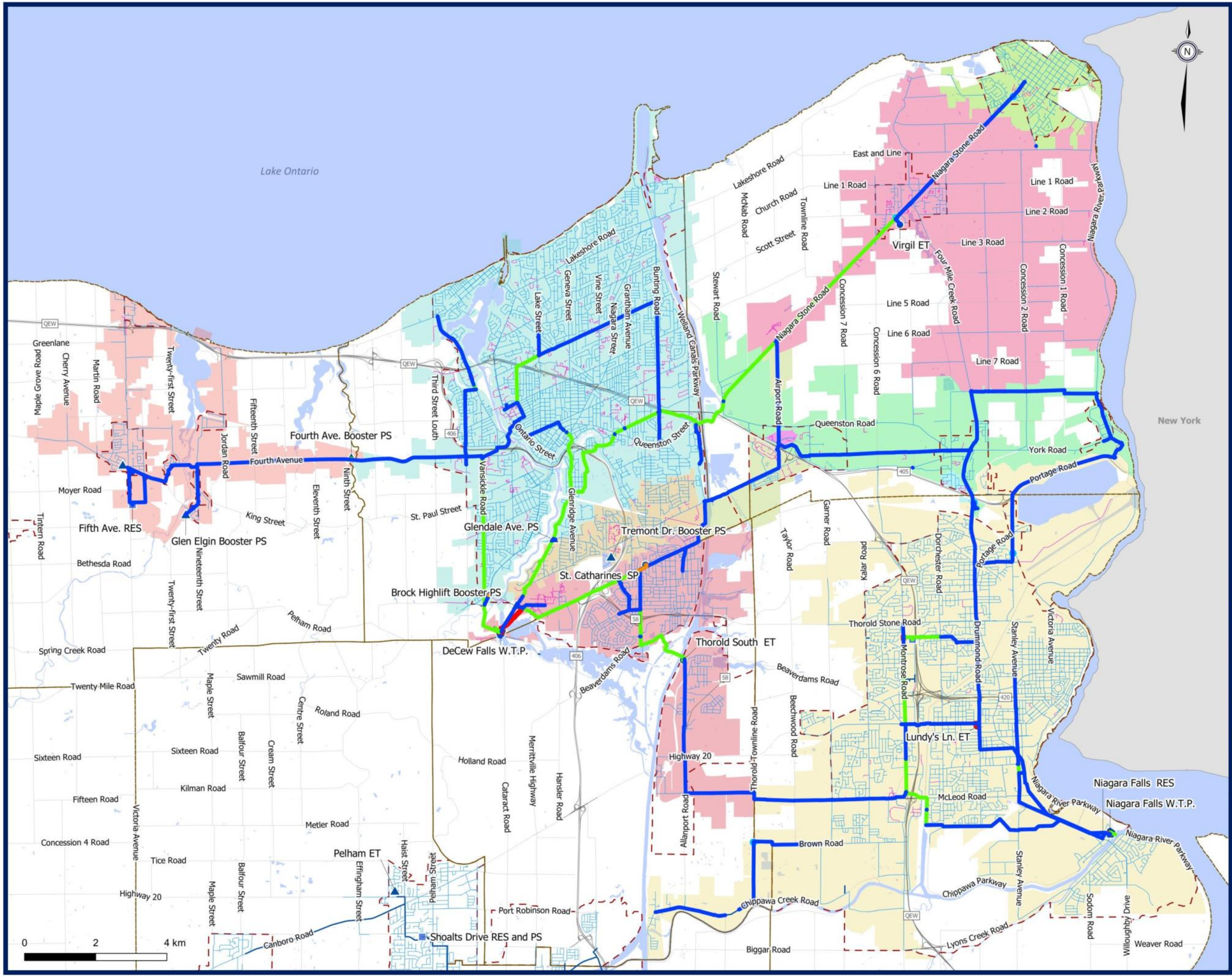

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2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- Region Mains
- Local Mains
- Private

Water Pressure Zones (HGL)

- 127
- 144
- 154
- 161
- 164
- 168
- 180
- 189
- 200
- 220
- 227
- 250 (NF)

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Maximum Velocity (m/s) - Regional Watermains

- < 0.6
- 0.6 - 1.5
- 1.5 - 2.0
- > 2.0

Figure 3.B.7
DeCew Falls System
Existing System Watermain Velocity

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B.4 System Opportunities and Constraints

Figure 3.B.8 highlights the existing opportunities and constraints.

B.4.1 DeCew Water Treatment Plant

- The current rated MDD capacity is 227.3 MLD, with an existing demand of 83.9 MLD. The projected 2051 MDD is 129.0 MLD, which is below 80% of the Water Treatment Plant rated capacity. As such, the Water Treatment Plant has surplus capacity to accommodate growth beyond 2051.

B.4.2 St. Catharines System

- St. Catharines has an existing and future storage and pumping surplus.
- The DeCew Water Treatment Plant High Lift and Brock High Lift Booster Pumping Station have a projected combined surplus of 30.9 MLD for post-2051.
- Increased intensification throughout St. Catharines increases transmission system needs; limiting available capacity to supplement peak flow transfers to the Niagara-on-the-Lake system.
- There is a projected overall system storage deficit within the DeCew system in 2051 and post-2051.

B.4.3 Lincoln System

- There is sufficient conveyance and pumping capacity to support 2051 growth.
- There is sufficient storage capacity to support existing demands, however, there is a projected 2051 and post-2051 storage deficit within the Lincoln zone and within the overall DeCew system.

B.4.4 Thorold System

- When reviewed in isolation, Thorold does not have sufficient storage capacity, however, there is sufficient conveyance capacity to support the storage deficiencies through transfers from the surplus storage at the DeCew Water Treatment Plant High Lift Pumps and Niagara Falls Water System to support existing demands.
- There is a projected overall system storage deficit within the DeCew system in 2051 and post-2051.
    - New storage within Thorold and/or increased conveyance from Niagara Falls and/or the DeCew Water Treatment Plant High Lift Pumps

B.4.5 Niagara-on-the-Lake System

- When reviewed in isolation, Niagara-on-the-Lake does not have sufficient storage capacity. There is some surplus conveyance capacity to support a portion of the storage deficiencies through transfers from the surplus storage from the St. Catharines and Thorold to support existing demands.

- There is a projected overall system storage deficit within the DeCew system in 2051 and post-2051.
    - New storage within Niagara-on-the-Lake and/or increase conveyance from St. Catharines and Thorold, and/or Niagara Falls is needed to address 2051 storage needs.

B.4.6 System Security of Supply & Interconnections

- There is a single transmission main to the Vineland system.
- There is a single watermain connection crossing the Welland Canal supporting the South Thorold area. However, this area can be backfed from the Niagara Falls system.
    - Operational challenges and high pressure issues in Zone 227 west of the canal when western system is isolated from the Thorold Elevated Tank.
- There is no regional feedermain from Niagara Falls to Niagara-on-the-Lake.
- The Niagara Falls Water Treatment Plant system has surplus capacity to support increased transfers to the DeCew system allowing for:
    - Increased security of supply to the DeCew system.
    - Alternative servicing strategies to support growth within Niagara-on-the-Lake and/or South Thorold.

Niagara Region

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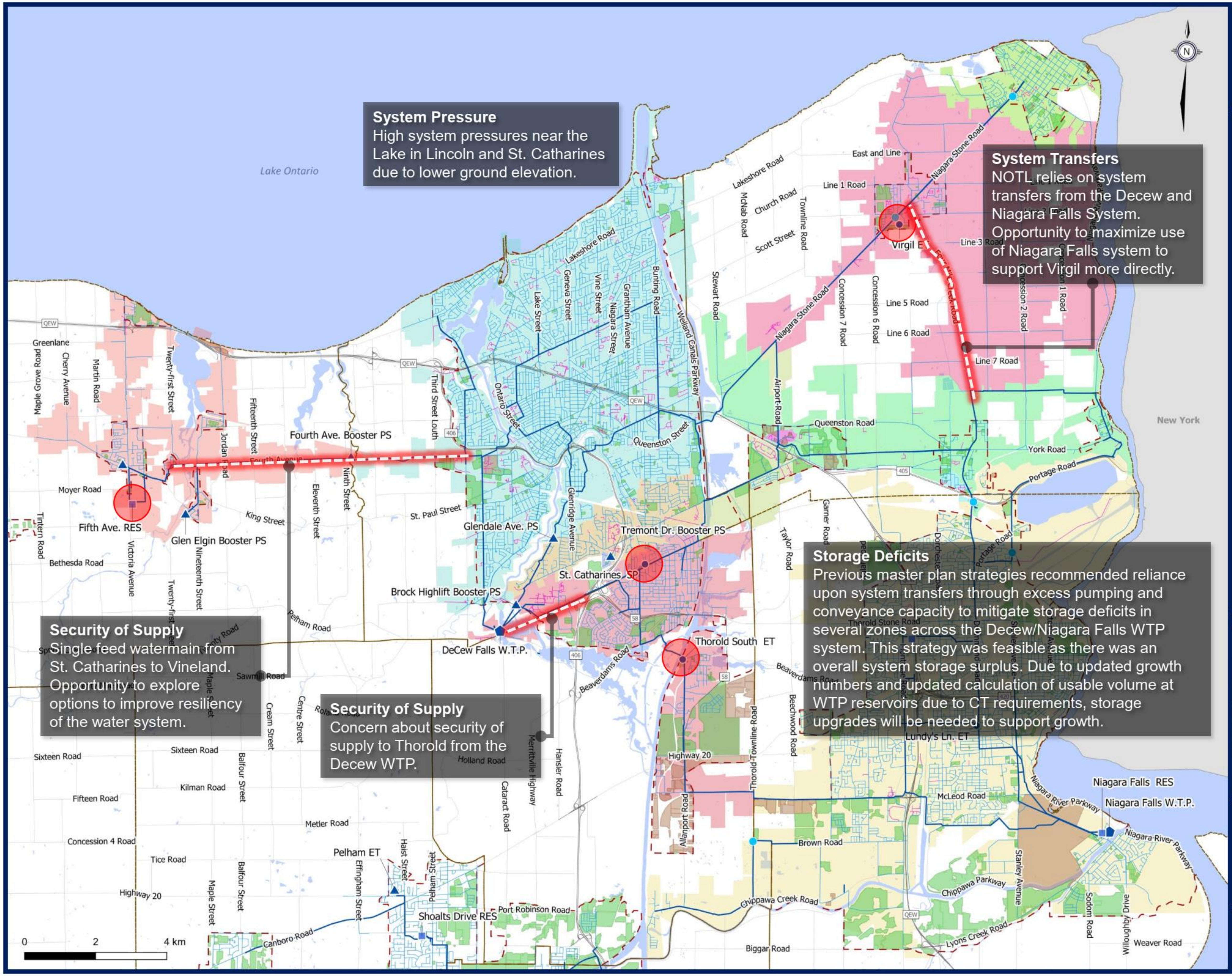


System Pressure
High system pressures near the Lake in Lincoln and St. Catharines due to lower ground elevation.

System Transfers
NOTL relies on system transfers from the Decew and Niagara Falls System. Opportunity to maximize use of Niagara Falls system to support Virgil more directly.

Security of Supply
Single feed watermain from St. Catharines to Vineland. Opportunity to explore options to improve resiliency of the water system.

Security of Supply
Concern about security of supply to Thorold from the Decew WTP.

Storage Deficits
Previous master plan strategies recommended reliance upon system transfers through excess pumping and conveyance capacity to mitigate storage deficits in several zones across the Decew/Niagara Falls WTP system. This strategy was feasible as there was an overall system storage surplus. Due to updated growth numbers and updated calculation of usable volume at WTP reservoirs due to CT requirements, storage upgrades will be needed to support growth.

Existing Water Infrastructure

⬟ Water Treatment Plant (W.T.P.)
▲ Pumping Station (P.S.)
● Elevated Tank (E.T.) / Standpipe (S.P.)
■ Reservoir (RES)
● Chlorine Facility
— Region Mains
— Local Mains
— Private

Water Pressure Zones (HGL)

🟩 127
🟥 144
🟥 154
🟪 161
🟦 164
🟩 168
🟩 180
🟦 189
🟧 200
🟪 220
🟥 227
🟨 250 (NF)

Other Features

▭ Municipal Boundary
🟦 Waterbodies
▭ Urban Area Boundary

Development Locations

🟩 Pre-2051
🟫 Post-2051

Figure 3.B.8
DeCew Falls System
System Opportunities and Constraints

GM BluePlan

November 2022
621016-W-002
WKID: 26917

B.5 Assessment of Alternatives

To address existing and growth-related capacity needs, the following servicing alternatives were evaluated:

- Baseline (No Changes),
- No storage expansion and maximize system transfers,
- Minimal storage expansion and continued reliance on system transfers,
- Moderate storage expansion and continued reliance on system transfers, and
- Focus on storage expansion and minimize system transfers.

All the evaluated alternatives include the followings works:

- New feedermain from south Niagara-on-the-Lake to Virgil ET to support transfers from Niagara Falls to Niagara-on-the-Lake; and,
- New feedermain from DeCew WTP to Townline Road East in Thorold to provide security of supply to Thorold from the DeCew WTP.
    - The Region is undertaking a separate study (target completion in 2023) to review the preferred sizing and alignment of this watermain.

The identified high pressure issues can be addressed through changes within the local distribution system through either the creation of new pressure zones or adjustments to existing zone boundaries, while the local capacity constraints will be addressed through localized capacity upgrades.

For discussion regarding system upgrade alternative for the Niagara Falls System, refer to **Volume 3 – Part C**.

B.5.1 Alternative 1 – No Storage Expansion and Maximize System Transfers

Alternative 1, highlighted in **Figure 3.B.9**, generally maintains the existing infrastructure and maximizes transfers between zones and municipalities with minimal new storage projects. It should be noted that sole reliance on system transfers to offset storage deficiency is likely not sufficient under future conditions as there will be an overall system storage deficit within the DeCew system, and there is no surplus storage in Niagara Falls to transfer under future conditions. Twinning of the single feed watermain to Vineland is especially important due to the reliance upon system transfers to support the system.

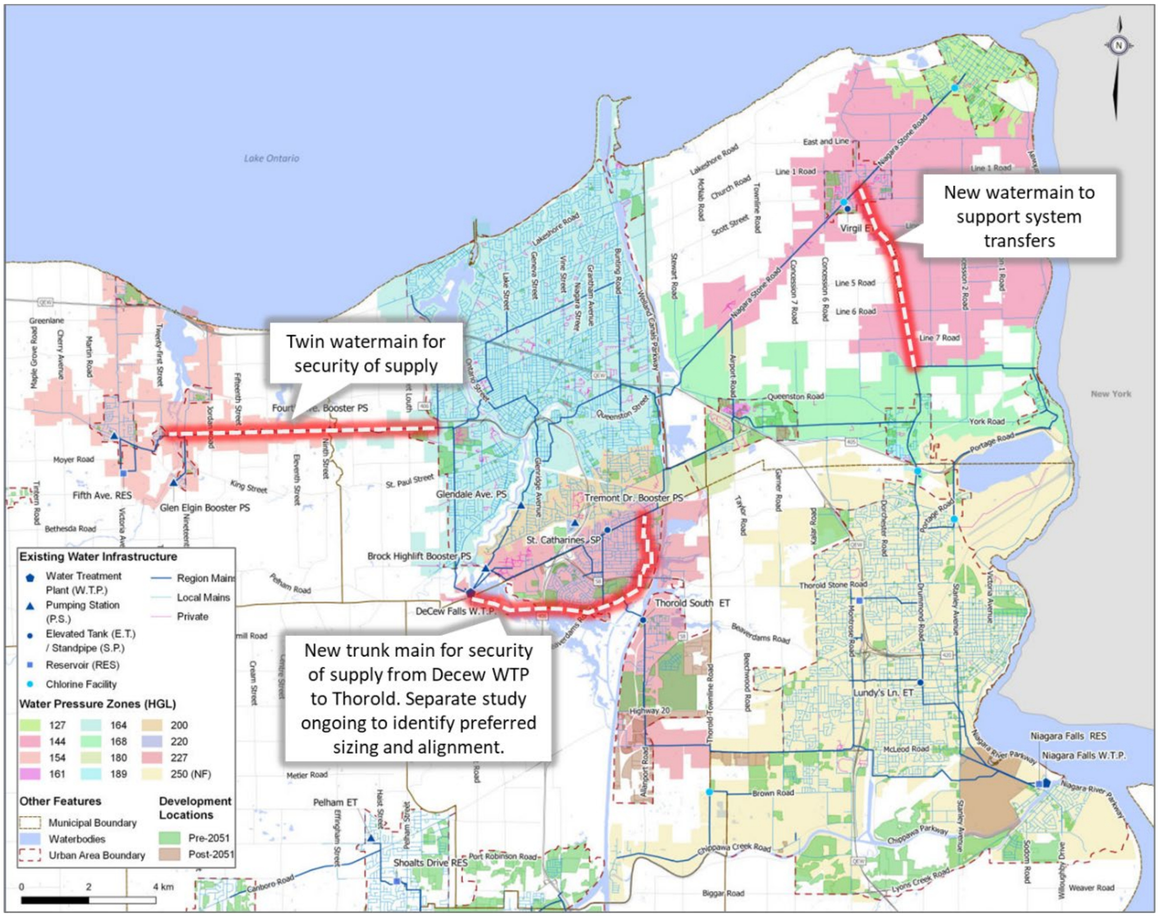
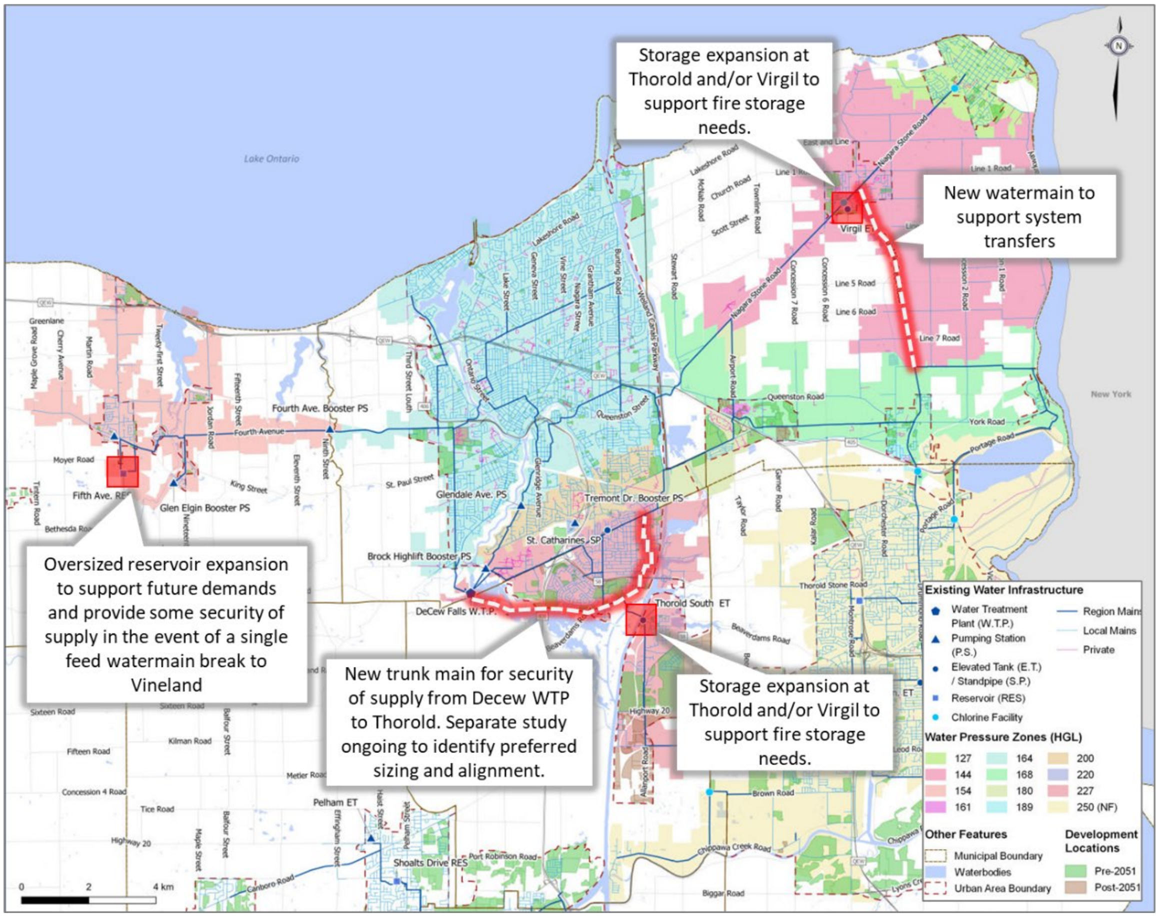


Figure 3.B.9 Alternative 1 – No Storage Expansion and Maximize System Transfers

B.5.2 Alternative 2 – Minimal Storage Expansion with System Transfers

Alternative 2, highlighted in **Figure 3.B.10**, consists of storage oversizing at the Fifth Avenue Reservoir to support 2051 and post-2051 flows and to provide security of supply in the event of a single feed watermain break to Vineland. This option relies on surplus pumping capacity at the DeCew WTP to support peak hour demands and utilizes existing storage at the DeCew WTP reservoirs to support balancing and emergency storage needs for the DeCew system. New elevated storage would be required to support fire storage needs in Thorold and Niagara-on-the-Lake, which could consist of one large ET in Thorold, or a combination of smaller ET upgrades in Thorold and Niagara-on-the-Lake. This strategy reduces reliance on transfers for fire flow and ensures that the overall system storage is not deficient.



Storage expansion at Thorold and/or Virgil to support fire storage needs.

New watermain to support system transfers

Oversized reservoir expansion to support future demands and provide some security of supply in the event of a single feed watermain break to Vineland

New trunk main for security of supply from Decew WTP to Thorold. Separate study ongoing to identify preferred sizing and alignment.

Storage expansion at Thorold and/or Virgil to support fire storage needs.

Figure 3.B.10 Alternative 2 – Minimal Storage Expansion with System Transfers

B.5.3 Alternative 3 – Moderate Storage Expansion with System Transfers

Alternative 3, highlighted in **Figure 3.B.11**, includes a reservoir expansion at the Fifth Avenue Reservoir to address 2051 and buildout deficiency, treating storage within Vineland independently from the remainder of the DeCew system due to the limited transfer points. This alternative also includes the twinning of the single feed watermain to Vineland to improve security of supply. This option relies on surplus pumping capacity at the DeCew WTP to support peak hour demands and utilizes existing storage at the DeCew WTP reservoirs to support emergency storage needs and balancing of the DeCew system. New elevated storage would be required to support fire storage needs in Thorold and Niagara-on-the-Lake, which could consist of one large ET in Thorold, or a combination of smaller ET upgrades in Thorold and Niagara-on-the-Lake. Long-term storage deficiencies can be addressed through post-2051 storage expansion at the DeCew WTP. This strategy reduces reliance on transfers for fire flow and ensures that the overall system storage is not deficient. It also maximizes the use of surplus existing pumping capacity which provides flexibility and time to the Region to further understand the timing and location of growth.

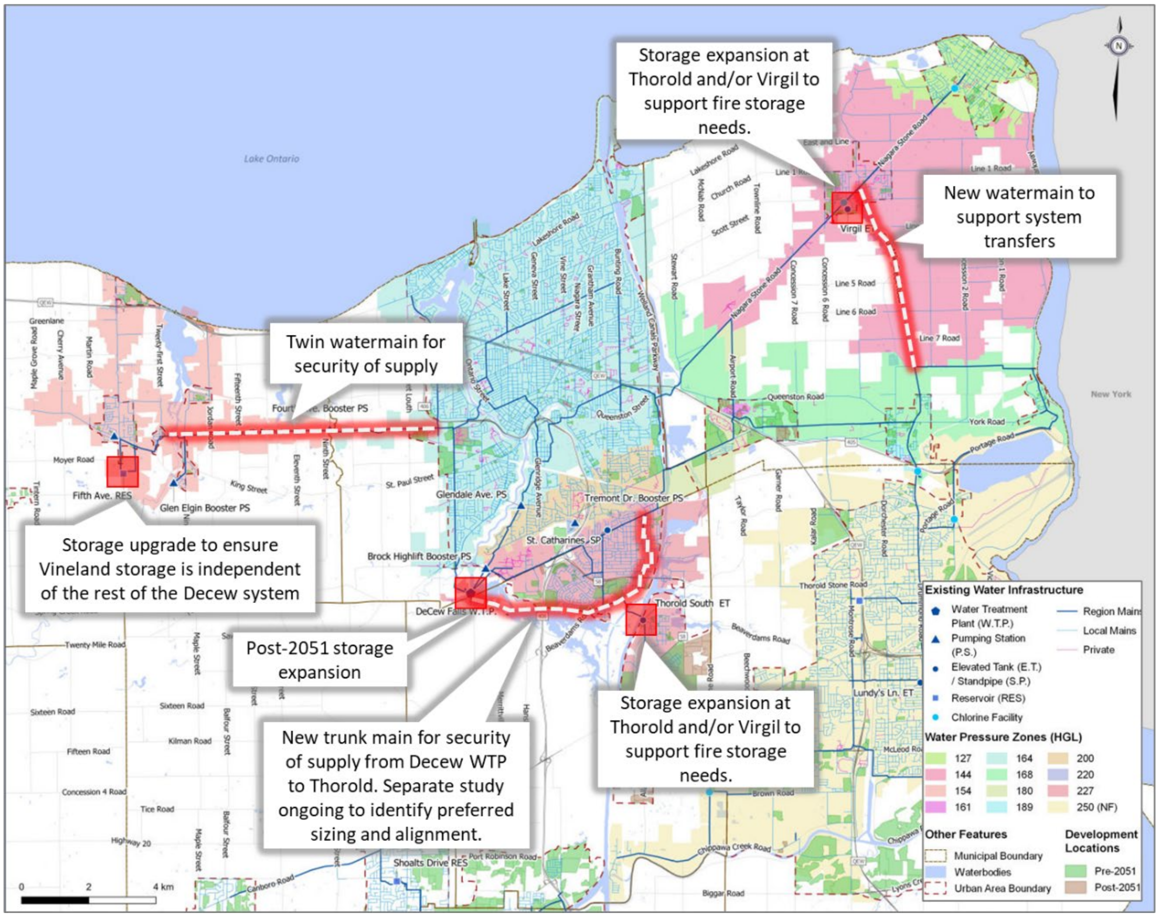


Figure 3.B.11 Alternative 3 – Moderate Storage Expansion with System Transfers

B.5.4 Alternative 4 – Focus on Storage Expansion and Minimize System Transfers

Alternative 4, highlighted in **Figure 3.B.12**, consists of storage upgrades or new storage facilities to ensure that each subzone of the DeCew system has sufficient storage to support growth to 2051 and post-2051. This alternative includes:

- Oversizing at the Fifth Avenue Reservoir to support 2051 and post-2051 flows and provide security of supply in the vent of a single feed watermain break to Vineland;
- Upgrade of Zone 2 Standpipe volume in St. Catharines;
- Upgrade of South Thorold ET volume;
- Upgrade of Virgil ET volume in NOTL; and,
- New storage to support south NOTL (replacement of decommissioned St. David's Standpipe).

This strategy minimizes reliance on transfers for fire flow and ensures that all subzones independently have sufficient storage.

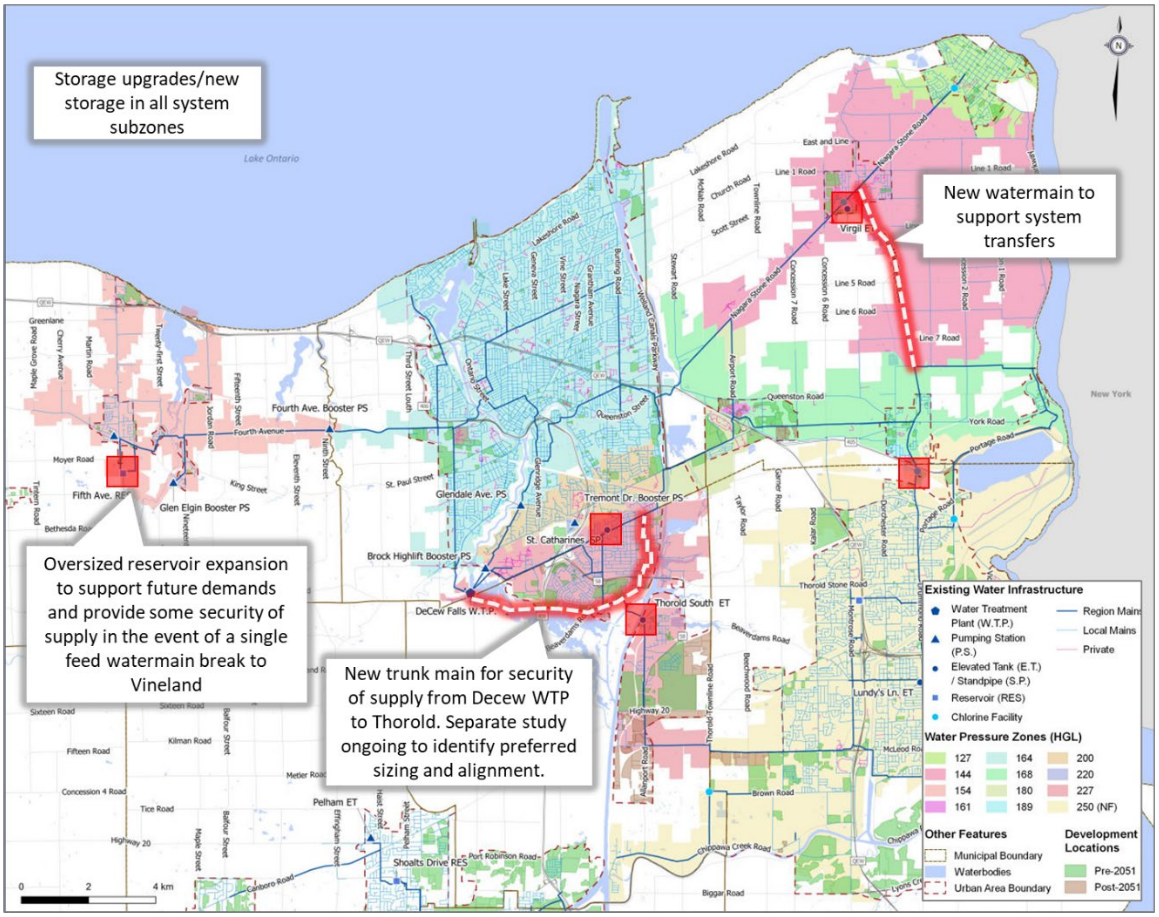


Figure 3.B.12 Alternative 4 – Focus on Storage Expansion and Minimize System Transfers

B.5.5 Alternatives Evaluation

Alternative 3 – Moderate storage expansion with system transfers is the preferred servicing strategy as:

- The baseline strategy does not satisfy future servicing needs of the water system.
- Alternative 3 – Moderate storage expansion with system transfers provides the following advantages in addressing the 2051 growth needs:
  - Reduces reliance on system transfers,
  - Ensures Vineland storage is independent of the remainder of the DeCew system,
  - Continues to make use of system transfers to support system deficits using existing infrastructure, and
  - Balances storage expansion with system transfers to ensure overall system storage is not deficient.

Table 3.B.12 Comparison of Alternatives

Category	Alternative 1	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Description	Maximize transfers	Storage expansion and system transfers	Storage expansion and system transfers, Vineland security of supply	Storage expansion and minimize transfers
Upgrades	• 6.8 km of 450 mm watermain (twinning from St. Catharines to Vineland)	• Two additional cells at Fifth Avenue Reservoir (8.5 ML) • Replace Thorold ET with larger tank (8.2 ML) or replace Thorold ET and Virgil ET with larger tanks	• One additional cell at Fifth Avenue Reservoir (4.25 ML) • 6.8 km of 450 mm watermain (twinning from St. Catharines to Vineland) • Replace Thorold ET with larger tank (8.2 ML) or replace Thorold ET and Virgil ET with larger tanks	• Two additional cells at Fifth Avenue Reservoir (8.5 ML) • Upgrade Zone 2 Standpipe volume • Upgrade Thorold ET volume • Upgrade Virgil ET volume • Replace St. David's Standpipe volume (decommissioned) • Upgrade new South NF ET volume
Advantages	• Address security of supply concerns through Vineland watermain twinning	• There is sufficient space on site for 2 additional cells at Fifth Avenue Reservoir • Reduces reliance on system transfers • Balances storage expansion with system transfers to ensure overall system storage is not deficient	• Reduces reliance on system transfers and ensures Vineland storage is self-sufficient • Balances storage expansion with system transfers to ensure overall system storage is not deficient	• Ensures that all subzones independently have sufficient storage
Disadvantages	• Relies on system transfers for a significant amount of storage in NOTL and Thorold • Overall system storage deficiency in 2051 and buildout	• Additional supply at Fifth Avenue Reservoir does not provide full redundancy in the event of a watermain failure on the single feed watermain to Vineland • Significant storage upgrades – high capital cost	• Significant storage upgrades – high capital cost	• Significant number of storage upgrades – highest capital cost • Does not optimize use of existing significant pumping capacity • Additional supply at Fifth Avenue Reservoir does not provide full redundancy in the event of a watermain failure on the single feed watermain to Vineland

B.6 Preferred Servicing Strategy

The following is a summary of the DeCew water servicing strategy:

- The DeCew Water Treatment Plant has sufficient capacity to support growth to year 2051 and beyond;
- Additional feedermain capacity is required in Niagara-on-the-Lake to support water supply to the growth areas;
- New feedermain from DeCew WTP to Townline Road East in Thorold;
- Twinning of the Fourth Avenue transmission main from St. Catharines to Vineland;
- Additional storage capacity in the following areas to support growth to 2051:
    - Fifth Avenue Reservoir
    - South Thorold ET
    - Virgil ET; and,
- Post-2051 reservoir expansion is recommended at the DeCew WTP to support post-2051 storage needs.

Figure 3.B.17 and **Figure 3.B.18** show the preferred servicing strategy, consisting of:

B.6.1 Storage

- One additional 4.25 ML cell at the Fifth Avenue Reservoir to support 2051 and post-2051 growth (W-S-007)
- New 4.5 ML ET in Niagara-on-the-Lake (W-S-008) – Twinning of the existing Virgil ET
- Replace the Thorold South ET with a new 11 ML ET (W-S-009)
- Additional 5 ML post-2051 in-ground reservoir expansion at the DeCew WTP (W-S-016)

B.6.2 Decommissioning of Existing Facilities

- The existing Thorold South ET will be decommissioned following the construction of the new larger Thorold ET (W-D-012)

B.6.3 Regional Watermains

- New 600 mm feedermain from south Niagara-on-the-Lake to Virgil ET (W-M-008)
- New 450 mm transmission main on Fourth Avenue from St. Catharines to Vineland (W-M-016)
- New 750 mm feedermain from DeCew WTP to Townline Road East in Thorold (W-M-022)

B.6.4 Studies and Programs

- The City of Thorold and the Town of Niagara-on-the-Lake, in coordination with the Region, should implement a targeted non-revenue water reduction program to address existing high non-revenue water rates; further details are provided in **Section B.8.3**.

- Region-wide WTP reservoir volume study to review CT volume and overall system storage

B.6.5 Future System Performance

Figure 3.B.13 to **Figure 3.B.16** present the future system performance, based on the preferred servicing strategy configuration and capacities.

For the majority of the system, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. Higher pressures exceeding 100 psi under average days demands are experienced in areas closer to Lake Ontario. Addressing large high-pressure areas was outside of the scope of the Region's MSPU, but they can be assessed at the local area municipality level, with potential options including do nothing, optimize the HGL for the entire zone, or the creation of new subzones. Low pressure below 40 psi are experienced in Lincoln Vineland near the Fifth Avenue Reservoir, which is expected as the watermains feed the inground reservoir which service Vineland and does not directly servicing residents or businesses. Further, low pressure below 40 psi is experienced in two small areas near the Zone 2 Standpipe in St. Catharines and on Glen Road in Vineland, which is also expected due to the high ground elevation.

The Region's target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for critical system areas. The fire flow target is not met on the transmission main on Portage Road from Niagara Falls pressure zone 250 to Niagara-on-the-Lake pressure zone 164, however, this area is outside of the urban area boundary and does not provide fire service to local residents or businesses. The fire flow target is not met on the Regional transmission main in Lincoln Vineland near the Fifth Avenue Reservoir, however this is to be expected as it is a low pressure watermain filling the reservoir.

In general, maximum water age is less than 7 days within the DeCew water system, except for minor local dead-end watermains. Based on limited information available for pressure zone 200 within St. Catharines, the water age is just over 7 days within the zone. However, details of the future operation of this standpipe along with the various PRVs which enter and exit the zone were not available at the time of this modelling exercise. As such, the results for this zone should be verified in the future as details are available for the operation of the zone.

In general, watermain velocity is less than 2 m/s, however there are many Regional watermains which experience velocities less than 0.6 m/s.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

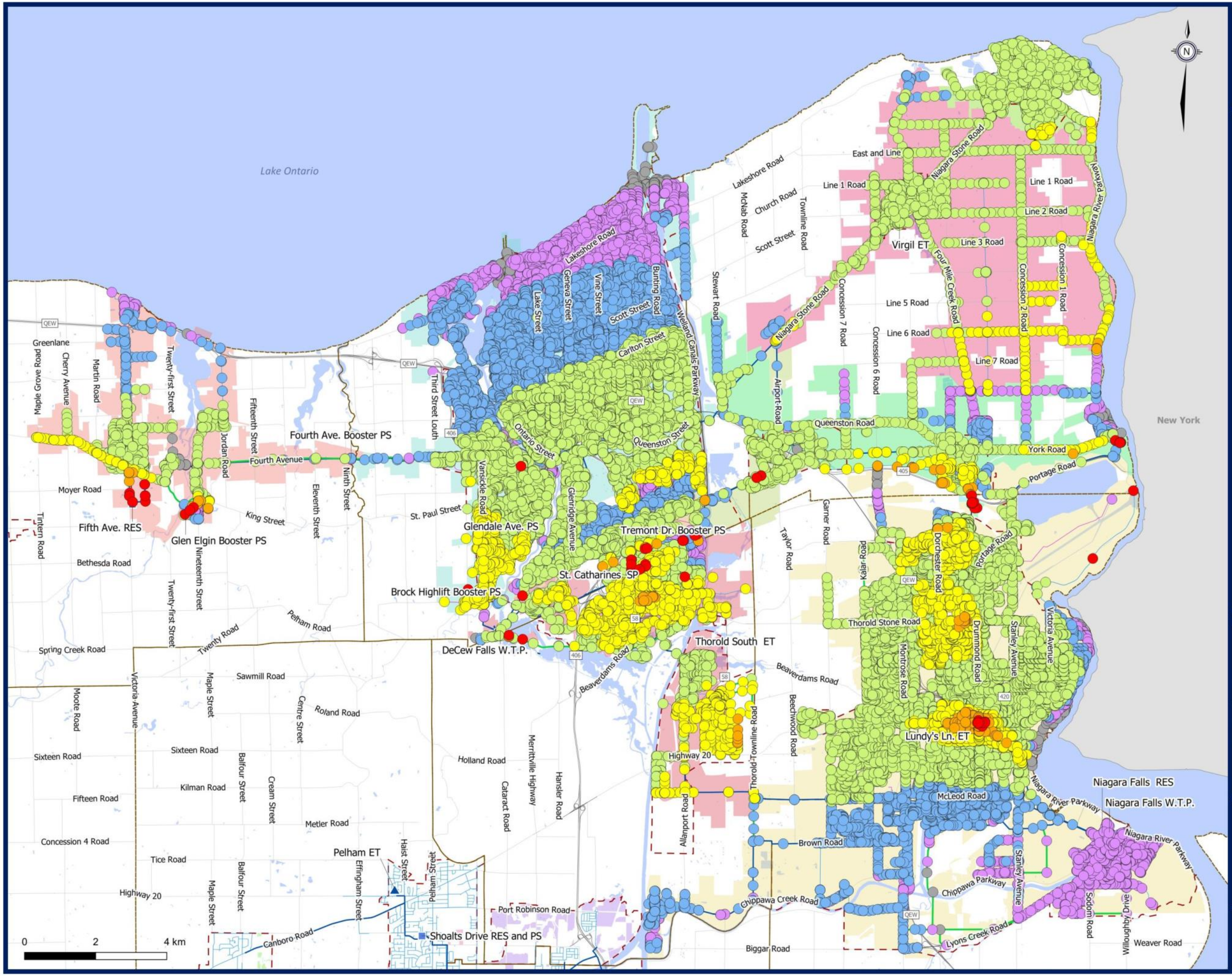
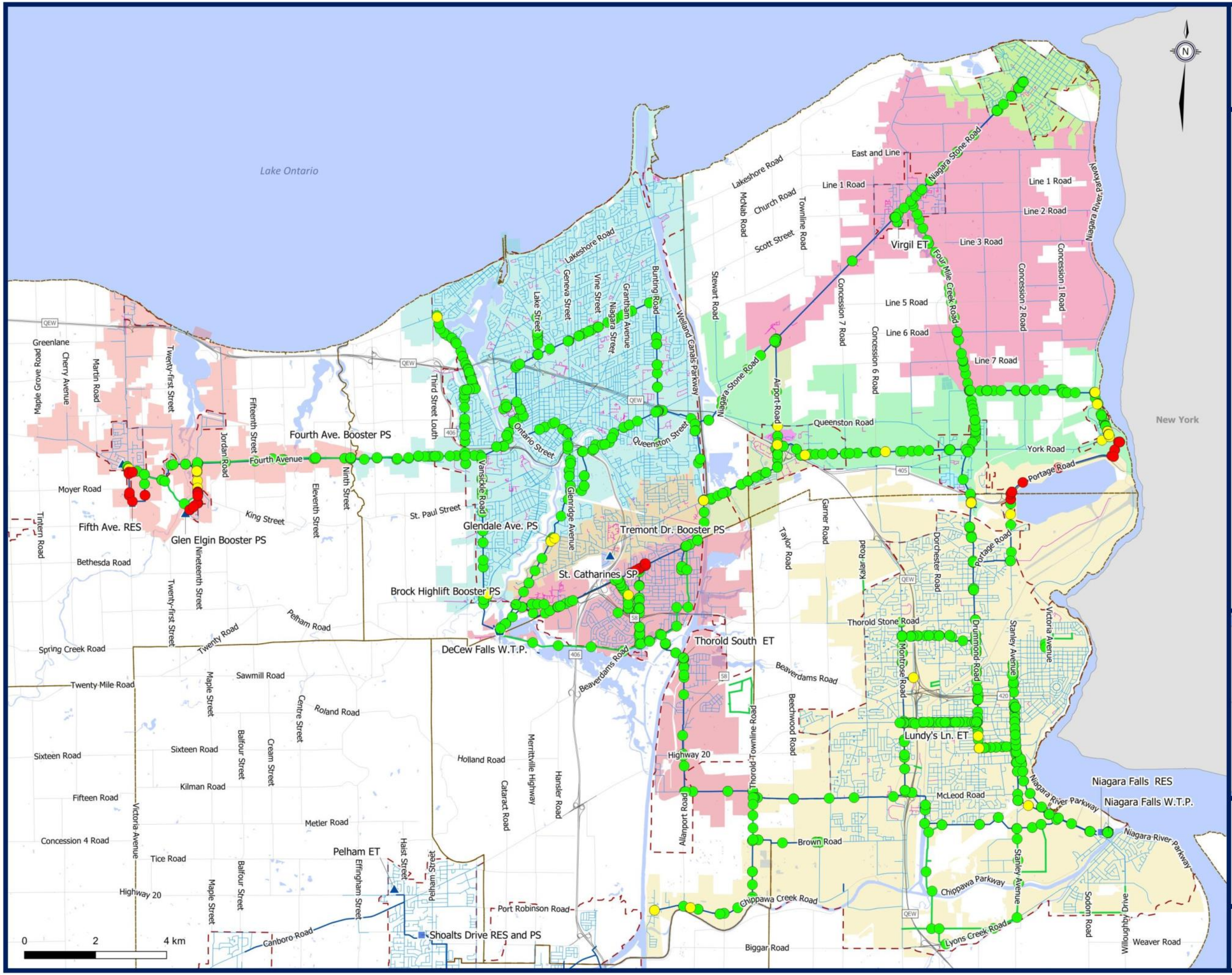


Figure 3.B.13
DeCew Falls System
2051 System Peak Hour Pressures

BluePlan ENGINEERING

December 2022
621016-W-008
WKID: 26917



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

🟩	127	🟦	164	🟫	200
🟥	144	🟩	168	🟪	220
🟥	154	🟩	180	🟥	227
🟪	161	🟦	189	🟨	250

Other Features

- ▭ Municipal Boundary
- ▭ Waterbodies
- ▭ Urban Area Boundary
- — Future Watermains

Regional Mains Available Fire Flow (L/s) - 30 psi Residual Pressure

- 🔴 < 125
- 🟢 > 250
- 🟡 125 - 250

Figure 3.B.14
DeCew Falls System
2051 System Fire Flows

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December 2022
621016-W-009
WKID: 26917

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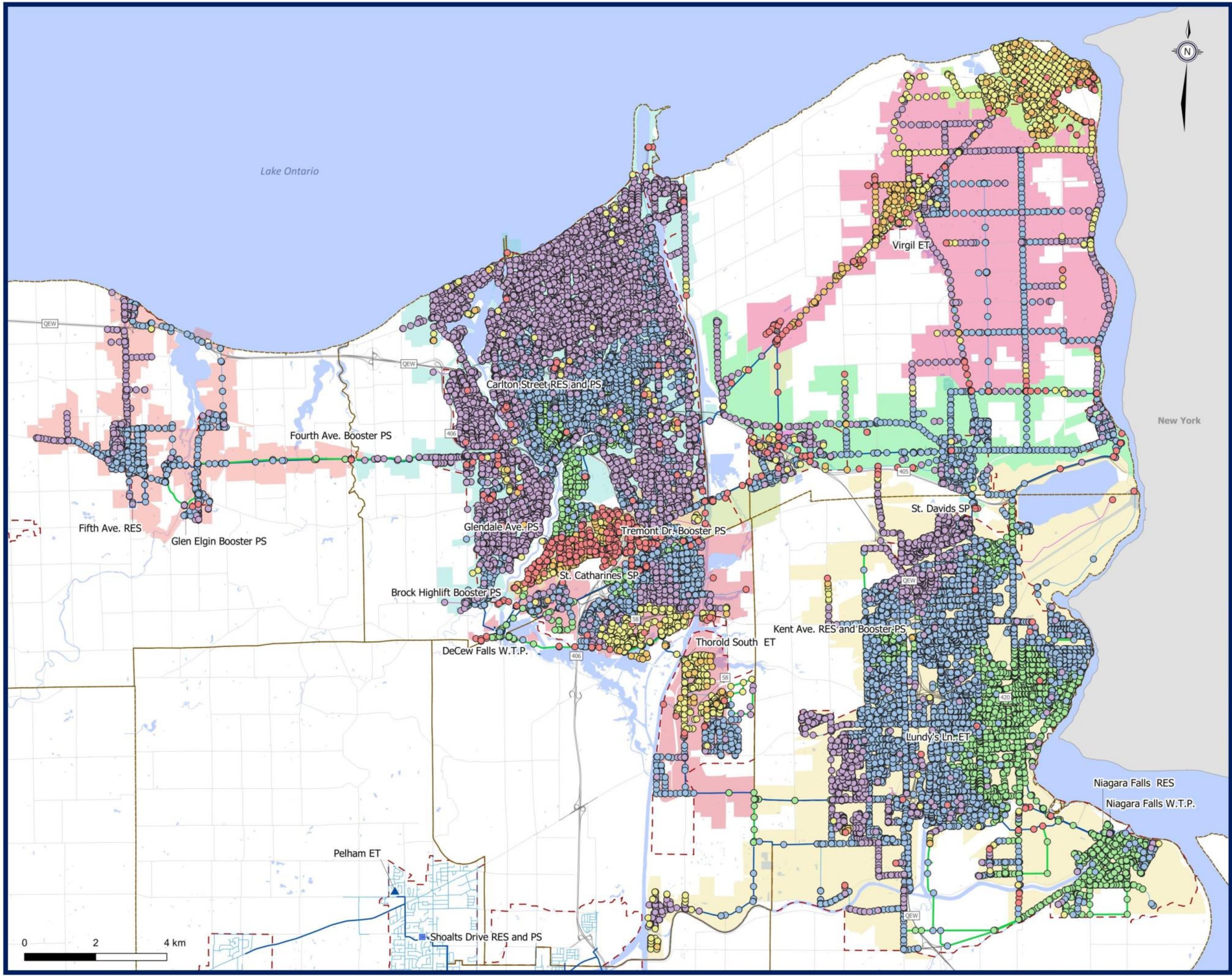

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

127	164	200
144	168	220
154	180	227
161	189	250 (NF)

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary
- Future Watermains

Water Age (days)

● < 1	● 4 - 6
● 1 - 2	● 6 - 7
● 2 - 4	● > 7

Figure 3.B.15
DeCew Falls System
2051 System Water Age

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May 2023
621016-W-011
WKID: 26917

Niagara Region

2021 Water and Wastewater Master
Servicing Plan Update

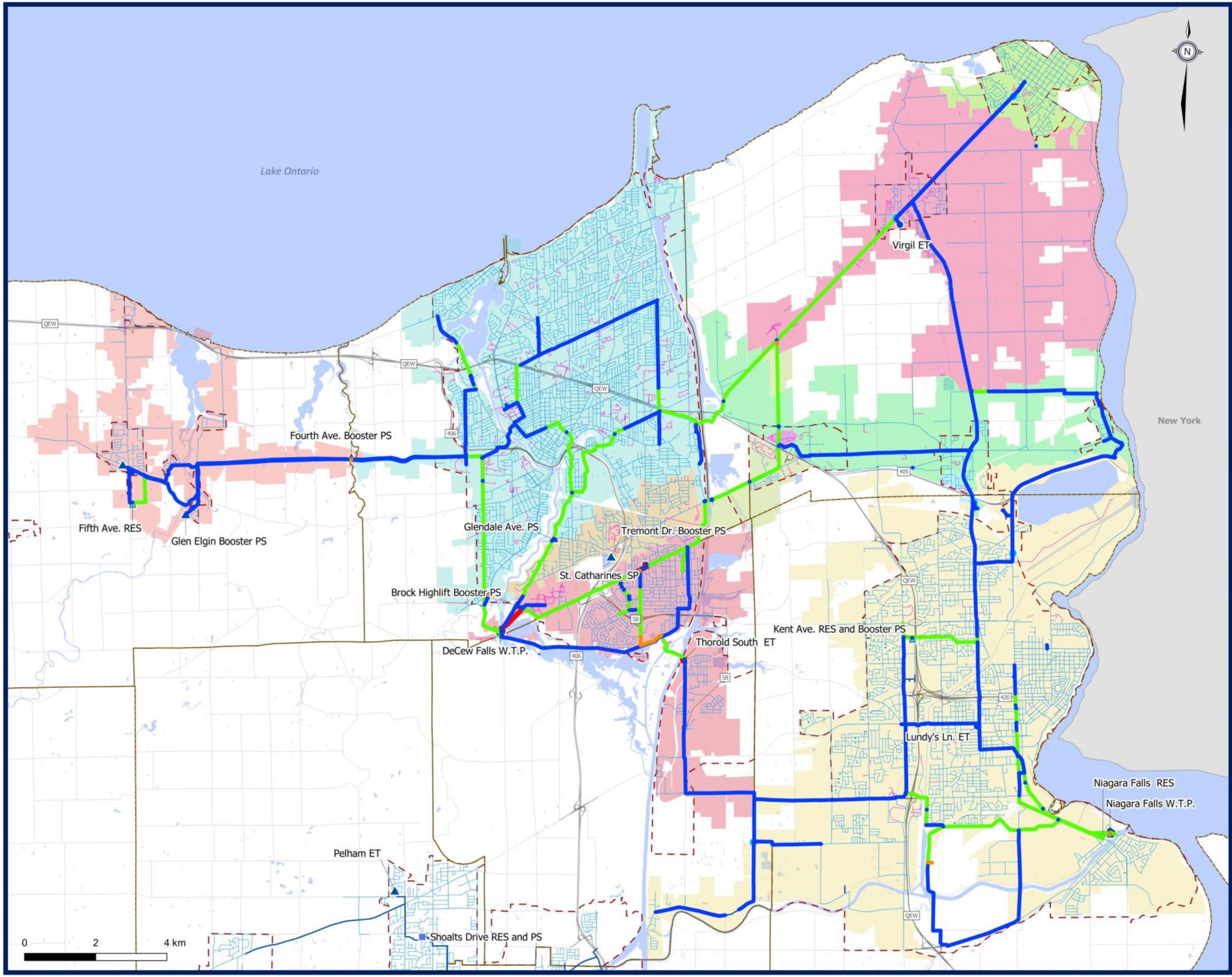

Figure 3.B.16
DeCew Falls System
2051 System Watermain Velocity

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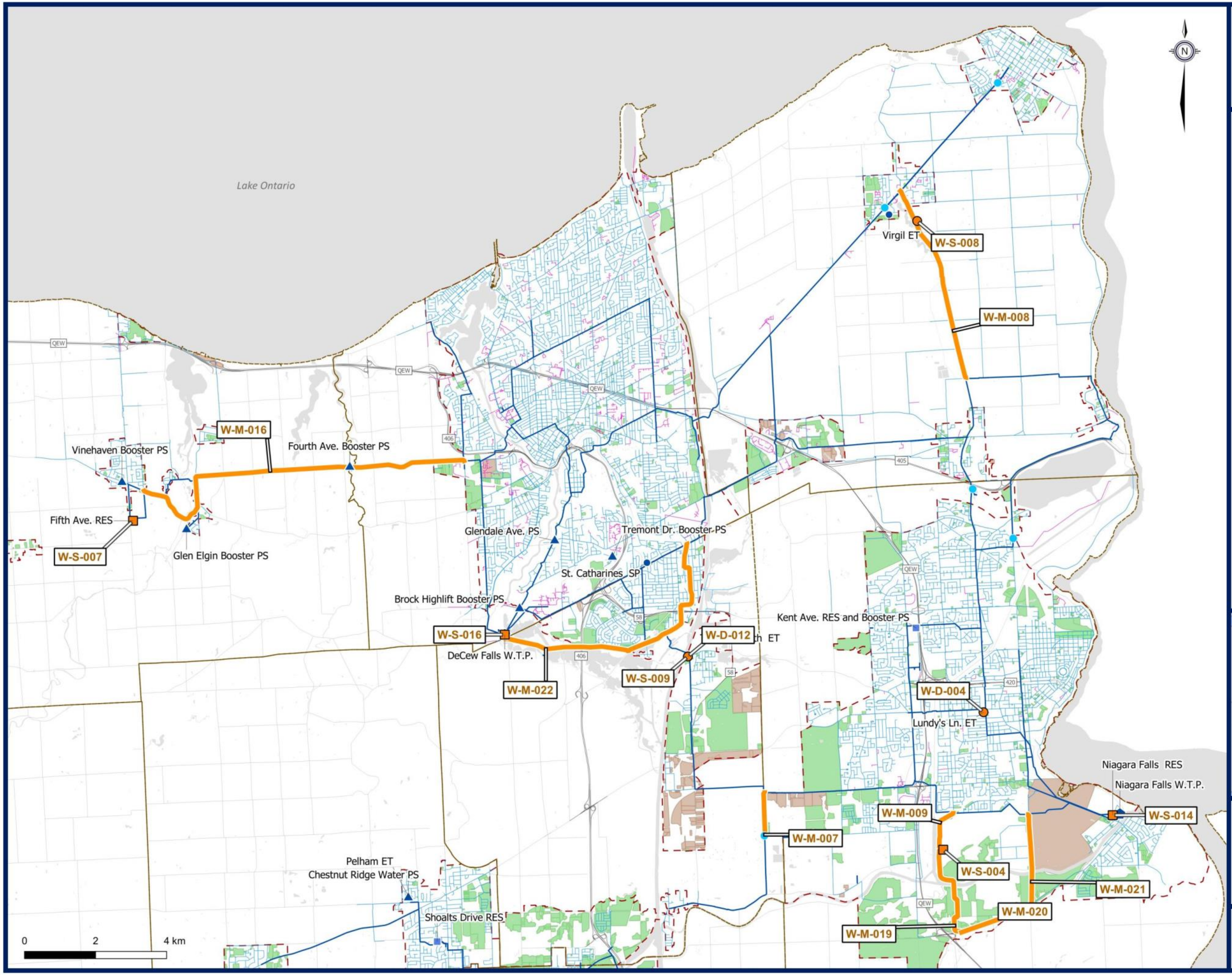
May 2023
621016-W-010
WKID: 26917

B.7 Capital Program

Figure 3.B.17 and **Figure 3.B.18** present the preferred servicing strategy map and schematic. **Table 3.B.13** summarizes the recommended project costing, timing, and Class EA requirements. Individual detailed project costing sheets are presented in **Section B.8.6**.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update



*Note that additional growth in existing built areas is anticipated

*Project alignments are preliminary and will be refined through subsequent projects (EA and/or detailed design)

Figure 3.B.17
DeCew Falls System
Preferred Water Servicing Strategy

GM BluePlan ENGINEERING

December 2022
620126-W-013
WKID: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

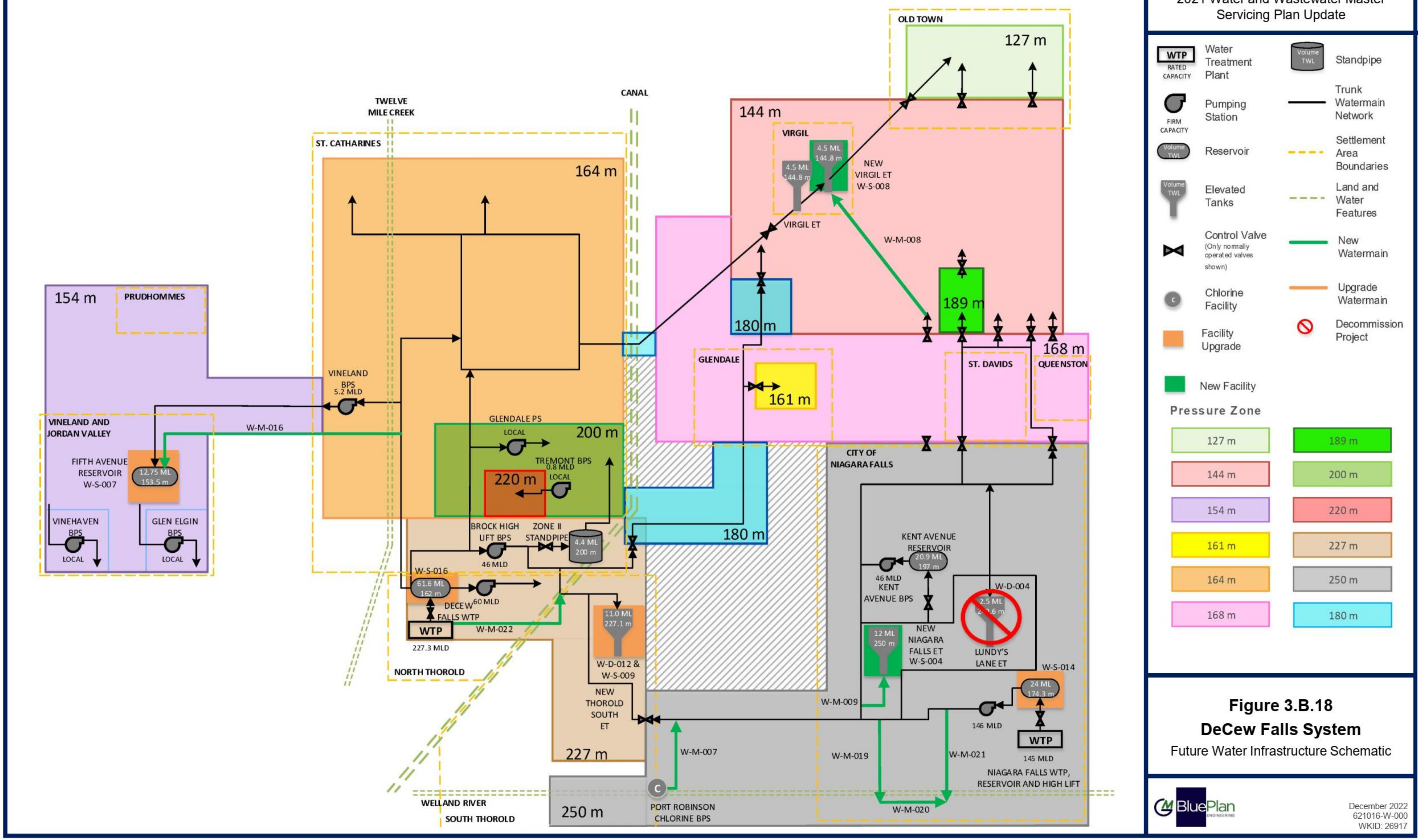


Figure 3.B.18

DeCew Falls System

Future Water Infrastructure Schematic

December 2022
621016-W-000
WKID: 26917

Table 3.B.13 Summary of DeCew Water 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 ($)
W-D-012	Decommissioning of Thorold South ET	Decommissioning of existing Thorold South ET, to be replaced by a new ET	N/A	2032-2051	Thorold	A+	N/A	Storage	$1,290,000
W-M-008	Secondary feed to Virgil ET (NOTL)	Feedermain from South NOTL to Virgil ET with PRV in NOTL to supply DeCew system from Niagara Falls system. Preliminary proposed alignment along Four Mile Creek.	600 mm	2032-2051	Niagara-on-the-Lake	A+	N/A	Watermain	$15,020,000
W-M-016	Fourth Ave Watermain Twinning	Fourth Avenue watermain twinning from St. Catharines to Vineland to address security of supply to Vineland. Preliminary alignment along Fourth Avenue, Nineteenth Street, and along King Street. Alignment subject to change through Schedule B EA.	450 mm	2042-2051	Lincoln	B	Separate EA Required	Watermain	$19,187,000
W-M-022	New feedermain from DeCew WTP to Townline Road East in Thorold	New feedermain from DeCew WTP to Townline Road East in Thorold. Provides security of supply for City of Thorold through a secondary watermain feed. Routing and need for the project to be determined through ongoing EA.	750 mm	2022-2026	Thorold	B	Ongoing (separate study)	Watermain	$62,270,000
W-S-007	Fifth Avenue Reservoir Expansion	One additional cell to support 2051 and post 2051 growth	4.25 ML	2042-2051	Lincoln	A+	N/A	Storage	$12,542,000
W-S-008	New elevated tank in NOTL	New ET in Virgil to support 2051 growth. Assuming property acquisition is required (5% for new site).	4.5 ML	2042-2051	Niagara-on-the-Lake	B	Separate EA Required	Storage	$10,734,000
W-S-009	Replace Thorold South ET	New larger Thorold South ET to replace existing ET Assuming property acquisition is required (5% for new site).	11.0 ML	2027-2031	Thorold	B	Separate EA Required	Storage	$25,605,000
W-S-016	In-ground Reservoir Expansion at DeCew WTP	In-ground Reservoir Expansion at DeCew WTP to support buildout growth and CT volume requirements.	5.0 ML	Post-2051	St. Catharines	A+	N/A	Storage	$11,352,000
W-ST-001(1)	Region Wide WTP Reservoir Volume Study	Study to review WTP reservoir CT volume and overall system storage	-	2022-2026	Region-Wide	A+	N/A	Storage	-
								Total	**$158,000,000**

(1) Project cost not included in subtotal as it is a Region-wide project

B.8 Project Implementation and Considerations

B.8.1 10-Year Program Sequencing

Th recommended year in service for the capital projects in presented in **Section B.7**. Special project implementation and considerations for the preferred servicing strategy consist of:

- The Region is undertaking a separate study (to be completed in 2023) to identify the preferred sizing and alignment for the new feedermain from DeCew WTP to Townline Road East in Thorold;
- Completion of the new Thorold South ET is needed before the Region can decommission the existing Thorold South ET;
- Replacement of the Thorold South ET was recommended prior to the other storage upgrades (i.e., new ET in Niagara-on-the-Lake) due to the elevation of the Thorold pressure zone and its ability to support multiple other zones in St. Catharines and Niagara-on-the-Lake through transfers; and,
- The secondary feedermain from south Niagara-on-the-Lake to Virgil is recommended prior to the new ET in Niagara-on-the-Lake to improve system transfers and maximize use of existing infrastructure in the short to medium term.

It is understood that the timing for the recommended projects may be subject to change due to a variety of external factors such as overall balancing of the Region’s capital budget, changes to growth projections, and other unforeseen circumstances. As such, **Table 3.B.14** presents the preferred priority of the projects within the first 10-years of the capital program.

Table 3.B.14 First 10-Years Project Sequencing

Master Plan ID	Name	In Service Period	Project Sequencing
W-M-022	New feedermain from DeCew WTP to Townline Road East in Thorold	2022-2026	1
W-S-009	Replace Thorold South ET	2027-2031	2

B.8.2 EA Requirements and Studies

The following summarizes the status of EA requirements for recommended capital projects which will require Schedule B or C EAs.

- **Currently ongoing separate EA studies:**
    - W-M-022 (New feedermain from DeCew WTP to Townline Road East in Thorold)
- **EA studies to be completed through separate studies:**
    - W-M-016 (Fourth Avenue watermain twinning – St. Catharines to Vineland)
    - W-S-008 (New elevated tank in NOTL)
    - W-S-009 (Replace Thorold South ET)

B.8.3 Region-Wide Projects and Collaboration with Local Area Municipalities

As part of the recommended capital program, it is recommended that the Region complete a WTP reservoir volume study across all WTP facilities to review CT volume and overall system storage. The intent of this study is to gain a clearer understanding of storage limitations at WTP facilities and how much usable volume can be accounted for within the system storage calculations.

Acknowledging that the overall water systems are jointly owned and operated by the Region and local area municipalities (LAM), the continued operation and expansion of the water systems to support existing users and accommodate projected growth relies upon the cooperation of the upper and lower tier municipalities. Major updates and adjustments to planning projections should be continued to be communicated as this may affect project details such as trigger timelines and design capacities, which is discussed further in **Section B.8.5**.

One initiative that will be predominately driven by the LAMs is NRW reduction. While NRW reduction programs should be completed in all municipalities, this 2021 MSPU assumes that the municipalities currently experiencing NRW rates greater than 25% will put specific focus on reducing NRW. The 2021 MSPU utilized an assumption of NRW reduction to at least 25% by 2051, however, municipality-specific targets can be reviewed by the LAMs. The non-revenue water rates for the DeCew system are generally borderline on the 25% threshold, with 23% in St. Catharines, 27% in Thorold, 26% in NOTL, and 9% in Lincoln. Non-revenue water reduction activities may include but are not limited to:

- Enhancement to the water metering program including:
  - Meter replacement program
  - Re-time monitoring of large water users;
- Leak detection program for watermains;
- Watermain replacement program;
- Improved tracking of unbilled authorized users and development of demand reduction strategies:
  - Fire department
  - Watermain flushing
  - Facility usage
- Development of bulk water user strategy and potential construction of additional bulk water station; and,
- Improved monitoring and enforcement of new construction water uses.

B.8.4 Sustainability Projects

It is important to recognize that the 2021 MSPU servicing strategies identify new infrastructure to service the additional growth out to year 2051 but these strategies are built by extending infrastructure from the existing systems and leveraging the existing Region infrastructure in place. It is essential that the existing infrastructure is maintained in good condition and performance to support servicing growth.

The Region continually establishes and implements a sustainability program that addresses priority projects to ensure the existing infrastructure is in a state-of-good-repair and continues to perform and meet the intended level of services.

Independent of the 2021 MSPU, the Region has completed a sustainability program analysis to identify the projects on a yearly basis, with focus on a 10 year program, to address the sustainability needs. This Sustainability Capital Plan is first developed to demonstrate the total investment needs and may identify a level of investment and implementation exceeding Region resources. The next steps for the Sustainability Capital Plan will be the development of the Financial Plan for existing Water and Wastewater assets which is anticipated to be completed in 2024. It should be noted that the Sustainability Capital Plan represents investment required over and above the growth-related 2021 MSPU program.

The 2021 MSPU undertook a process to review the Sustainability Program in conjunction with the growth-related program to eliminate duplicate projects and to align the timing of both growth and sustainability needs where appropriate in order to create efficiencies. This review was focused on the Sustainability Program for the next 10 years with the best information available at the time of this study.

The review process for integration of the MSPU program and the sustainability program was essential to demonstrate several key findings:

- There is opportunity to align growth and sustainability projects to bring efficiencies in costs and delivery;
- When planning and costing new infrastructure, lifecycle principles and costs must be considered. Existing and future infrastructure will have future service life replacements (i.e., pumps, electrical, roof, security upgrades at varying intervals from 5 – 40 years);
- Without maintenance of the existing infrastructure in a state of good repair and performance, there is risk that the growth-related program may not achieve desired capacities, timing, or level of service;
- There is also risk that implementing the growth-related program could have a negative impact on the level of service within the existing systems for the existing users; and,
- There are some major projects already considered under the sustainability program that are essential to the growth-related program such as the Welland WTP and WWTP.

The MSPU growth capital program focuses on the infrastructure needs to support growth and all the projects build upon the Region’s existing water systems. It is imperative that the Region’s sustainability capital program continues to be completed as needed alongside the recommended MSPU growth capital program to ensure that the existing system is operating at expected capacities and reliability such that it can support the recommended growth projects.

The sustainability projects consist of Region-wide projects and programs including but not limited to: replacement programs for boilers, water valves, generators, watermains, master meters, GAC, process piping, process electrical, and process instrumentation. DeCew system specific projects include:

- Lincoln
    - Watermain replacement along Victoria Avenue (Between King Street and Moyer Road)
- Niagara-on-the-Lake
    - St. David's Chlorination Facility upgrade
    - York Road watermain replacement
- St. Catharines
    - Glendale watermain valves
    - DeCew WTP Valve House Rehabilitation
    - DeCew WTP Low Lift Booster Station upgrade
    - DeCew WTP Plant 2 upgrades
    - DeCew WTP UV upgrade
    - DeCew WTP Plant 1 and 2 Mixing System
    - DeCew WTP Waste Optimization
    - Brock High Lift Pumping Station upgrades and valve replacements
    - Decommissioning Carlton Street Reservoir
    - DeCew WTP Plant 3 – Phase 2
    - DeCew WTP – interconnect 38 ML reservoir to the gravity shaft
    - Watermain replacement Stork Bridge

B.8.5 Project Implementation Flow Chart

The recommended design capacities within the capital program are based on the best available information at the time of analysis, including existing system demands, facility capacities, and projected growth. It is understood that this data is not static and often changes over the years between the regular updates of the Region's Master Plan. Design assumptions should be revisited before initiation of projects to reconfirm the appropriate design capacities, along with identification of any associated or dependent projects which can be combined or staged to optimize implementation efficiency and cost, and/or system operation.

To support the Region's process in implementing recommended MSPU capital projects, the following flow chart has been developed for the water system. This flow chart document is intended to be a reference resource for the Region and should be treated as a guideline to support existing internal Region processes in project implementation, as shown in **Figure 3.B.19**.

Niagara Region

WATER PROJECT IMPLEMENTATION

The intent of this document is to support the Region in confirming the scope of work for water infrastructure projects.

CONFIRM PROJECT SCOPE

To define Terms of Reference

☐ **What triggered this project?**
- Known development growth
- Forecasted growth
- Sustainability needs

☐ **Are there related or dependent projects that should be identified for streamlining opportunities or for project phasing?**
- Are there projects that need to be completed before this project?
- Are there projects within the same alignment or project area that could be combined (e.g., growth projects, wastewater, stormwater, corridor planning, sustainability projects, etc.)
- If there are related projects, could the project timing be adjusted to combine or stage projects more efficiently?

☐ **What is the project EA Schedule and status?**

☐ **Are there historic or ongoing operational issues in the project area?**
- Confirm with Regional and LAM operations and maintenance groups
- i.e. historic watermain breaks, water quality or pressure complaints, work order history, etc.

☐ **Are there any data gaps that should be incorporated into the Terms of Reference?**
- Refer to the Required Data section below for details
- How much does the project timeline and budget need to change to allow for the data collection?

☐ **Have the planning projections been updated to the best available information?**
- Consultation with Region and LAM planning groups to confirm planning projection
- Are projected needs for the project in place? Is actual growth in line with projected growth?)

☐ **Should the project be deferred until identified related works are completed?**

REQUIRED DATA

To support terms of reference and detailed design

☐ **Recently completed EA or servicing study**

(for growth triggered projects)

☐ **Historic demand records**
- Within the last 3 years
- Ideally one full year of SCADA records including facility demands, flow, and pressure records

☐ **Existing system hydrant testing or system pressure data to identify/verify existing system issues**

☐ **Asset inventory and condition assessment**
- All asset classes within the infrastructure type (watermain, storage, pumping, or treatment facility)
- Within the last 5 years
- Can be part of project scope if the data is not available and would not significantly alter project scope

☐ **Service area growth potential to confirm projected population and demands**
- Consultation with Region and LAM planning groups within the past year
- Growth information for 30-year horizon and beyond (maximum service area)
  - Population, jobs, land use, area
  - Current inventory of development areas with associated development status

IF THE REQUIRED DATA IS NOT AVAILABLE AND IF IT HAS THE POTENTIAL TO SIGNIFICANTLY ALTER SCOPE OF THE DESIGN, IT IS STRONGLY RECOMMENDED THAT THE APPROPRIATE DATA COLLECTION AND FIELD INVESTIGATION BE COMPLETED PRIOR TO PROCEEDING WITH DESIGN. ALTERNATIVELY, WHERE FEASIBLE, DATA COLLECTION SHOULD BE INCLUDED IN THE PROJECT SCOPE AND INTEGRATED INTO THE DESIGN PROCESS.

FLOW PROJECTIONS

To determine infrastructure capacity needs

EXISTING FLOWS

Average Day Demand (ADD)
- Historic SCADA to determine starting point average demand

Maximum Day Demand (MDD)
- Use peaking factors determined through MSPU to peak ADD
- There is a different peaking factor for each WTP system based on historic SCADA data

Peak Hour Demand (PHD)
- Diurnal curve based on historic data

Fire Flow (FF)
- MECP population-based

FUTURE FLOW PROJECTIONS

Existing Demand
- Scenarios depending on infrastructure type and design scenario (see next page

\+

Growth Population Demand Contributions
- Residential, 240 L/c/d
- Employment, 270 L/e/d

The design criteria presented in this document are based on the 2021 Master Servicing Plan Update Study

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STORAGE AND PUMPING FACILITY CONSIDERATIONS

☐ **What is the complete service area of the facility?**
- Some facilities support multiple pressure zones
- Some pressure zones are supported by multiple facilities

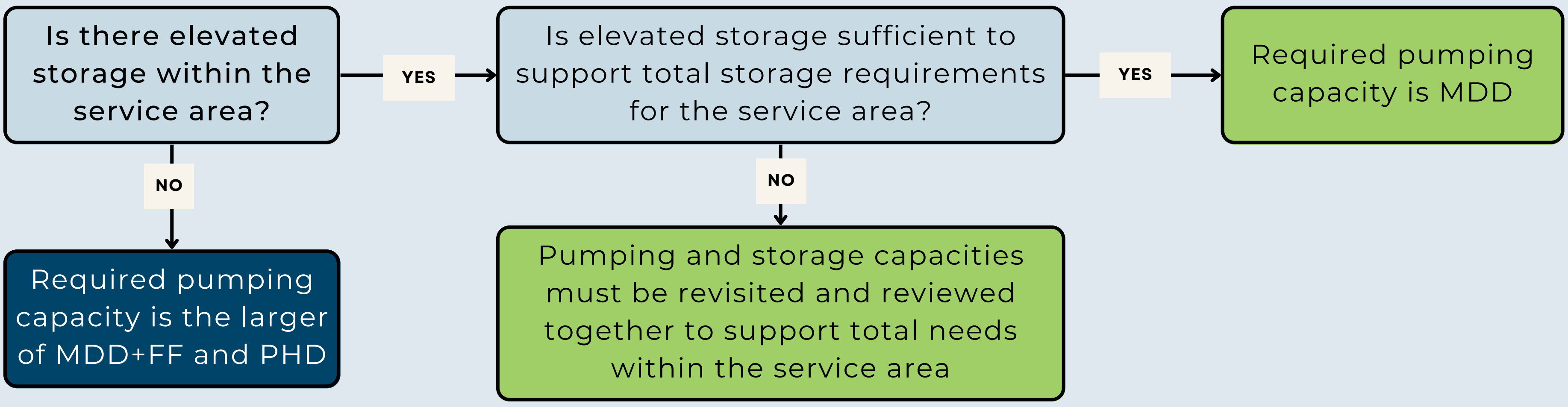
☐ **If there are storage deficits, can they be supplemented through flow transfers?**
- Is it hydraulically and operationally feasible?

☐ **Have storage and pumping facilites been reviewed in conjunction with one another?**
- Required pumping capacity varies based on available storage

☐ **What is the optimal HGL target for pumping and elevated storage facilities?**
- Region strives to maximize areas within 50 - 80 psi for Regional watermains and minimum residual pressure of 30 psi at MECP population-based fire flow target

PUMPING STATION SIZING

To define design flow scenario (MDD, MDD+FF, PHD)


Is there elevated storage within the service area?

YES

Is elevated storage sufficient to support total storage requirements for the service area?

YES

Required pumping capacity is MDD

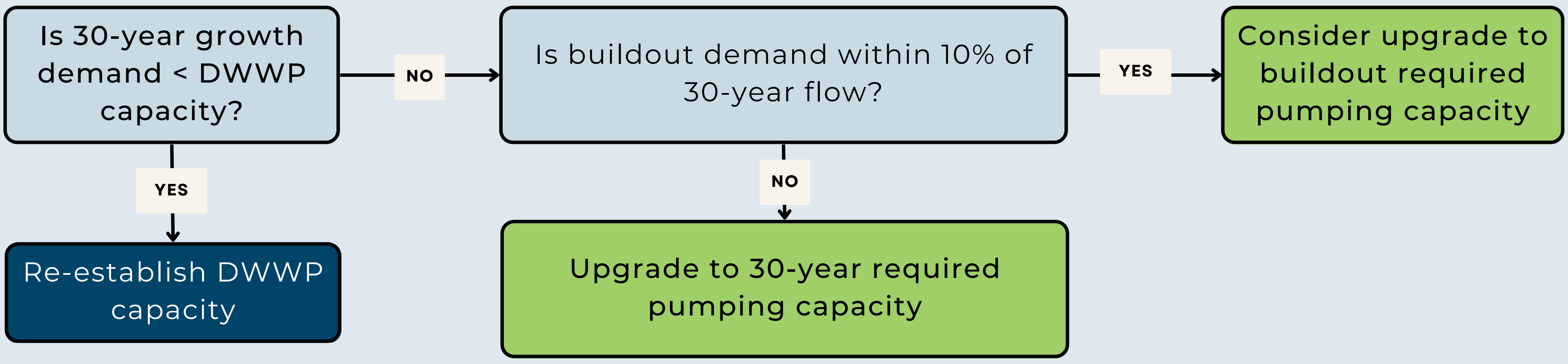
NO

Required pumping capacity is the larger of MDD+FF and PHD

NO

Pumping and storage capacities must be revisited and reviewed together to support total needs within the service area

To define design flow growth horizon (re-establish DWWP capacity, 30-year growth, buildout)


Is 30-year growth demand < DWWP capacity?

NO

Is buildout demand within 10% of 30-year flow?

YES

Consider upgrade to buildout required pumping capacity

YES

Re-establish DWWP capacity

NO

Upgrade to 30-year required pumping capacity

STORAGE SIZING

What are the system storage needs?
- System storage targets are based on MECP methodology, consistent with the 2021 Region MSPU
- Incorporate contact time storage needs at Water Treatment Plant Reservoirs
- Confirm fire flow storage strategy
- Review pumping capacity and impact on storage strategy

What timeline is considered for storage sizing?
- Is the storage sized at a minimum to support 30-year growth needs?
- What is the required storage sizing to support buildout needs?
- Is there a strategy to meet buildout needs?
- Is there opportunity for phased expansion?
- Is there a need for an alternative storage location?

TRUNK WATERMAIN SIZING

- Regional transmission mains should be sized to meet PHD and MDD+FF of maximum future service area (buildout) with a target velocity less than 1.5 m/s

B.8.6 Detailed Project Costing Sheets

The detailed project costing sheets for the recommended MSPU capital projects within the DeCew system are presented below.

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-D-012
PROJECT NAME: **Decommissioning of Thorold South ET**
PROJECT DESCRIPTION: Decommissioning of existing Thorold South ET, to be replaced by a new ET

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

Class Estimate Type:	Class 3	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	20%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Decommissioning						$800,000	
Additional Construction Costs	10%		ea.			$80,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$88,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$968,000**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 145,200	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$145,200**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$115,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$115,000**	
Non-Refundable HST	1.76%					$21,600	
Non-Refundable HST Sub-Total						**$21,600**	
Total (2022 Dollars)						**$1,290,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$1,290,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$25,800		
Design	Design fees, Region fees for design, contract admin	13%	$167,700		
Construction	Region fees, base costs and project contingency	85%	$1,096,500		
TOTAL			**$1,290,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-008**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**Secondary feed to Virgil ET (NOTL)**	**VERSION:**	
PROJECT DESCRIPTION:	Trunk main from South NOTL to Virgil ET with PRV in NOTL to supply Decew system from Niagara Falls system. Preliminary proposed alignment along Four Mile Creek.	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy	▨	= Field has drop down
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy	🟨	= Field must be manually populated
Accuracy Range:	30%		🟩	= Field auto-filled based on project details
Area Condition:	Rural	Area Condition uplifts unit cost and restoration		

PROPOSED DIAMETER:		600 mm	**CLASS EA REQUIREMENTS:**	A+
TOTAL LENGTH:		5700 m	**CONSTRUCTION ASSUMPTION:**	Watermain
	Tunnelled		0%	
	Open Cut	5700 m	100%	

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	5700 m	$1,439	$8,201,007	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	0%					$0	
Minor Creek Crossings			ea.	0	$236,000	$0	
Major Creek Crossings			ea.	0	$1,055,000	$0	
Road Crossings			ea.	1	$488,000	$488,000	Coordination at Virgil
Major Road Crossings (Highway)			ea.	0	$1,055,000	$0	
Utility Crossings			ea.	0	$488,000	$0	
Valve and Chamber			ea.	6	$55,000	$630,000	5 Major connections and 1 PRV
Updated Soils Regulation Uplift	2%					$164,020	
Additional Construction Costs	10%		ea.			$948,303	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,043,133	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$11,474,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$114,700	
Geotechnical Sub-Total Cost						**$114,700**	
Property Requirements	1.0%					$ 114,700	
Property Requirements Sub-Total						**$114,700**	
Consultant Engineering/Design	12%					$ 1,376,900	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,376,900**	
In House Labour/Engineering/Wages/CA	3%					$ 344,220	
In-house Labour/Wages Sub-Total						**$344,220**	
Project Contingency	10%					$1,342,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,342,000**	
Non-Refundable HST	1.76%					$253,800	
Non-Refundable HST Sub-Total						**$253,800**	
Total (2022 Dollars)						**$15,020,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$15,020,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$300,400		
Design	Design fees, Region fees for design, contract admin	13%	$1,952,600		
Construction	Region fees, base costs and project contingency	85%	$12,767,000		
TOTAL			**$15,020,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-016**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**Fourth Ave Watermain Twinning**	**VERSION:**	
PROJECT DESCRIPTION:	Fourth Avenue watermain twinning from St. Catharines to Vineland to address security of supply to Vineland. Preliminary alignment along Fourth Avenue, Nineteenth Street, and along King Street. Alignment subject to change through Schedule B EA.	**DATE UPDATED:**	
		UPDATED BY:	

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

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	450 mm	
TOTAL LENGTH:	9570 m	
Tunnelled		0%
Open Cut	9570 m	100%

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	9570 m	$1,071	$10,250,034	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	0%					$0	
Minor Creek Crossings			ea.	4	$206,000	$824,000	
Major Creek Crossings			ea.	0	$1,025,000	$0	
Road Crossings			ea.	0	$458,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,025,000	$0	
Utility Crossings			ea.	1	$458,000	$458,000	CN Rail crossing
Valve and Chamber			ea.	12	$40,000	$480,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$205,001	
Additional Construction Costs	10%		ea.			$1,221,703	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,343,874	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$14,783,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$147,800	
Geotechnical Sub-Total Cost						**$147,800**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	12%					$ 1,774,000	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,774,000**	
In House Labour/Engineering/Wages/CA	3.0%					$ 443,490	
In-house Labour/Wages Sub-Total						**$443,490**	
Project Contingency	10%					$1,715,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,715,000**	
Non-Refundable HST	1.76%					$324,200	
Non-Refundable HST Sub-Total						**$324,200**	
Total (2022 Dollars)						**$19,187,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$19,187,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$383,740		
Design	Design fees, Region fees for design, contract admin	13%	$2,494,310		
Construction	Region fees, base costs and project contingency	85%	$16,308,950		
TOTAL			**$19,187,000**		

PROJECT NO.: W-M-022

PROJECT NAME: New trunk main from Decew WTP to Townline Road East in Thorold

PROJECT DESCRIPTION: New trunk main from Decew WTP to Townline Road East in Thorold. Provides security of supply for City of Thorold through a secondary watermain feed. Routing and need for the project to be determined through ongoing EA.

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	750 mm	
TOTAL LENGTH:	8085 m	
Tunnelled	4043 m	50%
Open Cut	4043 m	50%

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	4043 m	$1,730	$6,993,710	
Pipe Construction - Tunneling			m	4043 m	$6,300	$25,467,750	Decew WTP to Beaverdams (conservative allowance)
Pipe Construction Uplift (Based on Area Conditions)	20%					$1,398,742	
Minor Creek Crossings			ea.	0	$296,000	$0	
Major Creek Crossings			ea.	1	$1,115,000	$1,115,000	Lake Moodie to Lake Gibson
Road Crossings			ea.	0	$548,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,115,000	$0	
Utility Crossings			ea.	0	$548,000	$0	
Valve and Chamber			ea.	4	$85,000	$340,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$649,229	
Additional Construction Costs	15%		ea.			$5,394,665	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$4,135,910	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$45,495,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$455,000	
Geotechnical Sub-Total Cost						**$455,000**	
Property Requirements	1.5%					$ 682,400	
Property Requirements Sub-Total						**$682,400**	
Consultant Engineering/Design	12%					$ 5,459,400	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$5,459,400**	
In House Labour/Engineering/Wages/CA	2.5%					$ 1,137,375	
In-house Labour/Wages Sub-Total						**$1,137,375**	
Project Contingency	15%					$7,984,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$7,984,000**	
Non-Refundable HST	1.76%					$1,057,300	
Non-Refundable HST Sub-Total						**$1,057,300**	
Total (2022 Dollars)						**$62,270,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$62,270,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$1,245,400		
Design	Design fees, Region fees for design, contract admin	13%	$8,095,100		
Construction	Region fees, base costs and project contingency	85%	$52,929,500		
TOTAL			**$62,270,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-S-007**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**Fifth Avenue Reservoir Expansion**	**VERSION:**	
PROJECT DESCRIPTION:	One additional cell to support 2051 and post-2051 growth	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Rural	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	4 ML

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	4 ML	$1,300,000	$5,525,000	
Related Works (Electrical, MCC, Generators, etc)	30%					$1,657,500	
Additional Construction Costs	15%		ea.			$1,077,375	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$825,988	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$9,086,000**	
Geotechnical / Hydrogeological / Materials	1.0%						existing site
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.5%						Existing site has room for expansion
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 1,362,900	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,362,900**	
In House Labour/Engineering/Wages/CA	3.0%					$ 272,580	
In-house Labour/Wages Sub-Total						**$272,580**	
Project Contingency	15%					$1,608,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,608,000**	
Non-Refundable HST	1.76%					$212,200	
Non-Refundable HST Sub-Total						**$212,200**	
Total (2022 Dollars)						**$12,542,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$12,542,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$250,840		
Design	Design fees, Region fees for design, contract admin	13%	$1,630,460		
Construction	Region fees, base costs and project contingency	85%	$10,660,700		
TOTAL			**$12,542,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-S-008

PROJECT NAME: New elevated tank in NOTL

PROJECT DESCRIPTION: New ET in Virgil to support 2051 growth. Assuming property acquisition is required (5% for new site).

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	4.5 ML

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	5 ML	$1,300,000	$5,850,000	
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$877,500	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$672,750	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$7,400,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$ 74,000	
Geotechnical Sub-Total Cost						**$74,000**	
Property Requirements	5.0%					$ 370,000	New site
Property Requirements Sub-Total						**$370,000**	
Consultant Engineering/Design	15%					$ 1,110,000	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,110,000**	
In House Labour/Engineering/Wages/CA	3.0%					$ 222,000	
In-house Labour/Wages Sub-Total						**$222,000**	
Project Contingency	15%					$1,376,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,376,000**	
Non-Refundable HST	1.76%					$181,800	
Non-Refundable HST Sub-Total						**$181,800**	
Total (2022 Dollars)						**$10,734,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$10,734,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$214,680		
Design	Design fees, Region fees for design, contract admin	13%	$1,395,420		
Construction	Region fees, base costs and project contingency	85%	$9,123,900		
TOTAL			**$10,734,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-S-009

PROJECT NAME: Replace Thorold South ET

PROJECT DESCRIPTION: New larger Thorold South ET to replace existing ET Assuming property acquisition is required (5% for new site).

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	11 ML

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	11 ML	$1,300,000	$14,300,000	
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$2,145,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,644,500	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$18,090,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$180,900	New site
Geotechnical Sub-Total Cost						**$180,900**	
Property Requirements	5.0%					$ 904,500	New site
Property Requirements Sub-Total						**$904,500**	
Consultant Engineering/Design	12%					$ 2,170,800	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$2,170,800**	
In House Labour/Engineering/Wages/CA	3.0%					$ 542,700	
In-house Labour/Wages Sub-Total						**$542,700**	
Project Contingency	15%					$3,283,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$3,283,000**	
Non-Refundable HST	1.76%					$433,500	
Non-Refundable HST Sub-Total						**$433,500**	
Total (2022 Dollars)						**$25,605,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$25,605,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$512,100		
Design	Design fees, Region fees for design, contract admin	13%	$3,328,650		
Construction	Region fees, base costs and project contingency	85%	$21,764,250		
TOTAL			**$25,605,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-S-016**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**In-ground Reservoir Expansion at Decew WTP**	**VERSION:**	
PROJECT DESCRIPTION:	In-ground Reservoir Expansion at Decew WTP to support post-2051 growth and CT volume requirements.	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy	▨	= Field has drop down
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy	🟨	= Field must be manually populated
Accuracy Range:	40%		🟩	= Field auto-filled based on project details
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration		

PROPOSED CAPACITY	5.0 ML

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	5.0 ML	$1,300,000	$6,500,000	
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$975,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$747,500	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$8,223,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$ 82,200	
Geotechnical Sub-Total Cost						**$82,200**	
Property Requirements						$ -	Existing site can accommodate
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 1,233,500	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,233,500**	
In House Labour/Engineering/Wages/CA	2.0%					$ 164,460	
In-house Labour/Wages Sub-Total						**$164,460**	
Project Contingency	15%					$1,455,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,455,000**	
Non-Refundable HST	1.76%					$193,500	
Non-Refundable HST Sub-Total						**$193,500**	
Total (2022 Dollars)						**$11,352,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$11,352,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$227,040		
Design	Design fees, Region fees for design, contract admin	13%	$1,475,760		
Construction	Region fees, base costs and project contingency	85%	$9,649,200		
TOTAL			**$11,352,000**		

PROJECT NO.: W-ST-001
PROJECT NAME: Region Wide WTP Reservoir Volume Study
PROJECT DESCRIPTION: Study to review WTP reservoir CT volume and overall system storage

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

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

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Grimsby WTP Reservoir							
Decew WTP Reservoir							
Niagara Falls WTP Reservoir							
Welland WTP Reservoir							
Port Colborne WTP Reservoir							
Rosehill (Fort Erie) WTP Reservoir							
Additional Construction Costs	10%		ea.			$0	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$0	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$0**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ -	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$0**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$4,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$4,000**	
Non-Refundable HST	1.76%					$100	
Non-Refundable HST Sub-Total						**$100**	
Total (2022 Dollars)						**$44,000**	Rounded to nearest $1,000
Other Estimate						**$100,000**	
Chosen Estimate						**$100,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$2,000		
Design	Design fees, Region fees for design, contract admin	13%	$13,000		
Construction	Region fees, base costs and project contingency	85%	$85,000		
TOTAL			**$100,000**		

C

Regional Municipality of Niagara

Part C

NIAGARA FALLS WATER SYSTEM

TABLE OF CONTENTS

List of Figures

List of Tables

C. Niagara Falls Water Treatment Plant

C.1 Existing System Overview

The Niagara Falls water system services the City of Niagara Falls and is interconnected with the DeCew water system to provide additional supply and storage capacity to the City of Thorold and Town of Niagara-on-the-Lake (NOTL). The system services an existing population of 95,283 and 38,252 employees within the Niagara Falls urban area boundary. Note that this population and employment total is based on the Region's 2021 allocation of Traffic Area Zones planning data and has been processed through the allocation methodology presented in **Volume 2** to refine the data to include only serviced populations. As such, the population and employment total may not directly match the system totals using the Region's unprocessed planning data.

The system is supplied by the Niagara Falls Water Treatment Plant, located on 3599 Macklem Street, Niagara Falls. The plant is a conventional surface water treatment plant with zebra mussel control, traveling screens, coagulation, flocculation, sedimentation, filtration, and disinfection. The Welland River serves as a source to the plant via Chippawa Creek. The plant has a rated capacity of 145.5 MLD (1,684L/s).

The system supplies local area municipalities via a watermain network, pumping stations, and storage reservoirs. The supply area has a single pressure zone (pressure zone 250 m).

Figure 3.C.1 and **Figure 3.C.2** present an overview of the water system and a water system schematic diagram, respectively.

Through this update of the Master Servicing Plan, the Region has highlighted the need to integrate the MSPU growth-related program with the Region's sustainability program intended to address the condition and performance of the existing infrastructure. The MSPU servicing strategies are based on the need to maintain appropriate levels of service throughout the systems and acknowledges that investment will be needed to support operations, maintenance, staff, and other resources related to maintaining the existing systems and facilities in a state of good repair and performance.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

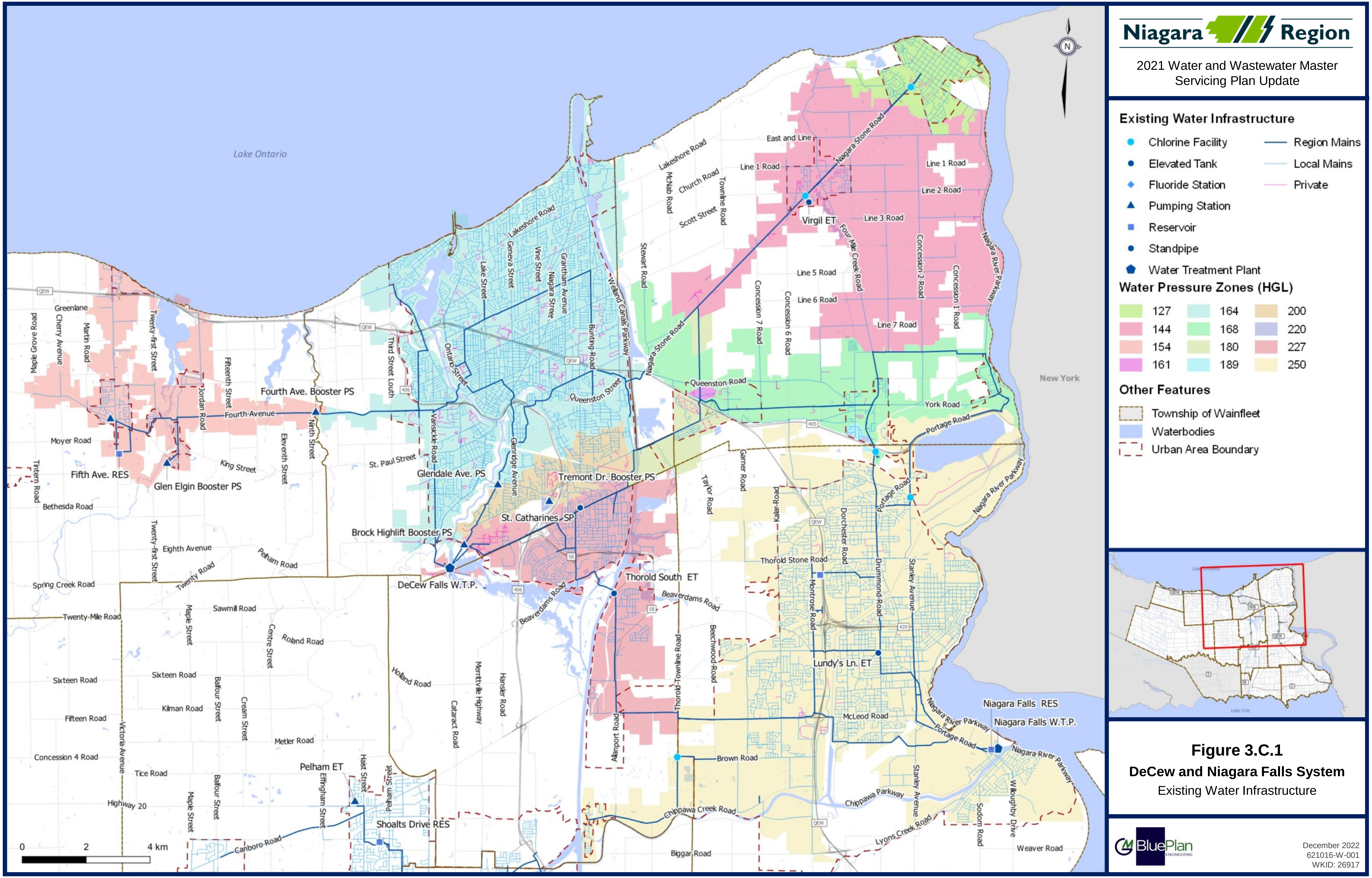


Figure 3.C.1

DeCew and Niagara Falls System

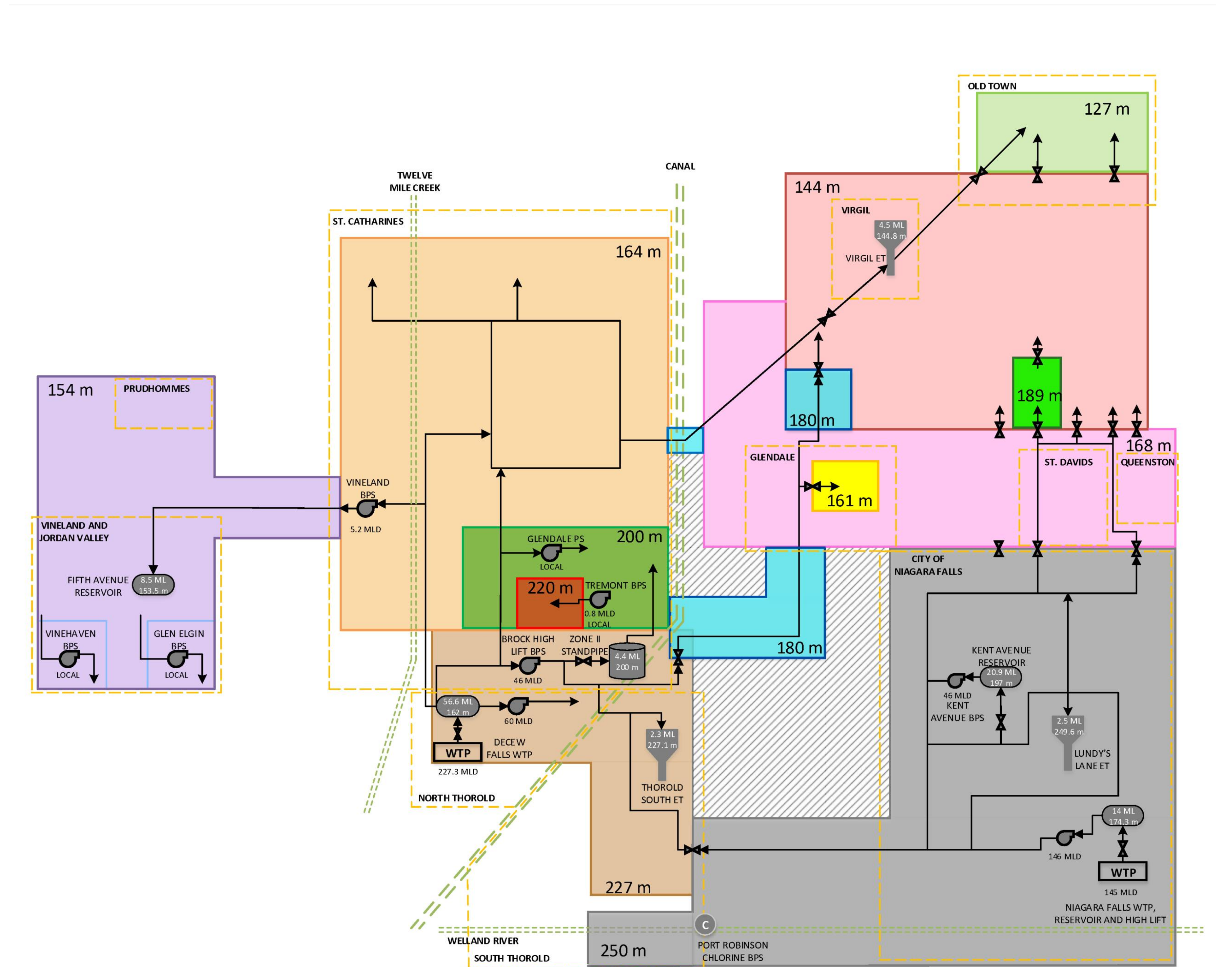
Existing Water Infrastructure

BluePlan ENGINEERING

December 2022
621016-W-001
WKID: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update



WTP RATED CAPACITY — Water Treatment Plant

FIRM CAPACITY — Pumping Station

Volume TWL — Reservoir

Volume TWL — Elevated Tanks

⋈ Control Valve (Only normally operated valves shown)

c — Chlorine Facility

Volume TWL — Standpipe

— Trunk Watermain Network

- - - Settlement Area Boundaries

- - - Land and Water Features

Pressure Zone

127 m	189 m
144 m	200 m
154 m	220 m
161 m	227 m
164 m	250 m
168 m	180 m

Figure 3.C.2

DeCew and Niagara Falls System

Existing Water Infrastructure Schematic

GM BluePlan ENGINEERING

December 2022
621016-W-000
WKID: 26917

C.1.1 Facility Overview

Table 3.C.1 to **Table 3.C.4** present details regarding the existing water treatment plant (WTP), pump stations, and storage facilities.

Table 3.C.1 Water Treatment Plant Overview

Plant Name	Niagara Falls Water Treatment Plant
Drinking Water Works Permit	Permit Number: 007-202 Issue Number: 9 Issued August 2, 2019
Address	3599 Macklem Street, Niagara Falls, ON, L2G 6C7
Source Water	Welland River via Chippawa Creek
Rated Maximum Day Demand Capacity	145.5 MLD
Key Processes	• Zebra mussel control • Travelling screens • Coagulation • Flocculation • Sedimentation • Filtration • Disinfection

Table 3.C.2 Water Treatment Plant Water Quality Objectives

Parameters for Niagara Region Contact Time Calculation	
pH	8
Temperature (degrees C)	0.5
Required CT	49
Required Giardia Inactivation via Disinfection	0.5-log
Required Virus Inactivation via Disinfection	2-log
Minimum Free Chlorine	0.8 mg/L

* Refer to the Safe Drinking Water Act, Ontario Drinking Water Quality Standards for a comprehensive listing of water quality standards.

Table 3.C.3 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone and Facility)	Discharge (Pressure Zone)	Pressure Zones Supplied	Number of Pumps (Total/ Firm)	Installed Capacity (MLD)	Firm Capacity (MLD)	Total Dynamic Head (m)
Niagara Falls WTP High Lift	3599 Macklem Street, Niagara Falls	WTP	250	168, 189 (NOTL), 227 (Thorold), 250	5/4	200.5	146.0	83.2
Kent Avenue BPS	4281 Kent Avenue, Niagara Falls	250 (via Kent Avenue Reservoir)	250	168, 189 (NOTL), 227 (Thorold), 250	3/2	91.0	46.0	57.9

Table 3.C.4 Storage Facilities Overview

Storage Facility	Location	Storage Type	Volume (ML)	Top Water Level (m)	Fire Supply Zones	Maximum Day Demand Supply Zones
Niagara Falls Water Treatment Plant Reservoir(1)	3599 Macklem Street, Niagara Falls	Pumped Reservoir	14	174.3	250 Pumped	All
Kent Avenue Reservoir	4281 Kent Avenue, Niagara Falls	Pumped Reservoir	20.9	196.9	250 Pumped	168 Pumped 227 Pumped 250 Pumped
Lundy's Lane Elevated Tank	6280 Lundy's Lane, Niagara Falls	Elevated Tank	2.5	249.6	250 Floating	168 Pumped 227 Pumped 250 Pumped

(1)Total WTP storage volume is 14 ML, however, due to contact time requirements from the MECP, the actual usable volume at the Niagara Falls WTP is calculated to be 5.7 ML under 2051 MDD and 4.9 ML under post-2051 MDD, as contact time cannot be used as system storage based on the MECP's CT requirement. Refer to **Section C.2.2** and **Volume 3 - Introduction** for additional information

C.2 Basis for Analysis

C.2.1 Flow Criteria, Performance, and Sizing Methodology

The Niagara Region Traffic Area Zone planning data was used to estimate growth related demands within the water system and to spatially allocate growth demands within each individual system. **Table 3.C.5** presents a summary of the flow criteria, performance, and sizing methodology that was utilized. Refer to **Volume 3 – Introduction** for additional information.

The Region's per capita water demand criteria was updated based on a historic review of the previous 3-year period local billing meter records. Given that more granular data was available to complete this analysis compared to previous master plan updates, the population and employment per capita rates were differentiated, and both were reduced compared to the Region's previous per capita rate to more closely reflect existing usage trends. Further detail regarding the per capita water demands is presented in **Volume 3 – Introduction.**

In some systems, the NRW was found to be extremely high (i.e. greater than 25%). The expected NRW due to unbilled account for water is 10 to 20%. It was recommended that the local municipalities and the Region work to decrease NRW as much as possible in the long-term. Through this 2021 MSPU, a new policy has been proposed for municipalities where existing NRW is greater than 25% to attempt to decrease the future NRW to a maximum of 25%, using local area municipality programs and initiatives. Existing non-revenue water rates within Niagara Falls is 18%. As such, adjustment to the starting point NRW for future growth projections was not required for the Niagara Falls system. Further detail regarding the non-revenue water analysis is presented in **Volume 3 – Introduction.**

Table 3.C.5 Flow Criteria, Performance and Sizing Methodology

Description			Criteria
Flow Criteria	Water Demand	Residential	240 L/c/d
		Employment	270 L/e/d
	Peaking Factor	Maximum Day	Based on historic average of maximum day peaking factors from 2016 – 2020
		Peak Hour Factor	Based on system mass balance using hourly SCADA data from 2018 – 2020
	Existing System Demands		Starting Point Methodology • Based on local billing meter records and production records to establish existing system demands • Growth demands are added to the existing system baseline using design criteria
System Performance Criteria	System Pressures		Acceptable pressure range of 40 – 100 psi • Regional objective of maximizing areas within the preferred range of 50 – 80 psi on Regional watermains
	Fire Flow		250 L/s on Regional watermains at residual pressure of 30 psi
	Velocity	Average Day	Flag areas less than 0.6 m/s minimum velocity
		MDD+FF or PHD	Flag areas greater than 1.5 m/s Trigger upgrades greater than 2 m/s
Sizing and Triggers	Plant and Facility Upgrade Triggers		• 80% trigger for plant and facility planning process (time based trigger on a case-by-base basis) • Complete plant and facility expansions before 90% capacity is reached
	Treatment Plant Sizing		Maximum day demand
	Pumping Station Sizing		Various potential demand scenarios: • Maximum day demand (MDD) • MDD + fire flow (250 L/s or MECP) • Peak Hour Demand (PHD) Appropriate design sizing scenario depends on the configuration of the service area for the pumping station. Refer to **Volume 3 - Introduction** for further discussion.
	Watermain Sizing		Regional transmission main system for PHD and MDD + fire flow demands
	Storage Sizing		MECP methodology (A + B + C) • Refer to **Section C.2.2** for discussion regarding contact time (CT) volume requirement at WTP reservoirs

C.2.2 Water Treatment Plant Reservoir Contact Time Volume Requirement

Due to the contact time requirements from the MECP, the actual usable volume at the Niagara Falls WTP reservoir is calculated to be less than the full volume of 14 ML, as contact time volume cannot be used as system storage based on the MECP's CT requirement. System storage capacity is presented and discussed in **Section C.3.4**.

A conservative assumption has been made for the usable volume at all water treatment plant reservoirs. The methodology for determining required CT is outlined in the MECP's Procedure for Disinfection of Drinking Water in Ontario. Detailed methodology and sample calculations for determining the required CT volume is presented in **Volume 3 – Introduction.**

Further, it should be noted that the Region applies a safety factor of 1.2 to all CT volume calculations as an additional buffer. However, it was determined that this safety factor would be removed for the purposes of storage sizing for the Region's 2021 MSPU, as all other parameters utilized within the CT calculation provide an inherent level of conservatism (i.e. temperature of 0.5 deg C and pH of 8).

C.2.3 Population Projections and Allocations

Table 3.C.6 outlines the existing and projected serviced population and employment by pressure zone.

Table 3.C.6 Niagara Falls Water Treatment Plant Existing and Projected Serviced Population and Employment by Pressure Zone

Pressure Zone	2021 Population & Employment			2051 Population & Employment			Post 2051 Population & Employment			2021-2051 Growth		
	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Total
250	95,283	38,252	133,536	140,334	59,348	199,682	163,244	63,363	226,608	45,051	21,095	66,146
DeCew 168	4,207	2,652	6,858	7,078	4,644	11,721	8,301	7,687	15,988	2,871	1,992	4,863
DeCew 189	656	143	798	986	147	1,133	986	187	1,174	331	4	335
DeCew 227	22,051	10,224	32,275	32,327	14,705	47,032	42,244	21,221	63,465	10,276	4,481	14,757
Total	**122,196**	**51,270**	**173,467**	**180,725**	**78,843**	**259,568**	**214,776**	**92,458**	**307,234**	**58,529**	**27,573**	**86,101**

Note: Population numbers may not sum due to rounding.

C.3 Existing System Performance

C.3.1 Starting Point Demands and Performance

The starting point demand and maximum day peaking factor for the Niagara Falls WTP was calculated using historic SCADA production data. Ten years of data (2011 to 2020) was reviewed to provide historical context and assess overall long-term trends, however, the most recent five years of data was used to determine the maximum day demand peaking factor. **Table 3.C.7** presents the historic water demand and water system maximum day peaking analysis. Based on the historic analysis the Niagara Falls WTP system has an existing average demand of 44.2 MLD and system peaking factor of 1.60.

Table 3.C.7 Historic Water Demand

Year	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Maximum Day Demand Peaking Factor
2011	52.2	83.2	1.59
2012	53.1	85.5	1.61
2013	46.7	70.4	1.51
2014	43.8	64.2	1.47
2015	46.2	70.2	1.52
5-Year Average	*48.4*	*74.7*	*1.5*
5-Year Peak	*53.1*	*85.5*	*1.6*
2016	47.4	77.5	1.64
2017	45.2	63.6	1.41
2018	44.8	74.5	1.66
2019	43.4	71.8	1.65
2020	40.1	65.6	1.63
5-Year Average	**44.2**	**70.6**	**1.60**
5-Year Peak	*47.4*	*77.5*	*1.66*
10-Year Average	*46.3*	*72.7*	*1.57*
10-Year Peak	*53.1*	*85.5*	*1.66*
MOECC Peaking Factor (Existing)	**1.65**		
MOECC Peaking Factor (2051)	**1.50**		

Table 3.C.8 Existing and Future Water System Demands by Pressure Zone

Pressure Zone	2021 Demand		2021 to 2051 Growth Demand		2051 Demand (Existing + Growth)		2051 Demand With NRW Reduction (Existing + Growth)(1)		Post 2051 Demand (Existing + Growth)		Post 2051 Demand With NRW Reduction (Existing + Growth)(1)	
	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)
250	43.0	64.5	16.5	26.4	59.5	90.9	59.5	90.9	66.1	101.4	66.1	101.4
DeCew 168	1.9	2.8	1.2	1.9	3.2	4.8	3.2	4.8	4.3	6.5	4.3	6.5
DeCew 189	0.2	0.3	0.1	0.1	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4
DeCew 227	7.8	11.4	3.7	5.8	11.5	17.2	11.5	17.2	15.7	23.8	15.7	23.8
Total	**53.0**	**79.0**	**21.5**	**34.3**	**74.5**	**113.3**	**74.4**	**113.3**	**86.3**	**132.1**	**86.3**	**132.1**

(1)Non-revenue water (NRW) adjustments were made within systems where existing NRW was higher than 25%. Assumption was made that the starting point NRW would be reduced to less than 25% for those systems when analysing 2051 and post-2051 scenarios. No adjustment was required for the Niagara Falls system.

C.3.2 Treatment Plant Capacity

Figure 3.C.3 shows the projected future demands at the Niagara Falls Water Treatment Plant, with and without projected transfers to the DeCew system. The plant has surplus capacity to support growth and will not reach 80% capacity within the 2051 time horizon.

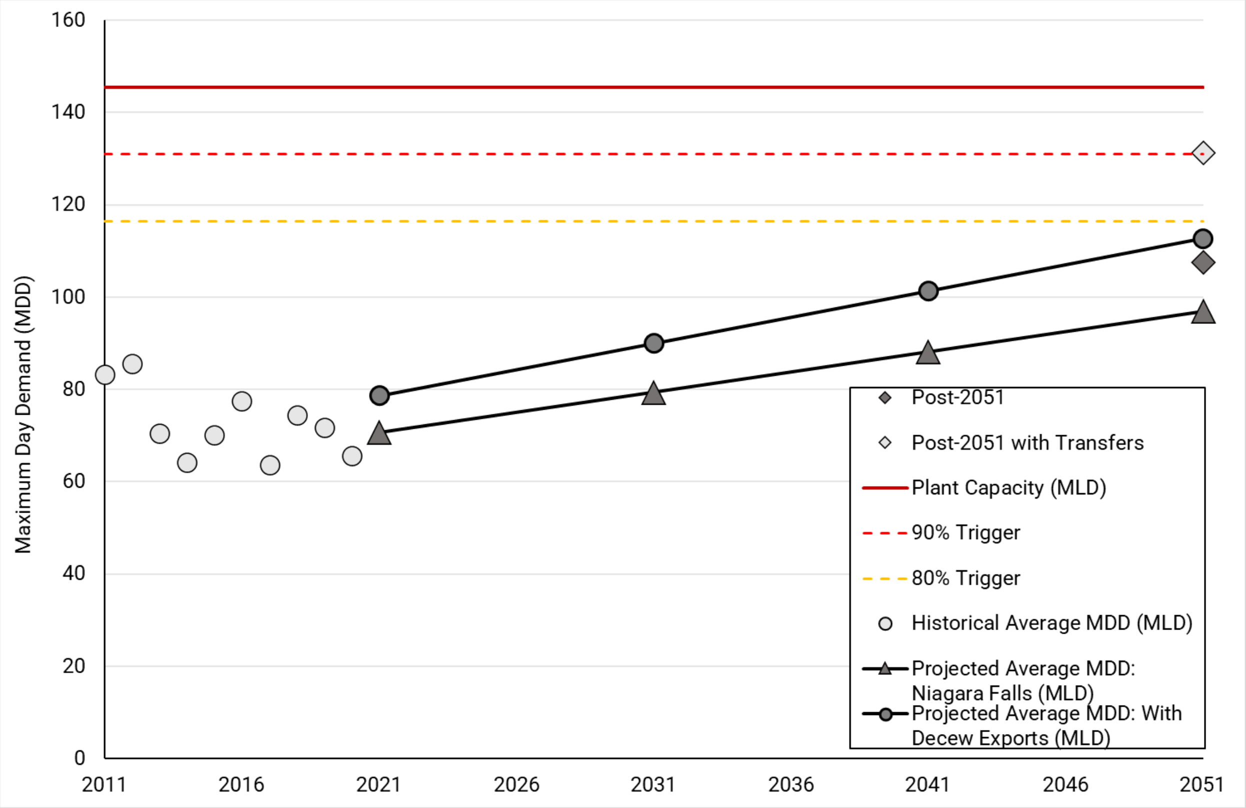


Figure 3.C.3 Projected Maximum Day Demand at Niagara Falls Water Treatment Plant

C.3.3 Pumping Capacity

Table 3.C.9 highlights the pumping station existing and projected capacity. As presented in **Section C.2.1**, there are various potential demand scenarios for pumping station capacity sizing depending on system configuration and available storage type and volume. As such, the design condition has been specified in the table below (i.e. maximum day demand, peak hour demand, or maximum day demand + fire flow), along with the 2021, 2051, and post-2051 design flows which correspond to the design condition for each respective pump station.

There is sufficient pumping capacity at the Niagara Falls WTP to support existing and projected growth demands to 2051 and beyond. Under the most conservative scenario, which includes flow transfers to the DeCew system to support Thorold (zone 227) and NOTL (zones 168 and 189), the existing pumping capacity is sufficient to support growth to 2051, with a small deficiency under the post-2051 scenario.

Table 3.C.9 System Pumping Station Performance

Pump Station	Firm Capacity (MLD)	Pressure Zones Supplied	Design Condition	2021 Maximum Day Demand (MLD)	2021 Design Flow (MLD)	2021 Surplus/ Deficit (MLD)	2051 Maximum Day Demand (MLD)	2051 Design Flow (MLD)	2051 Surplus/ Deficit (MLD)	Post 2051 Maximum Day Demand (MLD)	Post 2051 Design Flow (MLD)	Post 2051 Surplus/ Deficit (MLD)
Niagara Falls WTP/ High Lift PS	146.0	250	MDD (without transfers)	64.5	64.5	81.5	90.9	90.9	55.1	101.4	101.4	44.6
Kent Avenue BPS[1]	46.0											
Niagara Falls WTP/ High Lift PS	146.0	168, 189, 227, 250	MDD (with transfers to DeCew)[2]	79.0	79.0	67.0	113.3	113.3	32.7	148.2	148.2	-2.2
Kent Avenue BPS[1]	46.0											

[1] Firm Capacity plus fire pump due to design condition

[2] Conservative scenario as this includes all of pressure zones 227 (Thorold), 168 (NOTL), 189 (NOTL)

C.3.4 Storage Capacity

Using the MECP methodology for CT volume calculations and the corresponding MDD for each planning horizon, the required CT volume at the Niagara Falls WTP reservoir is 7.7 ML under 2051 MDD, and 8.6 ML under post-2051 MDD. As such, the remaining usable volume for system storage utilization at the Niagara Falls WTP reservoir is 6.3 ML under 2051 MDD, and 5.4 ML under post-2051 MDD. As a conservative assumption the 2051 MDD volume was utilized for the existing system capacity utilization table. **Table 3.C.10** presents the available system storage at the Niagara Falls WTP under various demand scenarios. **Table 3.C.11** highlights the storage existing and projected capacity.

Table 3.C.10 Available System Storage at the Niagara Falls WTP under 2051 MDD, Buildout MDD, and at MDWL Capacity

Niagara Falls WTP	2051 MDD	Buildout MDD	At MDWL Capacity
Minimum Reservoir Out/Treated Free Chlorine (mg/L)	0.8	0.8	0.8
Maximum Ph	8	8	8
Minimum Temperature (deg. C)	0.5	0.5	0.5
Reservoir Volume (ML)	14	14	14
Reservoir Baffle Factor	0.5	0.5	0.5
MDD (ML/D)	90.9	101.4	145.5
$CT_{required}$	49	49	49
Safety Factor	1	1	1
CT_{actual}	49	49	49
T_{10}	61.3	61.3	61.3
Reservoir Retention Time (min)	122.5	122.5	122.5
Min Volume Needed (ML)	7.7	8.6	12.4
Minimum Reservoir Level (%)	0.6	0.6	0.9
Storage Volume Available (ML)	**6.3**	**5.4**	**1.6**

Table 3.C.11 System Storage Capacities

Storage	Fire Supply Zones	MDD Supply Zones	2021 Rated Capacity (ML)	2051 Rated Capacity (ML)	Post 2051 Rated Capacity (ML)	2021 Total Available Storage (ML)	Existing Required Storage	Existing Surplus/ Deficit (ML)	2051 Total Available Storage (ML)	2051 Required Storage (ML)	2051 Surplus/ Deficit (ML)	Post 2051 Total Available Storage (ML)	Post 2051 Required Storage (ML)	Post 2051 Surplus/ Deficit (ML)
Niagara Falls WTP Reservoir(1)	250 Pumped	250	6.27(2)	6.27	5.37	29.6	31.3	-1.7	29.6	40.2	-10.6	28.7	44.1	-15.3
Kent Avenue Reservoir	250 Pumped	168, 189, 227, 250	20.91	20.91	20.91									
Lundy's Lane Elevated Tank	250 Floating	168, 189, 227, 250	2.46	2.46	2.46									

(1)Refer to **Section C.2.2** for discussion on contact time volume requirements at the WTP reservoir

(2)2051 MDD volume was utilized for the existing system capacity utilization table (conservative assumption)

There is an existing and future storage deficit within Niagara Falls which was not previously identified due to the change in methodology for calculating available system storage at the WTP reservoirs while accounting for contact time requirements. There is a significant reduction in available system storage at the Niagara Falls WTP Reservoir due to this adjustment, resulting in the existing storage deficits and increased future deficits.

C.3.5 System Pressures and Fire Flows

Figure 3.C.4 to **Figure 3.C.5** present the existing system performance, based on existing system configuration and capacities.

For the majority of the system, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. Higher pressures, exceeding 100 psi under average days demands, are experienced in south Niagara Falls due to lower ground elevations and the HGL of the pressure zone. Addressing large high-pressure areas such as this was outside of the scope of the Region's 2021 MSPU, but they can be assessed at the local area municipality level, with potential options including do nothing, optimize the HGL for the entire zone, or the creation of new subzones. Low pressure below 40 psi are experienced in Niagara Falls near the Lundy's Lane Elevated Tank due to the high ground elevations in relation to the target HGL of the pressure zone (250 m).

The Region's target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for critical system areas. The fire flow target is not met on the transmission main from Niagara Falls to Port Robinson East within the City of Thorold. This watermain is a long, dead-end watermain which would require looping to improve available fire flow, and Port Robinson East is predominately a residential community with lower local fire flow needs. System looping in this area presents challenges, as the option to connect Port Robinson East and West is not ideal. The HGL for Port Robinson East on the Niagara Falls WTP system is 250 m, while the HGL for Port Robinson West on the Welland WTP system is 220 m. As such, a PRV would need to be installed and there would be no significant improvement to available fire flows in Port Robinson East.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

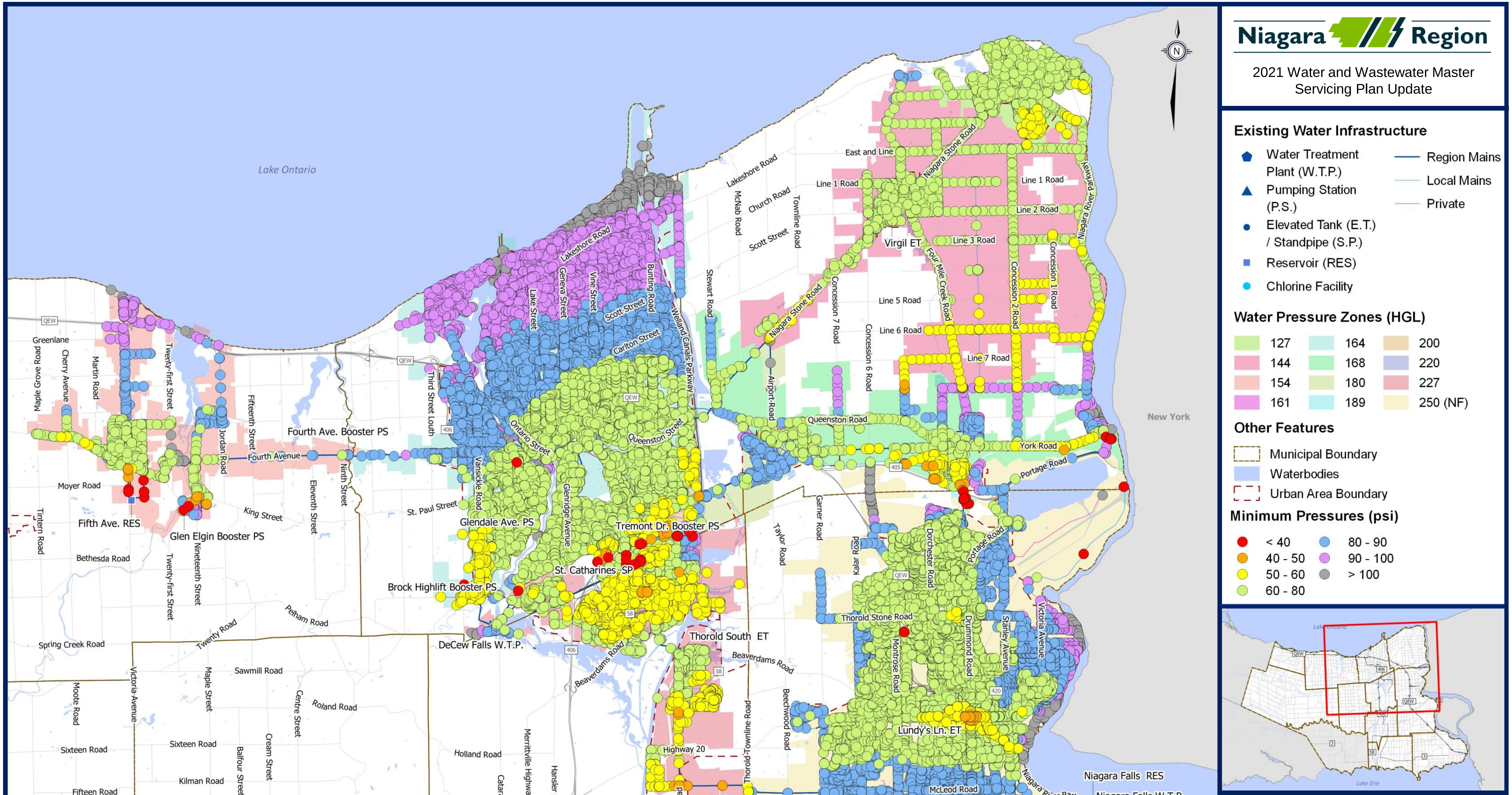


Figure 3.C.4

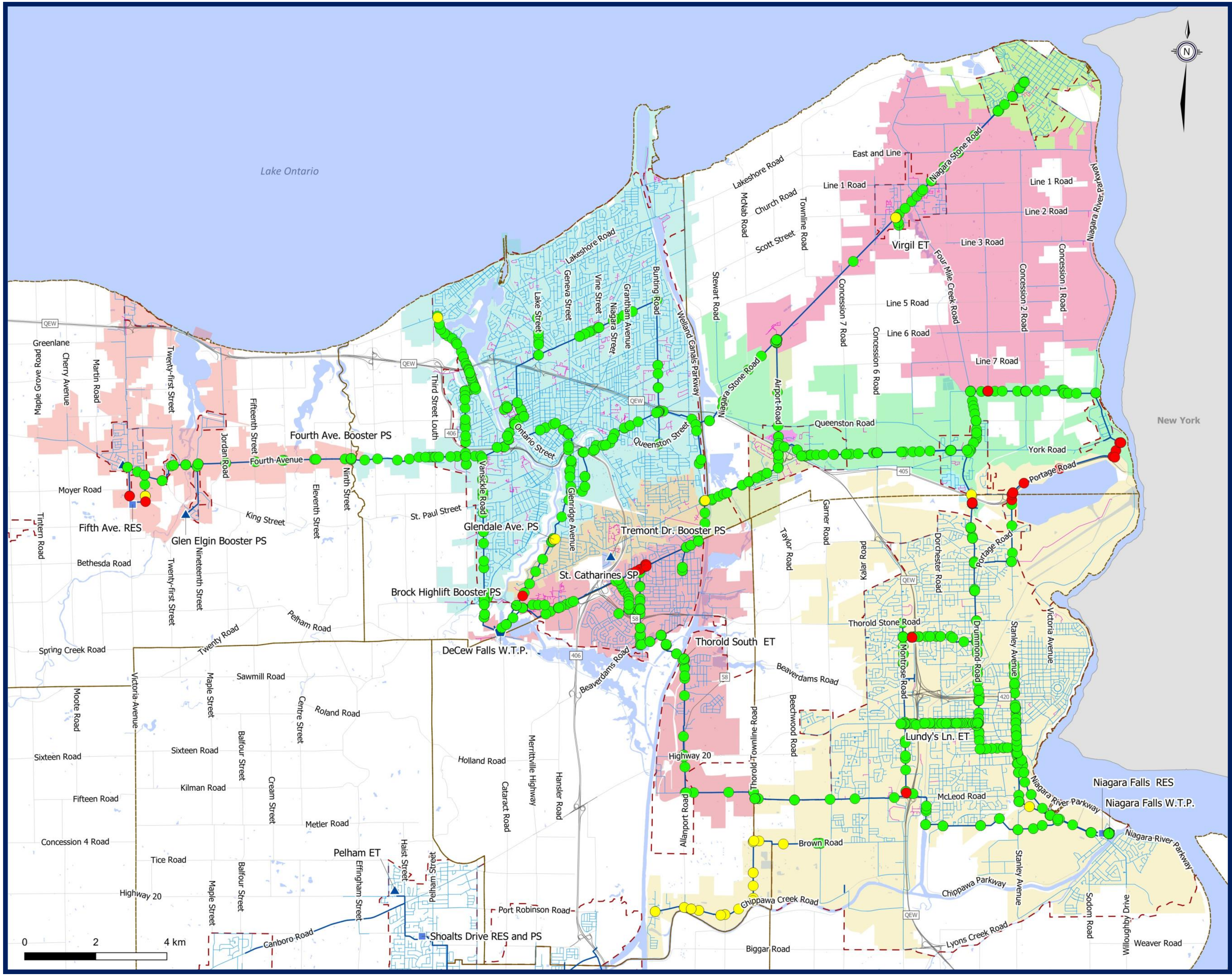
DeCew and Niagara Falls System

Existing System Peak Hour Pressures

December 2022
621016-W-004
WKID: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update



Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- Region Mains
- Local Mains
- Private

Water Pressure Zones (HGL)

🟩	127	🟦	164	🟫	200
🟥	144	🟩	168	🟪	220
🟧	154	🟩	180	🟥	227
🟪	161	🟦	189	🟨	250

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Regional Mains Available Fire Flow (L/s) - 30 psi Residual Pressure

- 🔴 < 125
- 🟢 > 250
- 🟡 125 - 250

Figure 3.C.5
DeCew and Niagara Falls System
Existing System Fire Flows

BluePlan ENGINEERING

December 2022
621016-W-005
WKID: 26917

C.3.6 Water Age and Watermain Capacity

Using the baseline system model, water age scenarios were created to identify average system water age. Using the Drinking Water Works Permits for each system, the locations of re-chlorination facilities were identified. Water age was reset to zero at these facilities for the water age model scenario. Water age is typically used as a proxy indicator for water quality, however, the exact correlation between water age and water quality can be highly variable depending on the source water quality, the distribution system material, and the secondary disinfectant that is used. A common threshold used within water system age is to flag areas where water age is greater than 7 days.

Figure 3.C.6 presents the existing system water age. Watermain velocities less than 0.6 m/s or greater than 1.5 m/s have been flagged and are shown in **Figure 3.C.7**.

In general, maximum water age is less than 7 days within the Niagara Falls water system, except for minor local dead-end watermains

In general, watermain velocity is less than 2 m/s, however there are many Regional watermains which experience velocities less than 0.6 m/s.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

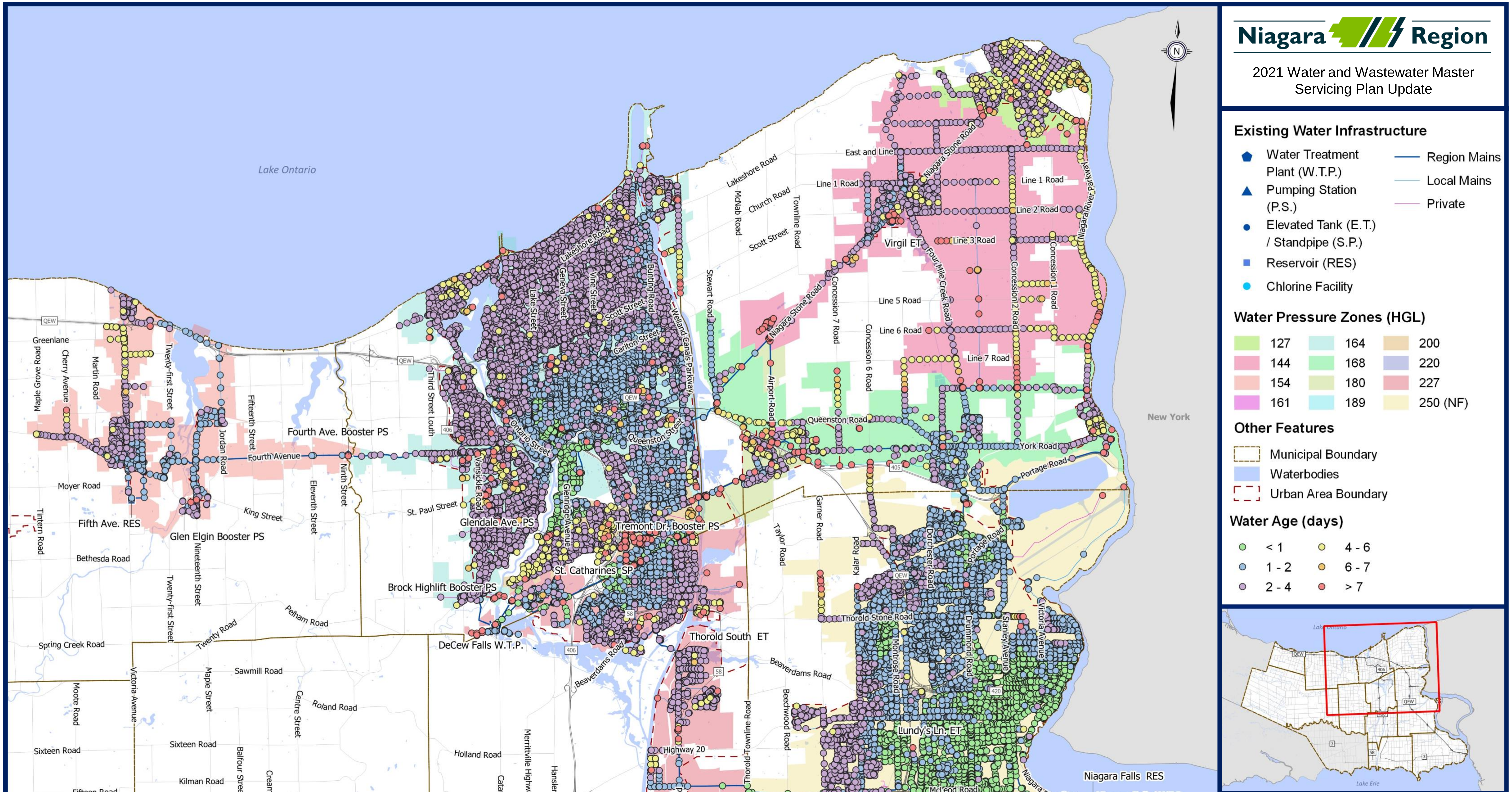


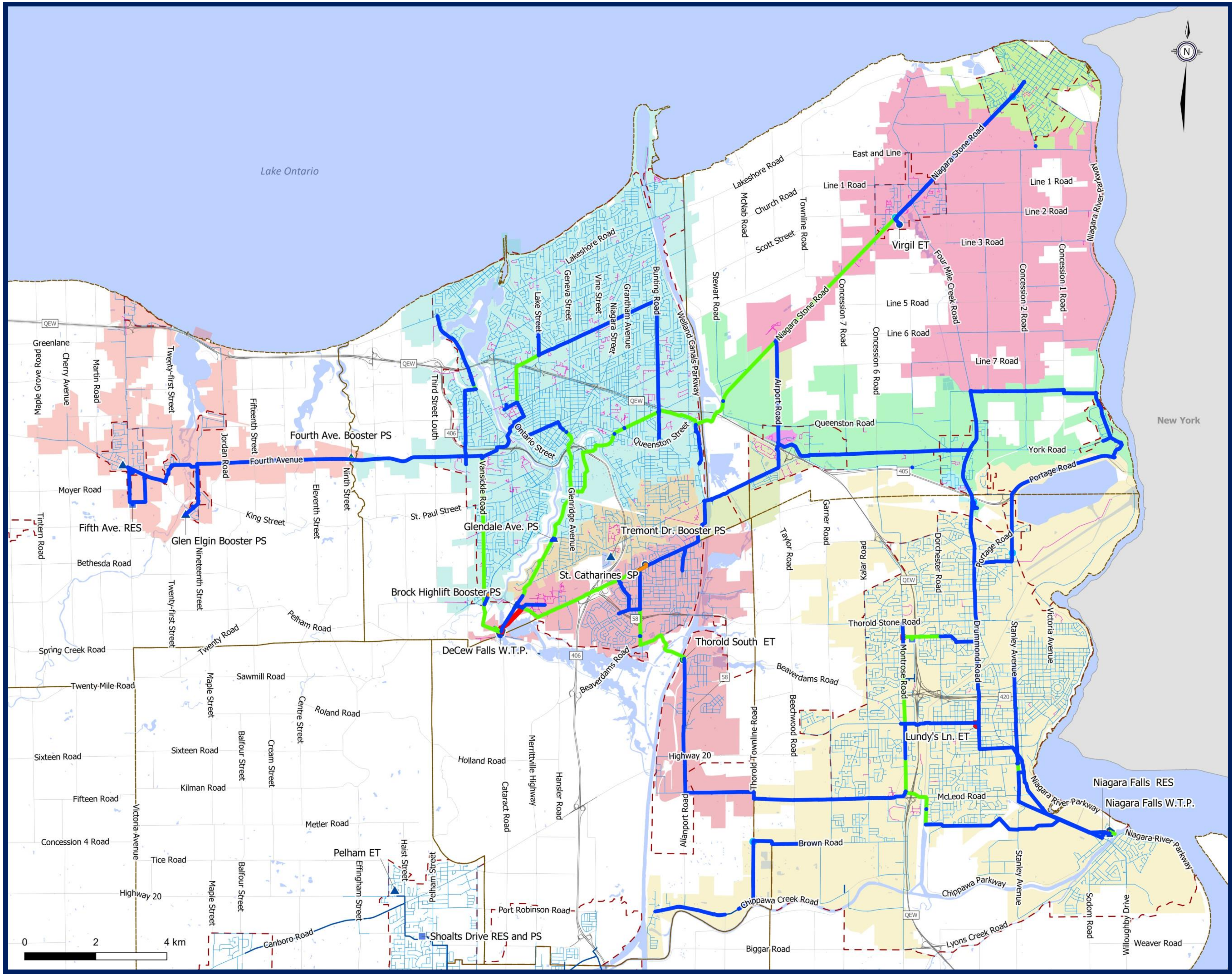
Figure 3.C.6

DeCew and Niagara Falls System

Existing System Water Age

BluePlan Engineering

December 2022
621016-W-006
WKID: 26917



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

⬟ Water Treatment Plant (W.T.P.)	— Region Mains
▲ Pumping Station (P.S.)	— Local Mains
● Elevated Tank (E.T.) / Standpipe (S.P.)	— Private
■ Reservoir (RES)	
● Chlorine Facility	

Water Pressure Zones (HGL)

🟩 127	▨ 164	▨ 200
🟥 144	🟩 168	▨ 220
▨ 154	▨ 180	🟥 227
▨ 161	▨ 189	▨ 250 (NF)

Other Features

- ▨ Municipal Boundary
- ▨ Waterbodies
- ▨ Urban Area Boundary

Maximum Velocity (m/s) - Regional Watermains

— < 0.6	— 1.5 - 2.0
— 0.6 - 1.5	— > 2.0

Figure 3.C.7

DeCew and Niagara Falls System

Existing System Watermain Velocity

GM BluePlan ENGINEERING

December 2022
621016-W-007
WKID: 26917

C.4 System Opportunities and Constraints

Figure 3.C.8 highlights the existing opportunities and constraints.

C.4.1 Niagara Falls Water Treatment Plant

- The current rated MDD capacity is 145.5 MLD, with an existing demand of 79 MLD. The projected 2051 MDD is 113.3 MLD (including conservative estimate of DeCew system transfers), which is below 80% of the water treatment plant rated capacity. As such, the Niagara Falls Water Treatment Plant has surplus capacity to accommodate growth beyond 2051.

C.4.2 Niagara Falls System

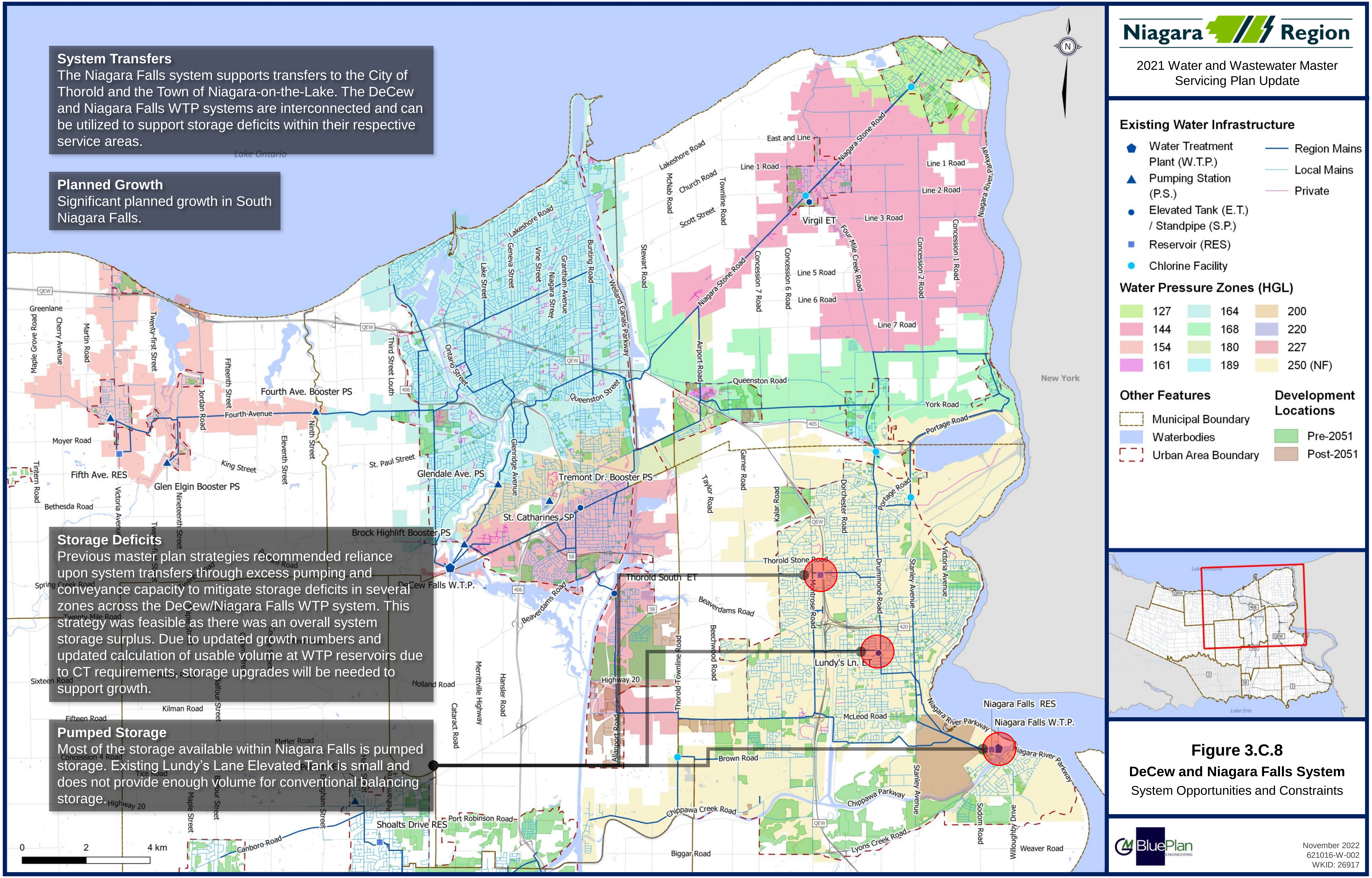
- The system has an existing and future storage deficit.
- Majority of the existing 29.6 ML of system storage is ground level pumped storage, with only 2.5 ML of elevated storage is available for conventional balancing storage. This leads to a:
    - Deficit of balancing storage within the system
    - Deficit of peak hour and/or fire flow pump capacity; needed to overcome existing balancing storage deficit
- New elevated storage is needed to address existing balancing storage deficit and to support increased transfers to the DeCew system.
- New ground level reservoir storage will not address balancing storage deficit and will need to also provide additional pumping capacity to address future peak hour and/or fire flow pump capacity needs.
- The existing Lundy’s Lane ET is a multi-legged ET that does not meet current seismic standards. The Region has intentions to replace all multi-legged ETs, including the Lundy’s Lane ET, in the near future. The future replacement of the Lundy’s Lane ET presents an opportunity to address the system and balancing storage deficit and to optimize the Niagara Falls system pressures.
- The existing Regional watermain network has sufficient capacity to support intensification within the existing network. However, the existing local distribution system has a large proportion of existing cast iron and small diameter watermains, leading to high head losses in the local watermains. Localized distribution upgrades may be needed to support intensification growth.
- Significant greenfield growth areas to the south, therefore a new watermain network is needed to service new south growth areas.

C.4.3 System Security of Supply & Interconnections

- The new transmission main from McLeod Road PRV to Brown Road was recommended through the previous master plan and is currently under construction. It will provide additional security of supply to Port Robinson East.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update



System Transfers
The Niagara Falls system supports transfers to the City of Thorold and the Town of Niagara-on-the-Lake. The DeCew and Niagara Falls WTP systems are interconnected and can be utilized to support storage deficits within their respective service areas.

Planned Growth
Significant planned growth in South Niagara Falls.

Storage Deficits
Previous master plan strategies recommended reliance upon system transfers through excess pumping and conveyance capacity to mitigate storage deficits in several zones across the DeCew/Niagara Falls WTP system. This strategy was feasible as there was an overall system storage surplus. Due to updated growth numbers and updated calculation of usable volume at WTP reservoirs due to CT requirements, storage upgrades will be needed to support growth.

Pumped Storage
Most of the storage available within Niagara Falls is pumped storage. Existing Lundy's Lane Elevated Tank is small and does not provide enough volume for conventional balancing storage.

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- Region Mains
- Local Mains
- Private

Water Pressure Zones (HGL)

127	164	200
144	168	220
154	180	227
161	189	250 (NF)

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Development Locations

- Pre-2051
- Post-2051

Figure 3.C.8

DeCew and Niagara Falls System

System Opportunities and Constraints

GM BluePlan ENGINEERING

November 2022
621016-W-002
WKID: 26917

C.5 Assessment of Alternatives

To address existing and growth-related capacity needs, the previous master servicing plan update recommended the following upgrades, which were re-confirmed and carried forward through the 2021 MSPU, as listed below:

- Construction of a new ET in south Niagara Falls with a larger volume to support growth and balancing storage needs;
- Decommissioning of the existing Lundy's Lane ET;
- New transmission main from McLeod PRV to Port Robinson Chlorine BPS;
- New transmission main to support the new ET in south Niagara Falls (from existing system to new ET location); and,
- New south Niagara Falls feedermain loop to support new growth areas.

Re-assessment of infrastructure sizing was completed to ensure it is sufficient to support the updated growth numbers, however, the strategy for upgrades within the Niagara Falls system as recommended through the previous MSPU remains unchanged. The following discusses the updated sizing recommendations:

- Increased sizing for the new south Niagara Falls ET due to changes in available system storage at the WTP reservoirs as a result of CT requirements, and to support increased growth projections;
- Increased sizing for the new south Niagara Falls feedermain loop to support new growth areas and post-2051 growth potential; and,
- Post-2051 reservoir expansion at the Niagara Falls WTP to support post-2051 storage needs.

Identified high pressure issues can be addressed through city-led changes within the local distribution system through either the creation of new pressure zones or adjustments to existing zone boundaries. While the local capacity constraints will be addressed through localized capacity upgrades.

It is noted that the Niagara Falls Elevated Tank Environmental Assessment is currently ongoing (end of 2023 completion target) was triggered by both the previously identified storage deficits and through state of good repair needs (replacement of multi-legged tanks to meet seismic code). Through the Niagara Falls ET EA, the sizing, location, and supporting transmission main upgrades will be confirmed. The Niagara Falls ET EA will also explore the feasibility of adjusting the system HGL to address the identified pressure issues. Although the overall strategy for the Niagara Falls system is not anticipated to change, the preferred ET location and watermain alignments identified through the EA will supersede the recommendations of the 2021 MSPU with respect to the Niagara Falls system strategy.

C.5.1 Alternatives Evaluation

The baseline strategy of no system upgrades does not satisfy future servicing needs of the water system. The recommended strategy for the Niagara Falls system provides the following advantages:

- Provides the required storage for attenuation of daily demands, fire fighting and emergency storage;
- Further distributes storage within the network, with Kent Reservoir in the north and the new reservoir in the south, which improves security of supply within the system; and,
- Additional system looping will support new growth areas in the south.

C.6 Preferred Servicing Strategy

The following is a summary of the Niagara Falls water servicing strategy:

- The Niagara Falls WTP has sufficient capacity to support growth to year 2051;
- The storage location in Niagara Falls will be optimized with additional storage capacity. The existing Lundy's Lane tank will be decommissioned;
- Due to the amount of growth in South Niagara Falls, a new feedermain will be required to support the growth demands; and,
- Additional feedermain capacity is required in the Port Robinson area due to growth and for Regional watermain system connectivity.

Figure 3.C.13 and **Figure 3.C.14** show the preferred servicing strategy, consisting of:

C.6.1 Storage

- A new 12.0 ML elevated tank (W-S-004) is to be built in South Niagara Falls growth area to support 2051 growth.
    - Note: the new storage does not support the full 2051 balancing storage needs, however, there is sufficient combined pumping capacity at the Kent Avenue Reservoir and Niagara Falls Water Treatment Plant to support peak hour and fire flow capacity needs.
- 10 ML reservoir storage volume expansion post-2051 at the Niagara Falls WTP to support long-term growth needs (W-S-014)

C.6.2 Decommissioning of Existing Facilities

- Lundy's Lane Elevated Tank will be decommissioned following the construction of the new elevated tank in south Niagara Falls (W-D-004)

C.6.3 Regional Watermains

- New 750 mm transmission main to New South Niagara Falls Elevated Tank (W-M-009)
- New 450 mm transmission main from PRV to Port Robinson Chlorine Booster Pumping Station (W-M-007)
- New 600 mm feedermain in South Niagara Falls (W-M-019, W-M-020, W-M-021)

C.6.4 Studies and Programs

- Region-wide WTP reservoir volume study to review CT volume and overall system storage

C.6.5 Future System Performance

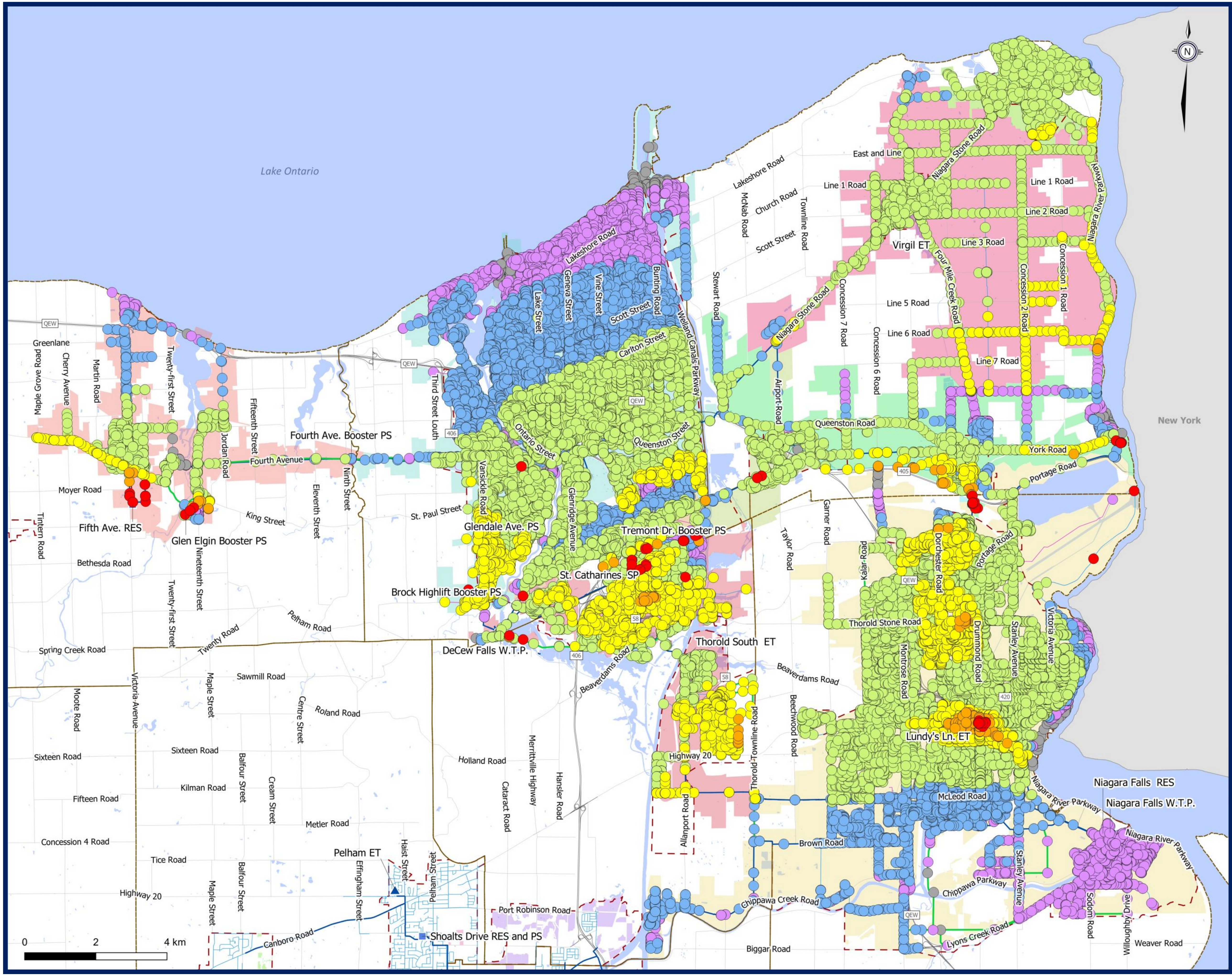
Figure 3.C.9 to **Figure 3.C.12** present the future system performance, based on the preferred servicing strategy configuration and capacities.

For the majority of the system, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. Higher pressures, exceeding 100 psi under average days demands, are experienced in south Niagara Falls due to lower ground elevations and the HGL of the pressure zone. Addressing large high-pressure areas such as this was outside of the scope of the Region's 2021 MSPU, but they can be assessed at the local area municipality level, with potential options including do nothing, optimize the HGL for the entire zone, or the creation of new subzones. Low pressure below 40 psi are experienced in Niagara Falls near the existing Lundy's Lane Elevated Tank due to the high ground elevations in relation to the target HGL of the pressure zone (250 m).

The Region's target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for critical system areas.

In general, maximum water age is less than 7 days within the Niagara Falls water system, except for minor local dead-end watermains

In general, watermain velocity is less than 2 m/s, however there are many Regional watermains which experience velocities less than 0.6 m/s.



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

🟩 127	🟦 164	🟧 200
🟥 144	🟩 168	🟪 220
🟥 154	🟩 180	🟥 227
🟪 161	🟦 189	🟨 250 (NF)

Other Features

- ┅ Municipal Boundary
- ■ Waterbodies
- ┅ Urban Area Boundary
- — Future Watermains

Minimum Pressures (psi)

● < 40	● 80 - 90
● 40 - 50	● 90 - 100
● 50 - 60	● > 100
● 60 - 80	

Figure 3.C.9

DeCew and Niagara Falls System

2051 System Peak Hour Pressures

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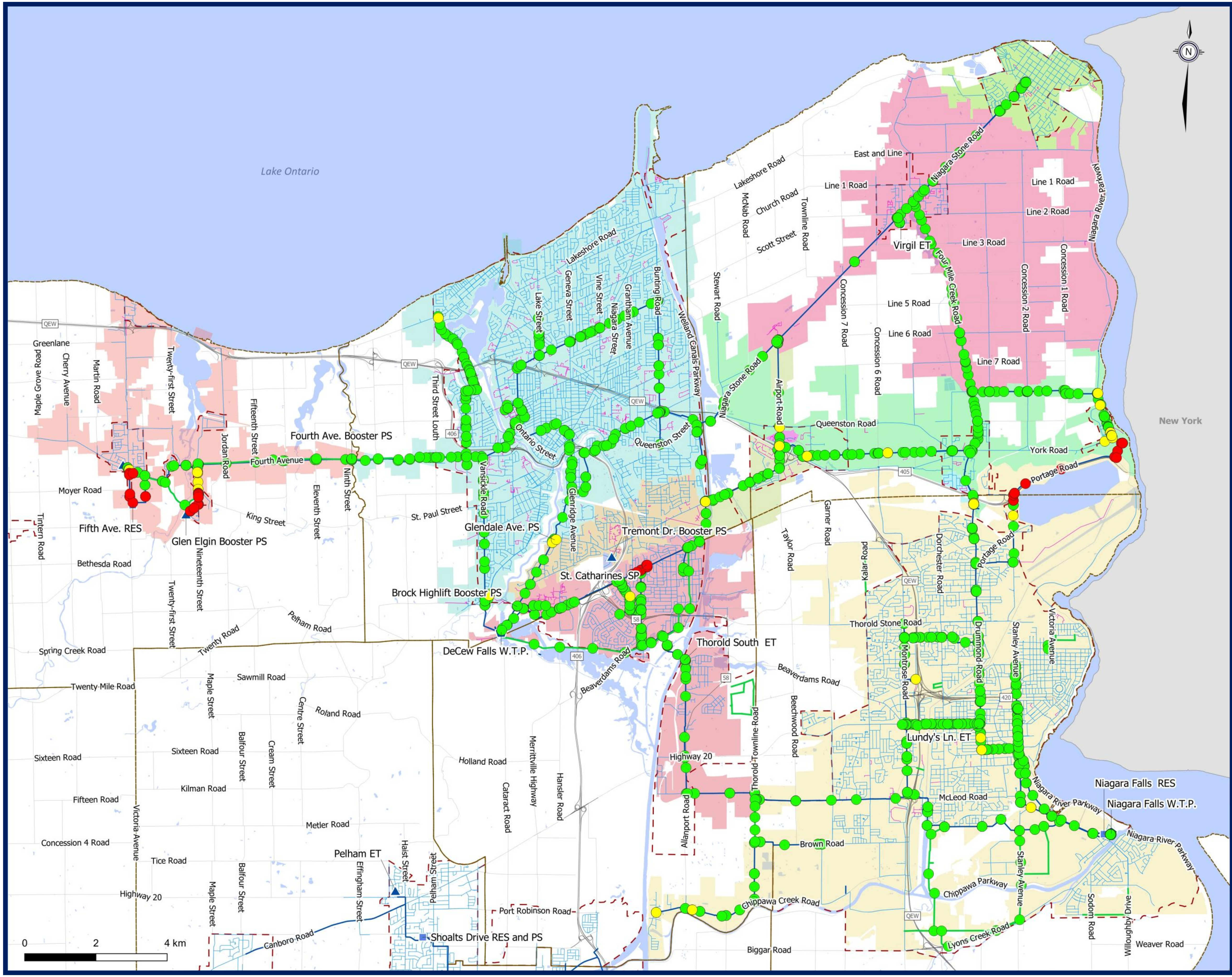
December 2022
621016-W-008
WKID: 26917



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

⬟	Water Treatment Plant (W.T.P.)
▲	Pumping Station (P.S.)
●	Elevated Tank (E.T.) / Standpipe (S.P.)
■	Reservoir (RES)
●	Chlorine Facility
—	Region Mains
—	Local Mains
—	Private

Water Pressure Zones (HGL)

🟩	127	■	164	■	200
🟥	144	🟩	168	■	220
■	154	■	180	🟥	227
■	161	■	189	■	250

Other Features

▭	Municipal Boundary
■	Waterbodies
▭	Urban Area Boundary
—	Future Watermains

Regional Mains Available Fire Flow (L/s) - 30 psi Residual Pressure

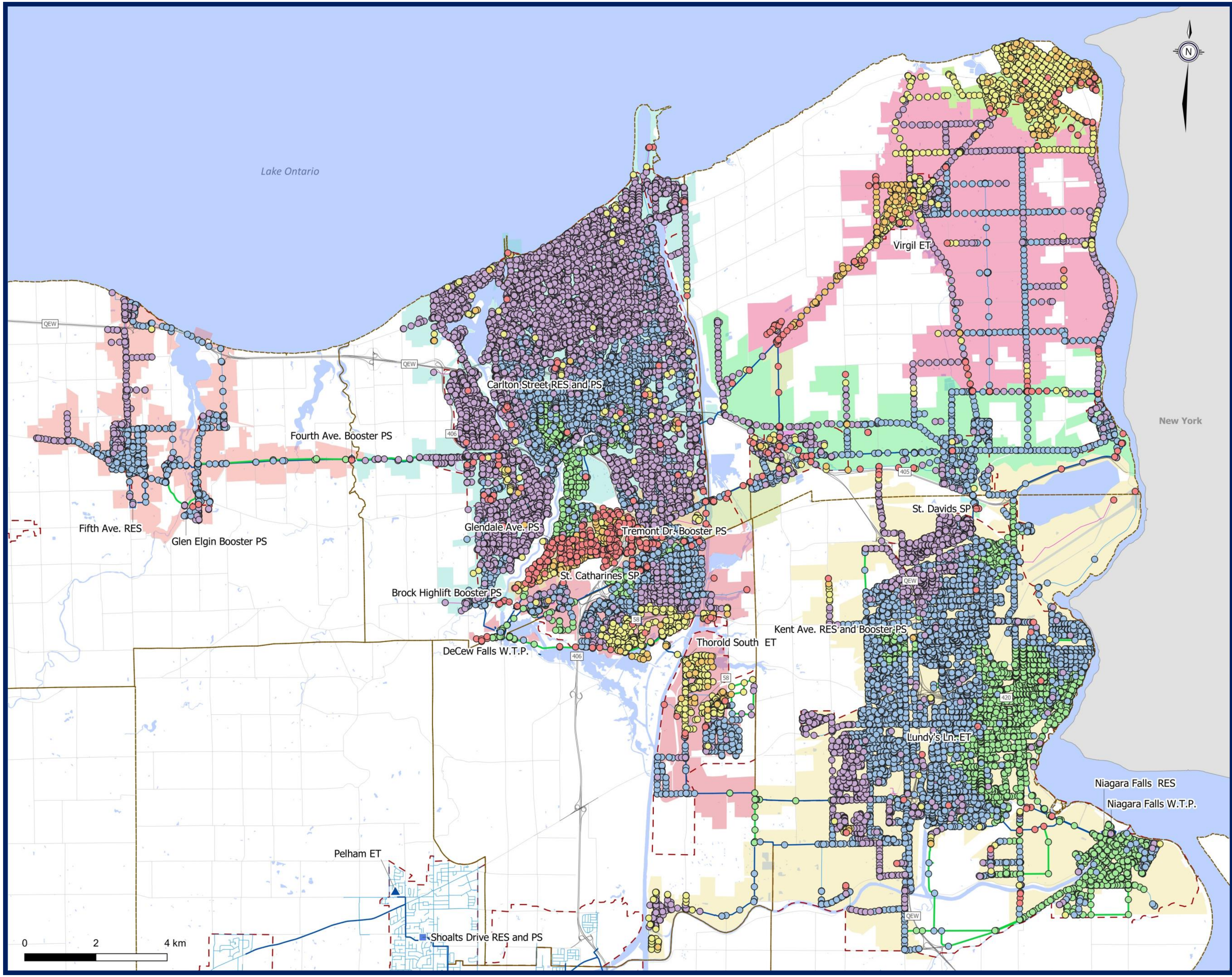
🔴	< 125	🟢	> 250
🟡	125 - 250		

Figure 3.C.10

DeCew and Niagara Falls System

2051 System Fire Flows

BluePlan Engineering
December 2022
621016-W-009
WKID: 26917



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

⬟ Water Treatment Plant (W.T.P.)
▲ Pumping Station (P.S.)
● Elevated Tank (E.T.) / Standpipe (S.P.)
■ Reservoir (RES)
● Chlorine Facility

— Region Mains
— Local Mains
— Private

Water Pressure Zones (HGL)

127	164	200
144	168	220
154	180	227
161	189	250 (NF)

Other Features

☐ Municipal Boundary
■ Waterbodies
☐ Urban Area Boundary
— Future Watermains

Water Age (days)

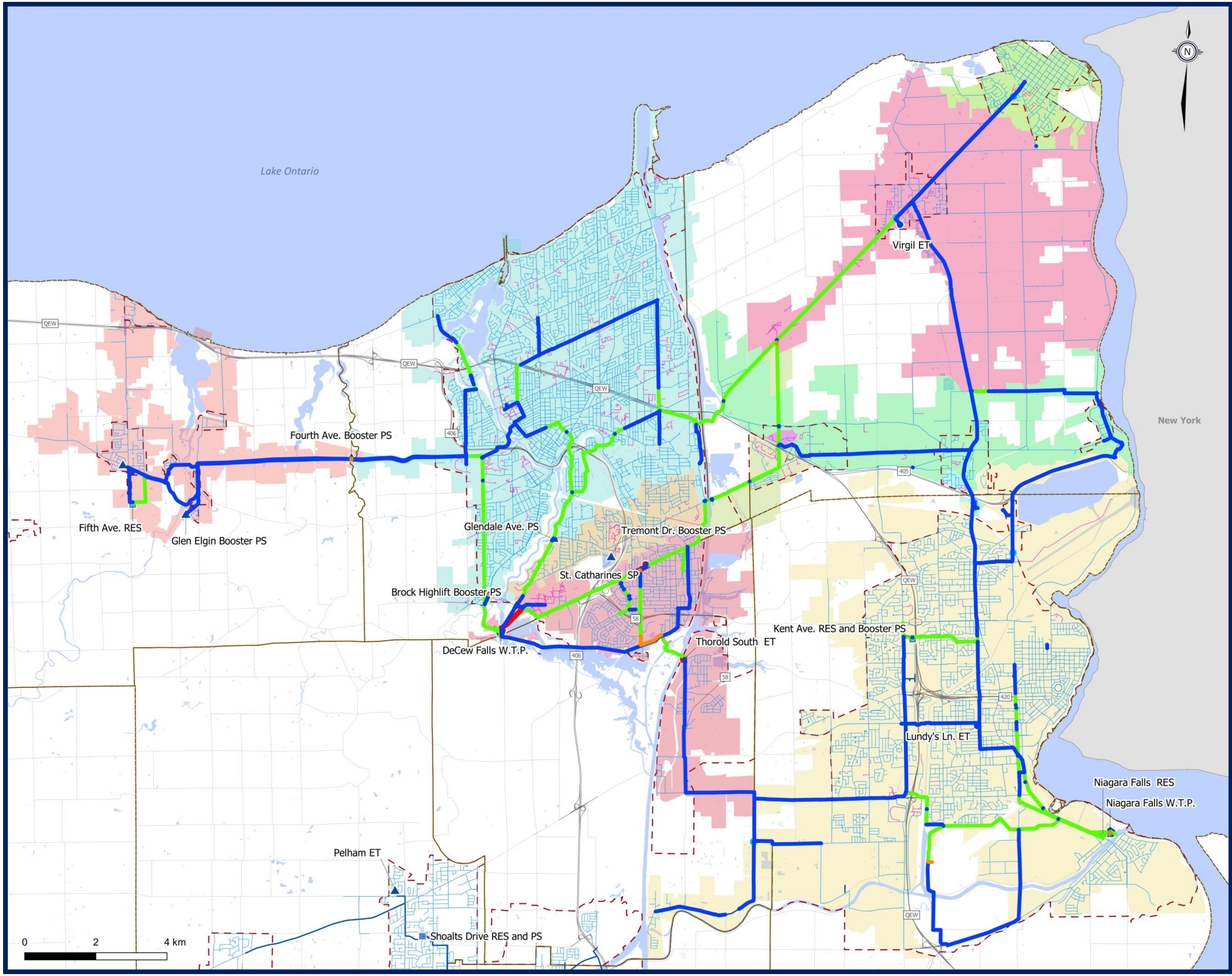
● < 1	● 4 - 6
● 1 - 2	● 6 - 7
● 2 - 4	● > 7

Figure 3.C.11

DeCew and Niagara Falls System

2051 System Water Age

May 2023
621016-W-011
WKID: 26917



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

🟩 127	164	200
🟥 144	168	220
154	180	227
161	189	250 (NF)

Other Features

- ▭ Municipal Boundary
- ▭ Waterbodies
- ▭ Urban Area Boundary

Maximum Velocity (m/s) - Regional Watermains

- — < 0.6
- — 0.6 - 1.5
- — 1.5 - 2.0
- — > 2.0

Figure 3.C.12

DeCew and Niagara Falls System

2051 System Watermain Velocity

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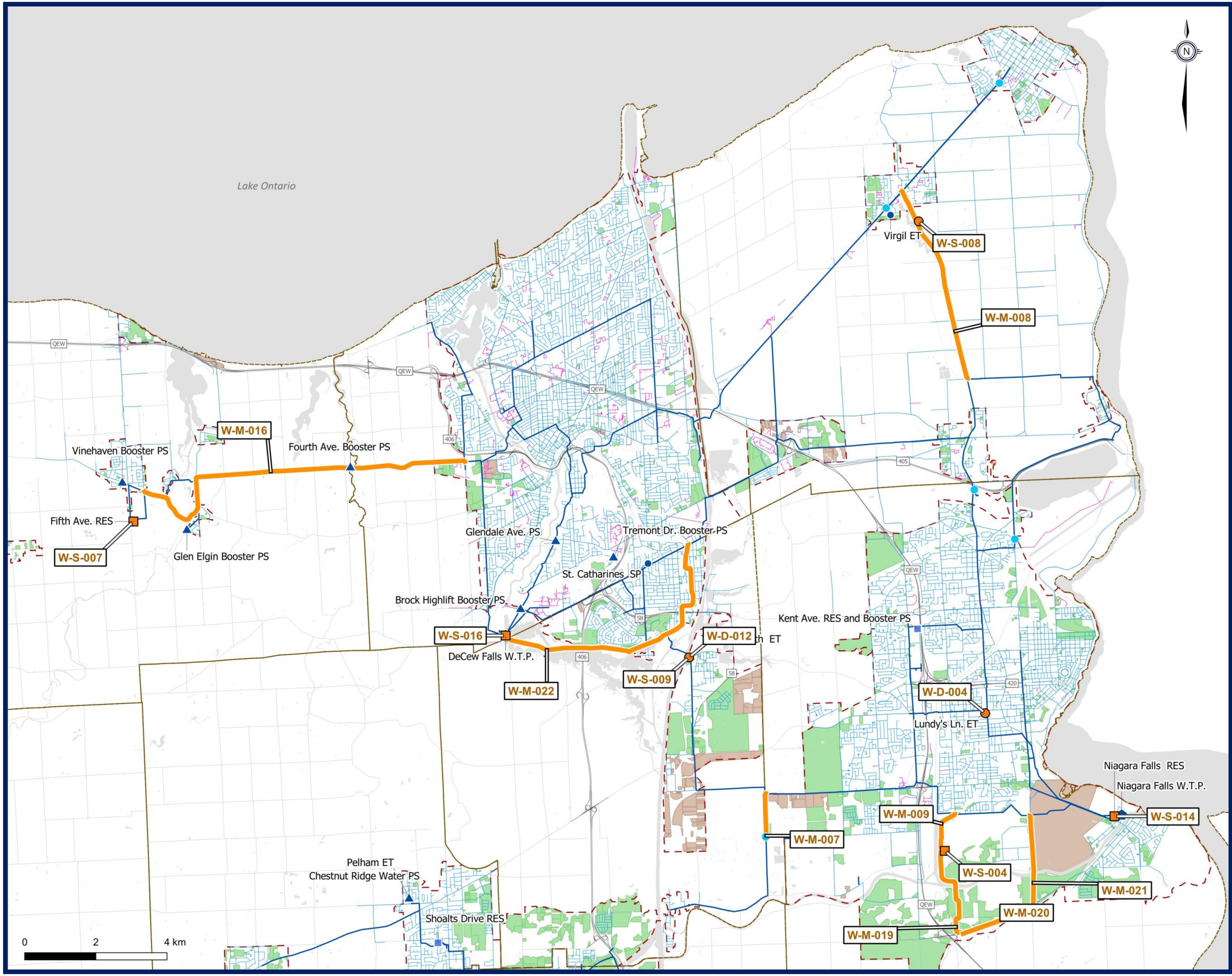
May 2023
621016-W-010
WKID: 26917

C.7 Capital Program

Figure 3.C.13 and **Figure 3.C.14** present the preferred servicing strategy map and schematic. **Table 3.C.12** summarizes the recommended project costing, timing, and Class EA requirements. Individual detailed project costing sheets are presented in **Section C.8.6**.



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Capital Program

- ⬟ Water Treatment Plant
- ▲ Pumping Station
- ■ Reservoir
- ● Elevated Tank
- ━ Watermains

Existing Water Infrastructure

- ⬟ Water Treatment Plant
- ■ Reservoir
- ▲ Pumping Station
- ● Elevated Tank / Standpipe
- ━ Region Mains
- ━ Local Mains
- ━ Private

Other Features

- ▭ Township of Wainfleet
- ▭ Waterbodies
- ▭ Urban Area Boundary

Development Locations

- ▨ Post-2051
- 🟩 Pre-2051

***Note that additional growth in existing built areas is anticipated**

***Project alignments are preliminary and will be refined through subsequent projects (EA and/or detailed design)**

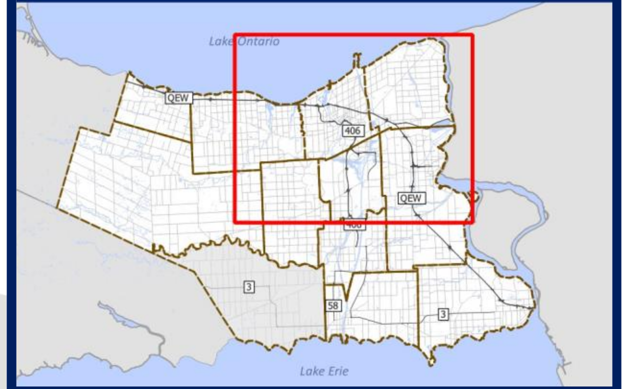


Figure 3.C.13

DeCew and Niagara Falls System

Preferred Water Servicing Strategy

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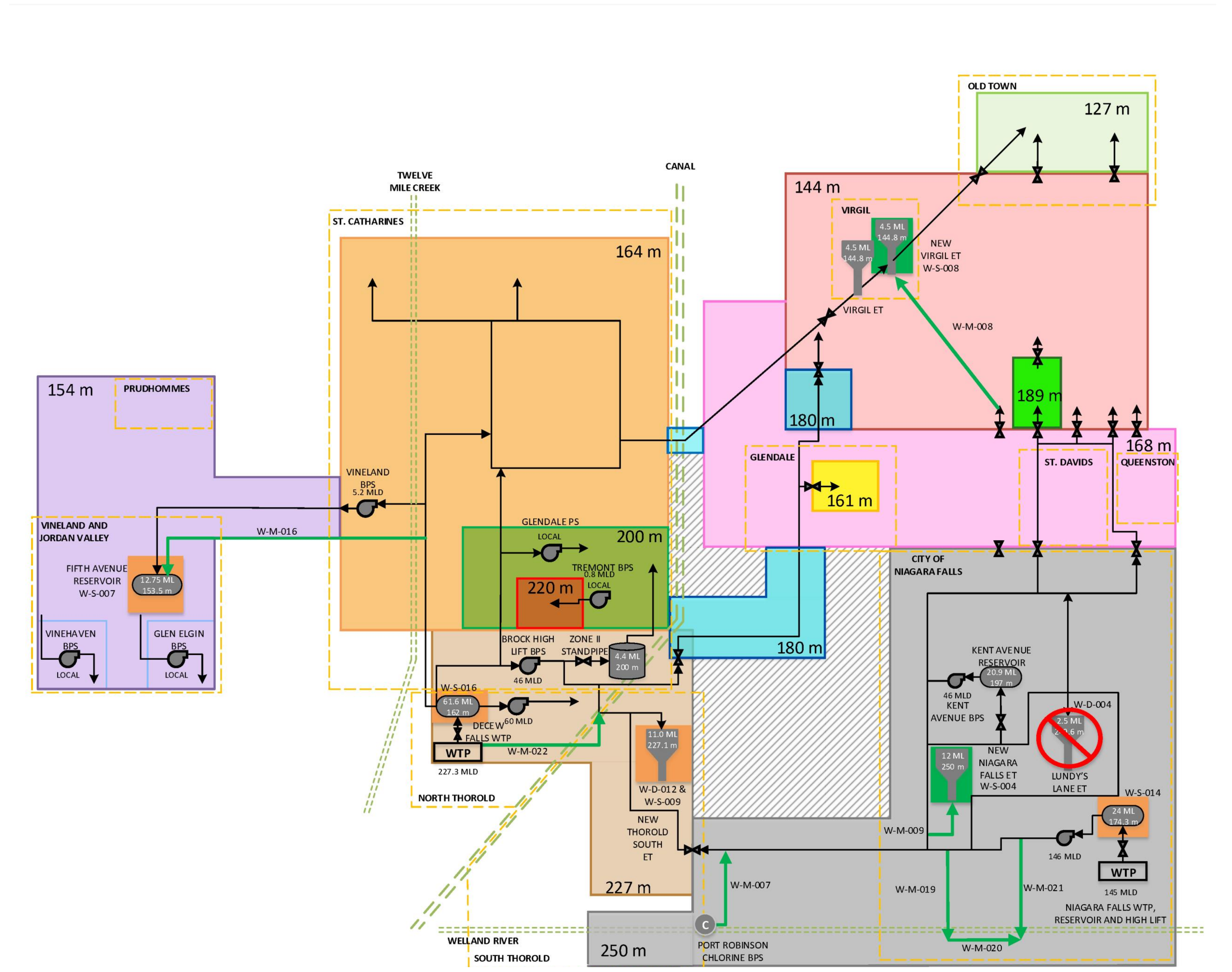
December 2022
620126-W-013
WKID: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update



WTP RATED CAPACITY — Water Treatment Plant

Volume TWL — Standpipe

FIRM CAPACITY — Pumping Station

Trunk Watermain Network

Volume TWL — Reservoir

Settlement Area Boundaries

Volume TWL — Elevated Tanks

Land and Water Features

⋈ Control Valve (Only normally operated valves shown)

New Watermain

C Chlorine Facility

Upgrade Watermain

🟧 Facility Upgrade

🚫 Decommission Project

🟩 New Facility

Pressure Zone

127 m	189 m
144 m	200 m
154 m	220 m
161 m	227 m
164 m	250 m
168 m	180 m

Figure 3.C.14

DeCew and Niagara Falls System

Future Water Infrastructure Schematic

BluePlan ENGINEERING

December 2022
621016-W-000
WKID: 26917

Table 3.C.12 Summary of Niagara Water 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 ($)
W-D-004	Decommissioning of Lundy's Lane ET	Lundy's Lane ET to be decommissioned and replaced by new South Niagara Falls ET	N/A	2027-2031	Niagara Falls	A+	N/A	Storage	$823,000
W-M-007	New transmission main from PRV to Port Robinson Chlorine BPS in Niagara Falls	New transmission main from PRV to Port Robinson Chlorine BPS in Niagara Falls	450 mm	2022-2026	Niagara Falls	A+	N/A	Watermain	$4,040,000
W-M-009	New Niagara Falls South transmission main to New Elevated Tank	New Niagara Falls South transmission main to provide additional supply to new growth areas.	750 mm	2022-2026	Niagara Falls	A+	N/A	Watermain	$5,466,000
W-M-019	New Niagara Falls South feedermain from Dorchester Road to Lyon's Creek Road	New Niagara Falls South feedermain to provide additional supply to new growth areas.	600 mm	2032-2051	Niagara Falls	B	Separate EA Required	Watermain	$24,950,000
W-M-020	New Niagara Falls South feedermain along Lyon's Creek Road	New Niagara Falls South feedermain to provide additional supply to new growth areas.	600 mm	2042-2051	Niagara Falls	B	Separate EA Required	Watermain	$6,982,000
W-M-021	New Niagara Falls South feedermain along Stanley Avenue	New Niagara Falls South feedermain to provide additional supply to new growth areas.	600 mm	2032-2051	Niagara Falls	B	Separate EA Required	Watermain	$16,048,000
W-S-004	New South Niagara Falls ET	New South Niagara Falls ET to replace the Lundy's Lane ET and provide additional storage.	12.0 ML	2022-2026	Niagara Falls	B	Ongoing (Separate Study)	Storage	$27,933,000
W-S-014	In-ground Reservoir Expansion at Niagara Falls WTP	In-ground Reservoir Expansion at Niagara Falls WTP to support buildout growth and CT volume requirements.	10.0 ML	Post-2051	Niagara Falls	B	Separate EA Required	Storage	$23,278,000
W-ST-001(1)	Region Wide WTP Reservoir Volume Study	Study to review WTP reservoir CT volume and overall system storage	-	2022-2026	Region-Wide	A+	N/A	Storage	-
								Total	**$109,520,000**

(1) Project cost not included in subtotal as it is a Region-wide project

C.8 Project Implementation and Considerations

C.8.1 10-Year Program Sequencing

The recommended year in service for the capital projects is presented in **Section C.7**. Special project implementation and considerations for the preferred servicing strategy consist of:

- The new transmission main from the McLeod PRV to Port Robinson Chlorine BPS in Niagara Falls is currently under construction;
- Completion of the new South Niagara Falls Tank is needed before the Region can decommission the Lundy's Lane Tank; and.
- The new South Niagara Falls feedermain has been recommended post-2031 will be triggered by growth and local distribution system needs. The new feedermain loop has been split into three phases to support the option for different timelines based on location and timing of growth
  - The south phase of the feedermain loop (W-M-020, shown on Lyon's Creek Road) has been recommended in the program in the 2042 – 2051 timeframe, which is later than the other two phases (W-M-019 and W-M-021 recommended in the 2032 – 2041 timeframe) as the City of Niagara Falls is currently building a local watermain along this south section to provide local servicing and security of supply for the new hospital in south Niagara Falls.
  - Both the City and Regional watermains are needed to service future projected growth, however, there is potential to construct the south phase of the Regional feedermain loop later because of the construction of the new City watermain.

It is understood that the timing for the recommended projects may be subject to change due to a variety of external factors such as overall balancing of the Region's capital budget, changes to growth projections, and other unforeseen circumstances. As such, **Table 3.C.13** presents the preferred priority of the projects within the first 10-years of the capital program.

Table 3.C.13 First 10-Years Project Sequencing

Master Plan ID	Name	In Service Period	Project Sequencing
W-M-007	New transmission main from PRV to Port Robinson Chlorine BPS in Niagara Falls	2022-2026	1
W-M-009	New Niagara Falls South transmission main to New Elevated Tank	2022-2026	2
W-S-004	New South Niagara Falls ET	2022-2026	2
W-D-004	Decommissioning of Lundy's Lane ET	2027-2031	3

C.8.2 EA Requirements and Studies

The following summarizes the status of EA requirements for recommended capital projects which will require Schedule B or C EAs.

- **Currently ongoing separate EA studies:**
    - W-S-004 (New South Niagara Falls ET) Schedule B
- **EA studies to be completed through separate studies:**
    - W-M-019, W-M-020, W-M-021 (New south Niagara Falls feedermain loop) Schedule B
    - W-S-014 (In-ground Reservoir Expansion at Niagara Falls WTP) Schedule B

C.8.3 Region-Wide Projects and Collaboration with Local Area Municipalities

As part of the recommended capital program, it is recommended that the Region complete a WTP reservoir volume study across all WTP facilities to review CT volume and overall system storage. The intent of this study is to gain a clearer understanding of storage limitations at WTP facilities and how much usable volume can be accounted for within the system storage calculations.

Acknowledging that the overall water systems are jointly owned and operated by the Region and local area municipalities (LAM), the continued operation and expansion of the water systems to support existing users and accommodate projected growth relies upon the cooperation of the upper and lower tier municipalities. Major updates and adjustments to planning projections should be continued to be communicated as this may affect project details such as trigger timelines and design capacities, which is discussed further in **Section C.8.5**.

One initiative that will be predominately driven by the LAMs is NRW reduction. While NRW reduction programs should be completed in all municipalities, this 2021 MSPU assumes that the municipalities currently experiencing NRW rates greater than 25% will put specific focus on reducing NRW. Existing non-revenue water rates within Niagara Falls is 18% as such NRW reduction was not identified as a priority recommendation, however, municipality-specific targets can be reviewed by the LAMs. NRW reduction program activities may include but are not limited to:

- Enhancement to the water metering program including:
    - Meter replacement program
    - Re-time monitoring of large water users
- Leak detection program for watermains,
- Watermain replacement program,
- Improved tracking of unbilled authorized users and development of demand reduction strategies:
    - Fire department
    - Watermain flushing
    - Facility usage,
- Development of bulk water user strategy and potential construction of additional bulk water station, and
- Improved monitoring and enforcement of new construction water uses.

C.8.4 Sustainability Projects

It is important to recognize that the 2021 MSPU servicing strategies identify new infrastructure to service the additional growth out to year 2051 but these strategies are built by extending infrastructure from the existing systems and leveraging the existing Region infrastructure in place. It is essential that the existing infrastructure is maintained in good condition and performance to support servicing growth.

The Region continually establishes and implements a sustainability program that addresses priority projects to ensure the existing infrastructure is in a state-of-good-repair and continues to perform and meet the intended level of services.

Independent of the 2021 MSPU, the Region has completed a sustainability program analysis to identify the projects on a yearly basis, with focus on a 10 year program, to address the sustainability needs. This Sustainability Capital Plan is first developed to demonstrate the total investment needs and may identify a level of investment and implementation exceeding Region resources. The next steps for the Sustainability Capital Plan will be the development of the Financial Plan for existing Water and Wastewater assets which is anticipated to be completed in 2024. It should be noted that the Sustainability Capital Plan represents investment required over and above the growth-related 2021 MSPU program.

The 2021 MSPU undertook a process to review the Sustainability Program in conjunction with the growth-related program to eliminate duplicate projects and to align the timing of both growth and sustainability needs where appropriate in order to create efficiencies. This review was focused on the Sustainability Program for the next 10 years with the best information available at the time of this study.

The review process for integration of the MSPU program and the sustainability program was essential to demonstrate several key findings:

- There is opportunity to align growth and sustainability projects to bring efficiencies in costs and delivery;
- When planning and costing new infrastructure, lifecycle principles and costs must be considered. Existing and future infrastructure will have future service life replacements (i.e., pumps, electrical, roof, security upgrades at varying intervals from 5 – 40 years);
- Without maintenance of the existing infrastructure in a state of good repair and performance, there is risk that the growth-related program may not achieve desired capacities, timing, or level of service;
- There is also risk that implementing the growth-related program could have a negative impact on the level of service within the existing systems for the existing users; and,
- There are some major projects already considered under the sustainability program that are essential to the growth-related program such as the Welland WTP and WWTP.

The 2021 MSPU growth capital program focuses on the infrastructure needs to support growth and all the projects build upon the Region's existing water systems. It is imperative that the Region's sustainability capital program continues to be completed as needed alongside the recommended 2021 MSPU growth capital program to ensure that the existing system is operating at expected capacities and reliability such that it can support the recommended growth projects.

The sustainability projects consist of Region-wide projects and programs including but not limited to: replacement programs for boilers, water valves, generators, watermains, master meters, GAC, process piping, process electrical, process instrumentation. Niagara Falls system specific projects include:

- Drummond Road Valve Rehabilitation
- Niagara Falls Raw Water Intake Relocation
- Watermain Replacement on Stanley Avenue (Highway 420 to Ferry Street)
- Niagara Falls High Lift/Low Lift Roof Replacement

C.8.5 Project Implementation Flow Chart

The recommended design capacities within the capital program are based on the best available information at the time of analysis, including existing system demands, facility capacities, and projected growth. It is understood that this data is not static and often changes over the years between the regular updates of the Region's Master Plan. Design assumptions should be revisited before initiation of projects to reconfirm the appropriate design capacities, along with identification of any associated or dependent projects which can be combined or staged to optimize implementation efficiency and cost, and/or system operation.

To support the Region's process in implementing all recommended 2021 MSPU capital projects, the following flow chart has been developed for the water system. This flow chart document is intended to be a reference resource for the Region and should be treated as a guideline to support existing internal Region processes in project implementation as shown in **Figure 3.C.15**.

WATER PROJECT IMPLEMENTATION

The intent of this document is to support the Region in confirming the scope of work for water infrastructure projects.

CONFIRM PROJECT SCOPE

To define Terms of Reference

☐ **What triggered this project?**
- Known development growth
- Forecasted growth
- Sustainability needs

☐ **Are there related or dependent projects that should be identified for streamlining opportunities or for project phasing?**
- Are there projects that need to be completed before this project?
- Are there projects within the same alignment or project area that could be combined (e.g., growth projects, wastewater, stormwater, corridor planning, sustainability projects, etc.)
- If there are related projects, could the project timing be adjusted to combine or stage projects more efficiently?

☐ **What is the project EA Schedule and status?**

☐ **Are there historic or ongoing operational issues in the project area?**
- Confirm with Regional and LAM operations and maintenance groups
- i.e. historic watermain breaks, water quality or pressure complaints, work order history, etc.

☐ **Are there any data gaps that should be incorporated into the Terms of Reference?**
- Refer to the Required Data section below for details
- How much does the project timeline and budget need to change to allow for the data collection?

☐ **Have the planning projections been updated to the best available information?**
- Consultation with Region and LAM planning groups to confirm planning projection
- Are projected needs for the project in place? Is actual growth in line with projected growth?)

☐ **Should the project be deferred until identified related works are completed?**

REQUIRED DATA

To support terms of reference and detailed design

☐ **Recently completed EA or servicing study**

(for growth triggered projects)

☐ **Historic demand records**
- Within the last 3 years
- Ideally one full year of SCADA records including facility demands, flow, and pressure records

☐ **Existing system hydrant testing or system pressure data to identify/verify existing system issues**

☐ **Asset inventory and condition assessment**
- All asset classes within the infrastructure type (watermain, storage, pumping, or treatment facility)
- Within the last 5 years
- Can be part of project scope if the data is not available and would not significantly alter project scope

☐ **Service area growth potential to confirm projected population and demands**
- Consultation with Region and LAM planning groups within the past year
- Growth information for 30-year horizon and beyond (maximum service area)
  - Population, jobs, land use, area
  - Current inventory of development areas with associated development status

IF THE REQUIRED DATA IS NOT AVAILABLE AND IF IT HAS THE POTENTIAL TO SIGNIFICANTLY ALTER SCOPE OF THE DESIGN, IT IS STRONGLY RECOMMENDED THAT THE APPROPRIATE DATA COLLECTION AND FIELD INVESTIGATION BE COMPLETED PRIOR TO PROCEEDING WITH DESIGN. ALTERNATIVELY, WHERE FEASIBLE, DATA COLLECTION SHOULD BE INCLUDED IN THE PROJECT SCOPE AND INTEGRATED INTO THE DESIGN PROCESS.

FLOW PROJECTIONS

To determine infrastructure capacity needs

EXISTING FLOWS

Average Day Demand (ADD)
- Historic SCADA to determine starting point average demand

Maximum Day Demand (MDD)
- Use peaking factors determined through MSPU to peak ADD
- There is a different peaking factor for each WTP system based on historic SCADA data

Peak Hour Demand (PHD)
- Diurnal curve based on historic data

Fire Flow (FF)
- MECP population-based

FUTURE FLOW PROJECTIONS

Existing Demand
- Scenarios depending on infrastructure type and design scenario (see next page

\+

Growth Population Demand Contributions
- Residential, 240 L/c/d
- Employment, 270 L/e/d

The design criteria presented in this document are based on the 2021 Master Servicing Plan Update Study

STORAGE AND PUMPING FACILITY CONSIDERATIONS

☐ **What is the complete service area of the facility?**
- Some facilities support multiple pressure zones
- Some pressure zones are supported by multiple facilities

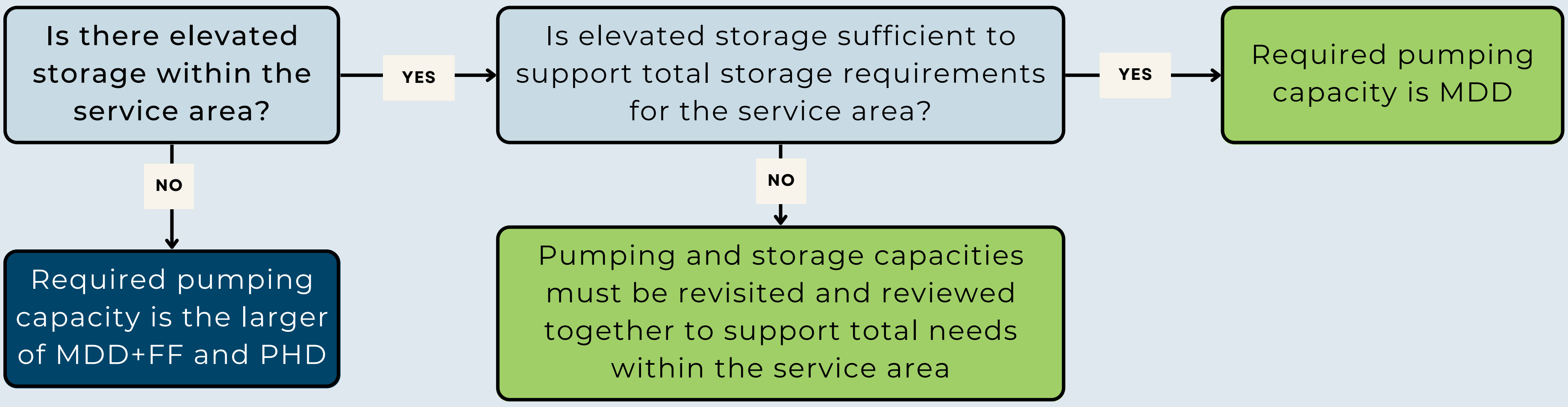
☐ **If there are storage deficits, can they be supplemented through flow transfers?**
- Is it hydraulically and operationally feasible?

☐ **Have storage and pumping facilites been reviewed in conjunction with one another?**
- Required pumping capacity varies based on available storage

☐ **What is the optimal HGL target for pumping and elevated storage facilities?**
- Region strives to maximize areas within 50 - 80 psi for Regional watermains and minimum residual pressure of 30 psi at MECP population-based fire flow target

PUMPING STATION SIZING

To define design flow scenario (MDD, MDD+FF, PHD)


Is there elevated storage within the service area?

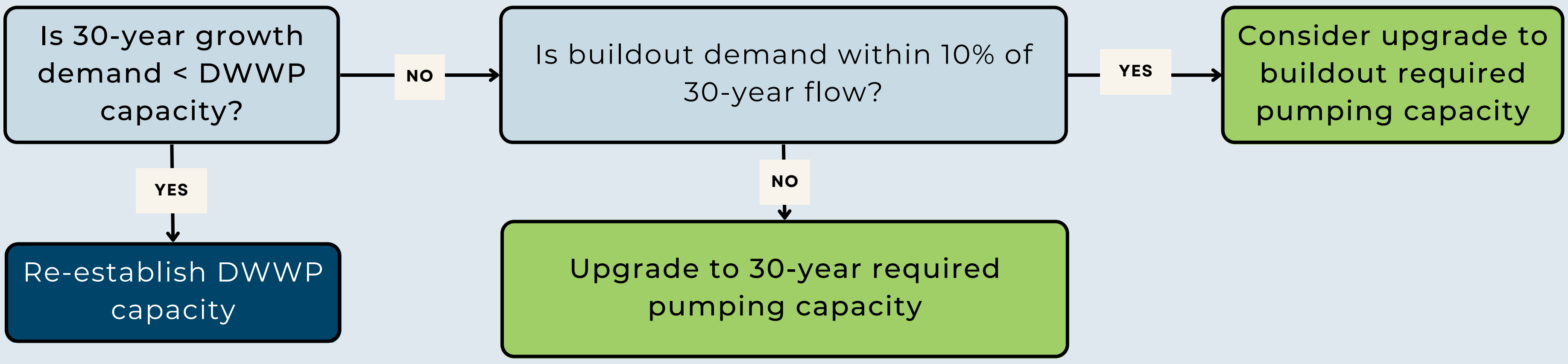
YES → Is elevated storage sufficient to support total storage requirements for the service area?

YES → Required pumping capacity is MDD

NO → Pumping and storage capacities must be revisited and reviewed together to support total needs within the service area

NO → Required pumping capacity is the larger of MDD+FF and PHD

To define design flow growth horizon (re-establish DWWP capacity, 30-year growth, buildout)


Is 30-year growth demand < DWWP capacity?

YES → Re-establish DWWP capacity

NO → Is buildout demand within 10% of 30-year flow?

YES → Consider upgrade to buildout required pumping capacity

NO → Upgrade to 30-year required pumping capacity

STORAGE SIZING

What are the system storage needs?
- System storage targets are based on MECP methodology, consistent with the 2021 Region MSPU
- Incorporate contact time storage needs at Water Treatment Plant Reservoirs
- Confirm fire flow storage strategy
- Review pumping capacity and impact on storage strategy

What timeline is considered for storage sizing?
- Is the storage sized at a minimum to support 30-year growth needs?
- What is the required storage sizing to support buildout needs?
- Is there a strategy to meet buildout needs?
- Is there opportunity for phased expansion?
- Is there a need for an alternative storage location?

TRUNK WATERMAIN SIZING

- Regional transmission mains should be sized to meet PHD and MDD+FF of maximum future service area (buildout) with a target velocity less than 1.5 m/s

C.8.6 Detailed Project Costing Sheets

The detailed project costing sheets for the recommended 2021 MSPU capital projects within the Niagara Falls system are presented below.

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-D-004**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**Decommissioning of Lundy's Lane ET**	**VERSION:**	
PROJECT DESCRIPTION:	Lundy's Lane ET to be decommissioned and replaced by new South Niagara Falls ET	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 3	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	20%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Decommissioning						$500,000	2016 lump sum inflated
Additional Construction Costs	10%		ea.			$50,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$55,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$605,000**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 90,800	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$90,800**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$74,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$74,000**	
Non-Refundable HST	1.76%					$13,500	
Non-Refundable HST Sub-Total						**$13,500**	
Total (2022 Dollars)						**$823,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$823,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$16,460		
Design	Design fees, Region fees for design, contract admin	13%	$106,990		
Construction	Region fees, base costs and project contingency	85%	$699,550		
TOTAL			**$823,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-007**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New trunk main from PRV to Port Robinson Chlorine BPS in Niagara Falls**	**VERSION:**	
PROJECT DESCRIPTION:	New trunk main from PRV to Port Robinson Chlorine BPS in Niagara Falls	**DATE UPDATED:**	
		UPDATED BY:	

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

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	450 mm	
TOTAL LENGTH:	1220 m	
Tunnelled		0%
Open Cut	1220 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	1220 m	$1,071	$1,306,692	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	0%					$0	
Minor Creek Crossings			ea.	1	$206,000	$206,000	
Major Creek Crossings			ea.	0	$1,025,000	$0	
Road Crossings			ea.	0	$458,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,025,000	$0	
Utility Crossings			ea.	0	$458,000	$0	
Valve and Chamber			ea.	4	$40,000	$160,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$26,134	
Additional Construction Costs	10%		ea.			$169,883	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$186,871	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$2,900,000**	**Override construction cost based on Region info**
Geotechnical / Hydrogeological / Materials	1.0%					$29,000	
Geotechnical Sub-Total Cost						**$29,000**	
Property Requirements	1.0%					$ 29,000	
Property Requirements Sub-Total						**$29,000**	
Consultant Engineering/Design	15%					$ 435,000	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$435,000**	
In House Labour/Engineering/Wages/CA	4%					$ 116,000	
In-house Labour/Wages Sub-Total						**$116,000**	
Project Contingency	10%					$351,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$351,000**	
Non-Refundable HST	1.76%					$65,900	
Non-Refundable HST Sub-Total						**$65,900**	
Total (2022 Dollars)						**$3,926,000**	Rounded to nearest $1,000
Other Estimate						**$4,040,000**	Received from Region (MSPU Status of Projects, Jan 28, 2022)
Chosen Estimate						**$4,040,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$80,800		
Design	Design fees, Region fees for design, contract admin	13%	$525,200		
Construction	Region fees, base costs and project contingency	85%	$3,434,000		
TOTAL			**$4,040,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-M-009

PROJECT NAME: New Niagara Falls South trunk main to New Elevated Tank

PROJECT DESCRIPTION: New Niagara Falls South trunk main to provide additional supply to new growth areas. Placeholder project - subject to change based on preferred elevated tank location which is to be confirmed through the corresponding elevated tank EA

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨ = Field has drop down
🟨 = Field must be manually populated
🟩 = Field auto-filled based on project details

PROPOSED DIAMETER:	750 mm	
TOTAL LENGTH:	1360 m	
Tunnelled		0%
Open Cut	1360 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	1360 m	$1,730	$2,352,862	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	20%					$470,572	
Minor Creek Crossings			ea.	0	$296,000	$0	
Major Creek Crossings			ea.	0	$1,115,000	$0	
Road Crossings			ea.	0	$548,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,115,000	$0	
Utility Crossings			ea.	0	$548,000	$0	
Valve and Chamber			ea.	2	$85,000	$170,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$47,057	
Additional Construction Costs	15%		ea.			$456,074	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$349,657	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$3,846,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$38,500	
Geotechnical Sub-Total Cost						**$38,500**	
Property Requirements	1.5%					$ 57,700	
Property Requirements Sub-Total						**$57,700**	
Consultant Engineering/Design	15%					$ 576,900	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$576,900**	
In House Labour/Engineering/Wages/CA	4.0%					$ 153,840	
In-house Labour/Wages Sub-Total						**$153,840**	
Project Contingency	15%					$701,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$701,000**	
Non-Refundable HST	1.76%					$91,900	
Non-Refundable HST Sub-Total						**$91,900**	
Total (2022 Dollars)						**$5,466,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$5,466,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$109,320		
Design	Design fees, Region fees for design, contract admin	13%	$710,580		
Construction	Region fees, base costs and project contingency	85%	$4,646,100		
TOTAL			**$5,466,000**		

PROJECT NO.:	**W-M-019**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New Niagara Falls South trunk main from Dorchester Road to Lyon's Creek Road**	**VERSION:**	
PROJECT DESCRIPTION:	New Niagara Falls South trunk main to provide additional supply to new growth areas (W-M-009, W-M-019, W-M-020, W-M-021 form the loop). Preliminary alignment along Dorchester Road, across the Welland River, through South NF WWTP property, and Dell Road. Preferred	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	600 mm	
TOTAL LENGTH:	3050 m	
Tunnelled	1525 m	50%
Open Cut	1525 m	50%

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	1525 m	$1,439	$2,194,129	
Pipe Construction - Tunneling			m	1525 m	$6,300	$9,607,500	Consider alignment through South NF WWTP property, tunneling across the Wellland River and additional needs due to soil conditions (context from South NF WWTP project). 50% tunnelled assumption.
Pipe Construction Uplift (Based on Area Conditions)	20%					$438,826	
Minor Creek Crossings			ea.	0	$236,000	$0	
Major Creek Crossings			ea.	1	$1,055,000	$1,055,000	Welland River
Road Crossings			ea.	0	$488,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,055,000	$0	
Utility Crossings			ea.	1	$488,000	$488,000	Rail
Valve and Chamber			ea.	6	$55,000	$330,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$236,033	
Additional Construction Costs	15%		ea.			$2,152,423	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,650,191	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$18,152,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$181,500	
Geotechnical Sub-Total Cost						**$181,500**	
Property Requirements	1.5%					$ 272,300	
Property Requirements Sub-Total						**$272,300**	
Consultant Engineering/Design	12%					$ 2,178,200	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$2,178,200**	
In House Labour/Engineering/Wages/CA	3.0%					$ 544,560	
In-house Labour/Wages Sub-Total						**$544,560**	
Project Contingency	15%					$3,199,000	Construction Contingency is dependant on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$3,199,000**	
Non-Refundable HST	1.76%					$422,100	
Non-Refundable HST Sub-Total						**$422,100**	
Total (2022 Dollars)						**$24,950,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$24,950,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$499,000		
Design	Design fees, Region fees for design, contract admin	13%	$3,243,500		
Construction	Region fees, base costs and project contingency	85%	$21,207,500		
TOTAL			**$24,950,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-020**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New Niagara Falls South trunk main along Lyon's Creek Road**	**VERSION:**	
PROJECT DESCRIPTION:	New Niagara Falls South trunk main to provide additional supply to new growth areas (W-M-009, W-M-019, W-M-020, W-M-021 form the loop). Preliminary alignment along Lyon's Creek Road from Dell Road to Stanley Avenue. Preferred alignment to be determined through EA	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	600 mm	
TOTAL LENGTH:	2150 m	
Tunnelled	0 m	0%
Open Cut	2150 m	100%

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	2150 m	$1,439	$3,093,362	
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	20%					$618,672	
Minor Creek Crossings			ea.	0	$236,000	$0	
Major Creek Crossings			ea.	0	$1,055,000	$0	
Road Crossings			ea.	0	$488,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,055,000	$0	
Utility Crossings			ea.	0	$488,000	$0	
Valve and Chamber			ea.	2	$55,000	$110,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$61,867	
Additional Construction Costs	15%		ea.			$582,585	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$446,649	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$4,913,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$49,100	
Geotechnical Sub-Total Cost						**$49,100**	
Property Requirements	1.5%					$ 73,700	
Property Requirements Sub-Total						**$73,700**	
Consultant Engineering/Design	15%					$ 737,000	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$737,000**	
In House Labour/Engineering/Wages/CA	4.0%					$ 196,520	
In-house Labour/Wages Sub-Total						**$196,520**	
Project Contingency	15%					$895,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$895,000**	
Non-Refundable HST	1.76%					$117,400	
Non-Refundable HST Sub-Total						**$117,400**	
Total (2022 Dollars)						**$6,982,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$6,982,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$139,640		
Design	Design fees, Region fees for design, contract admin	13%	$907,660		
Construction	Region fees, base costs and project contingency	85%	$5,934,700		
TOTAL			**$6,982,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-M-021

PROJECT NAME: New Niagara Falls South trunk main along Stanley Avenue

PROJECT DESCRIPTION: New Niagara Falls South trunk main to provide additional supply to new growth areas (W-M-009, W-M-019, W-M-020, W-M-021 form the loop). Preliminary alignment along Stanley Avenue from Lyon's Creek Road to exstiing Region 1050 mm watermain approximately 700 m

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	600 mm	
TOTAL LENGTH:	2520 m	
Tunnelled	756 m	30%
Open Cut	1764 m	70%

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	1764 m	$1,439	$2,537,996	
Pipe Construction - Tunneling			m	756 m	$6,300	$4,762,800	30% tunnelled assumption
Pipe Construction Uplift (Based on Area Conditions)	20%					$507,599	
Minor Creek Crossings			ea.	0	$236,000	$0	
Major Creek Crossings			ea.	1	$1,055,000	$1,055,000	Welland River Crossing
Road Crossings			ea.	0	$488,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,055,000	$0	
Utility Crossings			ea.	0	$488,000	$0	
Valve and Chamber			ea.	4	$55,000	$220,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$146,016	
Additional Construction Costs	15%		ea.			$1,384,412	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,061,382	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$11,675,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$116,800	
Geotechnical Sub-Total Cost						**$116,800**	
Property Requirements	1.5%					$ 175,100	
Property Requirements Sub-Total						**$175,100**	
Consultant Engineering/Design	12%					$ 1,401,000	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,401,000**	
In House Labour/Engineering/Wages/CA	3.0%					$ 350,250	
In-house Labour/Wages Sub-Total						**$350,250**	
Project Contingency	15%					$2,058,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$2,058,000**	
Non-Refundable HST	1.76%					$271,500	
Non-Refundable HST Sub-Total						**$271,500**	
Total (2022 Dollars)						**$16,048,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$16,048,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$320,960		
Design	Design fees, Region fees for design, contract admin	13%	$2,086,240		
Construction	Region fees, base costs and project contingency	85%	$13,640,800		
TOTAL			**$16,048,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-S-004**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New South Niagara Falls ET**	**VERSION:**	
PROJECT DESCRIPTION:	New South Niagara Falls ET to replace the Lundy's Lane ET and provide additional storage. Final preferred location to be determined through the EA process. Preliminary location shown on map. Assuming property acquisition is required (5% for new site).	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	12 ML

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	12 ML	$1,300,000	$15,600,000	Site to be confirmed
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$2,340,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,794,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$19,734,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$197,300	
Geotechnical Sub-Total Cost						**$197,300**	
Property Requirements	5.0%					$ 986,700	5% for new facility
Property Requirements Sub-Total						**$986,700**	
Consultant Engineering/Design	12%					$ 2,368,100	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$2,368,100**	
In House Labour/Engineering/Wages/CA	3.0%					$ 592,020	
In-house Labour/Wages Sub-Total						**$592,020**	
Project Contingency	15%					$3,582,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$3,582,000**	
Non-Refundable HST	1.76%					$472,900	
Non-Refundable HST Sub-Total						**$472,900**	
Total (2022 Dollars)						**$27,933,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$27,933,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$558,660		
Design	Design fees, Region fees for design, contract admin	13%	$3,631,290		
Construction	Region fees, base costs and project contingency	85%	$23,743,050		
TOTAL			**$27,933,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-S-014**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**In-ground Reservoir Expansion at Niagara Falls WTP**	**VERSION:**	
PROJECT DESCRIPTION:	In-ground Reservoir Expansion at Niagara Falls WTP to support post-2051 growth and CT volume requirements. Also provides flexibility to support potential employment development in the QEW corridor. Assuming property acquisition is required (5% for new site).	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	10.0 ML

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	10.0 ML	$1,300,000	$13,000,000	
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$1,950,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,495,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$16,445,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$ 164,500	
Geotechnical Sub-Total Cost						**$164,500**	
Property Requirements	5.0%					$ 822,300	Potential need for land acquistiion
Property Requirements Sub-Total						**$822,300**	
Consultant Engineering/Design	12%					$ 1,973,400	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,973,400**	
In House Labour/Engineering/Wages/CA	3.0%					$ 493,350	
In-house Labour/Wages Sub-Total						**$493,350**	
Project Contingency	15%					$2,985,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$2,985,000**	
Non-Refundable HST	1.76%					$394,100	
Non-Refundable HST Sub-Total						**$394,100**	
Total (2022 Dollars)						**$23,278,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$23,278,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$465,560		
Design	Design fees, Region fees for design, contract admin	13%	$3,026,140		
Construction	Region fees, base costs and project contingency	85%	$19,786,300		
TOTAL			**$23,278,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: **W-ST-001**

PROJECT NAME: **Region Wide WTP Reservoir Volume Study**

PROJECT DESCRIPTION: Study to review WTP reservoir CT volume and overall system storage

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

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

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Grimsby WTP Reservoir							
Decew WTP Reservoir							
Niagara Falls WTP Reservoir							
Welland WTP Reservoir							
Port Colborne WTP Reservoir							
Rosehill (Fort Erie) WTP Reservoir							
Additional Construction Costs	10%		ea.			$0	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$0	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$0**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ -	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$0**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$4,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$4,000**	
Non-Refundable HST	1.76%					$100	
Non-Refundable HST Sub-Total						**$100**	
Total (2022 Dollars)						**$44,000**	Rounded to nearest $1,000
Other Estimate						**$100,000**	
Chosen Estimate						**$100,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$2,000		
Design	Design fees, Region fees for design, contract admin	13%	$13,000		
Construction	Region fees, base costs and project contingency	85%	$85,000		
TOTAL			**$100,000**		

D

Regional Municipality of Niagara

Part D

FORT ERIE (ROSEHILL) WATER SYSTEM

TABLE OF CONTENTS

List of Figures

List of Tables

D. Rosehill Water Treatment Plant

D.1 Existing System Overview

The Fort Erie (Rosehill) system services the Town of Fort Erie. The system services an existing population of 33,957 and 10,264 employees. Note that this population and employment total is based on the Region's 2021 allocation of Traffic Area Zones planning data and has been processed through the allocation methodology presented in **Volume 2** to refine the data to include only serviced populations. As such, the population and employment total may not directly match the system totals using the Region's unprocessed planning data.

The system is supplied by the Rosehill Water Treatment Plant, located on 300 Rosehill Road, Fort Erie. The plant is a conventional surface water treatment plant, with zebra mussel control, raw water screening, coagulation, flocculation, sedimentation, filtration, disinfection, and pH correction. Lake Erie serves as a source to the plant. The plant has a rated capacity of 50.0 MLD (579 L/s).

The system supplies local area municipalities via a watermain network, pumping stations, and storage reservoirs. The supply area has a single pressure zone. **Figure 3.D.1** and **Figure 3.D.2** present an overview of the water system and a water system schematic diagram, respectively.

Through this update of the Master Servicing Plan, the Region has highlighted the need to integrate the MSPU growth-related program with the Region's sustainability program intended to address the condition and performance of the existing infrastructure. The MSPU servicing strategies are based on the need to maintain appropriate levels of service throughout the systems and acknowledges that investment will be needed to support operations, maintenance, staff, and other resources related to maintaining the existing systems and facilities in a state of good repair and performance.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

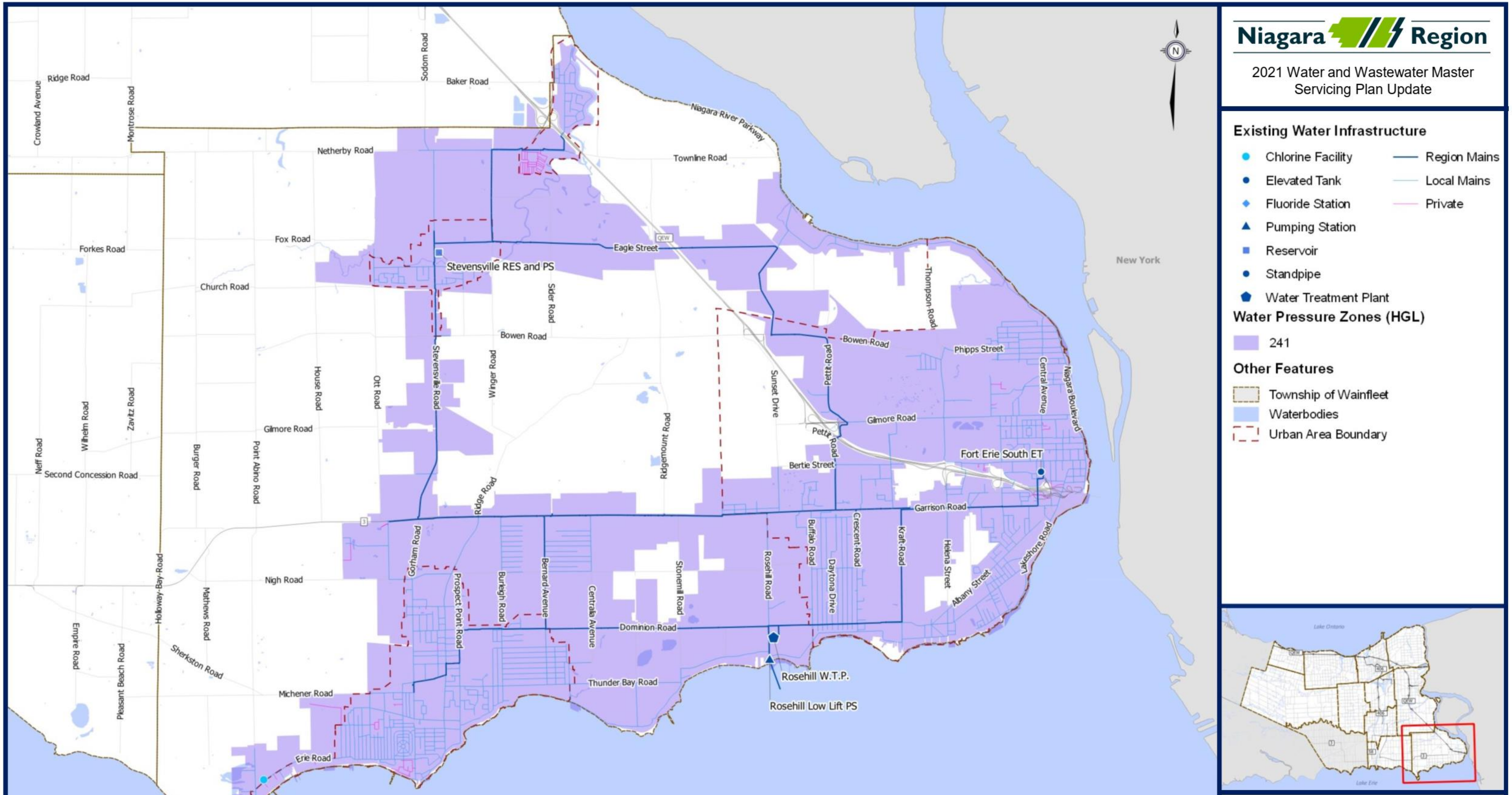


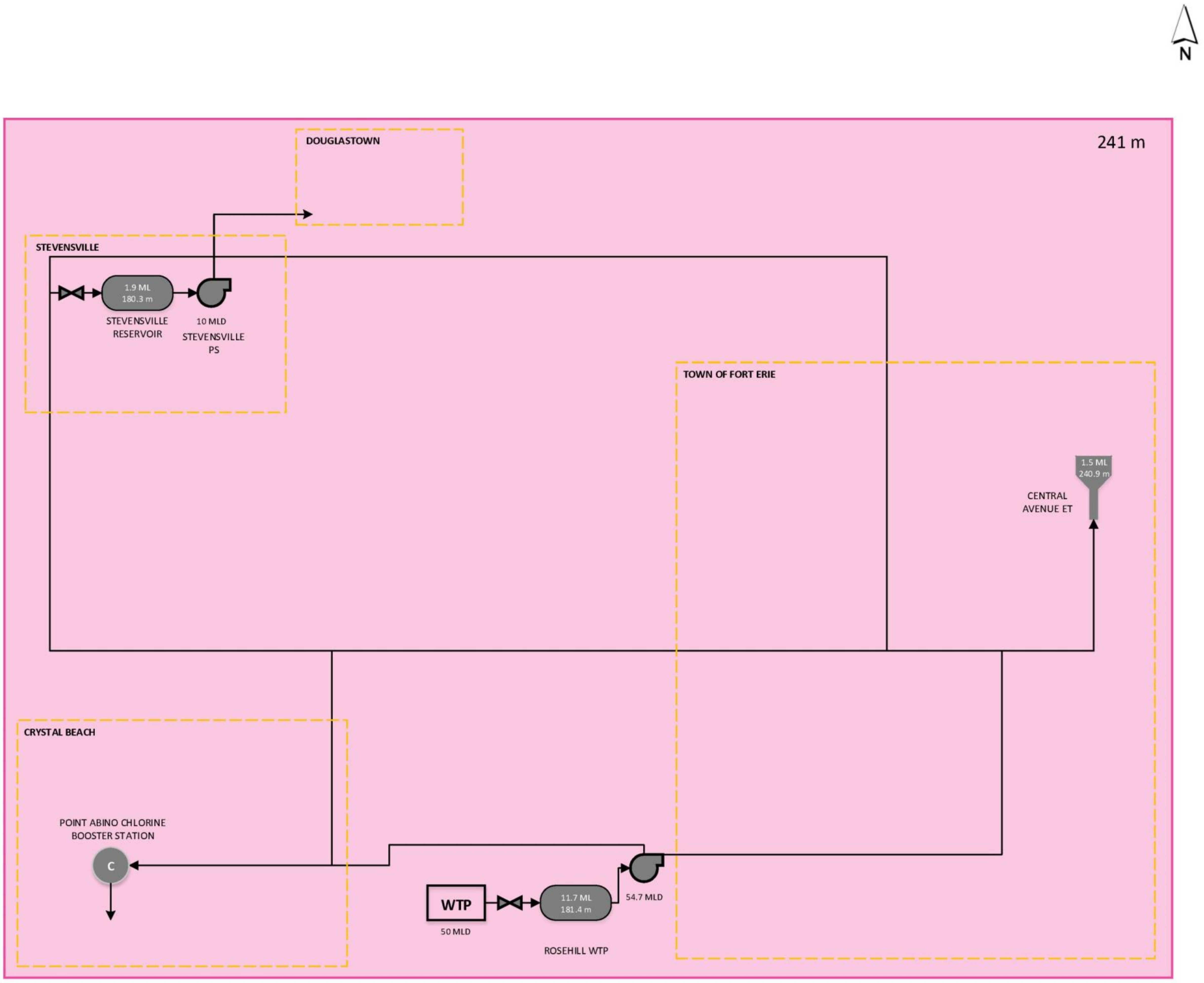
Figure 3.D.1

Fort Erie

Existing Water Infrastructure

BluePlan ENGINEERING

December 2022
621016-W-001
WKID: 26917



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

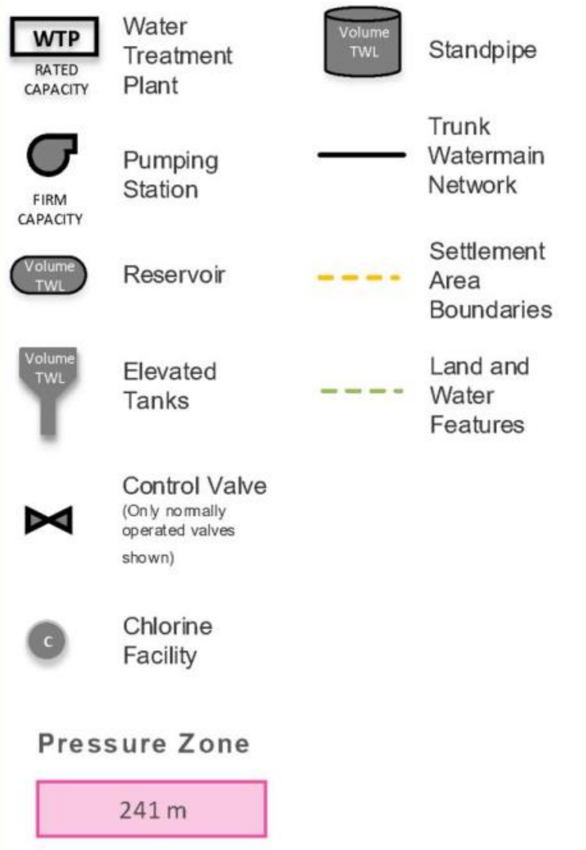


Figure 3.D.2

Fort Erie System

Existing Water Infrastructure Schematic

BluePlan ENGINEERING

December 2022
621016-W-000
WKID: 26917

D.1.1 Facility Overview

Table 3.D.1 to **Table 3.D.4** present details regarding the existing water treatment plant (WTP), pump stations, and storage facilities.

Table 3.D.1 Water Treatment Plant Overview

Plant Name	Rosehill Water Treatment Plant
Drinking Water Works Permit	Permit Number: 007-203 Issue Number: 9 Issued August 2, 2019
Address	300 Rosehill Road, Fort Erie, ON, L2A 5M4
Source Water	Lake Erie
Rated Maximum Day Demand Capacity	50.0 MLD
Key Processes	Zebra mussel control Travelling screens Coagulation Flocculation Sedimentation Filtration Disinfection pH correction

Table 3.D.2 Water Treatment Plant Water Quality Objectives

Parameters for Niagara Region Contact Time Calculation	
pH	8
Temperature (degrees C)	0.5
Required CT	49
Required Giardia Inactivation via Disinfection	0.5-log
Required Virus Inactivation via Disinfection	2-log
Minimum Free Chlorine	0.8 mg/L

* Refer to the Safe Drinking Water Act, Ontario Drinking Water Quality Standards for a comprehensive listing of water quality standards.

Table 3.D.3 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone and Facility)	Discharge (Pressure Zone)	Pressure Zones Supplied	Number of Pumps (Total/ Firm)	Installed Capacity (MLD)	Firm Capacity (MLD)	Total Dynamic Head (m)
Rosehill WTP High Lift	300 Rosehill Road, Fort Erie	WTP	241	241	4/3	82.2	54.7	70.4
Stevensville PS	2650 Stevensville Road, Fort Erie	241	241	241	4/3	15.4	10.0	43.0

Table 3.D.4 Storage Facilities Overview

Storage Facility	Location	Storage Type	Volume (ML)	Top Water Level (m)	Fire Supply Zones	Maximum Day Demand Supply Zones
Rosehill Water Treatment Plant Reservoir(1)	300 Rosehill Road, Fort Erie	Pumped Reservoir	11.7	181.4	241	241
Central Avenue Elevated Tank	115 Central Avenue, Fort Erie	Elevated Tank	1.5	240.9	241	241
Stevensville Reservoir	2650 Stevensville Road, Fort Erie	Pumped Reservoir	1.9	180.3	241	241
New Fort Erie ET(2)	1886 Pettit Street, Fort Erie	Elevated Tank	9	241	241	241

(1) Total WTP storage volume is 11.7 ML, however, due to contact time requirements from the MECP, the actual usable volume at the Rosehill WTP is calculated to be 9.4 ML under 2051 MDD and 8.9 ML under post-2051 MDD, as contact time cannot be used as system storage based on the MECP's CT requirement. Refer to **Section D.2.2** and **Volume 3 - Introduction** for additional information.

D.2 Basis for Analysis

D.2.1 Flow Criteria, Performance, and Sizing Methodology

The Niagara Region Traffic Area Zone planning data was used to estimate growth related demands within the water system and to spatially allocate growth demands within each individual system. **Table 3.D.5** presents a summary of the flow criteria, performance, and sizing methodology that was utilized. Refer to **Volume 3 – Introduction** for additional information.

The Region's per capita water demand criteria was updated based on a historic review of the previous 3-year period local billing meter records. Given that more granular data was available to complete this analysis compared to previous master plan updates, the population and employment per capita rates were differentiated, and both were reduced compared to the Region's previous per capita rate to more closely reflect existing usage trends. Further detail regarding the per capita water demands is presented in **Volume 3 – Introduction.**

In some systems, the NRW was found to be extremely high (i.e., greater than 25%). The expected NRW due to unbilled account for water is 10 to 20%. It was recommended that the local municipalities and the Region work to decrease NRW as much as possible in the long-term. Through this 2021 MSPU, a new policy has been proposed for municipalities where existing NRW is greater than 25% to attempt to decrease the future NRW to a maximum of 25%, using local area municipality programs and initiatives. The existing non-revenue water rate within the Fort Erie System is 35%. When projecting future 2051 and buildout flows, the existing 2021 starting point NRW was reduced to 25% of existing billed demands. Further detail regarding the non-revenue water analysis is presented in **Volume 3 – Introduction.**

Table 3.D.5 Flow Criteria, Performance and Sizing Methodology

Description			Criteria
Flow Criteria	Water Demand	Residential	240 L/c/d
		Employment	270 L/e/d
	Peaking Factor	Maximum Day	Based on historic average of maximum day peaking factors from 2016 – 2020
		Peak Hour Factor	Based on system mass balance using hourly SCADA data from 2018 – 2020
	Existing System Demands		Starting Point Methodology • Based on local billing meter records and production records to establish existing system demands • Growth demands are added to the existing system baseline using design criteria
System Performance Criteria	System Pressures		Acceptable pressure range of 40 – 100 psi • Regional objective of maximizing areas within the preferred range of 50 – 80 psi on Regional watermains
	Fire Flow		250 L/s on Regional watermains at residual pressure of 30 psi
	Velocity	Average Day	Flag areas less than 0.6 m/s minimum velocity
		MDD+FF or PHD	Flag areas greater than 1.5 m/s Trigger upgrades greater than 2 m/s
Sizing and Triggers	Plant and Facility Upgrade Triggers		• 80% trigger for plant and facility planning process (time-based trigger on a case-by-base basis) • Complete plant and facility expansions before 90% capacity is reached
	Treatment Plant Sizing		Maximum day demand
	Pumping Station Sizing		Various potential demand scenarios: • Maximum day demand (MDD) • MDD + fire flow (250 L/s or MECP) • Peak Hour Demand (PHD) Appropriate design sizing scenario depends on the configuration of the service area for the pumping station. Refer to **Volume 3 - Introduction** for further discussion.
	Watermain Sizing		Regional transmission main system for PHD and MDD + fire flow demands
	Storage Sizing		MECP methodology (A + B + C) • Refer to **Section D.2.2** for discussion regarding contact time (CT) volume requirement at WTP reservoirs

D.2.2 Water Treatment Plant Reservoir Contact Time Volume Requirement

Due to the contact time requirements from the MECP, the actual usable volume at the Rosehill WTP reservoir is calculated to be less than the full volume of 11.7 ML, as contact time volume cannot be used as system storage based on the MECP's CT requirement. System storage capacity is presented and discussed in **Section D.3.4**.

A conservative assumption has been made for the usable volume at all water treatment plant reservoirs. The methodology for determining required CT is outlined in the MECP's Procedure for Disinfection of Drinking Water in Ontario. Detailed methodology and sample calculations for determining the required CT volume is presented in **Volume 3 – Introduction.**

Further, it should be noted that the Region applies a safety factor of 1.2 to all CT volume calculations as an additional buffer. However, it was determined that this safety factor would be removed for the purposes of storage sizing for the Region's 2021 MSPU, as all other parameters utilized within the CT calculation provide an inherent level of conservatism (i.e., temperature of 0.5 deg C and pH of 8).

D.2.3 Growth Population Projections and Allocations

Table 3.D.6 outlines the existing and projected serviced population and employment by pressure zone.

Table 3.D.6 Rosehill Water Treatment Plant Existing and Projected Serviced Population and Employment by Pressure Zone

Pressure Zone	2021 Population & Employment			2051 Population & Employment			Post 2051 Population & Employment			2021-2051 Growth		
	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Population & Employment
241	33,957	10,264	44,222	48,106	17,570	65,676	61,814	20,253	82,067	14,149	7,305	21,454
Total	**33,957**	**10,264**	**44,222**	**48,106**	**17,570**	**65,676**	**61,814**	**20,253**	**82,067**	**14,149**	**7,305**	**21,454**

Note: Population numbers may not sum due to rounding.

D.3 Existing System Performance

D.3.1 Starting Point Demands and Performance

The starting point demand and maximum day peaking factor for the Rosehill WTP was calculated using historic SCADA production data. Ten years of data (2011 to 2020) was reviewed to provide historical context and assess overall long-term trends; however, the most recent five years of data was used to determine the maximum day demand peaking factor. **Table 3.D.7** presents the historic water demand and water system maximum day peaking analysis. Based on the historic analysis, the Rosehill WTP system has an existing average demand of 12.1 MLD and system peaking factor of 1.55.

Table 3.D.7 Historic Water Demand

Year	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Maximum Day Demand Peaking Factor
2011	12.8	22.3	1.75
2012	12.8	22.2	1.73
2013	11.9	17.9	1.51
2014	12.6	17.6	1.40
2015	11.8	15.6	1.32
5-Year Average	**12.4**	**19.1**	**1.5**
5-Year Peak	**12.8**	**22.3**	**1.7**
2016	13.2	20.8	1.58
2017	12.4	18.0	1.45
2018	12.9	19.9	1.54
2019	11.2	16.2	1.45
2020	11.0	19.0	1.73
5-Year Average	**12.1**	**18.8**	**1.55**
5-Year Peak	**13.2**	**20.8**	**1.73**
10-Year Average	**12.2**	**18.9**	**1.55**
10-Year Peak	**13.2**	**22.3**	**1.75**
MECP Peaking Factor (Existing)	**1.80**		
MECP Peaking Factor (2051)	**1.75**		

Local billing meter records were provided by the local area municipalities for the years of 2018 – 2020. Using this more granular data, along with Region billing meter data, system non-revenue water was calculated for each municipality, as well as system demands for each pressure zone. To estimate future system demands, the projected residential and employment growth populations were then converted to expected flows using the criteria presented in **Table 3.D.5**. Existing and future water system demands by pressure zone are presented in **Table 3.D.8.**

Table 3.D.8 Existing and Future Water System Demands by Pressure Zone

Pressure Zone	2021 Demand		2021 to 2051 Growth Demand		2051 Demand (Existing + Growth)		2051 Demand With NRW Reduction (Existing + Growth) (1)		Post 2051 Demand (Existing + Growth)		Post 2051 Demand With NRW Reduction (Existing + Growth) (1)	
	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)
241	12.6	17.3	5.4	8.3	18.0	25.6	16.8	24.4	22.0	31.9	20.8	30.6
Total	**12.6**	**17.3**	**5.4**	**8.3**	**18.0**	**25.6**	**16.8**	**24.4**	**22.0**	**31.9**	**20.8**	**30.6**

(1) Non-revenue water (NRW) adjustments were made within systems where existing NRW was higher than 25%. Assumption was made that the starting point NRW would be reduced to less than 25% for those systems when analysing 2051 and post-2051 scenarios.

D.3.2 Treatment Plant Capacity

Figure 3.D.3 shows the projected future demands at the Rosehill Water Treatment Plant. The plant has surplus capacity to support growth and will not reach 80% capacity within the 2051 time horizon.

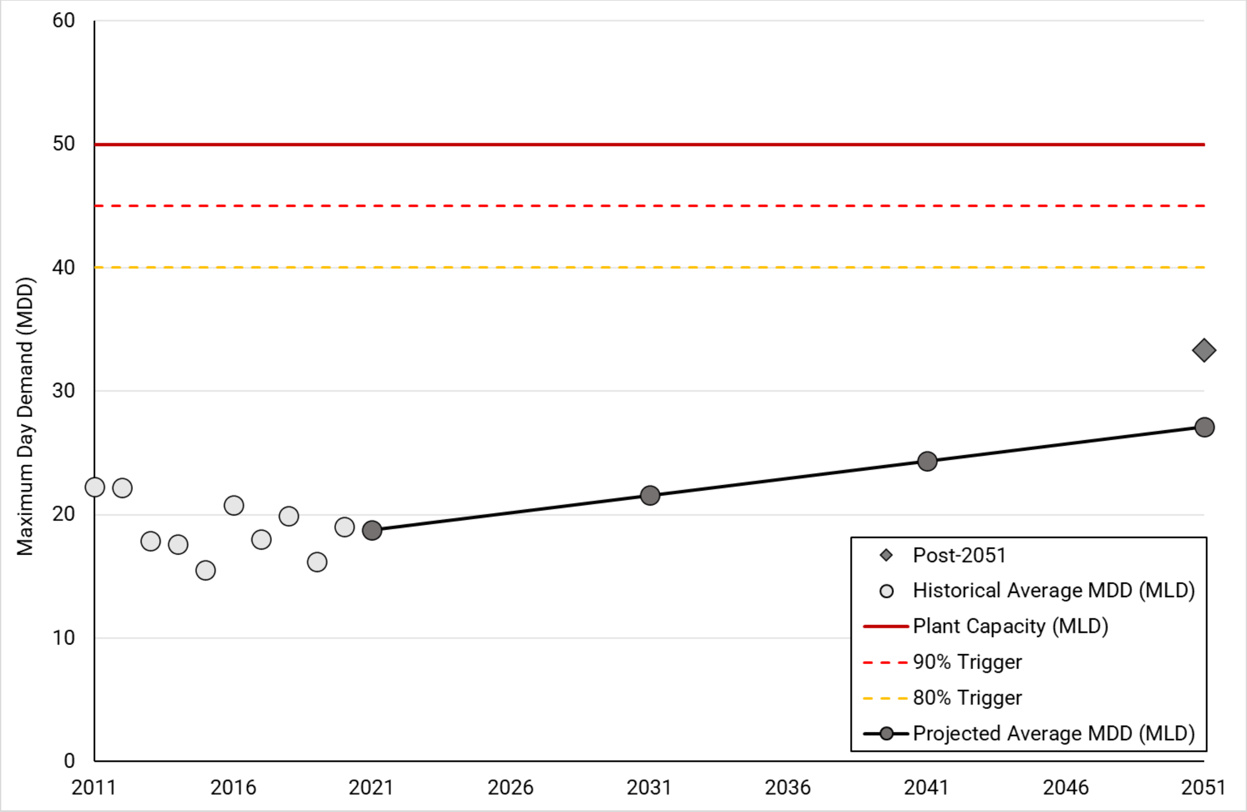


Figure 3.D.3 Projected Maximum Day Demand at Rosehill Water Treatment Plant

D.3.3 Pumping Capacity

Table 3.D.9 highlights the pumping station existing and projected capacity. As presented in **Section D.2.1**, there are various potential demand scenarios for pumping station capacity sizing depending on system configuration and available storage type and volume. As such, the design condition has been specified in the table below (i.e., maximum day demand, peak hour demand, or maximum day demand + fire flow), along with the 2021, 2051, and post-2051 design flows which correspond to the design condition for each respective pump station.

Pumping capacity within the Rosehill WTP system is sufficient to support existing and future demands.

Table 3.D.9 System Pumping Station Performance

Pump Station	Firm Capacity (MLD)	Pressure Zones Supplied	Total Effective Capacity (MLD)	Design Condition	2021 Maximum Day Demand (MLD)	2021 Design Flow (MLD)	2021 Surplus/ Deficit (MLD)	2051 Maximum Day Demand (MLD)	2051 Design Flow (MLD)	2051 Surplus/ Deficit (MLD)	Post 2051 Maximum Day Demand (MLD)	Post 2051 Design Flow (MLD)	Post 2051 Surplus/ Deficit (MLD)
Rosehill WTP/ High Lift PS	54.7	241	54.7	Peak Hour Demand	17.3	26.0	28.7	24.4	36.6	18.1	30.6	46.0	8.7
Stevensville PS(1)	10.0	241											

(1) Stevensville pumping capacity not included in total effective capacity

D.3.4 Storage Capacity

Using the MECP methodology for CT volume calculations and the corresponding MDD for each planning horizon, the required CT volume at the Rosehill WTP reservoir is 2.1 ML under 2051 MDD, and 2.6 ML under post-2051 MDD. As such, the remaining usable volume for system storage utilization at the Rosehill WTP reservoir is 9.6 ML under 2051 MDD, and 9.1 ML under post-2051 MDD. As a conservative assumption the 2051 MDD volume was utilized for the existing system capacity utilization table. **Table 3.D.10** presents the available system storage at the Rosehill WTP under various demand scenarios.

Table 3.D.10 Available System Storage at the Rosehill WTP under 2051 MDD, Post-2051 MDD, and at MDWL Capacity

Rosehill WTP	2051 MDD	Post-2051 MDD	At MDWL Capacity
Minimum Reservoir Out/Treated Free Chlorine (mg/L)	0.8	0.8	0.8
Maximum Ph	8	8	8
Minimum Temperature (deg. C)	0.5	0.5	0.5
Reservoir Volume (ML)	12	12	12
Reservoir Baffle Factor	0.5	0.5	0.5
MDD (ML/D)	24.4	30.6	50.0
$CT_{required}$	49	49	49
Safety Factor	1	1	1
CT_{actual}	49	49	49
T_{10}	61.3	61.3	61.3
Reservoir Retention Time (min)	122.5	122.5	122.5
Min Volume Needed (ML)	2.1	2.6	4.3
Minimum Reservoir Level (%)	0.2	0.2	0.4
Storage Volume Available (ML)	**9.6**	**9.1**	**7.4**

Table 3.D.11 highlights the storage existing and projected capacity.

The Region has recently completed the Fort Erie ET Environmental Assessment that recommended the existing Central Avenue ET and Stevensville Reservoir be replaced with a new 8 ML ET; this recommendation has been incorporated into the storage analysis.

Table 3.D.11 System Storage Capacities

Storage	Fire Supply Zones	MDD Supply Zones	2021 Rated Capacity (ML)	2051 Rated Capacity (ML)	Post 2051 Rated Capacity (ML)	2021 Total Available Storage (ML)	Existing Required Storage	Existing Surplus/ Deficit (ML)	2051 Total Available Storage (ML)	2051 Required Storage (ML)	2051 Surplus/ Deficit (ML)	Post 2051 Total Available Storage (ML)	Post 2051 Required Storage (ML)	Post 2051 Surplus/ Deficit (ML)
Rosehill WTP Reservoir(1)	241 Pumped	241	9.59(4)	9.59	9.06	13.0	15.6	-2.6	17.6	17.8	-0.2	17.1	19.8	-2.7
Central Avenue Elevated Tank(2)	241 Floating	241	1.48	N/A	N/A									
Stevensville Reservoir(2)	241 Pumped	241	1.9	N/A	N/A									
New Fort Erie ET(3)	241 Floating	241	N/A	8.0	8.0									

(1)Refer to **Section D.2.2** for discussion on contact time volume requirements at the WTP reservoir

(2)To be decommissioned before 2051, volume not included in 2051 or Post-2051 available storage

(3)To be commissioned after 2021, volume not included in 2021 available storage

(4)2051 MDD volume was utilized for the existing system capacity utilization table (conservative assumption)

There is an existing storage deficit within the Rosehill WTP system which will be addressed by construction of the new 9 ML Fort Erie ET. This new larger elevated tank will support existing and future storage needs for the entire Fort Erie system, allowing for the Central Avenue ET and Stevensville Reservoir and Pumping Station to be decommissioned.

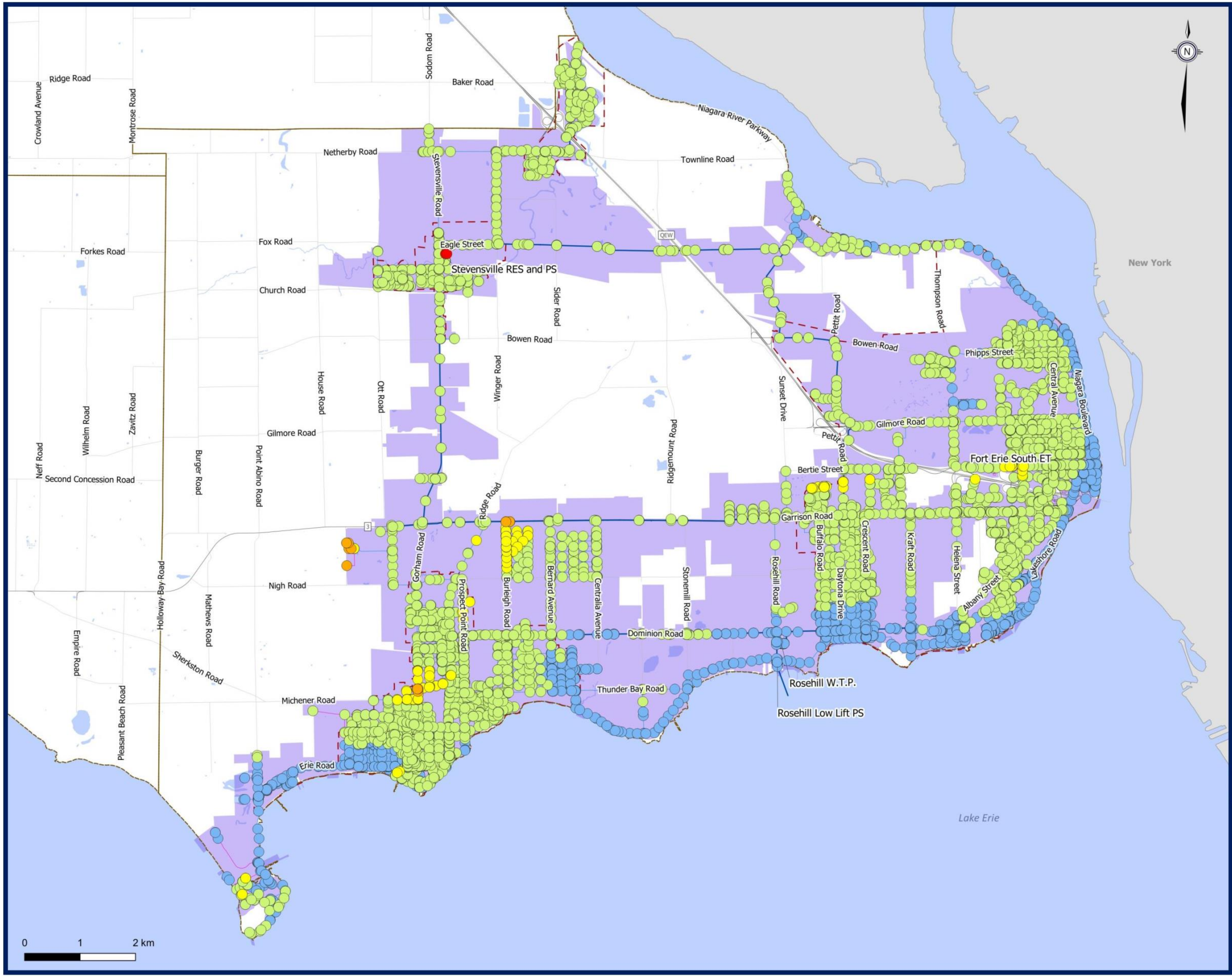
D.3.5 System Pressures and Fire Flows

Figure 3.D.4 to **Figure 3.D.5** present the existing system performance, based on existing system configuration and capacities.

In general, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. Most pressures in Fort Erie fall between 60 and 80 psi, with higher pressures along the Lake ranging from 80 to 90 psi.

The Region's target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for most critical system areas. The fire flow target is not met at the following locations:

- The west end of the Regional watermain in Crystal Beach urban area or the north end of the Regional watermain in the Douglastown urban area.
  - There are no existing Regional watermain loops at these locations to maintain the higher fire flow.
  - These are not critical areas in terms of fire flow requirements for the Regional watermain as the existing land use is primarily residential which has a lower fire flow need compared to institutional, commercial, or industrial land uses.
- The Regional watermains on Garrison Road west of Bernard Avenue, and on Stevensville Road south of Bowen Road.
  - This is due to the smaller watermain size (300 mm), the distance from elevated storage and the WTP, and the smaller pumping capacity available at the Stevensville Reservoir and Pumping Station.
  - This is also not a critical area in terms of fire flow requirements for the Regional watermain as it is outside of the urban area boundary, the existing land use is of much lower density and is predominately agricultural and residential.



2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

- ■ 241

Other Features

- ▭ Municipal Boundary
- ■ Waterbodies
- ▭ Urban Area Boundary

Minimum Pressures (psi)

- 🔴 < 40
- 🟠 40 - 50
- 🟡 50 - 60
- 🟢 60 - 80
- 🔵 80 - 90

Figure 3.D.4

Fort Erie

Existing System Peak Hour Pressures

December 2022
621016-W-004
WKID: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

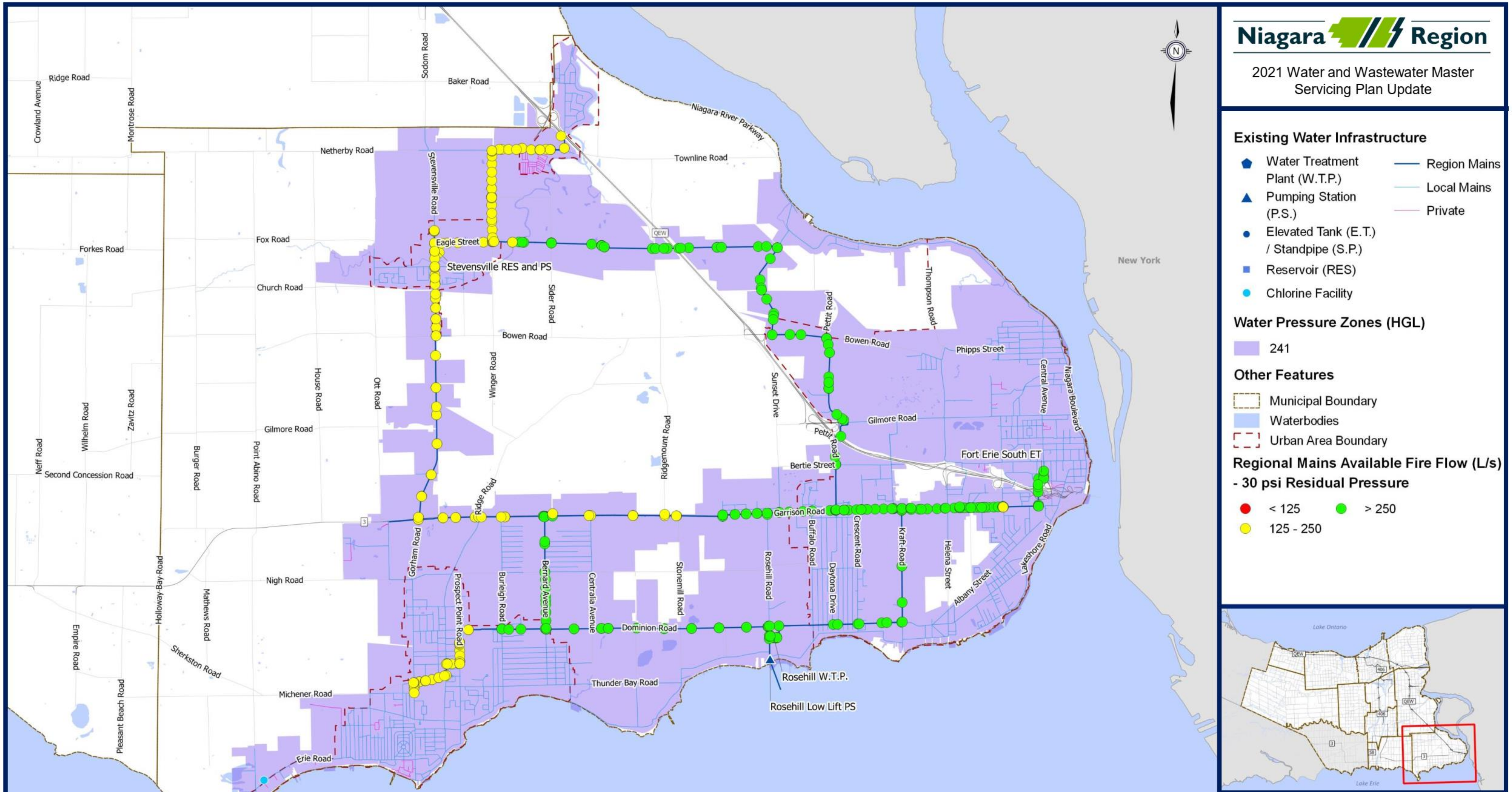


Figure 3.D.5
Fort Erie

Existing System Fire Flows

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December 2022
621016-W-005
WKID: 26917

D.3.6 Water Age and Watermain Capacity

Using the baseline system model, water age scenarios were created to identify average system water age. Using the Drinking Water Works Permits for each system, the locations of re-chlorination facilities were identified. Water age was reset to zero at these facilities for the water age model scenario. Water age is typically used as a proxy indicator for water quality, however, the exact correlation between water age and water quality can be highly variable depending on the source water quality, the distribution system material, and the secondary disinfectant that is used. A common threshold that within water system age is to flag areas where water age is greater than 7 days.

Figure 3.D.6 presents the existing system water age. Watermain velocities less than 0.6 m/s or greater than 1.5 m/s have been flagged and are shown in **Figure 3.D.7**.

In general, maximum water age is less than 7 days within the Fort Erie water system, except for minor local dead-end watermains.

In general, watermain velocity is less than 2 m/s, however there are many Regional watermains which experience velocities less than 0.6 m/s.

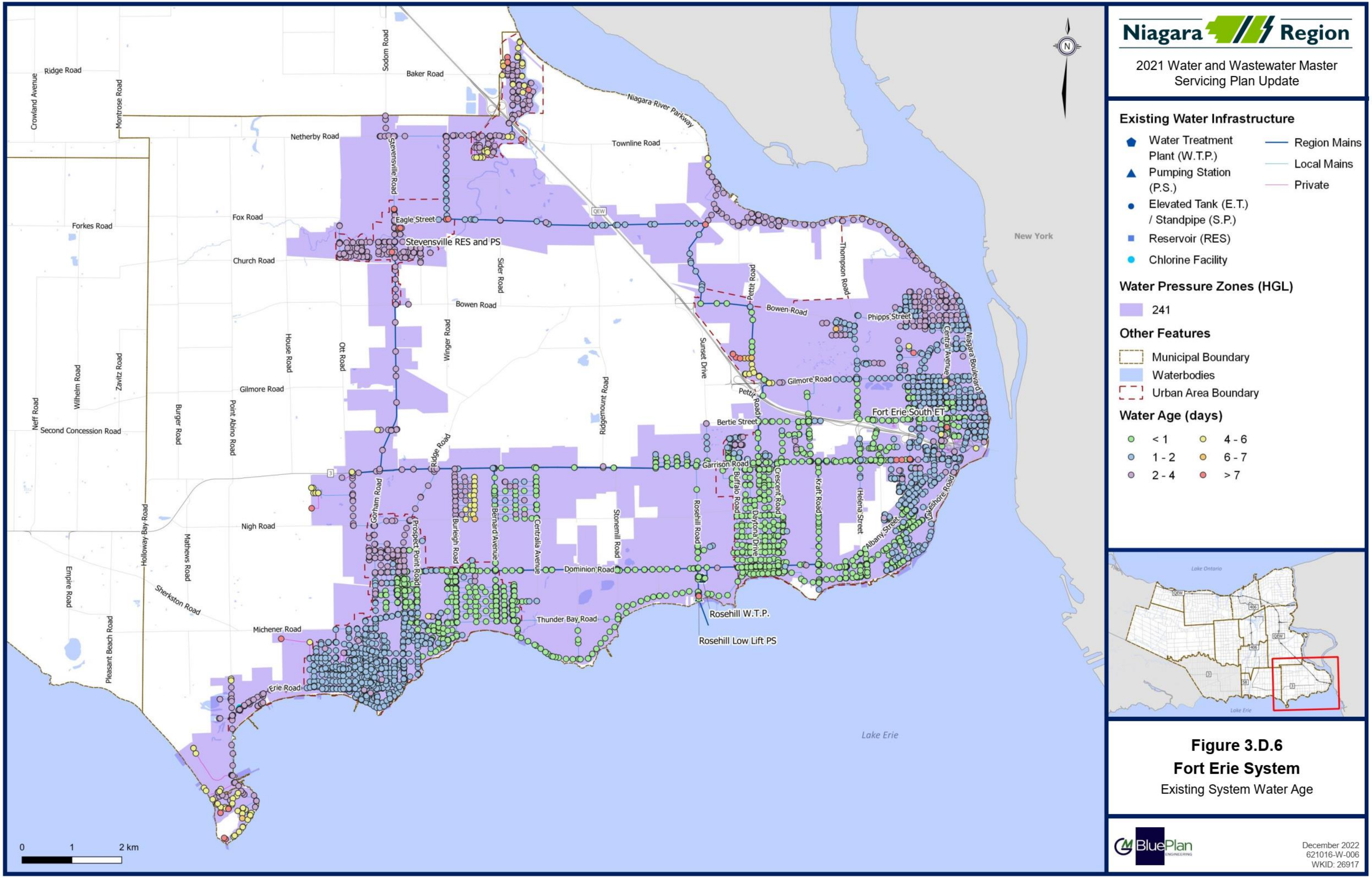
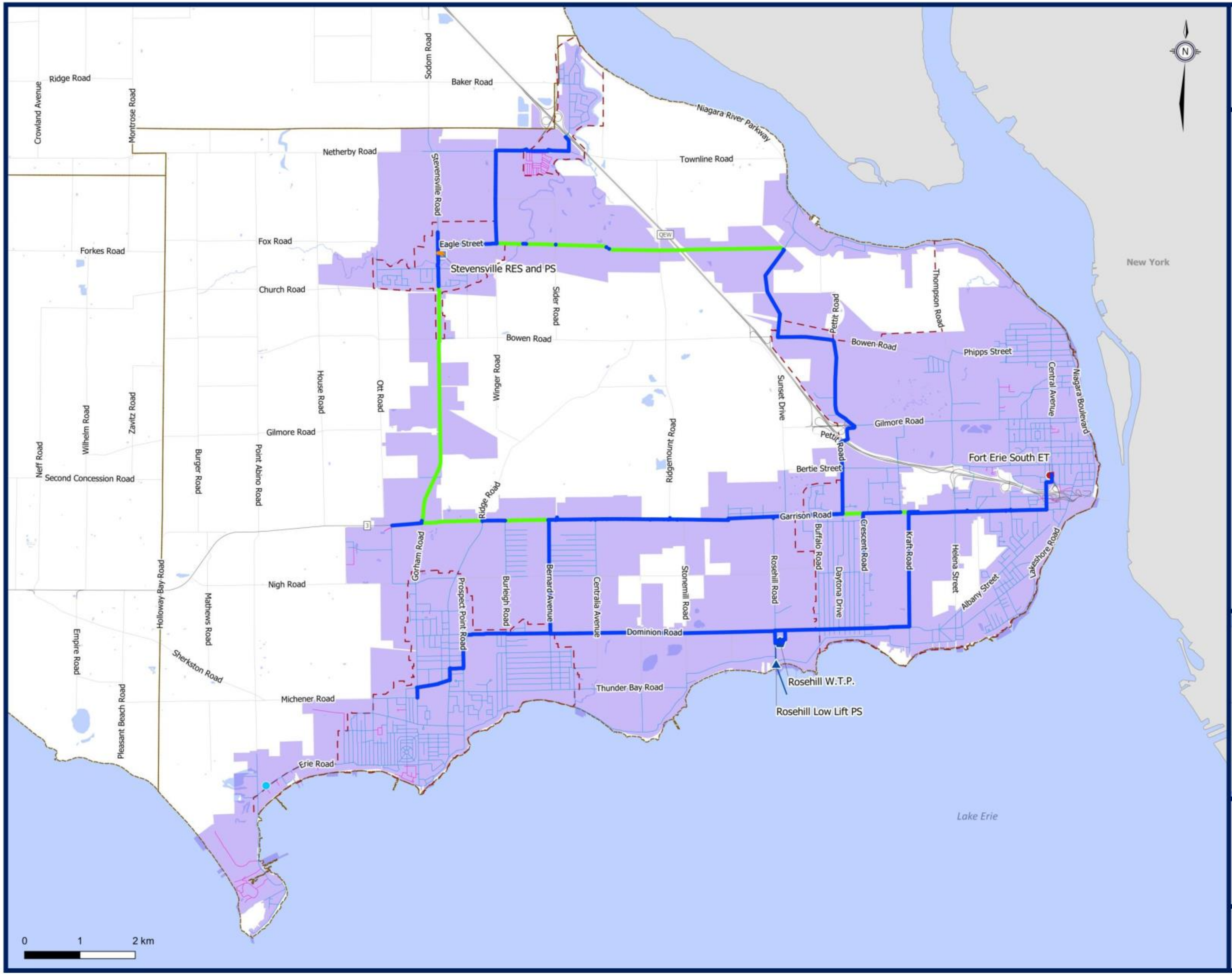


Figure 3.D.6
Fort Erie System
Existing System Water Age

December 2022
621016-W-006
WKID: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update



Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- Region Mains
- Local Mains
- Private

Water Pressure Zones (HGL)

- 241

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Maximum Velocity (m/s) - Regional Watermains

- < 0.6
- 0.6 - 1.5
- 1.5 - 2.0
- > 2.0

Figure 3.D.7
Fort Erie System
Existing System Watermain Velocity

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December 2022
621016-W-007
WKID: 26917

D.4 System Opportunities and Constraints

Figure 3.D.8 highlights the existing opportunities and constraints.

D.4.1 Rosehill Water Treatment Plant

- The current rated MDD capacity is 50.0 MLD, with an existing demand of 17.3 MLD. The projected 2051 MDD is 24.4 MLD and the post-2051 projected MDD is 30.6 MLD, which is below 80% of the water treatment plant rated capacity. As such, the water treatment plant has surplus capacity to accommodate growth beyond 2051.

D.4.2 Fort Erie System

- The system has an existing and future pumping surplus.
- There is an existing storage deficit of 2.6 ML, which will be addressed through the addition of the new Fort Erie ET which will support existing and future storage needs for the entire system, however, the sizing of the new Fort Erie ET will need to be increased from the previously recommended 6 ML.
    - The new elevated storage will allow for the decommissioning of the Stevensville Reservoir and Pumping Station and the Central Avenue ET.

D.4.3 System Security of Supply & Interconnections

- With the decommissioning of the Central Avenue ET after the construction of the new Fort Erie ET, there will be a need for an additional Regional watermain to re-establish a similar level of security of supply to the central Fort Erie area.
- There is ongoing discussion between the Region and the Town of Fort Erie regarding local watermain service connections to Regional watermains.
    - Refer to **Volume 2** for more discussion regarding these policies.

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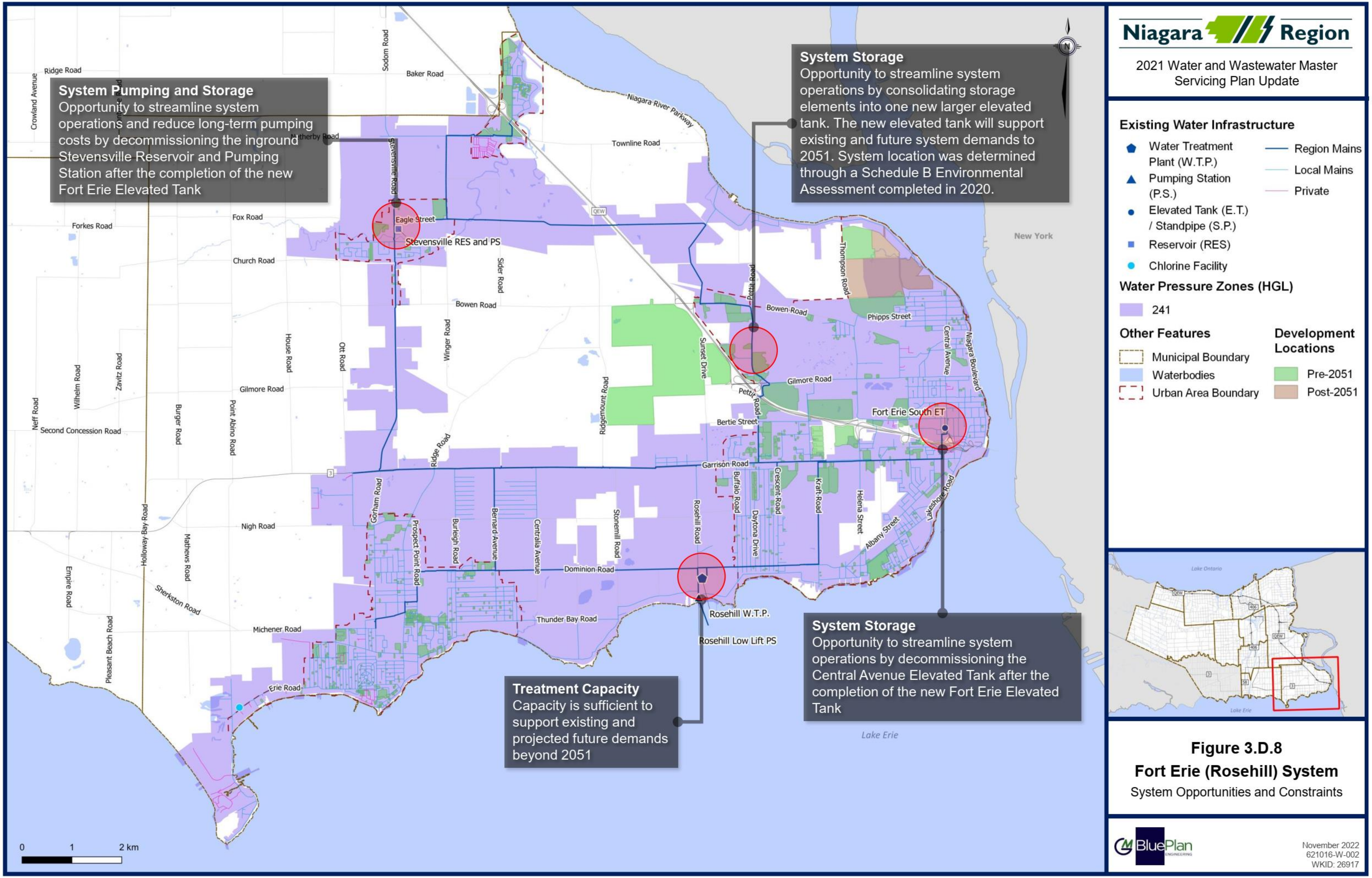

System Pumping and Storage
Opportunity to streamline system operations and reduce long-term pumping costs by decommissioning the inground Stevensville Reservoir and Pumping Station after the completion of the new Fort Erie Elevated Tank

System Storage
Opportunity to streamline system operations by consolidating storage elements into one new larger elevated tank. The new elevated tank will support existing and future system demands to 2051. System location was determined through a Schedule B Environmental Assessment completed in 2020.

Treatment Capacity
Capacity is sufficient to support existing and projected future demands beyond 2051

System Storage
Opportunity to streamline system operations by decommissioning the Central Avenue Elevated Tank after the completion of the new Fort Erie Elevated Tank

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

- ▨ 241

Other Features

- ⬚ Municipal Boundary
- ▨ Waterbodies
- ⬚ Urban Area Boundary

Development Locations

- 🟩 Pre-2051
- 🟫 Post-2051

Figure 3.D.8
Fort Erie (Rosehill) System
System Opportunities and Constraints

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November 2022
621016-W-002
WKID: 26917

D.5 Assessment of Alternatives

To address existing and growth-related capacity needs, the previous master servicing plan update recommended the following upgrades, which were re-confirmed and carried forward through the 2021 MSPU, as listed below:

- Construction of a new ET in central Fort Erie with a larger volume to support growth and balancing storage needs;
- Decommissioning of the existing Stevensville Reservoir and Pumping Station as well as Central Avenue Elevated Tank following completion of the new ET; and,
- New feedermain to support security of supply to central Fort Erie.

Additional alternatives were not reviewed in detail, as the recommended strategy addresses system needs. Further, the Region has already completed the Environmental Assessment of the new ET and initiated design of the new feedermain, as such the review of alternatives was limited to the re-assessment of infrastructure sizing to ensure it is sufficient to support the updated growth numbers. The following discusses the updated sizing recommendations:

- The currently planned infrastructure is sufficient to me the 2051 growth horizon; and,
- Post-2051 reservoir expansion at the Rose Hill WTP may be required to support post-2051 storage needs.

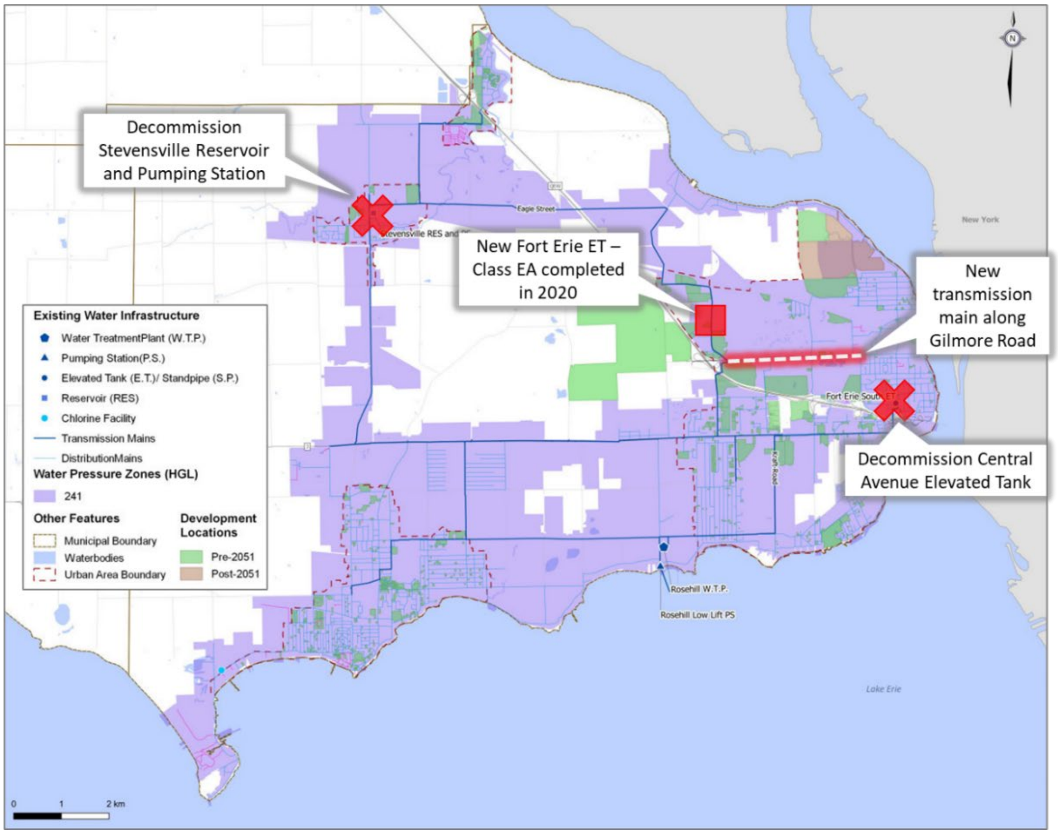


Figure 3.D.9 New Consolidated Elevated Storage

D.6 Preferred Servicing Strategy

The following is a summary of the Fort Erie water servicing strategy as recommended through the 2016 Master Servicing Plan Update and carried forward through this update:

- The Rosehill WTP has sufficient capacity to support growth beyond 2051;
- The components of the Fort Erie water strategy are focused on providing additional storage for the growth in the area while optimizing the storage/pumping relationship to reduce long term lifecycle costs;
- A new elevated tank will be provided in central Fort Erie to support the system growth and directly support the employment centre;
- The new tank will allow for decommissioning of the existing Stevensville Reservoir and Pumping Station as well as Central Avenue Elevated Tank; and,
- Additional feedermain capacity is required to support security of supply to central Fort Erie.

Figure 3.D.14 and **Figure 3.D.15** show the preferred servicing strategy and schematic, consisting of:

D.6.1 Storage

- A new 9.0 ML elevated tank is to be built in central Fort Erie to improve existing conditions, support growth, and increase floating storage in the zone.
  - Note that the recommended volume has been increased from the 8.0 ML recommended through the 2016 Master Servicing Plan in order to accommodate growth to 2051
  - Consider the addition of a rechlorination process at this elevated tank

D.6.2 Regional Watermains

- New 450 mm feedermain in Central Fort Erie

D.6.3 Decommissioning of Existing Facilities

- The Central Avenue Elevated Tank and Stevensville Reservoir and Pumping Station will be decommissioned following the construction of the new elevated tank in central Fort Erie.

D.6.4 Studies and Programs

- The Town of Fort Erie, in coordination with the Region, should implement a targeted non-revenue water reduction program to address existing high non-revenue water rates. Further details are provided in **Section D.8.3**; and,
- Region-wide WTP reservoir volume study to review CT volume and overall system storage.

D.6.5 Future System Performance

Figure 3.D.10 to **Figure 3.D.13** present the future system performance, based on preferred servicing strategy configuration and capacities.

In general, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. Most pressures in Fort Erie fall between 60 and 80 psi, with higher pressures along the Lake ranging from 80 to 90 psi.

The Region's target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for most critical system areas. The fire flow target is not met at the following locations:

- The west end of the Regional watermain in Crystal Beach urban area or the north end of the Regional watermain in the Douglastown urban area.
    - There are no existing Regional watermain loops at these locations to maintain the higher fire flow.
    - These are not critical areas in terms of fire flow requirements for the Regional watermain as the existing land use is primarily residential which has a lower fire flow need compared to institutional, commercial, or industrial land uses.
- The Regional watermains on Garrison Road west of Bernard Avenue, and on Stevensville Road south of Bowen Road.
    - This is due to the smaller watermain size (300 mm), the distance from elevated storage and the WTP, and the smaller pumping capacity available at the Stevensville Reservoir and Pumping Station.

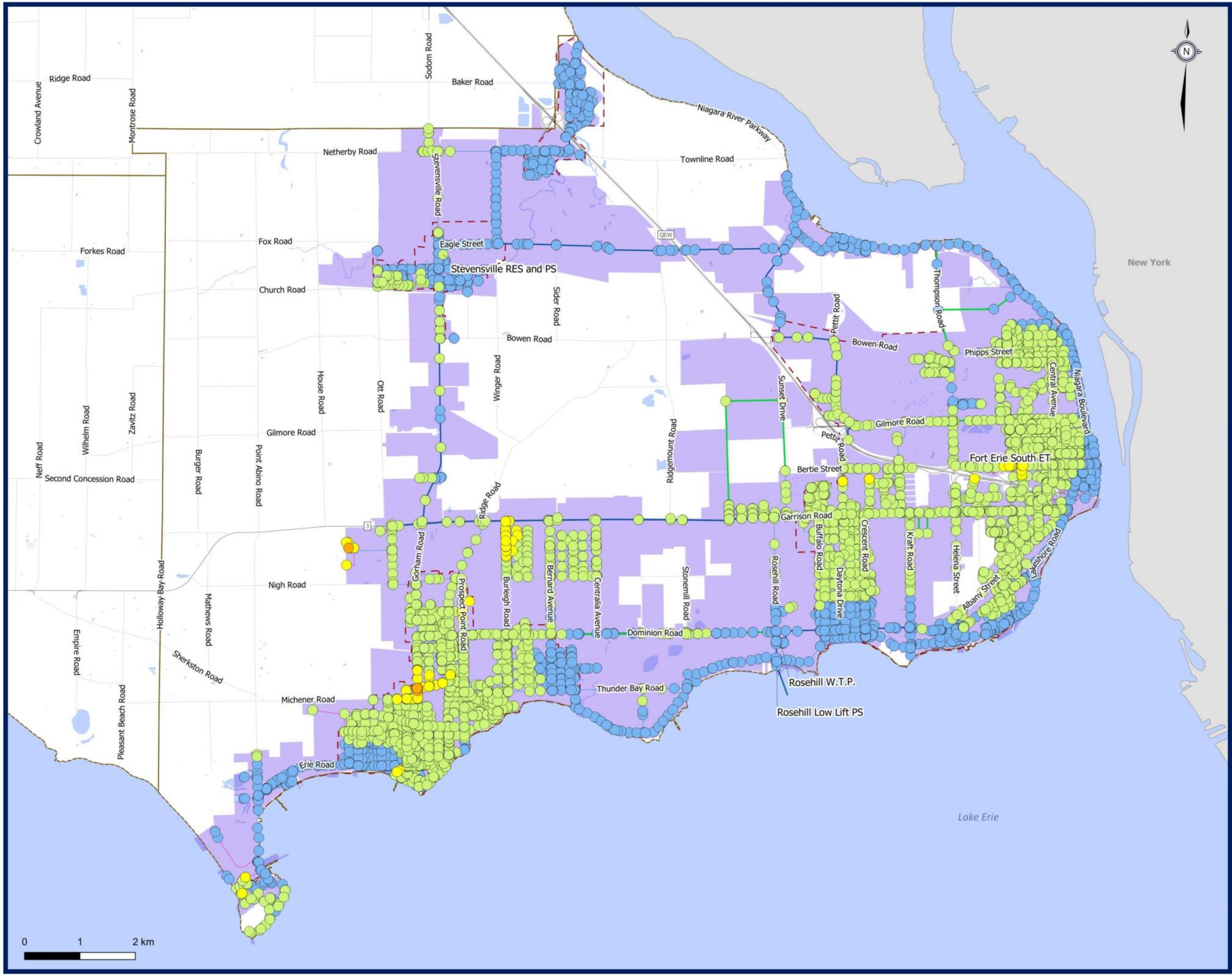
This is also not a critical area in terms of fire flow requirements for the Regional watermain as it is outside of the urban area boundary, the existing land use is of much lower density and is predominately agricultural and residential.

In general, maximum water age is less than 7 days within the Fort Erie water system, except for the Stevensville Douglastown area and on Eagle Street. This increase in water age compared to the existing system performance is due to the decommissioning of the Stevensville Douglastown Reservoir and Pumping Station, where modelled age was reset to zero due to the rechlorination facility at the station. There is opportunity to include rechlorination at the new Fort Erie elevated tank location if needed.

In general, watermain velocity is less than 2 m/s, however there are many Regional watermains which experience velocities less than 0.6 m/s.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update



Existing Water Infrastructure

⬟ Water Treatment Plant (W.T.P.)
▲ Pumping Station (P.S.)
● Elevated Tank (E.T.) / Standpipe (S.P.)
■ Reservoir (RES)
● Chlorine Facility
— Region Mains
— Local Mains
— Private

Water Pressure Zones (HGL)

■ 241

Other Features

▭ Municipal Boundary
■ Waterbodies
▭ Urban Area Boundary
— Future Watermains

Minimum Pressures (psi)

● < 40
● 40 - 50
● 50 - 60
● 60 - 80
● 80 - 90
● 90 - 100
● > 100

Figure 3.D.10
Fort Erie System
2051 System Peak Hour Pressures

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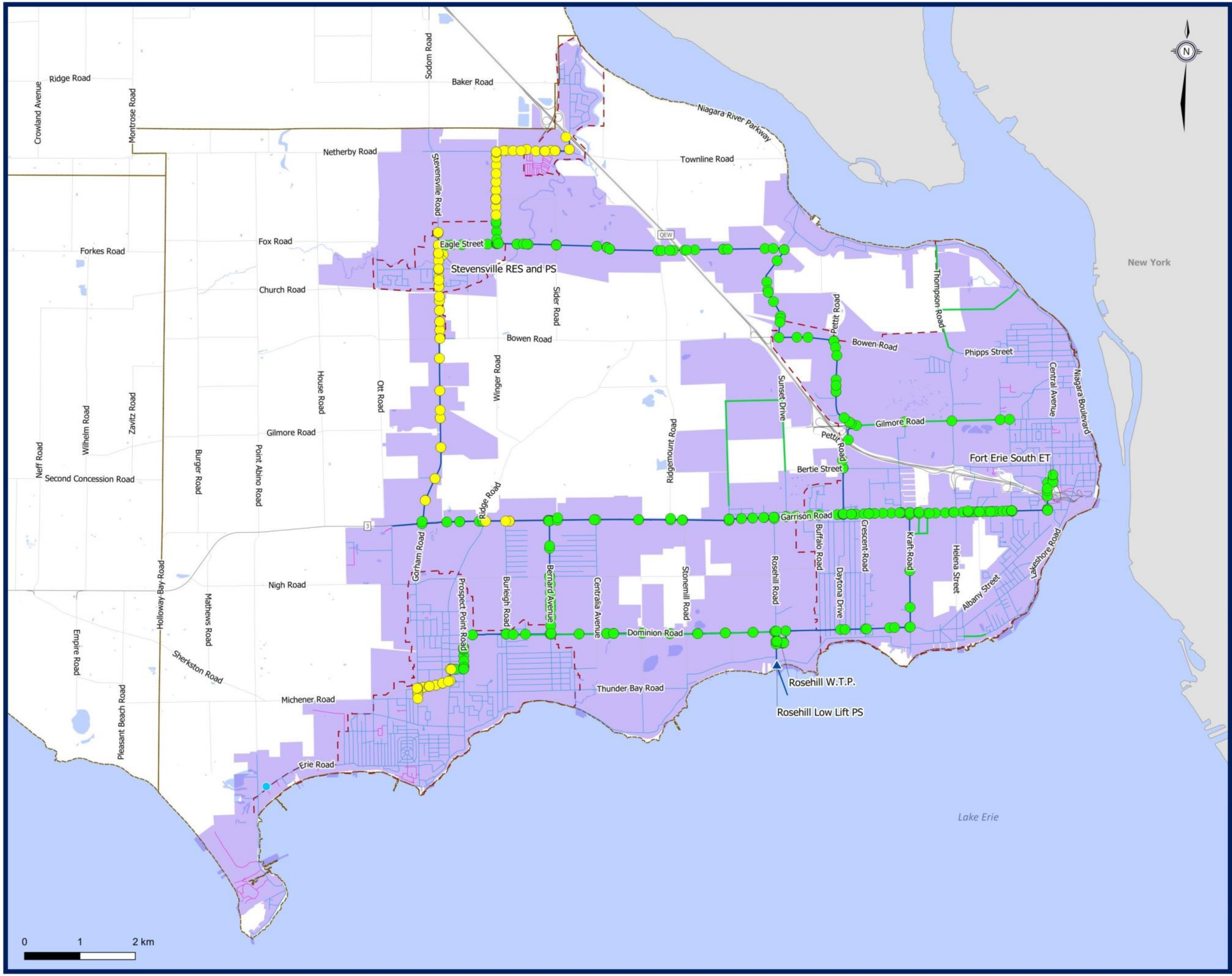
December 2022
621016-W-008
WKID: 26917



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

- ■ 241

Other Features

- ☐ Municipal Boundary
- ■ Waterbodies
- ☐ Urban Area Boundary
- — Future Watermains

Regional Mains Available Fire Flow (L/s) - 30 psi Residual Pressure

- 🔴 < 125
- 🟢 > 250
- 🟡 125 - 250

Figure 3.D.11

Fort Erie System

2051 System Fire Flows

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December 2022
621016-W-009
WKID: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

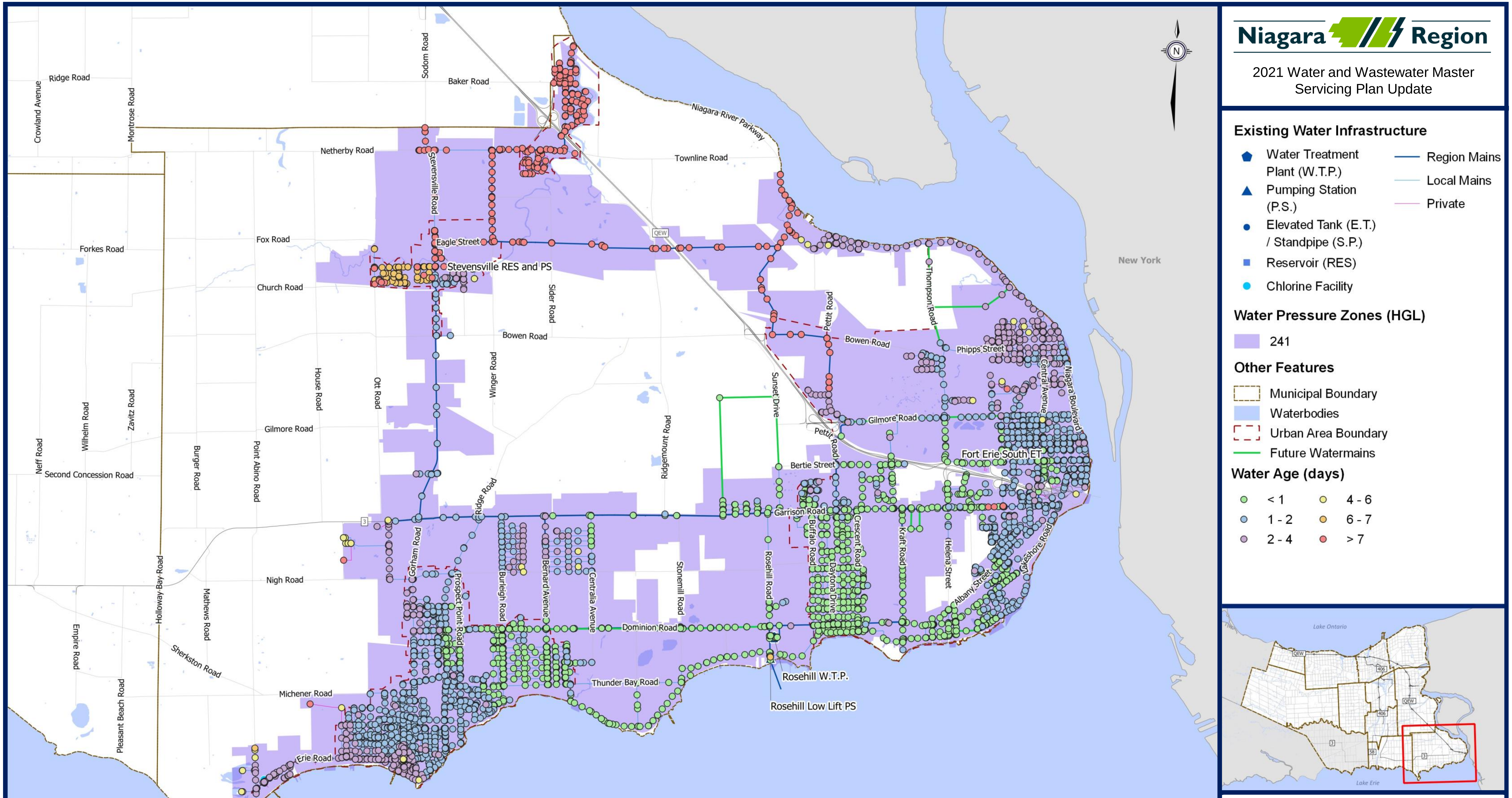

Figure 3.D.12
Fort Erie System
2051 System Water Age

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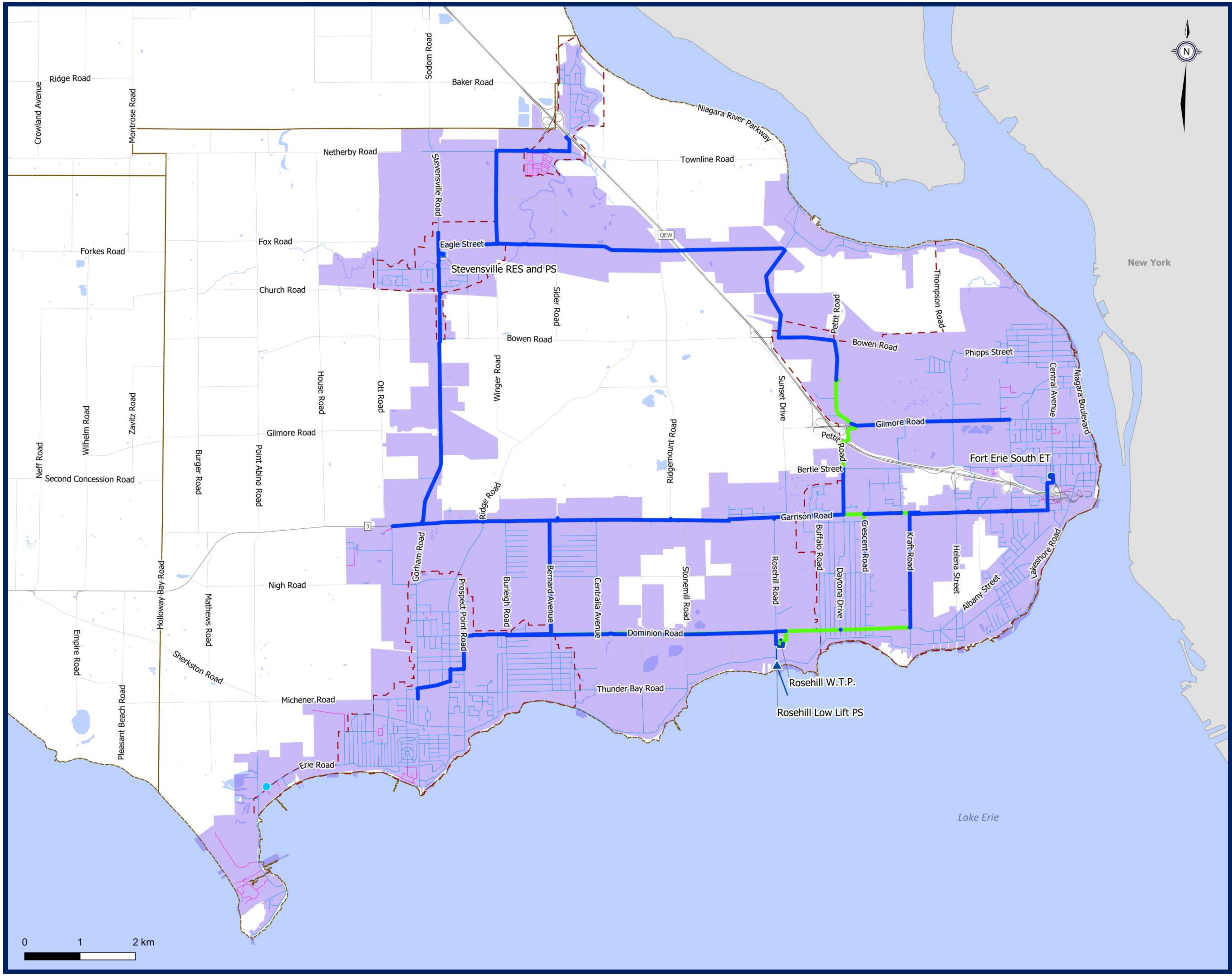
May 2023
621016-W-011
WKID: 26917



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

- ■ 241

Other Features

- ▭ Municipal Boundary
- ■ Waterbodies
- ▭ Urban Area Boundary

Maximum Velocity (m/s) - Regional Watermains

- — < 0.6
- — 0.6 - 1.5

Figure 3.D.13
Fort Erie System

2051 System Watermain Velocity

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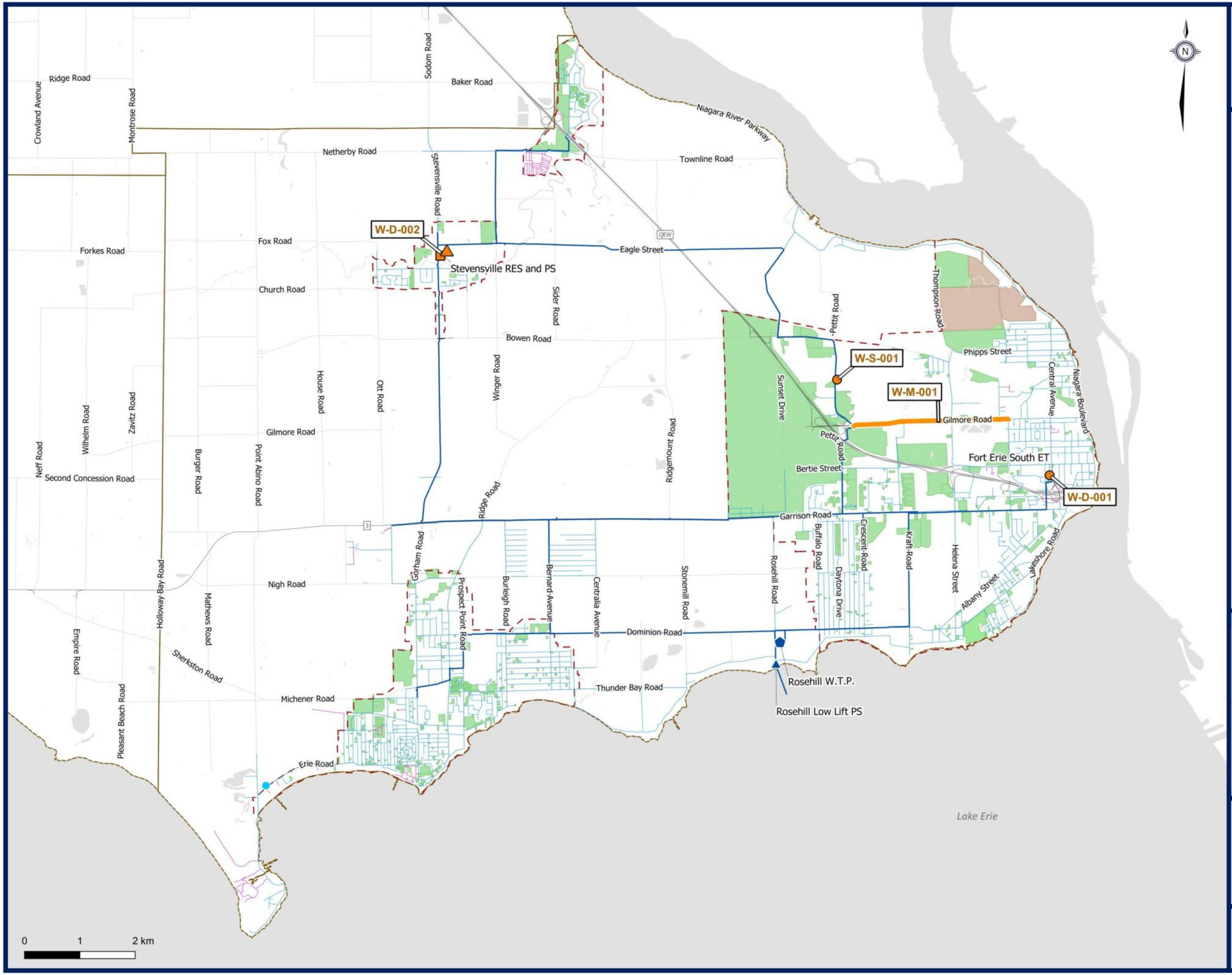
May 2023
621016-W-010
WKID: 26917

D.7 Capital Program

Figure 3.D.14 and **Figure 3.D.15** present the preferred servicing strategy map and schematic. **Table 3.D.12** summarizes the recommended project costing, implementation schedule and Class EA requirements. Individual detailed project costing sheets are presented in **Section D.8.6**.



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Capital Program

- ⬟ Water Treatment Plant
- ■ Reservoir
- ▲ Pumping Station
- ● Elevated Tank
- ━ Watermains

Existing Water Infrastructure

- ⬟ Water Treatment Plant
- ■ Reservoir
- ▲ Pumping Station
- ● Elevated Tank / Standpipe
- ━ Region Mains
- ━ Local Mains
- ━ Private

Other Features

- ▭ Township of Wainfleet
- ▭ Waterbodies
- ▭ Urban Area Boundary

Development Locations

- 🟫 Post-2051
- 🟩 Pre-2051

***Note that additional growth in existing built areas is anticipated**

***Project alignments are preliminary and will be refined through subsequent projects (EA and/or detailed design)**

Figure 3.D.14

Fort Erie

Preferred Water Servicing Strategy

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December 2022
620126-W-013
WKID: 26917

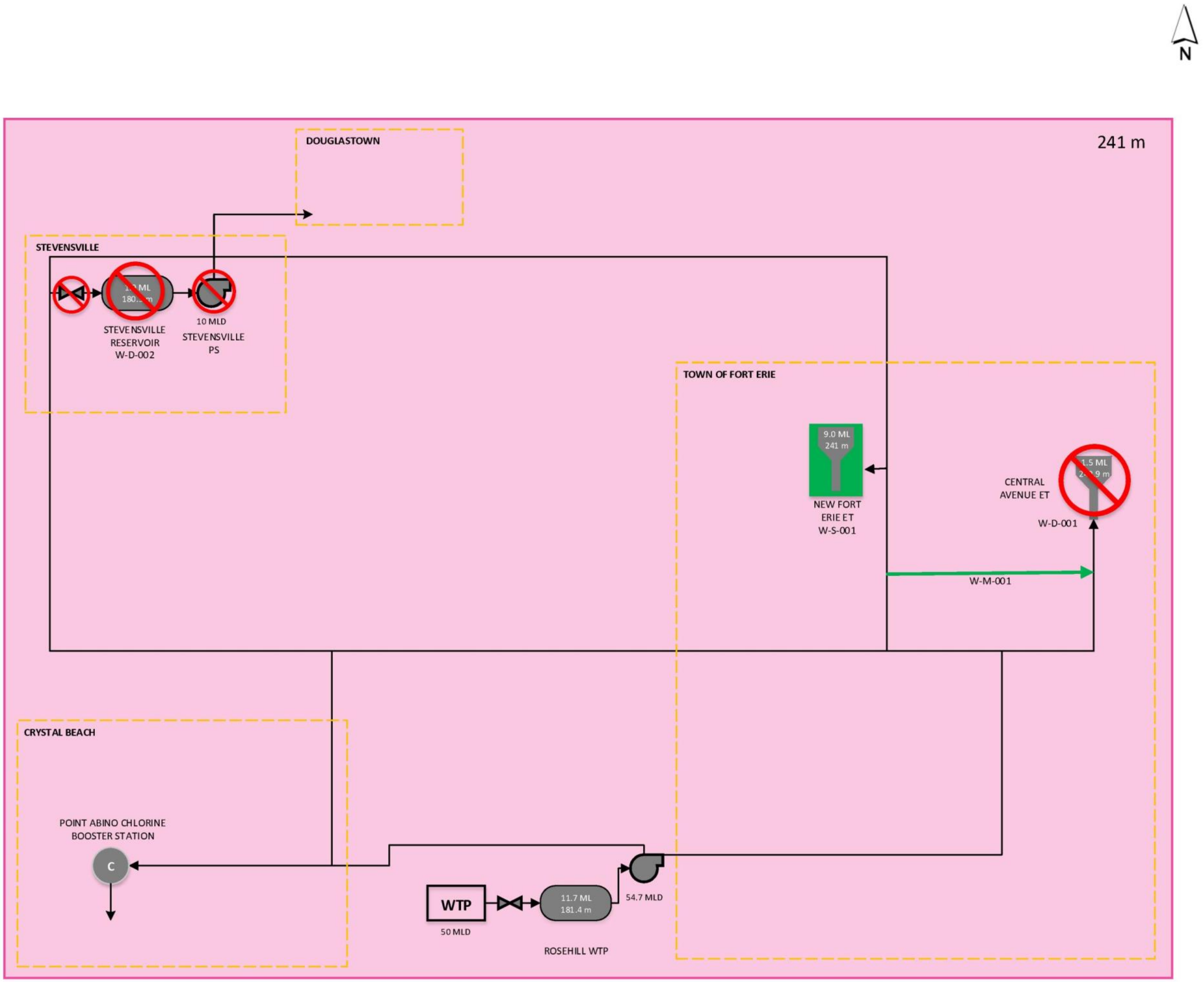


Figure 3.D.15
Fort Erie System

Future Water Infrastructure Schematic

Table 3.D.12 Summary of Rosehill Water 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 ($)
W-D-001	Decommissioning of Central Ave (Fort Erie South) ET	New Fort Erie ET to replace the Central Ave ET and Stevensville Reservoir; Central Ave ET to be decommissioned	N/A	2027-2031	Fort Erie	A+	N/A	Storage	$823,000
W-D-002	Decommissioning of Stevensville Res + PS	New Fort Erie ET to replace the Central Ave ET and Stevensville Reservoir; Stevensville Reservoir and Pumping Station to be decommissioned	N/A	2027-2031	Fort Erie	A+	N/A	Storage	$1,611,000
W-M-001	New feedermain in Central Fort Erie	New feedermain in Central Fort Erie	450 mm	2022-2026	Fort Erie	A+	N/A	Watermain	$12,299,000
W-S-001	New Fort Erie ET	New Fort Erie ET to replace the Central Ave ET and Stevensville Reservoir	9.0 ML	2022-2026	Fort Erie	B	Satisfied (separate study)	Storage	$20,084,000
W-ST-001(1)	Region Wide WTP Reservoir Volume Study	Study to review WTP reservoir CT volume and overall system storage	-	2022-2026	Region-Wide	A+	N/A	Storage	-
								Total	**$34,817,000**

(1) Project cost not included in subtotal as it is a Region-wide project

D.8 Project Implementation and Considerations

D.8.1 10-Year Program Sequencing

The recommended year in service for the capital projects is presented in **Section D.7**. Special project implementation and considerations for the preferred servicing strategy consist of:

- Completion of the new elevated tank is needed before the Region can decommission the existing facilities, and
- Design of the new feedermain in Central Fort Erie (W-M-001) is currently underway.

It is understood that the timing for the recommended projects may be subject to change due to a variety of external factors such as overall balancing of the Region's capital budget, changes to growth projections, and other unforeseen circumstances. As such, **Table 3.D.13** presents the preferred priority of the projects within the first 10-years of the capital program.

Table 3.D.13 First 10-Years Project Sequencing

Master Plan ID	Name	In Service Period	Project Sequencing
W-M-001	New feedermain in Central Fort Erie	2022-2026	1
W-S-001	New Fort Erie ET	2022-2026	1
W-D-001	Decommissioning of Central Ave (Fort Erie South) ET	2027-2031	2
W-D-002	Decommissioning of Stevensville Res + PS	2027-2031	2

D.8.2 EA Requirements and Studies

The only recommended capital project within Fort Erie that requires a separate Schedule B or C EA is W-S-001 (New Fort Erie ET) which has been satisfied through the Schedule B EA completed in 2020.

D.8.3 Region-Wide Projects and Collaboration with Local Area Municipalities

As part of the recommended capital program, it is recommended that the Region complete a WTP reservoir volume study across all WTP facilities to review CT volume and overall system storage. The intent of this study is to gain a clearer understanding of storage limitations at WTP facilities and how much usable volume can be accounted for within the system storage calculations.

Acknowledging that the overall water systems are jointly owned and operated by the Region and local area municipalities (LAM), the continued operation and expansion of the water systems to support existing users and accommodate projected growth relies upon the cooperation of the upper and lower tier municipalities. Major updates and adjustments to planning projections should be continued to be communicated as this may affect project details such as trigger timelines and design capacities, which is discussed further in **Section D.8.5**.

One initiative that will be predominately driven by the LAMs is NRW reduction. While NRW reduction programs should be completed in all municipalities, this 2021 MSPU assumes that the municipalities currently experiencing NRW rates greater than 25% will put specific focus on reducing NRW. The 2021 MSPU utilized an assumption of NRW reduction to at least 25% by 2051, however, municipality-specific targets can be reviewed by the LAMs. The existing NRW rate in Fort Erie is 35%. The program activities may include but are not limited to:

- Enhancement to the water metering program including:
    - Meter replacement program
    - Re-time monitoring of large water users
- Leak detection program for watermains,
- Watermain replacement program,
- Improved tracking of unbilled authorized users and development of demand reduction strategies:
    - Fire department
    - Watermain flushing
    - Facility usage,
- Development of bulk water user strategy and potential construction of additional bulk water station, and
- Improved monitoring and enforcement of new construction water uses.

D.8.4 Sustainability Projects

It is important to recognize that the 2021 MSPU servicing strategies identify new infrastructure to service the additional growth out to year 2051 but these strategies are built by extending infrastructure from the existing systems and leveraging the existing Region infrastructure in place. It is essential that the existing infrastructure is maintained in good condition and performance to support servicing growth.

The Region continually establishes and implements a sustainability program that addresses priority projects to ensure the existing infrastructure is in a state-of-good-repair and continues to perform and meet the intended level of services.

Independent of the 2021 MSPU, the Region has completed a sustainability program analysis to identify the projects on a yearly basis, with focus on a 10 year program, to address the sustainability needs. This Sustainability Capital Plan is first developed to demonstrate the total investment needs and may identify a level of investment and implementation exceeding Region resources. The next steps for the Sustainability Capital Plan will be the development of the Financial Plan for existing Water and Wastewater assets which is anticipated to be completed in

2024. It should be noted that the Sustainability Capital Plan represents investment required over and above the growth-related 2021 MSPU program.

The 2021 MSPU undertook a process to review the Sustainability Program in conjunction with the growth-related program to eliminate duplicate projects and to align the timing of both growth and sustainability needs where appropriate in order to create efficiencies. This review was focused on the Sustainability Program for the next 10 years with the best information available at the time of this study.

The review process for integration of the MSPU program and the sustainability program was essential to demonstrate several key findings:

- There is opportunity to align growth and sustainability projects to bring efficiencies in costs and delivery;
- When planning and costing new infrastructure, lifecycle principles and costs must be considered. Existing and future infrastructure will have future service life replacements (i.e., pumps, electrical, roof, security upgrades at varying intervals from 5 – 40 years);
- Without maintenance of the existing infrastructure in a state of good repair and performance, there is risk that the growth-related program may not achieve desired capacities, timing, or level of service;
- There is also risk that implementing the growth-related program could have a negative impact on the level of service within the existing systems for the existing users; and,
- There are some major projects already considered under the sustainability program that are essential to the growth-related program such as the Welland WTP and WWTP.

The 2021 MSPU growth capital program focuses on the infrastructure needs to support growth and all the projects build upon the Region's existing water systems. It is imperative that the Region's sustainability capital program continues to be completed as needed alongside the recommended 2021 MSPU growth capital program to ensure that the existing system is operating at expected capacities and reliability such that it can support the recommended growth projects.

The sustainability projects consist of Region-wide projects and programs including but not limited to: replacement programs for boilers, water valves, generators, watermains, master meters, GAC, process piping, process electrical, process instrumentation. Fort Erie system specific projects include:

- Garrison Road watermain replacement – Kraft Road to Benner Avenue and at Concession Road intersection
- Rosehill WTP new intake
- Rosehill WTP new outfall

D.8.5 Project Implementation Flow Chart

The recommended design capacities within the capital program are based on the best available information at the time of analysis, including existing system demands, facility capacities, and projected growth. It is understood that this data is not static and often changes over the years between the regular updates of the Region's Master Plan. Design assumptions should be revisited before initiation of projects to reconfirm the appropriate design capacities, along with identification of any associated or dependent projects which can be combined or staged to optimize implementation efficiency and cost, and/or system operation.

To support the Region's process in implementing all recommended 2021 MSPU capital projects, the following flow chart has been developed for the water system. This flow chart document is intended to be a reference resource for the Region and should be treated as a guideline to support existing internal Region processes in project implementation, as shown in **Figure 3.D.16**.

Niagara Region

WATER PROJECT IMPLEMENTATION

The intent of this document is to support the Region in confirming the scope of work for water infrastructure projects.

CONFIRM PROJECT SCOPE

To define Terms of Reference

☐ **What triggered this project?**
- Known development growth
- Forecasted growth
- Sustainability needs

☐ **Are there related or dependent projects that should be identified for streamlining opportunities or for project phasing?**
- Are there projects that need to be completed before this project?
- Are there projects within the same alignment or project area that could be combined (e.g., growth projects, wastewater, stormwater, corridor planning, sustainability projects, etc.)
- If there are related projects, could the project timing be adjusted to combine or stage projects more efficiently?

☐ **What is the project EA Schedule and status?**

☐ **Are there historic or ongoing operational issues in the project area?**
- Confirm with Regional and LAM operations and maintenance groups
- i.e. historic watermain breaks, water quality or pressure complaints, work order history, etc.

☐ **Are there any data gaps that should be incorporated into the Terms of Reference?**
- Refer to the Required Data section below for details
- How much does the project timeline and budget need to change to allow for the data collection?

☐ **Have the planning projections been updated to the best available information?**
- Consultation with Region and LAM planning groups to confirm planning projection
- Are projected needs for the project in place? Is actual growth in line with projected growth?)

☐ **Should the project be deferred until identified related works are completed?**

REQUIRED DATA

To support terms of reference and detailed design

☐ **Recently completed EA or servicing study**
(for growth triggered projects)

☐ **Historic demand records**
- Within the last 3 years
- Ideally one full year of SCADA records including facility demands, flow, and pressure records

☐ **Existing system hydrant testing or system pressure data to identify/verify existing system issues**

☐ **Asset inventory and condition assessment**
- All asset classes within the infrastructure type (watermain, storage, pumping, or treatment facility)
- Within the last 5 years
- Can be part of project scope if the data is not available and would not significantly alter project scope

☐ **Service area growth potential to confirm projected population and demands**
- Consultation with Region and LAM planning groups within the past year
- Growth information for 30-year horizon and beyond (maximum service area)
  - Population, jobs, land use, area
  - Current inventory of development areas with associated development status

IF THE REQUIRED DATA IS NOT AVAILABLE AND IF IT HAS THE POTENTIAL TO SIGNIFICANTLY ALTER SCOPE OF THE DESIGN, IT IS STRONGLY RECOMMENDED THAT THE APPROPRIATE DATA COLLECTION AND FIELD INVESTIGATION BE COMPLETED PRIOR TO PROCEEDING WITH DESIGN. ALTERNATIVELY, WHERE FEASIBLE, DATA COLLECTION SHOULD BE INCLUDED IN THE PROJECT SCOPE AND INTEGRATED INTO THE DESIGN PROCESS.

FLOW PROJECTIONS

To determine infrastructure capacity needs

EXISTING FLOWS

Average Day Demand (ADD)
- Historic SCADA to determine starting point average demand

Maximum Day Demand (MDD)
- Use peaking factors determined through MSPU to peak ADD
- There is a different peaking factor for each WTP system based on historic SCADA data

Peak Hour Demand (PHD)
- Diurnal curve based on historic data

Fire Flow (FF)
- MECP population-based

FUTURE FLOW PROJECTIONS

Existing Demand
- Scenarios depending on infrastructure type and design scenario (see next page

+

Growth Population Demand Contributions
- Residential, 240 L/c/d
- Employment, 270 L/e/d

The design criteria presented in this document are based on the 2021 Master Servicing Plan Update Study

BluePlan ENGINEERING

STORAGE AND PUMPING FACILITY CONSIDERATIONS

☐ **What is the complete service area of the facility?**
- Some facilities support multiple pressure zones
- Some pressure zones are supported by multiple facilities

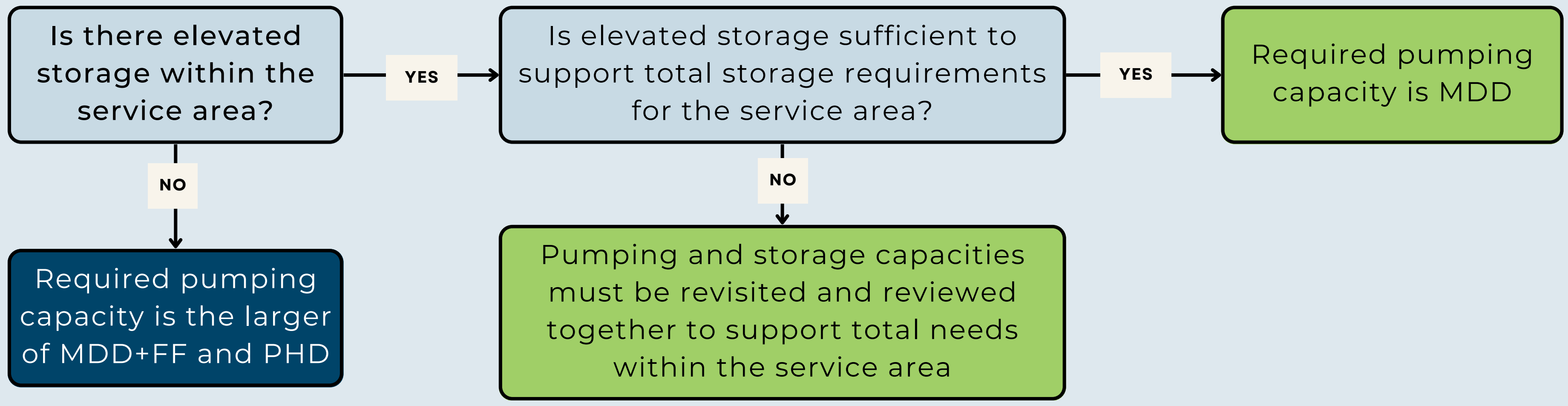
☐ **If there are storage deficits, can they be supplemented through flow transfers?**
- Is it hydraulically and operationally feasible?

☐ **Have storage and pumping facilites been reviewed in conjunction with one another?**
- Required pumping capacity varies based on available storage

☐ **What is the optimal HGL target for pumping and elevated storage facilities?**
- Region strives to maximize areas within 50 - 80 psi for Regional watermains and minimum residual pressure of 30 psi at MECP population-based fire flow target

PUMPING STATION SIZING

To define design flow scenario (MDD, MDD+FF, PHD)



Is there elevated storage within the service area?

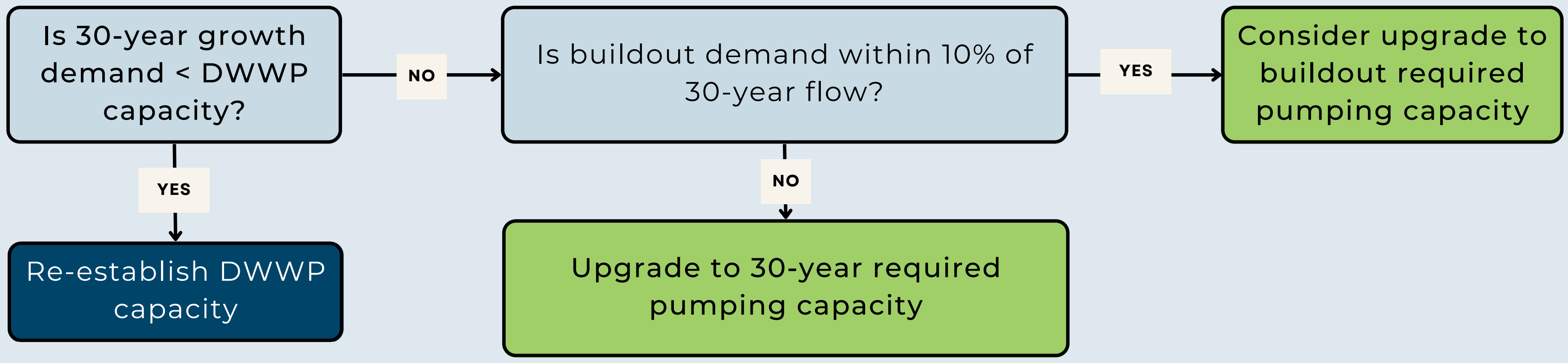
YES → Is elevated storage sufficient to support total storage requirements for the service area?

YES → Required pumping capacity is MDD

NO → Pumping and storage capacities must be revisited and reviewed together to support total needs within the service area

NO → Required pumping capacity is the larger of MDD+FF and PHD

To define design flow growth horizon (re-establish DWWP capacity, 30-year growth, buildout)



Is 30-year growth demand < DWWP capacity?

YES → Re-establish DWWP capacity

NO → Is buildout demand within 10% of 30-year flow?

YES → Consider upgrade to buildout required pumping capacity

NO → Upgrade to 30-year required pumping capacity

STORAGE SIZING

What are the system storage needs?
- System storage targets are based on MECP methodology, consistent with the 2021 Region MSPU
- Incorporate contact time storage needs at Water Treatment Plant Reservoirs
- Confirm fire flow storage strategy
- Review pumping capacity and impact on storage strategy

What timeline is considered for storage sizing?
- Is the storage sized at a minimum to support 30-year growth needs?
- What is the required storage sizing to support buildout needs?
- Is there a strategy to meet buildout needs?
- Is there opportunity for phased expansion?
- Is there a need for an alternative storage location?

TRUNK WATERMAIN SIZING

- Regional transmission mains should be sized to meet PHD and MDD+FF of maximum future service area (buildout) with a target velocity less than 1.5 m/s

D.8.6 Detailed Project Costing Sheets

The detailed project costing sheets for the recommended 2021 MSPU capital projects within the Fort Erie system are presented below.

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-D-001**	**CAPITAL BUDGET YEAR:**
PROJECT NAME:	**Decommissioning of Central Ave (Fort Erie South) ET**	**VERSION:**
PROJECT DESCRIPTION:	New Fort Erie ET to replace the Central Ave ET and Stevensville Reservoir; Central Ave ET to be decommissioned	**DATE UPDATED:**
		UPDATED BY:

Class Estimate Type:	Class 3	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	20%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Decommissioning						$500,000	2016 lump sum inflated
Additional Construction Costs	10%		ea.			$50,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$55,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$605,000**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 90,800	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$90,800**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$74,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$74,000**	
Non-Refundable HST	1.76%					$13,500	
Non-Refundable HST Sub-Total						**$13,500**	
Total (2022 Dollars)						**$823,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$823,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$16,460		
Design	Design fees, Region fees for design, contract admin	13%	$106,990		
Construction	Region fees, base costs and project contingency	85%	$699,550		
TOTAL			**$823,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-D-002**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**Decommissioning of Stevensville Res + PS**	**VERSION:**	
PROJECT DESCRIPTION:	New Fort Erie ET to replace the Central Ave ET and Stevensville Reservoir; Stevensville Reservoir and Pumping Station to be decommissioned	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 3	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	20%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Decommissioning						$1,000,000	2016 lump sum inflated
Additional Construction Costs	10%		ea.			$100,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$110,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$1,210,000**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 181,500	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$181,500**	
In House Labour/Engineering/Wages/CA	4.0%					$ 48,400	
In-house Labour/Wages Sub-Total						**$48,400**	
Project Contingency	10%					$144,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$144,000**	
Non-Refundable HST	1.76%					$27,000	
Non-Refundable HST Sub-Total						**$27,000**	
Total (2022 Dollars)						**$1,611,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$1,611,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$32,220		
Design	Design fees, Region fees for design, contract admin	13%	$209,430		
Construction	Region fees, base costs and project contingency	85%	$1,369,350		
TOTAL			**$1,611,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-001**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New trunk main in Central Fort Erie**	**VERSION:**	
PROJECT DESCRIPTION:	New trunk main in Central Fort Erie	**DATE UPDATED:**	
		UPDATED BY:	

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

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	450 mm	
TOTAL LENGTH:	2820 m	
Tunnelled		0%
Open Cut	2820 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	2820 m	$1,071	$3,020,386	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	20%					$604,077	
Minor Creek Crossings			ea.	3	$206,000	$618,000	
Major Creek Crossings			ea.	1	$1,025,000	$1,025,000	
Road Crossings			ea.	1	$458,000	$458,000	Interchange
Major Road Crossings (Highway)			ea.	0	$1,025,000	$0	
Utility Crossings			ea.	0	$458,000	$0	
Valve and Chamber			ea.	12	$40,000	$480,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$60,408	
Additional Construction Costs	10%		ea.			$626,587	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$689,246	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$9,160,000**	**Override construction cost based on Region info**
Geotechnical / Hydrogeological / Materials	1.0%					$91,600	
Geotechnical Sub-Total Cost						**$91,600**	
Property Requirements	1.0%					$ 91,600	
Property Requirements Sub-Total						**$91,600**	
Consultant Engineering/Design	15%					$ 1,374,000	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,374,000**	
In House Labour/Engineering/Wages/CA	3.0%					$ 274,800	
In-house Labour/Wages Sub-Total						**$274,800**	
Project Contingency	10%					$1,099,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,099,000**	
Non-Refundable HST	1.76%					$208,000	
Non-Refundable HST Sub-Total						**$208,000**	
Total (2022 Dollars)						**$12,299,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$12,299,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$245,980		
Design	Design fees, Region fees for design, contract admin	13%	$1,598,870		
Construction	Region fees, base costs and project contingency	85%	$10,454,150		
TOTAL			**$12,299,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-S-001

PROJECT NAME: New Fort Erie ET

PROJECT DESCRIPTION: New Fort Erie ET to replace the Central Ave ET and Stevensville Reservoir

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	9 ML

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	9 ML	$1,300,000	$11,700,000	
Trunk watermain connection			m	0 m	$0	$0	Fronting existing trunk main
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$1,755,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,345,500	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$14,801,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$148,000	
Geotechnical Sub-Total Cost						**$148,000**	
Property Requirements	1.5%					$ -	Location already owned by Region - per Fort Erie ET EA
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	12%					$ 1,776,100	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,776,100**	
In House Labour/Engineering/Wages/CA	3.0%					$ 444,030	
In-house Labour/Wages Sub-Total						**$444,030**	
Project Contingency	15%					$2,575,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$2,575,000**	
Non-Refundable HST	1.76%					$339,700	
Non-Refundable HST Sub-Total						**$339,700**	
Total (2022 Dollars)						**$20,084,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$20,084,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$401,680		
Design	Design fees, Region fees for design, contract admin	13%	$2,610,920		
Construction	Region fees, base costs and project contingency	85%	$17,071,400		
TOTAL			**$20,084,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-ST-001
PROJECT NAME: Region Wide WTP Reservoir Volume Study
PROJECT DESCRIPTION: Study to review WTP reservoir CT volume and overall system storage

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

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

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Grimsby WTP Reservoir							
Decew WTP Reservoir							
Niagara Falls WTP Reservoir							
Welland WTP Reservoir							
Port Colborne WTP Reservoir							
Rosehill (Fort Erie) WTP Reservoir							
Additional Construction Costs	10%		ea.			$0	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$0	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$0**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ -	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$0**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$4,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$4,000**	
Non-Refundable HST	1.76%					$100	
Non-Refundable HST Sub-Total						**$100**	
Total (2022 Dollars)						**$44,000**	Rounded to nearest $1,000
Other Estimate						**$100,000**	
Chosen Estimate						**$100,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$2,000		
Design	Design fees, Region fees for design, contract admin	13%	$13,000		
Construction	Region fees, base costs and project contingency	85%	$85,000		
TOTAL			**$100,000**		

E

Regional Municipality of Niagara

Part E

PORT COLBORNE WATER SYSTEM

TABLE OF CONTENTS

List of Figures

List of Tables

E. Port Colborne Water Treatment Plant

E.1 Existing System Overview

The Port Colborne system services the City of Port Colborne. The system services an existing population of 17,356 and 5,083 employees. Note that this population and employment total is based on the Region's 2021 allocation of Traffic Area Zones planning data and has been processed through the allocation methodology presented in **Volume 2** to refine the data to include only serviced populations. As such, the population and employment total may not directly match the system totals using the Region's unprocessed planning data.

The system is supplied by the Port Colborne Water Treatment Plant, located on 32 King Street, Port Colborne. The plant is a conventional surface water treatment plant, with zebra mussel control, traveling screens, coagulation, flocculation, sedimentation, filtration, and disinfection. Lake Erie (via the Welland Canal) serves as a source to the plant. The plant has a rated capacity of 36.0 MLD (417 L/s).

The system supplies local area municipalities via a watermain network, pumping stations, and storage reservoirs. The supply area has a single pressure zone.

Figure 3.E.1 and **Figure 3.E.2** present an overview of the water system and a water system schematic diagram, respectively.

Through this update of the Master Servicing Plan, the Region has highlighted the need to integrate the MSPU growth-related program with the Region's sustainability program intended to address the condition and performance of the existing infrastructure. The MSPU servicing strategies are based on the need to maintain appropriate levels of service throughout the systems and acknowledges that investment will be needed to support operations, maintenance, staff, and other resources related to maintaining the existing systems and facilities in a state of good repair and performance.

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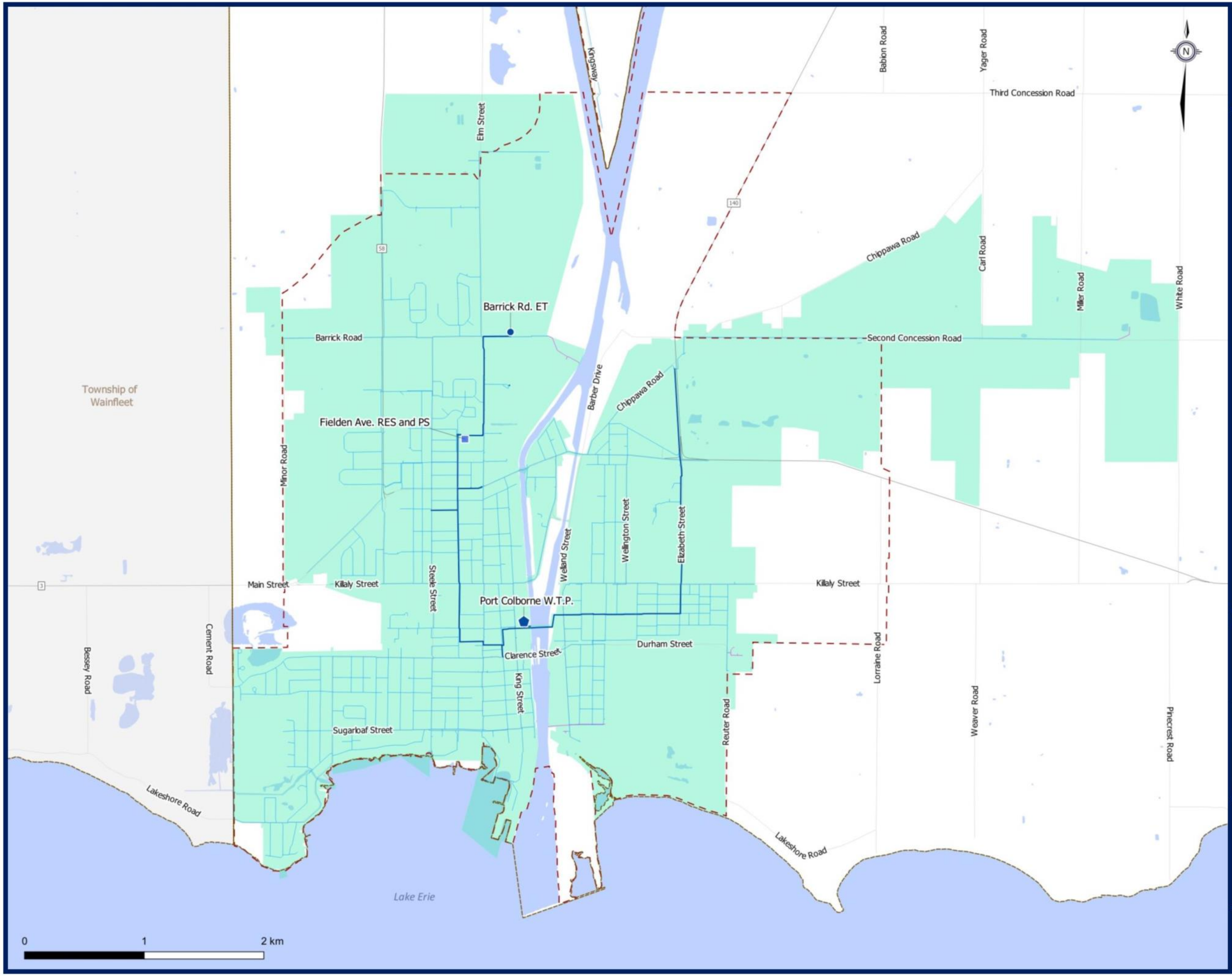

Existing Water Infrastructure

●	Chlorine Facility	—	Region Mains
●	Elevated Tank	—	Local Mains
◆	Fluoride Station	—	Private
▲	Pumping Station		
■	Reservoir		
●	Standpipe		
⬟	Water Treatment Plant		

Water Pressure Zones (HGL)

🟩 223

Other Features

▨ Township of Wainfleet

🟦 Waterbodies

▭ Urban Area Boundary

Figure 3.E.1
Port Colborne
Existing Water Infrastructure

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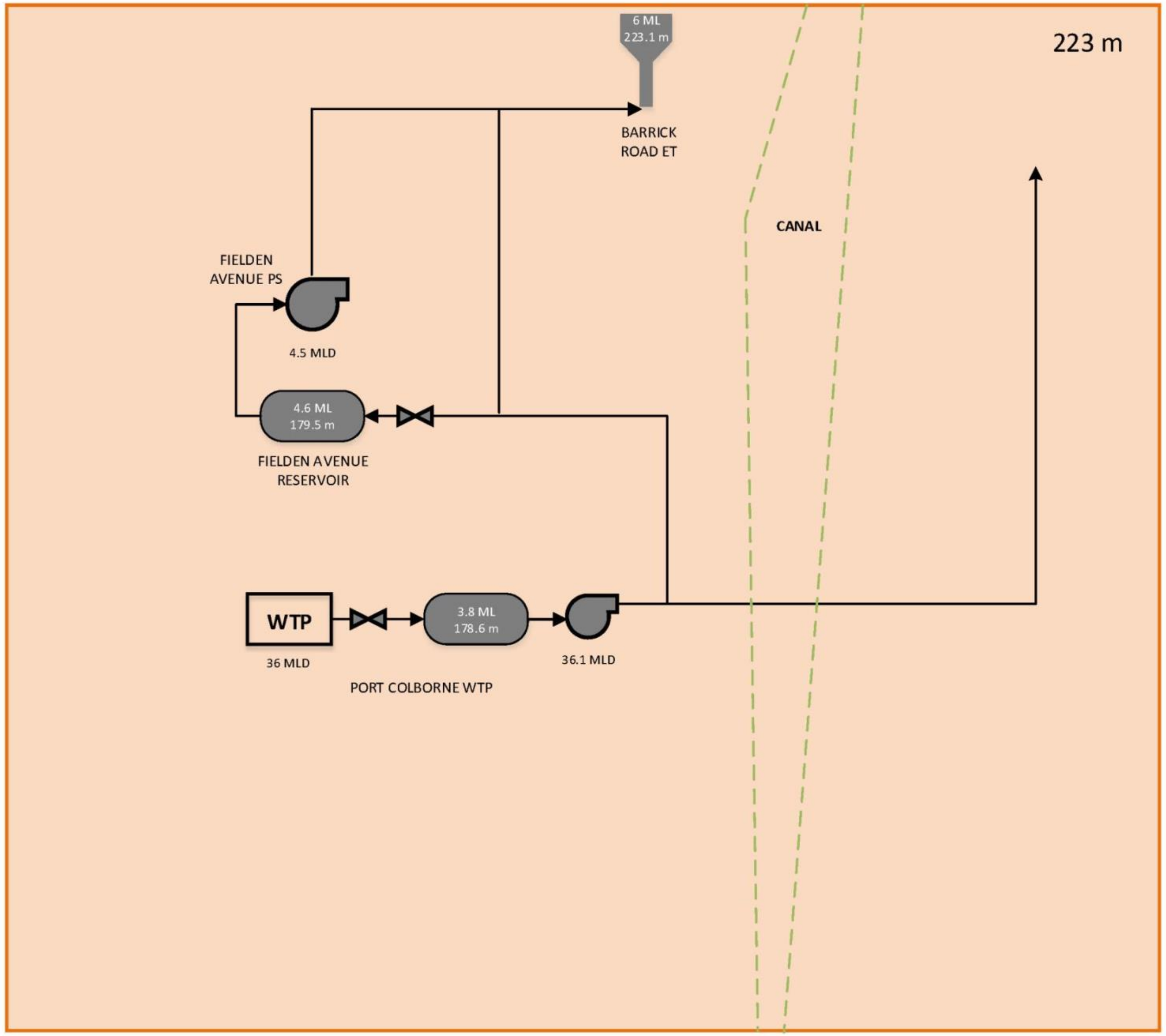

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WTP RATED CAPACITY Water Treatment Plant

FIRM CAPACITY Pumping Station

Volume TWL Reservoir

Volume TWL Elevated Tanks

Control Valve (Only normally operated valves shown)

C Chlorine Facility

Volume TWL Standpipe

Trunk Watermain Network

Settlement Area Boundaries

Land and Water Features

Pressure Zone

223 m

Figure 3.E.2

Port Colborne System

Existing Water Infrastructure Schematic

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E.1.1 Facility Overview

Table 3.E.1 to **Table 3.E.4** present details regarding the existing water treatment plant (WTP), pump stations, and storage facilities.

Table 3.E.1 Water Treatment Plant Overview

Plant Name	Port Colborne Water Treatment Plant
Drinking Water Works Permit	Permit Number: 007-201 Issue Number: 6 Issued August 2, 2019
Address	323 King Street, Port Colborne, ON, L3K 4H2
Source Water	Lake Erie via Welland Canal
Rated Maximum Day Demand Capacity	36.0 MLD
Key Processes	Zebra mussel control Travelling screens Coagulation Flocculation Sedimentation Filtration Disinfection

Table 3.E.2 Water Treatment Plant Water Quality Objectives

Parameters for Niagara Region Contact Time Calculation	
pH	8
Temperature (degrees C)	0.5
Required CT	49
Required Giardia Inactivation via Disinfection	0.5-log
Required Virus Inactivation via Disinfection	2-log
Minimum Free Chlorine	0.8 mg/L

* Refer to the Safe Drinking Water Act, Ontario Drinking Water Quality Standards for a comprehensive listing of water quality standards.

Table 3.E.3 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone and Facility)	Discharge (Pressure Zone)	Pressure Zones Supplied	Number of Pumps (Total/ Firm)	Installed Capacity (MLD)	Firm Capacity (MLD)	Total Dynamic Head (m)
Port Colborne WTP High Lift	323 King Street, Port Colborne	WTP	223	223	5/4	51.2	36.1	48.8
Fielden Avenue BPS	805 Fielden Avenue, Port Colborne	223	223	223	2/1	9.0	4.5	61.0

Table 3.E.4 Storage Facilities Overview

Storage Facility	Location	Storage Type	Volume (ML)	Top Water Level (m)	Fire Supply Zones	Maximum Day Demand Supply Zones
Port Colborne Water Treatment Plant Reservoir(1)	323 King Street, Port Colborne	Pumped Reservoir	3.8	178.6	223	223
Fielden Avenue Reservoir	805 Fielden Avenue, Port Colborne	Pumped Reservoir	4.6	179.5	223	223
Barrick Road Elevated Tank	Barrick Road and Elm Street, Port Colborne	Elevated Tank	6	223	223	223

(1) Total WTP storage volume is 3.8 ML, however, due to contact time requirements from the MECP, the actual usable volume at the Port Colborne WTP is calculated to be 2.9 ML under 2051 MDD and 2.4 ML under post-2051 MDD, as contact time cannot be used as system storage based on the MECP's CT requirement. Refer to **Section E.2.2** and **Volume 3 - Introduction** for additional information.

E.2 Basis for Analysis

E.2.1 Flow Criteria, Performance, and Sizing Methodology

The Niagara Region Traffic Area Zone planning data was used to estimate growth related demands within the water system and to spatially allocate growth demands within each individual system. **Table 3.E.5** presents a summary of the flow criteria, performance, and sizing methodology that was utilized. Refer to **Volume 3 – Introduction** for additional information.

The Region's per capita water demand criteria was updated based on a historic review of the previous 3-year period local billing meter records. Given that more granular data was available to complete this analysis compared to previous master plan updates, the population and employment per capita rates were differentiated, and both were reduced compared to the Region's previous per capita rate to more closely reflect existing usage trends. Further detail regarding the per capita water demands is presented in **Volume 3 – Introduction.**

In some systems, the NRW was found to be extremely high (i.e. greater than 25%). The expected NRW due to unbilled account for water is 10 to 20%. It was recommended that the local municipalities and the Region work to decrease NRW as much as possible in the long-term. Through this 2021 MSPU, a new policy has been proposed for municipalities where existing NRW is greater than 25% to attempt to decrease the future NRW to a maximum of 25%, using local area municipality programs and initiatives. The existing non-revenue water rates within the Port Colborne system is 41%. As such, when projecting future 2051 and buildout flows, the existing 2021 starting point NRW was reduced to 25% of existing billed demands. Further detail regarding the non-revenue water analysis is presented in **Volume 3 – Introduction.**

Table 3.E.5 Flow Criteria, Performance, and Sizing Methodology

Description			Criteria
Flow Criteria	Water Demand	Residential	240 L/c/d
		Employment	270 L/e/d
	Peaking Factor	Maximum Day	Based on historic average of maximum day peaking factors from 2016 – 2020
		Peak Hour Factor	Based on system mass balance using hourly SCADA data from 2018 – 2020
	Existing System Demands		Starting Point Methodology • Based on local billing meter records and production records to establish existing system demands • Growth demands are added to the existing system baseline using design criteria
System Performance Criteria	System Pressures		Acceptable pressure range of 40 – 100 psi • Regional objective of maximizing areas within the preferred range of 50 – 80 psi on Regional watermains
	Fire Flow		250 L/s on Regional watermains at residual pressure of 30 psi
	Velocity	Average Day	Flag areas less than 0.6 m/s minimum velocity
		MDD+FF or PHD	Flag areas greater than 1.5 m/s Trigger upgrades greater than 2 m/s
Sizing and Triggers	Plant and Facility Upgrade Triggers		• 80% trigger for plant and facility planning process (time-based trigger on a case-by-base basis) • Complete plant and facility expansions before 90% capacity is reached
	Treatment Plant Sizing		Maximum day demand
	Pumping Station Sizing		Various potential demand scenarios: • Maximum day demand (MDD) • MDD + fire flow (250 L/s or MECP) • Peak Hour Demand (PHD) Appropriate design sizing scenario depends on the configuration of the service area for the pumping station. Refer to **Volume 3 - Introduction** for further discussion.
	Watermain Sizing		Regional transmission main system for PHD and MDD + fire flow demands
	Storage Sizing		MECP methodology (A + B + C) • Refer to **Section E.2.2** for discussion regarding contact time (CT) volume requirement at WTP reservoirs

E.2.2 Water Treatment Plant Reservoir Contact Time Volume Requirement

Due to the contact time requirements from the MECP, the actual usable volume at the Port Colborne WTP reservoir is calculated to be less than the full volume of 3.8 ML, as contact time volume cannot be used as system storage based on the MECP's CT requirement. System storage capacity is presented and discussed in **Section E.3.4.**

A conservative assumption has been made for the usable volume at all water treatment plant reservoirs. The methodology for determining required CT is outlined in the MECP's Procedure for Disinfection of Drinking Water in Ontario. Detailed methodology and sample calculations for determining the required CT volume is presented in **Volume 3 – Introduction.**

Further, it should be noted that the Region applies a safety factor of 1.2 to all CT volume calculations as an additional buffer. However, it was determined that this safety factor would be removed for the purposes of storage sizing for the Region's 2021 MSPU, as all other parameters utilized within the CT calculation provide an inherent level of conservatism (i.e. temperature of 0.5 deg C and pH of 8).

E.2.3 Growth Population Projections and Allocations

Table 3.E.6 outlines the existing and projected serviced population and employment by pressure zone.

Table 3.E.6 Port Colborne Water Treatment Plant Existing and Projected Serviced Population and Employment by Pressure Zone

Pressure Zone	2021 Population & Employment			2051 Population & Employment			Post 2051 Population & Employment			2021-2051 Growth		
	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Population & Employment
223	17,356	5,083	22,439	21,496	7,040	28,536	36,769	11,246	48,015	4,140	1,956	6,097
Total	**17,356**	**5,083**	**22,439**	**21,496**	**7,040**	**28,536**	**36,769**	**11,246**	**48,015**	**4,140**	**1,956**	**6,097**

Note: Population numbers may not sum due to rounding.

E.3 Existing System Performance

E.3.1 Starting Point Demands and Performance

The starting point demand and maximum day peaking factor for the Port Colborne WTP was calculated using historic SCADA production data. Ten years of data (2011 to 2020) was reviewed to provide historical context and assess overall long-term trends, however, the most recent five years of data was used to determine the maximum day demand peaking factor. **Table 3.E.7** presents the historic water demand and water system maximum day peaking analysis. Based on the historic analysis the Port Colborne WTP system has an existing average demand of 7.9 MLD and system peaking factor of 1.59.

Table 3.E.7 Historic Water Demand

Year	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Maximum Day Demand Peaking Factor
2011	8.2	11.8	1.45
2012	7.9	12.3	1.55
2013	7.9	12.0	1.52
2014	8.6	14.0	1.64
2015	9.0	14.9	1.65
5-Year Average	*8.3*	*13.0*	*1.6*
5-Year Peak	*9.0*	*14.9*	*1.6*
2016	7.7	11.4	1.47
2017	8.7	14.2	1.62
2018	8.8	14.2	1.60
2019	7.3	12.4	1.71
2020	6.8	10.5	1.53
5-Year Average	**7.9**	**12.5**	**1.59**
5-Year Peak	*8.8*	*14.2*	*1.71*
10-Year Average	*8.1*	*12.8*	*1.57*
10-Year Peak	*9.0*	*14.9*	*1.71*
MECP Peaking Factor (Existing)	**1.90**		
MECP Peaking Factor (2051)	**1.80**		

Local billing meter records were provided by the local area municipalities for the years of 2018 – 2020. Using this more granular data, along with Region billing meter data, system non-revenue water was calculated for each municipality, as well as system demands for each pressure zone. To estimate future system demands, the projected residential and employment growth populations were then converted to expected flows using the criteria presented in **Table 3.E.5**. Existing and future water system demands by pressure zone are presented in **Table 3.E.8**.

Table 3.E.8 Existing and Future Water System Demands by Pressure Zone

Pressure Zone	2021 Demand		2021 to 2051 Growth Demand		2051 Demand (Existing + Growth)		2051 Demand With NRW Reduction (Existing + Growth) (1)		Post 2051 Demand (Existing + Growth)		Post 2051 Demand With NRW Reduction (Existing + Growth)(1)	
	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)
223	8.2	11.2	1.5	2.4	9.7	13.6	8.3	12.1	14.5	21.2	13.1	19.8
Total	**8.2**	**11.2**	**1.5**	**2.4**	**9.7**	**13.6**	**8.3**	**12.1**	**14.5**	**21.2**	**13.1**	**19.8**

(1)Non-revenue water (NRW) adjustments were made within systems where existing NRW was higher than 25%. Assumption was made that the starting point NRW would be reduced to 25% for those systems when analysing 2051 and post-2051 scenarios.

E.3.2 Treatment Plant Capacity

Figure 3.E.3 shows the projected future demands at the Port Colborne Water Treatment Plant. The plant has surplus capacity to support projected growth and will not reach 80% capacity within the 2051 time horizon.

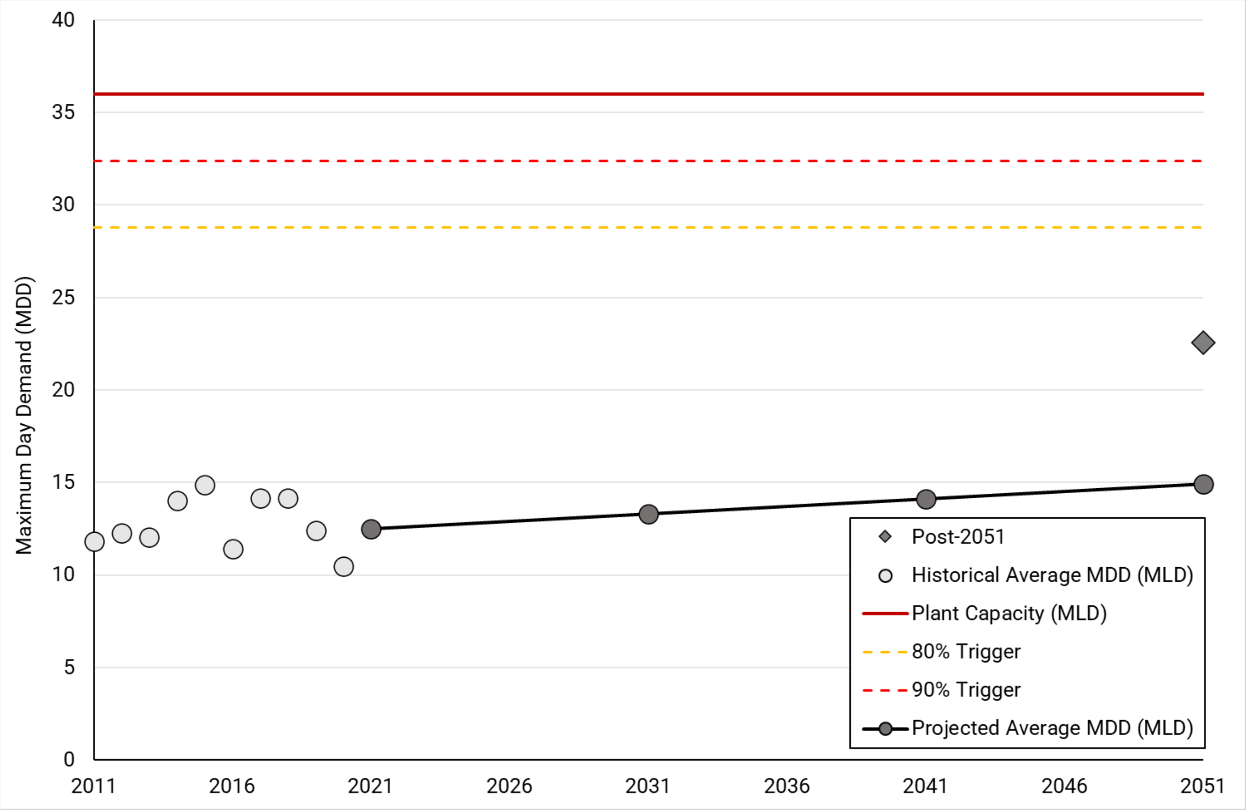

Figure 3.E.3 Projected Maximum Day Demand at Port Colborne Water Treatment Plant

E.3.3 Pumping Capacity

Table 3.E.9 highlights the pumping station existing and projected capacity. As presented in **Section E.2.1**, there are various potential demand scenarios for pumping station capacity sizing depending on system configuration and available storage type and volume. As such, the design condition has been specified in the table below (i.e. maximum day demand, peak hour demand, or maximum day demand + fire flow), along with the 2021, 2051, and post-2051 design flows which correspond to the design condition for each respective pump station.

Pumping capacity within the Port Colborne WTP system is sufficient to support existing and future demands.

Table 3.E.9 System Pumping Station Performance

Pump Station	Firm Capacity (MLD)	Pressure Zones Supplied	Total Effective Capacity (MLD)	Design Condition	Existing Maximum Day Demand (MLD)	Design Flow (MLD)	Existing Surplus/ Deficit (MLD)	2051 Maximum Day Demand (MLD)	2051 Design Flow (MLD)	2051 Surplus/ Deficit (MLD)	Post-2051 Maximum Day Demand (MLD)	Post-2051 Design Flow (MLD)	Post-2051 Surplus/ Deficit (MLD)
Port Colborne WTP/ High Lift PS	36.1	223	36.1	PHD	11.2	16.8	19.3	12.1	18.2	17.9	19.8	29.7	6.4
Fielden Avenue BPS[1]	4.5	223											

[1] Pump capacity not included in total effective capacity

E.3.4 Storage Capacity

Using the MECP methodology for CT volume calculations and the corresponding MDD for each planning horizon, the required CT volume at the Port Colborne WTP reservoir is 0.9 ML under 2051 MDD, and 1.4 ML under post-2051 MDD. As such, the remaining usable volume for system storage utilization at the Port Colborne WTP reservoir is 2.9 ML under 2051 MDD, and 2.4 ML under post-2051 MDD. As a conservative assumption the 2051 MDD volume was utilized for the existing system capacity utilization table. **Table 3.E.10** presents the available system storage at the Port Colborne WTP under various demand scenarios.

Table 3.E.10 Available System Storage at the Port Colborne WTP under 2051 MDD, Post-2051 MDD, and at MDWL Capacity

Port Colborne WTP	2051 MDD	Post-2051 MDD	At MDWL Capacity
Minimum Reservoir Out/Treated Free Chlorine (mg/L)	0.8	0.8	0.8
Maximum Ph	8	8	8
Minimum Temperature (deg. C)	0.5	0.5	0.5
Reservoir Volume (ML)	3.8	3.8	3.8
Reservoir Baffle Factor	0.7	0.7	0.7
2051 MDD (ML/D)	12.1	19.8	36.0
$CT_{required}$	49	49	49
Safety Factor	1	1	1
CT_{actual}	49	49	49
T_{10}	61.3	61.3	61.3
Reservoir Retention Time (min)	87.5	87.5	87.5
Min Volume Needed (ML)	0.7	1.2	2.2
Minimum Reservoir Level (%)	0.2	0.3	0.6
Storage Volume Available (ML)	**3.1**	**2.6**	**1.6**

Table 3.E.11 highlights the storage existing and projected capacity. The 2016 MSP recommended the decommissioning of the Fielden Reservoir due to age and condition of the facility and due to there being sufficient 2041 storage without the Fielden Reservoir. Two storage scenarios are presented in **Table 3.E.11,** with and without the Fielden Reservoir.

Table 3.E.11 System Storage Capacities

Storage	Fire Supply Zones	MDD Supply Zones	2021 Rated Capacity (ML)	2051 Rated Capacity (ML)	Post-2051 Rated Capacity (ML)	2021 Total Available Storage (ML)	2021 Required Storage	2021 Surplus/ Deficit (ML)	2051 Total Available Storage (ML)	2051 Required Storage (ML)	2051 Surplus/ Deficit (ML)	Post-2051 Total Available Storage (ML)	Post-2051 Required Storage (ML)	Post-2051 Surplus/ Deficit (ML)
Port Colborne WTP Reservoir(1)	223 Pumped	223	3.06(3)	3.06	2.60	13.62	9.4	4.2	13.6	11.1	2.5	13.2	16.4	-3.2
Fielden Avenue Reservoir	223 Pumped	223	4.554	4.554	4.554									
Barrick Road ET	223 Floating	223	6	6	6									
Port Colborne WTP Reservoir(1)	223 Pumped	223	3.06	3.06	2.60	13.62	9.4	4.0	9.1	11.1	-2.1	8.6	16.4	-7.8
Fielden Avenue Reservoir(2)	223 Pumped	223	4.554	N/A	N/A									
Barrick Road ET	223 Floating	223	6	6	6									

(1)Refer to **Section E.2.2** for discussion on contact time volume requirements at the WTP reservoir

(2)Without Fielden Reservoir, as recommended in the 2016 MSP, to be decommissioned before 2051, volume not included in 2051 or Post-2051 available storage

(3)2051 MDD volume was utilized for the existing system capacity utilization table (conservative assumption)

E.3.5 System Pressures and Fire Flows

Figure 3.E.4 to **Figure 3.E.5** present the existing system performance, based on existing system configuration and capacities.

In general, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. Most pressures in Port Colborne fall between 50 and 60 psi, which some localized areas experiencing pressures between 40 and 50 psi due to ground elevation. It has been noted through discussions with the local area municipality that the lower pressures are preferred due to the age and condition of the local watermain system. Pressures less than 40 psi are experienced at the far east extremity of the system on Second Concession Road due to the long dead-end watermain.

The Region’s target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for most critical system areas. The fire flow target is not met at the north end of the Regional watermain on Elizabeth Street, as there is no existing Regional watermain loop to maintain the higher fire flow. This is currently not a critical area for the Regional watermain as the existing level of development is low, however, significant future growth is planned for the area, increasing the need for additional Regional watermain looping to improve available fire flows in the area.

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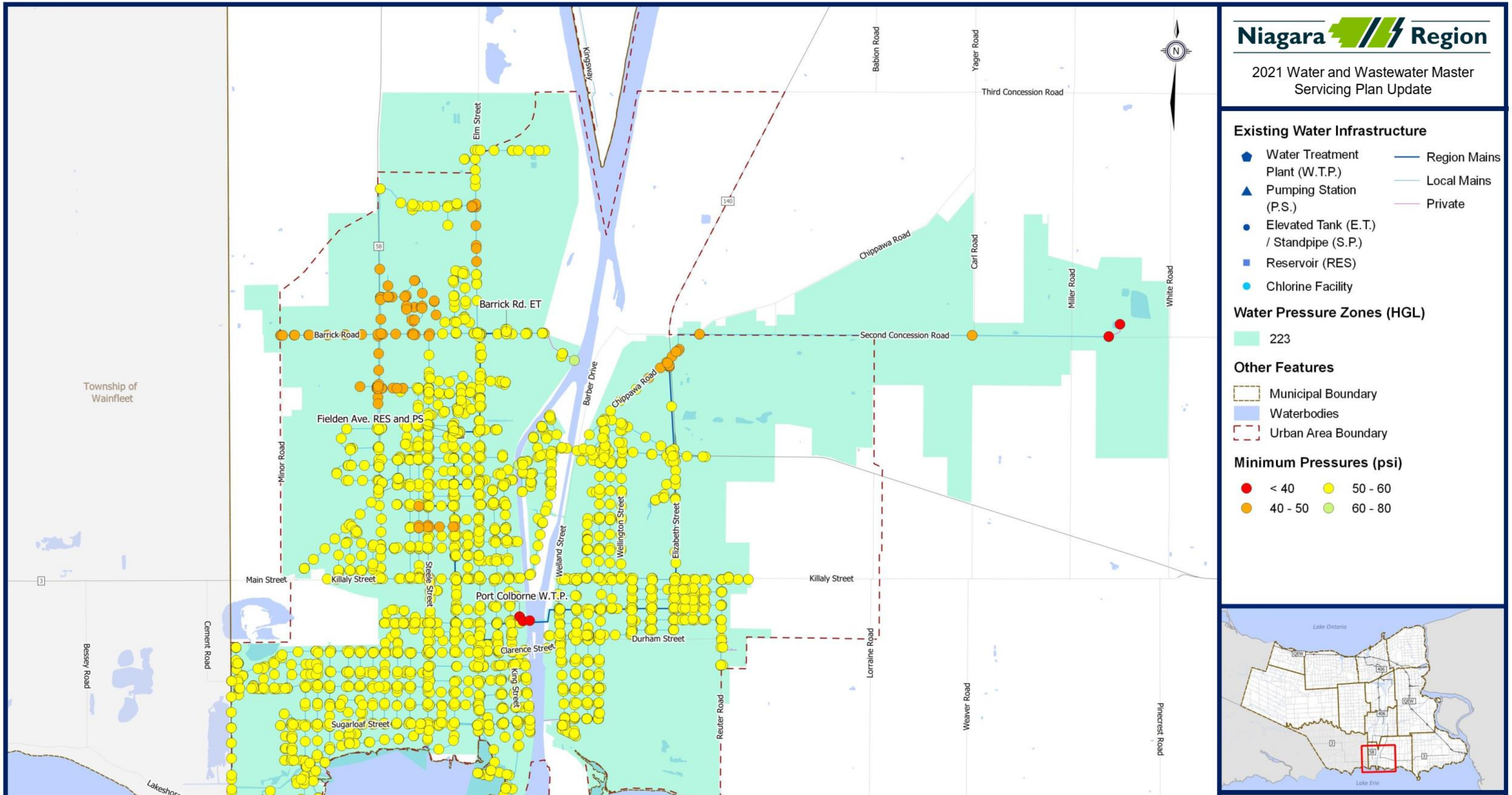

Figure 3.E.4
Port Colborne

Existing System Peak Hour Pressures

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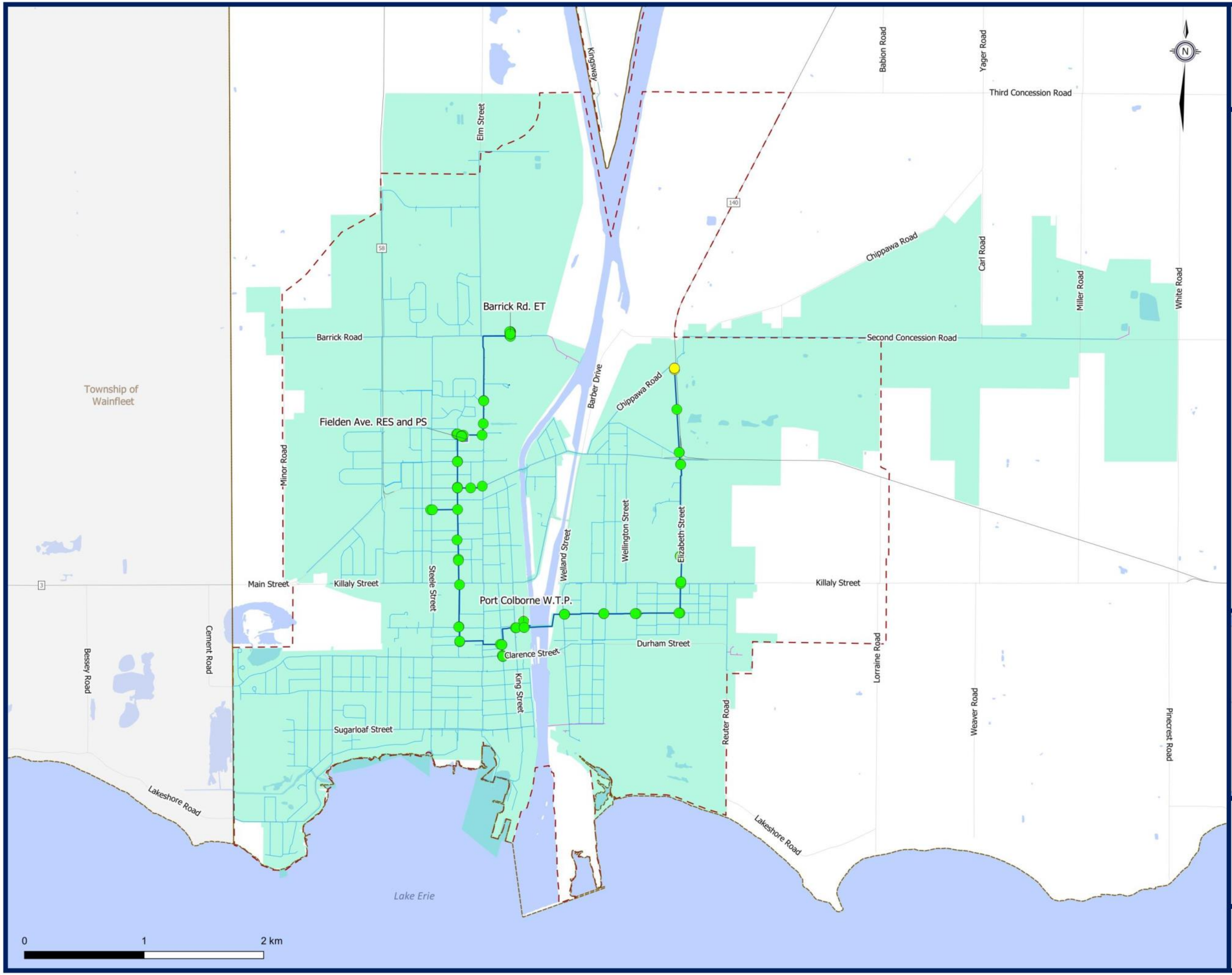

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- Region Mains
- Local Mains
- Private

Water Pressure Zones (HGL)

- 🟩 223

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Regional Mains Available Fire Flow (L/s) - 30 psi Residual Pressure

- 🔴 < 125
- 🟢 > 250
- 🟡 125 - 250

Figure 3.E.5
Port Colborne
Existing System Fire Flows

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E.3.6 Water Age and Watermain Capacity

Using the baseline system model, water age scenarios were created to identify average system water age. Using the Drinking Water Works Permits for each system, the locations of re-chlorination facilities were identified. Water age was reset to zero at these facilities for the water age model scenario. Water age is typically used as a proxy indicator for water quality, however, the exact correlation between water age and water quality can be highly variable depending on the source water quality, seasonal changes in water temperature, the distribution system material, and the secondary disinfectant that is used. A common threshold used within water system age is to flag areas where water age is greater than 7 days.

Figure 3.E.6 presents the existing system water age. Watermain velocities less than 0.6 m/s or greater than 1.5 m/s have been flagged and are shown in **Figure 3.E.7.**

In general, maximum water age is less than 7 days within the Port Colborne water system, except for minor local dead-end watermains

In general, watermain velocity is less than 2 m/s, however most of the Regional watermains in Port Colborne experience velocities less than 0.6 m/s.

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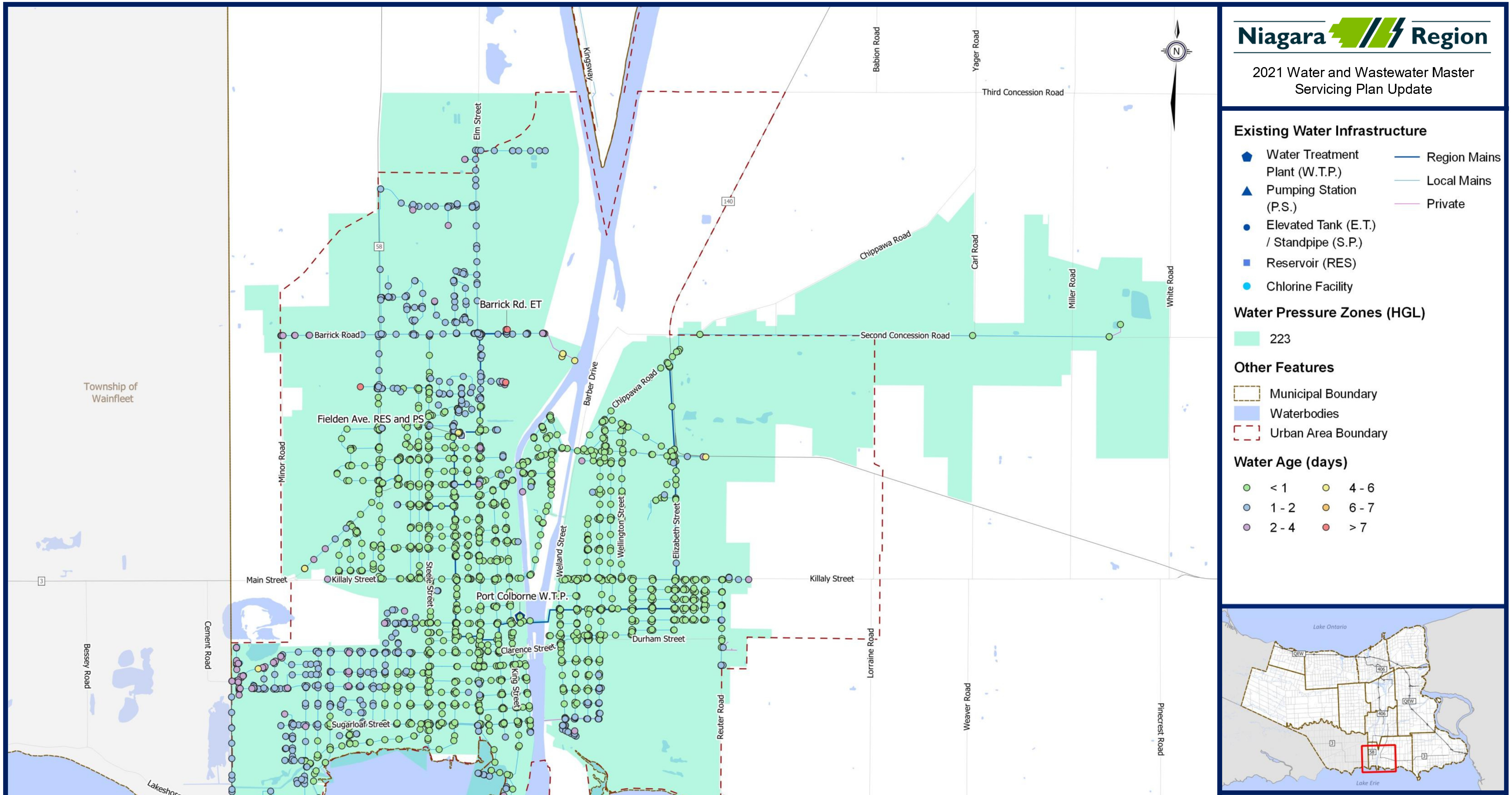

Figure 3.E.6
Port Colborne System
Existing System Water Age

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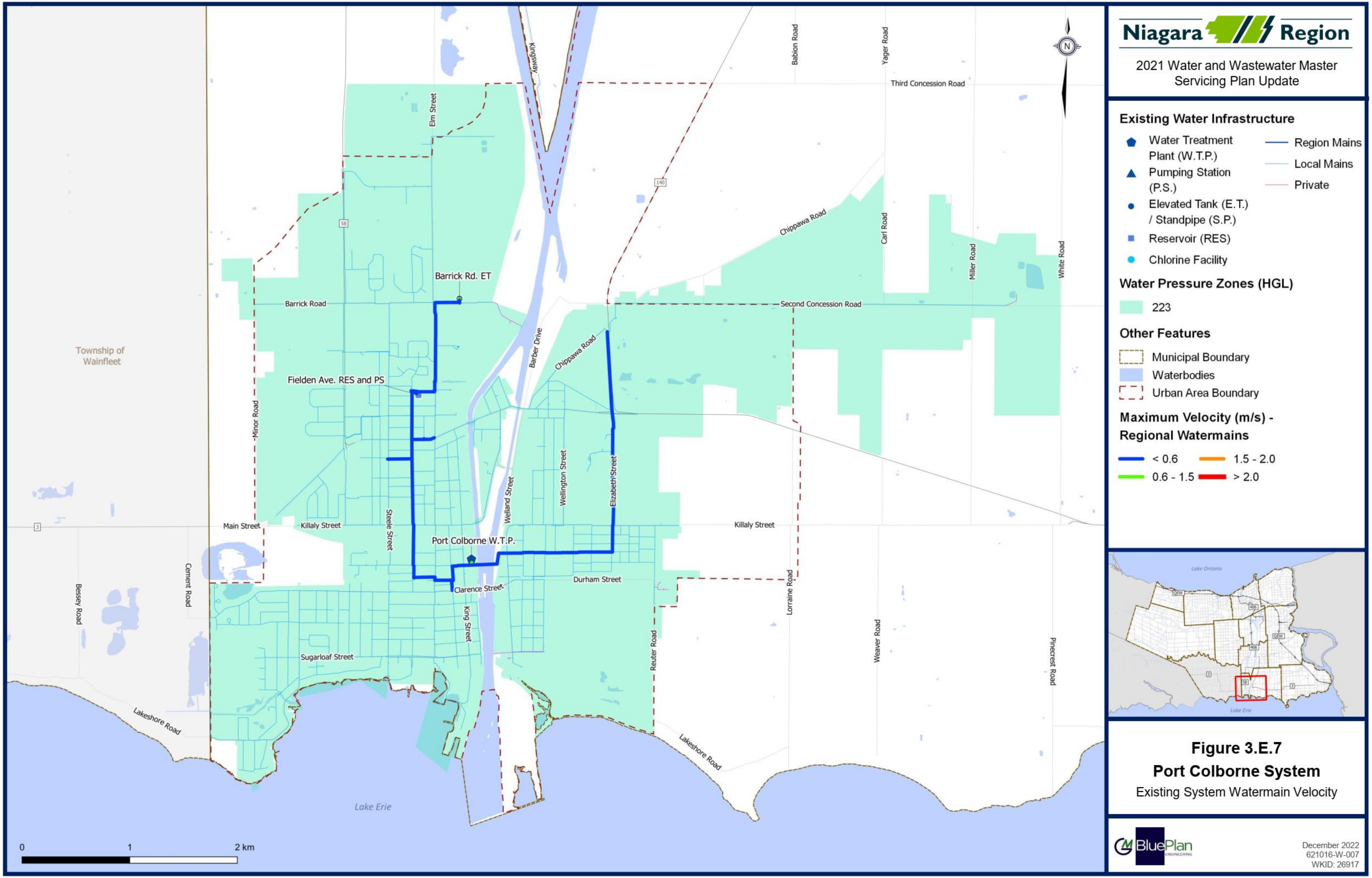

Figure 3.E.7
Port Colborne System
Existing System Watermain Velocity

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E.4 System Opportunities and Constraints

Figure 3.E.8 highlights the existing opportunities and constraints.

E.4.1 Port Colborne Water Treatment Plant

- The current rated MDD capacity is 36.0 MLD, with an existing demand of 11.2 MLD. The projected 2051 MDD is 12.1 MLD and the projected post-2051 MDD is 19.8 MLD, which is below 80% of the water treatment plant rated capacity. As such, the water treatment plant has surplus capacity to accommodate growth beyond 2051.
- Due to the large long-term surplus of treatment and pumping capacity projected at the water treatment plant, with less than 50% of the water treatment plant rated capacity being utilized by 2051, there are opportunities to reduce the amount of balancing storage that needs to be maintained within the Port Colborne water system. However, the final servicing strategy was developed using the Region’s existing balancing storage requirement of 25% of MDD.

E.4.2 Port Colborne System

- Fielden Avenue Reservoir:
    - Current configuration presents existing operational issues related to water quality and sub-optimal pumping strategy.
    - The existing Fielden Avenue Reservoir and pump station is approaching the end of its design life and would require rehabilitation to maintain ongoing operations
    - Decommissioning of the Fielden Reservoir will result in a storage deficit before 2051, which can be managed through the large long-term surplus of treatment and pumping capacity projected at the WTP.
- When not considering potential reductions in balancing storage needs due to surplus capacity at the water treatment plan, the system has the following storage characteristics:
    - Existing configuration has a storage surplus of 4.0 ML.
    - Without decommissioning the Fielden Avenue Reservoir and Pumping Station (PS), there is sufficient storage to meet 2051 growth needs, however, there will be a total storage deficit to meet buildout demands.
    - Decommissioning the Fielden Avenue Reservoir and PS will decrease total system storage, resulting in a projected 2051 storage deficit of 2.2 ML.
- The system generally has adequate minimum peak hour pressures and fire flow.
- The existing system experiences high NRW rates (41%), which is an opportunity to reduced existing NRW inline with the 25% target maximum rate.

E.4.3 System Security of Supply and Interconnections

- There is only one Regional feed to the east side of the canal.
- There is no floating storage east of the canal.

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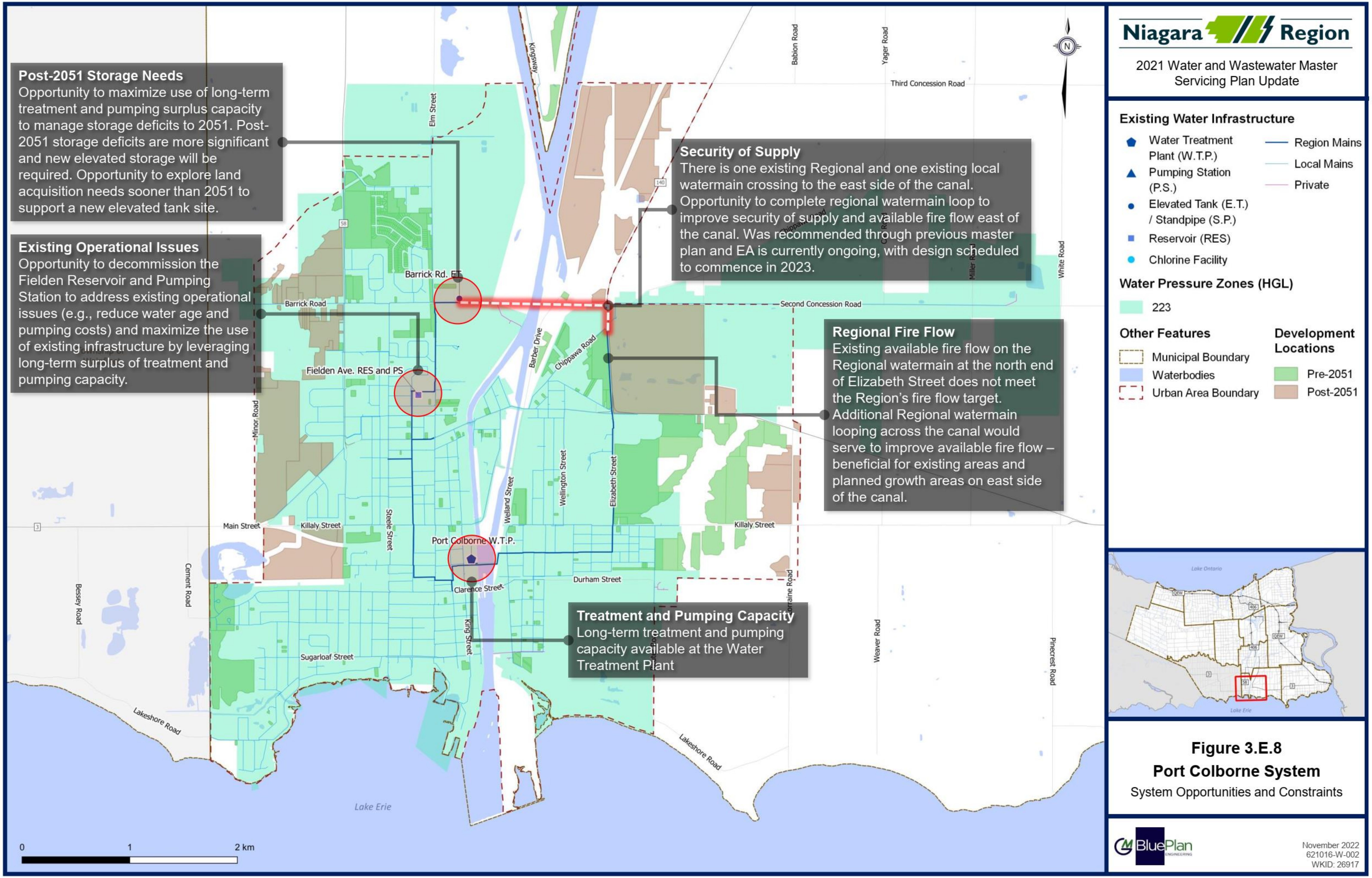


Post-2051 Storage Needs
Opportunity to maximize use of long-term treatment and pumping surplus capacity to manage storage deficits to 2051. Post-2051 storage deficits are more significant and new elevated storage will be required. Opportunity to explore land acquisition needs sooner than 2051 to support a new elevated tank site.

Existing Operational Issues
Opportunity to decommission the Fielden Reservoir and Pumping Station to address existing operational issues (e.g., reduce water age and pumping costs) and maximize the use of existing infrastructure by leveraging long-term surplus of treatment and pumping capacity.

Security of Supply
There is one existing Regional and one existing local watermain crossing to the east side of the canal. Opportunity to complete regional watermain loop to improve security of supply and available fire flow east of the canal. Was recommended through previous master plan and EA is currently ongoing, with design scheduled to commence in 2023.

Regional Fire Flow
Existing available fire flow on the Regional watermain at the north end of Elizabeth Street does not meet the Region's fire flow target. Additional Regional watermain looping across the canal would serve to improve available fire flow – beneficial for existing areas and planned growth areas on east side of the canal.

Treatment and Pumping Capacity
Long-term treatment and pumping capacity available at the Water Treatment Plant

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- Region Mains
- Local Mains
- Private

Water Pressure Zones (HGL)

- 🟩 223

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Development Locations

- 🟩 Pre-2051
- 🟫 Post-2051

Figure 3.E.8
Port Colborne System
System Opportunities and Constraints

BluePlan ENGINEERING

November 2022
621016-W-002
WKID: 26917

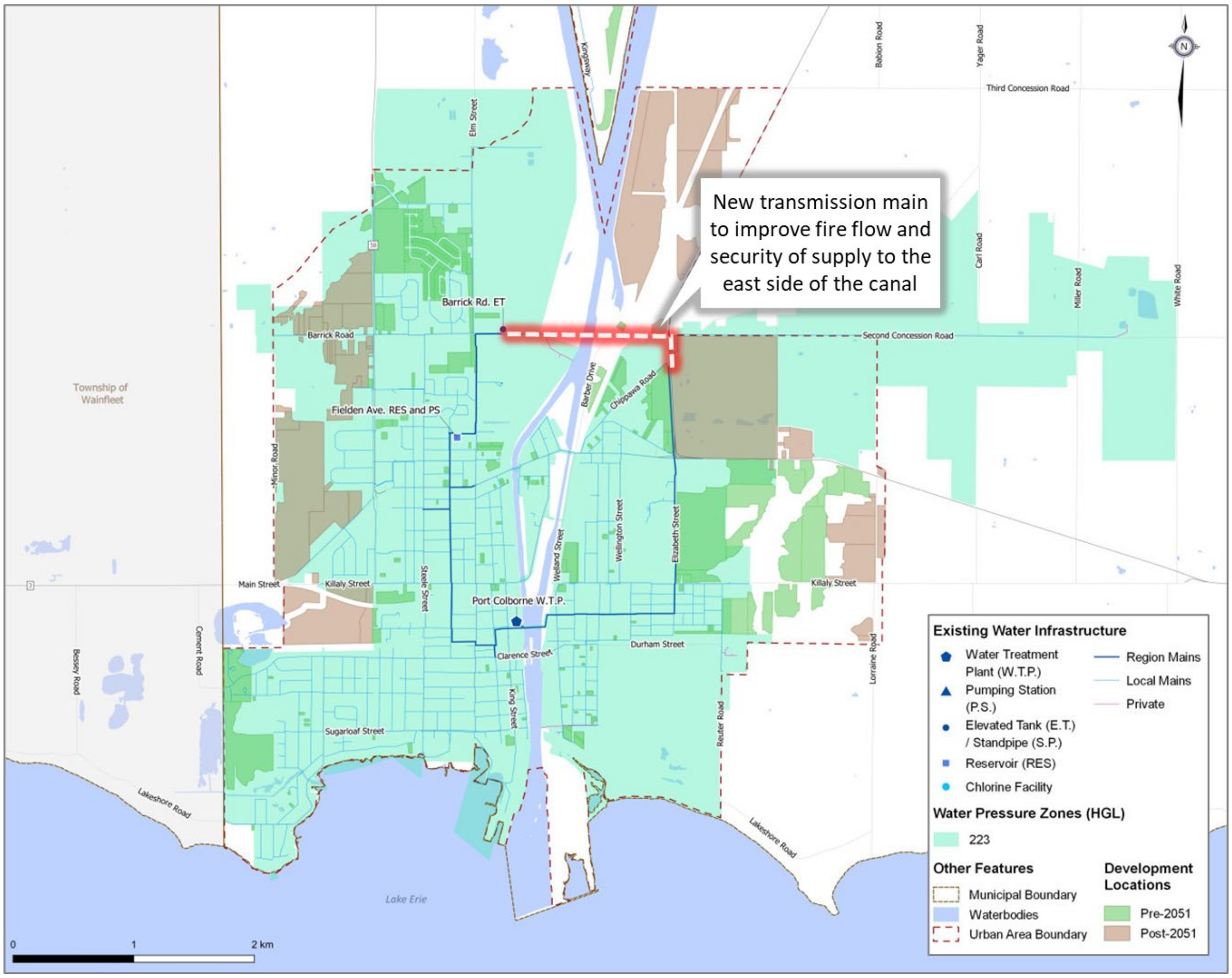
E.5 Assessment of Alternatives

To address existing and growth-related capacity needs, the following servicing alternatives were evaluated:

- Baseline (No Changes),
- Maintain Fielden Reservoir and Pumping Station, and
- Decommission Fielden Reservoir and Pumping Station.

E.5.1 Alternative 1 – Maintain Fielden Reservoir and Pumping Station

Alternative 1, highlighted in **Figure 3.E.9**, represents the status quo, maintaining the long-term operation of the Fielden Reservoir and Pumping Station. The new transmission main from Barrick ET, across the east side of the canal to the existing Regional watermain on Elizabeth Street, serves to improve fire flows on the east side of the canal as well as provide security of supply to the east side of the canal.



New transmission main to improve fire flow and security of supply to the east side of the canal

Figure 3.E.9 Alternative 1 – Maintain Fielden Reservoir and Pumping Station

E.5.2 Alternative 2 – Decommission Fielden Reservoir and Pumping Station

Alternative 2, highlighted in **Figure 3.E.10**, includes the decommissioning of the Fielden Reservoir and Pumping station, as well as a new elevated storage tank post-2051 to support long-term growth needs. The new transmission main from Barrick ET, across the east side of the canal to the existing Regional watermain on Elizabeth Street, serves to improve fire flows on the east side of the canal as well as provide security of supply to the east side of the canal.

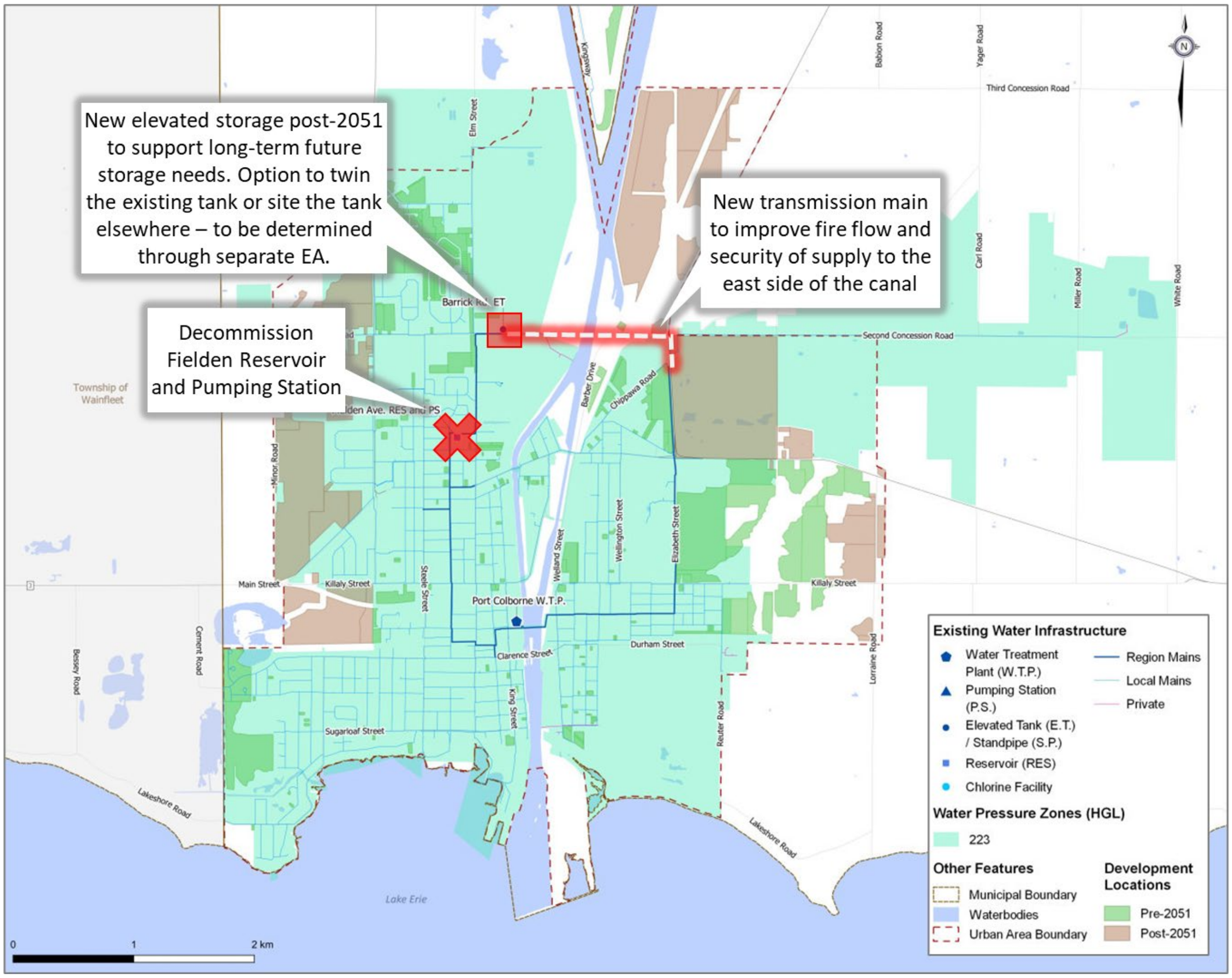


Figure 3.E.10 Alternative 2 – Decommission Fielden Reservoir and Pumping Station

E.5.3 Alternatives Evaluation

Table 3.E.12 presents the two alternatives along with their advantages and disadvantages.

Through discussion with Region staff and based on the relative advantages and disadvantages of the alternatives, Alternative 2 - Decommission Fielden Reservoir and Pumping Station is the preferred servicing strategy as:

- The baseline strategy does not satisfy future servicing needs of the water system.
- Alternative 2 allows for:
    - Addresses existing operational issues through the decommissioning of the Fielden Reservoir and Pumping Station; and
    - Maximizes the use of existing supply and pumping capacity at the Port Colborne Water Treatment Plant.

Table 3.E.12 Comparison of Alternatives

Category	Alternative 1	Alternative 2 (Preferred)
Description	Maintain Fielden Reservoir	Decommission Fielden Reservoir
Upgrades	• No upgrades • New transmission main from Barrick ET to east side of canal	• Decommission Fielden Reservoir and PS • New transmission main from Barrick ET to east side of canal
Advantages	• System storage is adequate to support 2051 • Significant surplus pumping capacity • Security of supply and available fire flow improved to the east side of the canal	• Addresses existing operational issues with current configuration • Small storage deficiency under 2051 without Fielden Reservoir can be supplemented via surplus pumping capacity • Reduced pumping costs and reduced water age • Security of supply and available fire flow improved to the east side of the canal • Provides flexibility in the timing of the new ET to better align with future growth
Disadvantages	• Current configuration presents operational issues related to water quality and sub-optimal pumping strategy • Higher pumping costs • Post-2051 storage is required (3.4 ML)	• Post-2051 storage is required (7.9 ML)

E.6 Preferred Servicing Strategy

The following is a summary of the Port Colborne water servicing strategy:

- The Port Colborne Water Treatment Plant has sufficient capacity to support growth beyond 2051;
- The components of the Port Colborne water strategy are focused on providing additional storage for the growth in the area while optimizing the storage/pumping relationship to reduce long term lifecycle costs;
- The Fielden Reservoir and Pumping Station will be decommissioned, which will address existing operational issues, reduce long-term lifecycle costs, and maximize the use of surplus pumping and treatment capacity at the WTP to address peak flows;
- Additional feedermain will be provided crossing the Canal to support growth on the east and west side of Port Colborne; and,
- New elevated storage will support long-term projected growth (post-2051).

Figure 3.E.15 and **Figure 3.E.16** show the preferred servicing strategy and schematic, consisting of:

E.6.1 Storage

- New 9.0 ML elevated tank post-2051 to support long-term growth needs (W-S-012). For the purposes of this master plan, the location of the new elevated tank is shown as at the Barrick Road ET location as a twinned ET, however, the preferred location of the ET will be determined through a separate EA supporting the project.

E.6.2 Decommissioning of Existing Facilities

- The Fielden Avenue Reservoir and Pumping Station will be decommissioned to optimize system operations and energy use (W-D-007).

E.6.3 Regional Watermains

- New 450 mm watermain across the canal to improve security of supply to the east side (W-M-002)

E.6.4 Studies and Programs

Special project implementation and considerations for the preferred servicing strategy consist of:

- The new elevated tank is recommended to be in service post-2051 but has been included in the capital program to provide visibility of the project to the Region and to allow additional time for the Region to contemplate property acquisition needs for the site. Further, it is noted that if the Region is unable to leverage the surplus pumping and treatment capacity of the WTP, the timing of the new elevated tank may need to be advanced;

- The City, in coordination with the Region, should implement a targeted non-revenue water reduction program to address existing high non-revenue water rates; further details are provided in **Section E.8.3**; and,
- Region-wide WTP reservoir volume study to review CT volume and overall system storage.

E.6.5 Future System Peformance

Figure 3.E.11 to **Figure 3.E.14** present the future system performance, based on the preferred servicing strategy configuration and capacities.

In general, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. Most pressures in Port Colborne fall between 50 and 60 psi, which some localized areas experiencing pressures between 40 and 50 psi due to ground elevation. It has been noted through discussions with the local area municipality that the lower pressures are preferred due to the age and condition of the local watermain system. Pressures less than 40 psi are experienced at the far east extremity of the system on Second Concession Road due to the long dead-end watermain.

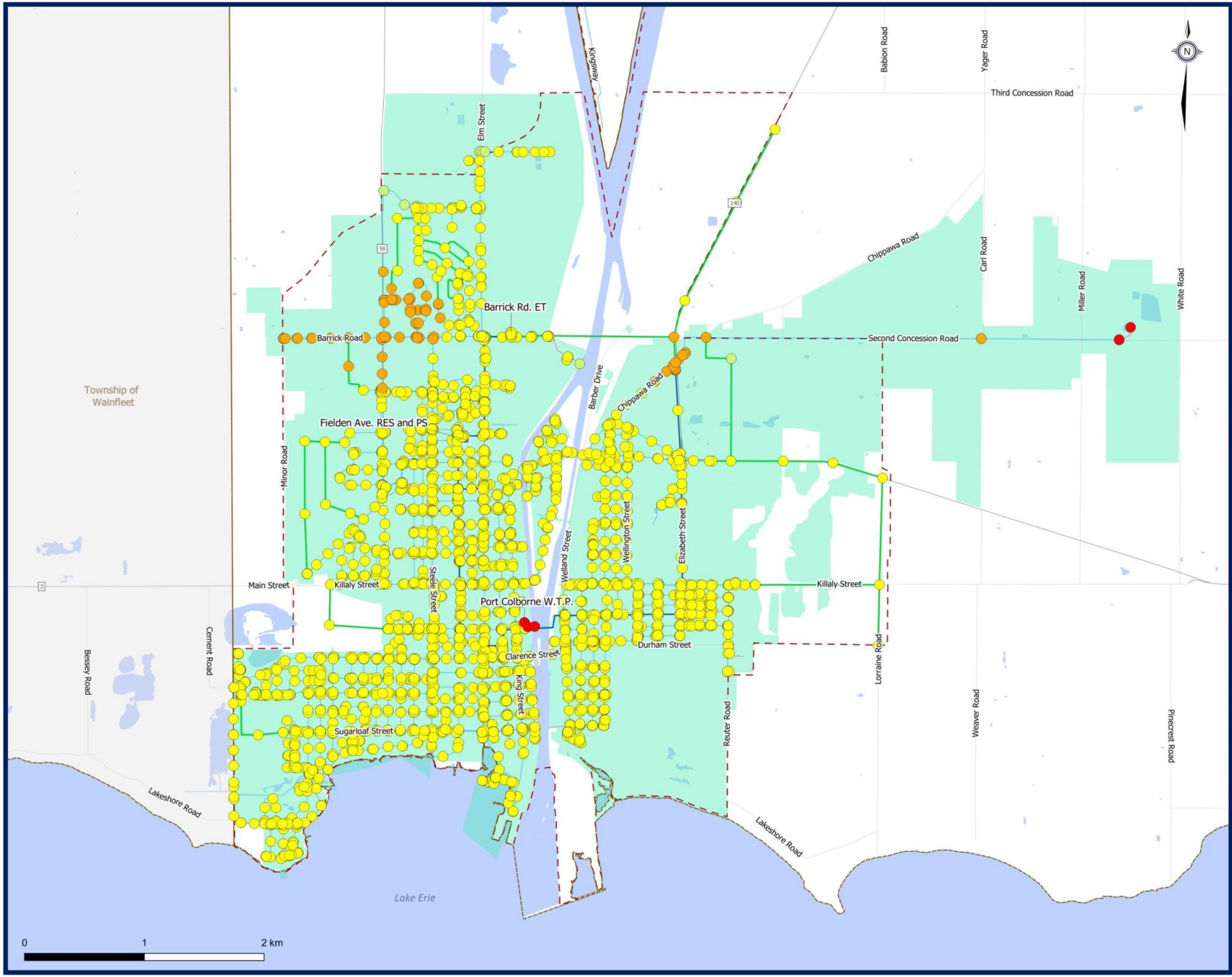
The Region’s target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for most critical system areas. The fire flow target is not met at the north end of the Regional watermain on Elizabeth Street, as there is no existing Regional watermain loop to maintain the higher fire flow. This is currently not a critical area for the Regional watermain as the existing level of development is low, however, significant future growth is planned for the area, increasing the need for additional Regional watermain looping to improve available fire flows in the area.

In general, maximum water age is less than 7 days within the Port Colborne water system, except for minor local dead-end watermains

In general, watermain velocity is less than 2 m/s, however most of the Regional watermains in Port Colborne experience velocities less than 0.6 m/s.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update



Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

- 🟩 223

Other Features

- ▭ Municipal Boundary
- ▭ Waterbodies
- ▭ Urban Area Boundary
- — Future Watermains

Minimum Pressures (psi)

- ● < 40
- ● 40 - 50
- ● 50 - 60
- ● 60 - 80

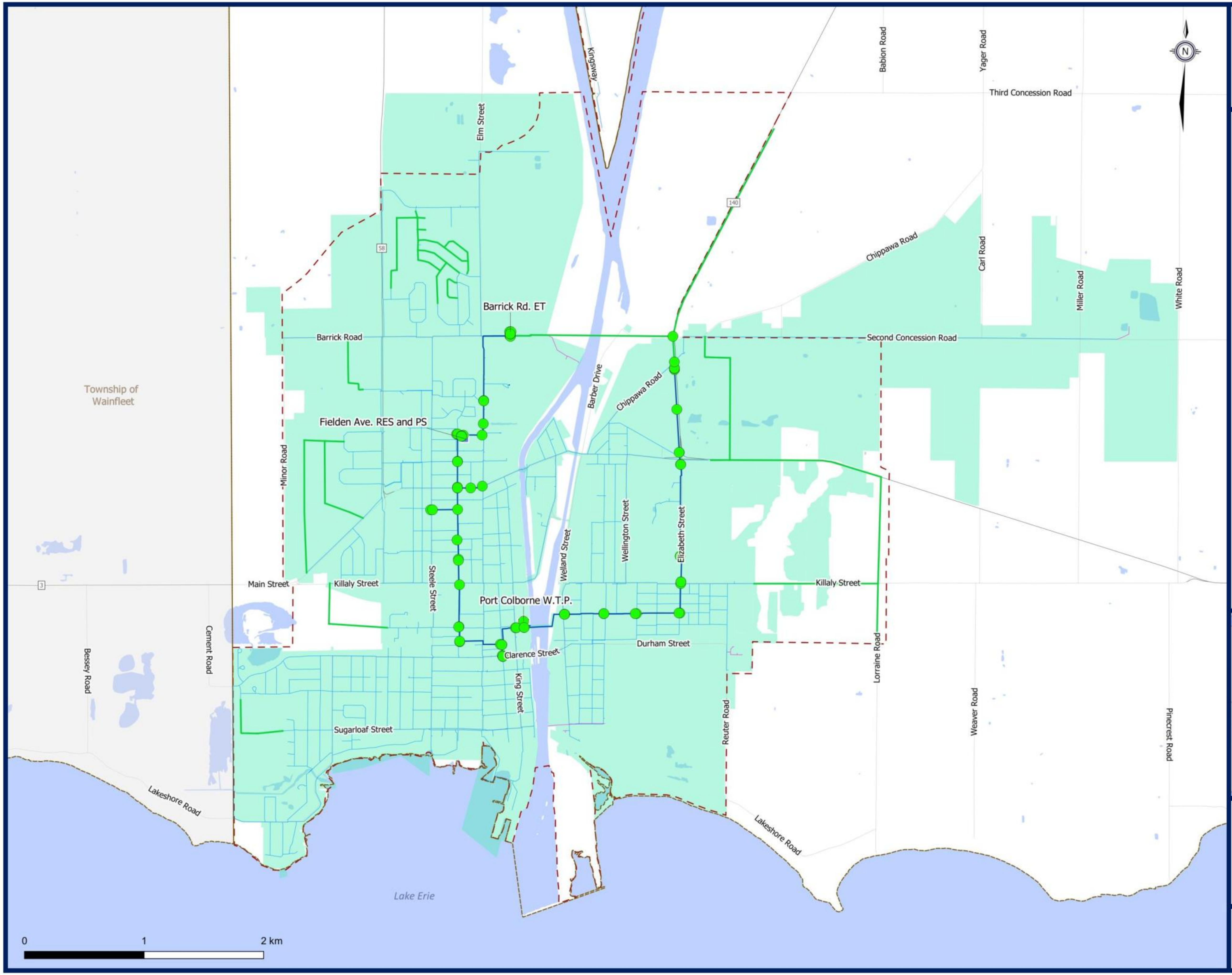
Figure 3.E.11

Port Colborne System

2051 System Peak Hour Pressures

GM BluePlan ENGINEERING

December 2022
621016-W-008
WKID: 26917



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

- 🟩 223

Other Features

- ☐ Municipal Boundary
- ▨ Waterbodies
- ☐ Urban Area Boundary
- — Future Watermains

Regional Mains Available Fire Flow (L/s) - 30 psi Residual Pressure

- 🔴 < 125
- 🟡 125 - 250
- 🟢 > 250

Figure 3.E.12
Port Colborne System

2051 System Fire Flows

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621016-W-009
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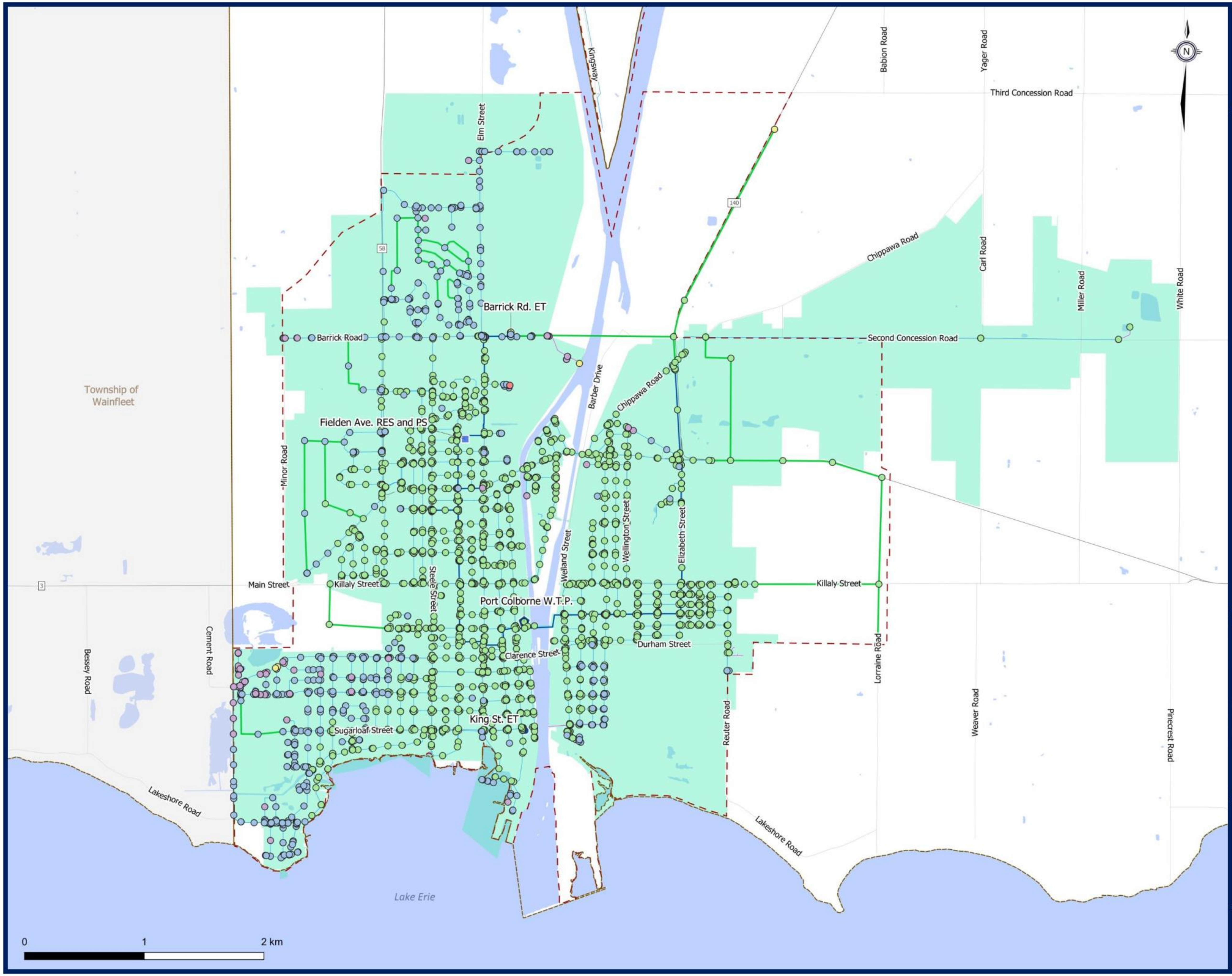

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

- 🟩 223

Other Features

- ▭ Municipal Boundary
- ▭ Waterbodies
- ▭ Urban Area Boundary
- — Future Watermains

Water Age (days)

● < 1	● 4 - 6
● 1 - 2	● 6 - 7
● 2 - 4	● > 7

Figure 3.E.13
Port Colborne System
2051 System Water Age

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May 2023
621016-W-011
WKID: 26917

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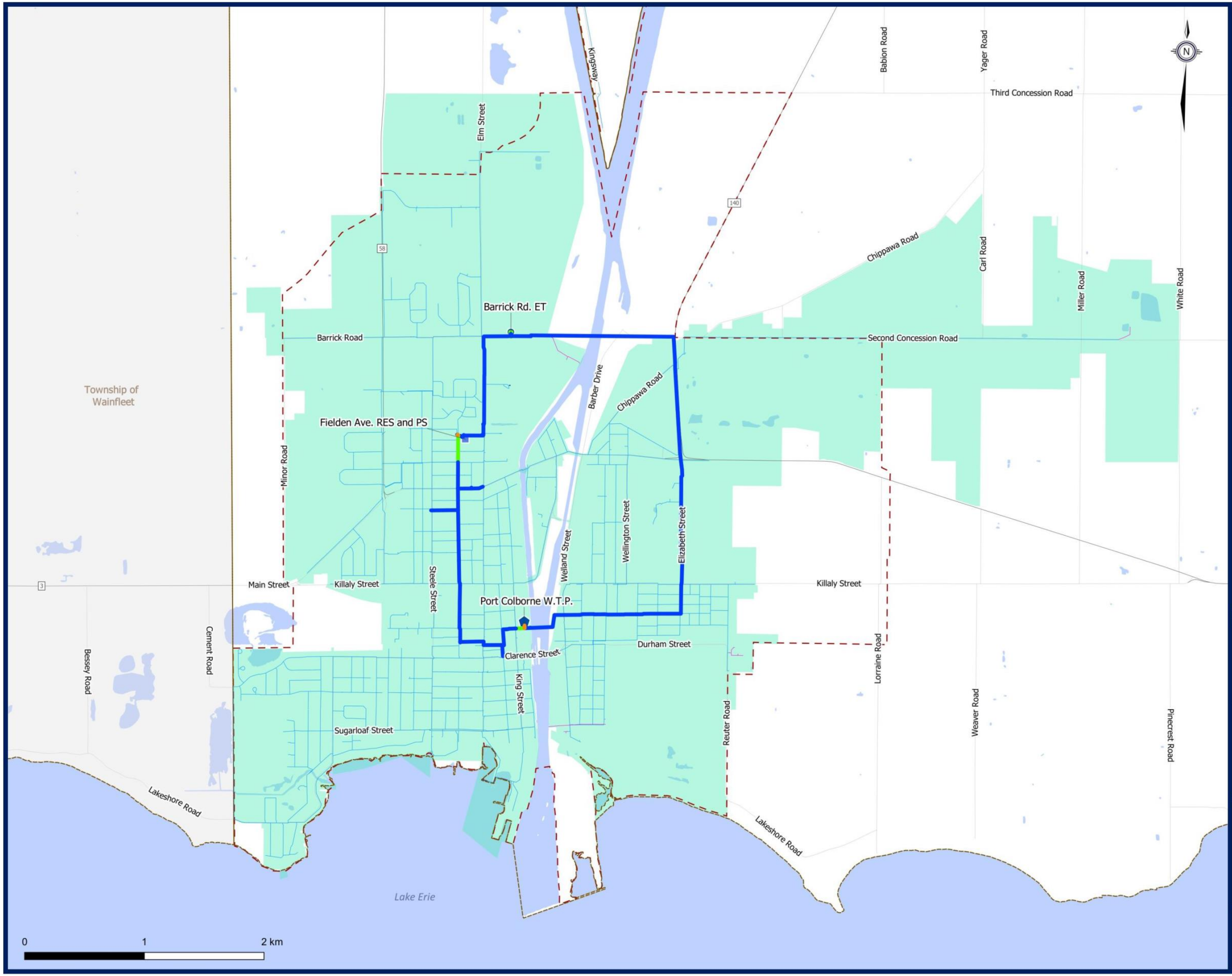
2021 Water and Wastewater Master Servicing Plan Update



Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

- 🟩 223

Other Features

- ☐ Municipal Boundary
- ■ Waterbodies
- ☐ Urban Area Boundary

Maximum Velocity (m/s) - Regional Watermains

- — < 0.6
- — 0.6 - 1.5
- — 1.5 - 2.0

Figure 3.E.14
Port Colborne System

2051 System Watermain Velocity

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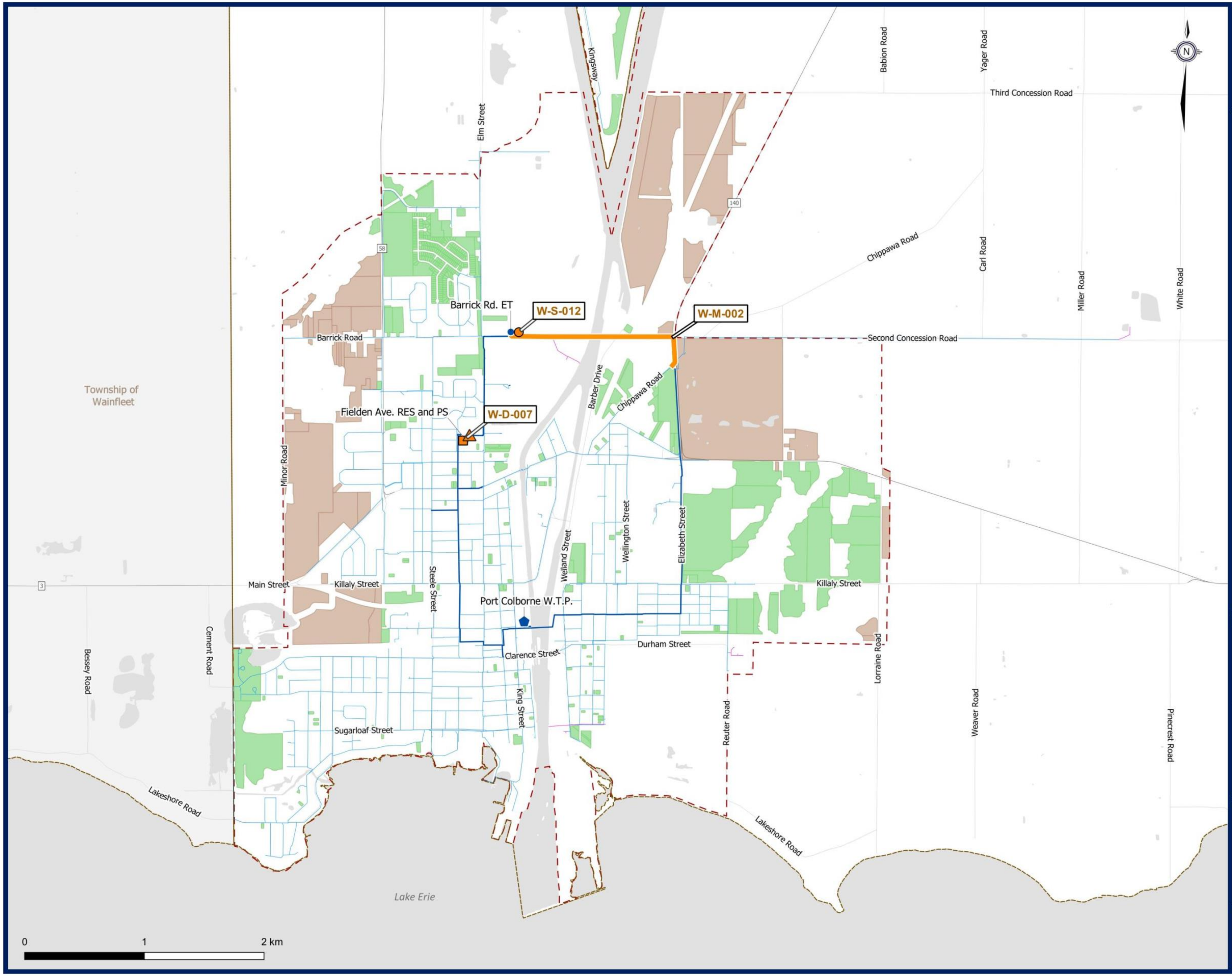
May 2023
621016-W-010
WKID: 26917

E.7 Capital Program

Figure 3.E.15 and **Figure 3.E.16** present the preferred servicing strategy map and schematic. **Table 3.E.13** summarizes the recommended project costing, implementation schedule and Class EA requirements. Individual detailed project costing sheets are presented in **Section E.8.6**.



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Capital Program

- ⬟ Water Treatment Plant
- ▲ Pumping Station
- ■ Reservoir
- ● Elevated Tank
- ━ Watermains

Existing Water Infrastructure

- ⬟ Water Treatment Plant
- ■ Reservoir
- ▲ Pumping Station
- ● Elevated Tank / Standpipe
- ━ Region Mains
- ━ Local Mains
- ━ Private

Other Features

- ▨ Township of Wainfleet
- ▨ Waterbodies
- ▨ Urban Area Boundary

Development Locations

- 🟫 Post-2051
- 🟩 Pre-2051

***Note that additional growth in existing built areas is anticipated**

***Project alignments are preliminary and will be refined through subsequent projects (EA and/or detailed design)**

Figure 3.E.15

Port Colborne

Preferred Water Servicing Strategy

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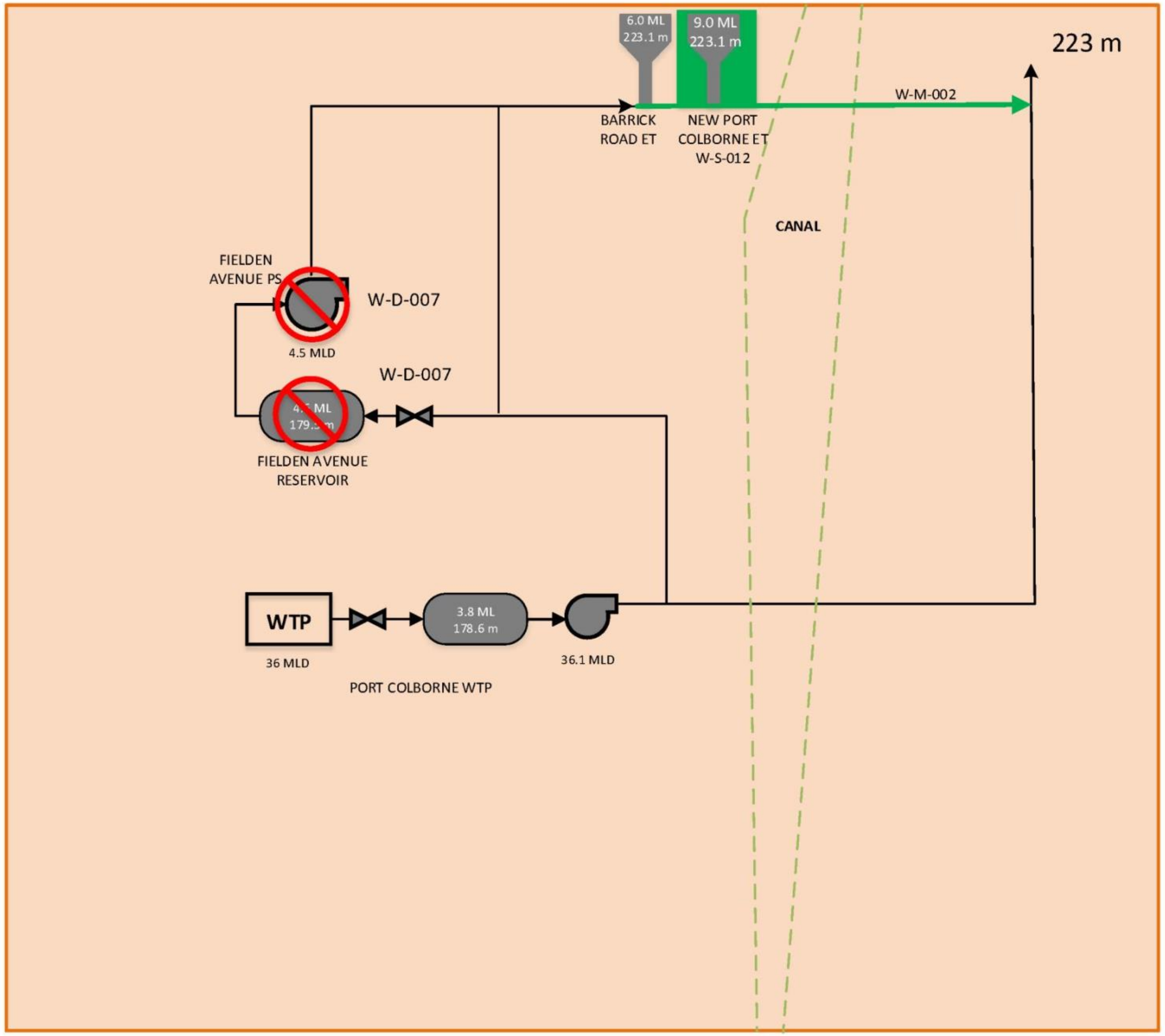
December 2022
620126-W-013
WKID: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update



WTP RATED CAPACITY	Water Treatment Plant	Volume TWL	Standpipe
FIRM CAPACITY	Pumping Station		Trunk Watermain Network
Volume TWL	Reservoir		Settlement Area Boundaries
Volume TWL	Elevated Tanks		Land and Water Features
⋈	Control Valve (Only normally operated valves shown)		New Watermain
C	Chlorine Facility		Upgrade Watermain
🟧	Facility Upgrade	🚫	Decommissior Project
🟩	New Facility		

Pressure Zone

223 m

Figure 3.E.16
Port Colborne System
Future Water Infrastructure Schematic

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December 2022
621016-W-000
WKID: 26917

Table 3.E.13 Summary of Port Colborne Water 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 ($)
W-D-007	Decommissioning of Fielden Ave Res + PS	Decommissioning of Fielden Avenue Reservoir and Pumping Station	N/A	2027-2031	Port Colborne	A+	N/A	Storage	$1,611,000
W-M-002	New feedermain to Port Colborne East side	New feedermain to East side of Port Colborne across canal	450 mm	2027-2031	Port Colborne	A+	N/A	Watermain	$12,251,000
W-S-012	New Port Colborne Elevated tank	Twin existing Barrick Road ET to support post-2051 growth. Assuming property acquisition is required (5% for new site).	9.0 ML	Post-2051	Port Colborne	B	Separate EA Required	Storage	$20,950,000
W-ST-001(1)	Region Wide WTP Reservoir Volume Study	Study to review WTP reservoir CT volume and overall system storage	-	2022-2026	Region-Wide	A+	N/A	Storage	-
								Total	**$34,812,000**

(1) Project cost not included in subtotal as it is a Region-wide project

E.8 Project Implementation and Considerations

E.8.1 10-Year Program Sequencing

The recommended year in service for the capital projects is presented in **Section E.7**.

It is understood that the timing for the recommended projects may be subject to change due to a variety of external factors such as overall balancing of the Region's capital budget, changes to growth projections, and other unforeseen circumstances. As such, **Table 3.E.14** presents the preferred priority of the projects within the first 10-years of the capital program.

Table 3.E.14 First 10-Years Project Sequencing

Master Plan ID	Name	In Service Period	Project Sequencing
W-M-002	New feedermain to Port Colborne East side	2027-2031	1
W-D-007	Decommissioning of Fielden Ave Res + PS	2027-2031	2

E.8.2 EA Requirements and Studies

The only recommended capital project within Port Colborne that requires a separate EA is W-S-012 (New Port Colborne Elevated Tank) which will require the completion of a separate Schedule B EA prior to proceeding with design and construction.

E.8.3 Region-Wide Projects and Collaboration with Local Area Municipalities

As part of the recommended capital program, it is recommended that the Region complete a WTP reservoir volume study across all WTP facilities to review CT volume and overall system storage. The intent of this study is to gain a clearer understanding of storage limitations at WTP facilities and how much usable volume can be accounted for within the system storage calculations.

Acknowledging that the overall water systems are jointly owned and operated by the Region and local area municipalities (LAM), the continued operation and expansion of the water systems to support existing users and accommodate projected growth relies upon the cooperation of the upper and lower tier municipalities. Major updates and adjustments to planning projections should be continued to be communicated as this may affect project details such as trigger timelines and design capacities, which is discussed further in **Section E.8.5**.

One initiative that will be predominately driven by the LAMs is NRW reduction. While NRW reduction programs should be completed in all municipalities, this 2021 MSPU assumes that the municipalities currently experiencing NRW rates greater than 25% will put specific focus on reducing NRW. The 2021 MSPU utilized an assumption of NRW reduction to at least 25% by 2051, however, municipality-specific targets can be reviewed by the LAMs. The existing NRW rate in Port Colborne is 41%, which is significantly higher than the average NRW noted in other LAMs. The program activities may include but are not limited to:

- Enhancement to the water metering program including:
    - Meter replacement program
    - Re-time monitoring of large water users
- Leak detection program for watermains,
- Watermain replacement program,
- Improved tracking of unbilled authorized users and development of demand reduction strategies:
    - Fire department
    - Watermain flushing
    - Facility usage,
- Development of bulk water user strategy and potential construction of additional bulk water station, and
- Improved monitoring and enforcement of new construction water uses.

E.8.4 Sustainability Projects

It is important to recognize that the 2021 MSPU servicing strategies identify new infrastructure to service the additional growth out to year 2051 but these strategies are built by extending infrastructure from the existing systems and leveraging the existing Region infrastructure in place. It is essential that the existing infrastructure is maintained in good condition and performance to support servicing growth.

The Region continually establishes and implements a sustainability program that addresses priority projects to ensure the existing infrastructure is in a state-of-good-repair and continues to perform and meet the intended level of services.

Independent of the 2021 MSPU, the Region has completed a sustainability program analysis to identify the projects on a yearly basis, with focus on a 10 year program, to address the sustainability needs. This Sustainability Capital Plan is first developed to demonstrate the total investment needs and may identify a level of investment and implementation exceeding Region resources. The next steps for the Sustainability Capital Plan will be the development of the Financial Plan for existing Water and Wastewater assets which is anticipated to be completed in 2024. It should be noted that the Sustainability Capital Plan represents investment required over and above the growth-related 2021 MSPU program.

The 2021 MSPU undertook a process to review the Sustainability Program in conjunction with the growth-related program to eliminate duplicate projects and to align the timing of both growth and sustainability needs where appropriate in order to create efficiencies. This review was focused on the Sustainability Program for the next 10 years with the best information available at the time of this study.

The review process for integration of the MSPU program and the sustainability program was essential to demonstrate several key findings:

- There is opportunity to align growth and sustainability projects to bring efficiencies in costs and delivery;
- When planning and costing new infrastructure, lifecycle principles and costs must be considered. Existing and future infrastructure will have future service life replacements (i.e., pumps, electrical, roof, security upgrades at varying intervals from 5 – 40 years);
- Without maintenance of the existing infrastructure in a state of good repair and performance, there is risk that the growth-related program may not achieve desired capacities, timing, or level of service;
- There is also risk that implementing the growth-related program could have a negative impact on the level of service within the existing systems for the existing users; and,
- There are some major projects already considered under the sustainability program that are essential to the growth-related program such as the Welland WTP and WWTP.

The 2021 MSPU growth capital program focuses on the infrastructure needs to support growth and all the projects build upon the Region's existing water systems. It is imperative that the Region's sustainability capital program continues to be completed as needed alongside the recommended 2021 MSPU growth capital program to ensure that the existing system is operating at expected capacities and reliability such that it can support the recommended growth projects.

The sustainability projects consist of Region-wide projects and programs including but not limited to: replacement programs for boilers, water valves, generators, watermains, master meters, GAC, process piping, process electrical, process instrumentation. Port Colborne system specific projects include:

- Port Colborne WTP Reservoir and Storage Program

E.8.5 Project Implementation Flow Chart

The recommended design capacities within the capital program are based on the best available information at the time of analysis, including existing system demands, facility capacities, and projected growth. It is understood that this data is not static and often changes over the years between the regular updates of the Region’s Master Plan. Design assumptions should be revisited before initiation of projects to reconfirm the appropriate design capacities, along with identification of any associated or dependent projects which can be combined or staged to optimize implementation efficiency and cost, and/or system operation.

To support the Region’s process in implementing all recommended 2021 MSPU capital projects, the following flow chart has been developed for the water system. This flow chart document is intended to be a reference resource for the Region and should be treated as a guideline to support existing internal Region processes in project implementation, as shown in **Figure 3.E.17**.

Niagara Region

WATER PROJECT IMPLEMENTATION

The intent of this document is to support the Region in confirming the scope of work for water infrastructure projects.

CONFIRM PROJECT SCOPE

To define Terms of Reference

☐ **What triggered this project?**
- Known development growth
- Forecasted growth
- Sustainability needs

☐ **Are there related or dependent projects that should be identified for streamlining opportunities or for project phasing?**
- Are there projects that need to be completed before this project?
- Are there projects within the same alignment or project area that could be combined (e.g., growth projects, wastewater, stormwater, corridor planning, sustainability projects, etc.)
- If there are related projects, could the project timing be adjusted to combine or stage projects more efficiently?

☐ **What is the project EA Schedule and status?**

☐ **Are there historic or ongoing operational issues in the project area?**
- Confirm with Regional and LAM operations and maintenance groups
- i.e. historic watermain breaks, water quality or pressure complaints, work order history, etc.

☐ **Are there any data gaps that should be incorporated into the Terms of Reference?**
- Refer to the Required Data section below for details
- How much does the project timeline and budget need to change to allow for the data collection?

☐ **Have the planning projections been updated to the best available information?**
- Consultation with Region and LAM planning groups to confirm planning projection
- Are projected needs for the project in place? Is actual growth in line with projected growth?)

☐ **Should the project be deferred until identified related works are completed?**

REQUIRED DATA

To support terms of reference and detailed design

☐ **Recently completed EA or servicing study**

(for growth triggered projects)

☐ **Historic demand records**
- Within the last 3 years
- Ideally one full year of SCADA records including facility demands, flow, and pressure records

☐ **Existing system hydrant testing or system pressure data to identify/verify existing system issues**

☐ **Asset inventory and condition assessment**
- All asset classes within the infrastructure type (watermain, storage, pumping, or treatment facility)
- Within the last 5 years
- Can be part of project scope if the data is not available and would not significantly alter project scope

☐ **Service area growth potential to confirm projected population and demands**
- Consultation with Region and LAM planning groups within the past year
- Growth information for 30-year horizon and beyond (maximum service area)
  - Population, jobs, land use, area
  - Current inventory of development areas with associated development status

IF THE REQUIRED DATA IS NOT AVAILABLE AND IF IT HAS THE POTENTIAL TO SIGNIFICANTLY ALTER SCOPE OF THE DESIGN, IT IS STRONGLY RECOMMENDED THAT THE APPROPRIATE DATA COLLECTION AND FIELD INVESTIGATION BE COMPLETED PRIOR TO PROCEEDING WITH DESIGN. ALTERNATIVELY, WHERE FEASIBLE, DATA COLLECTION SHOULD BE INCLUDED IN THE PROJECT SCOPE AND INTEGRATED INTO THE DESIGN PROCESS.

FLOW PROJECTIONS

To determine infrastructure capacity needs

EXISTING FLOWS

Average Day Demand (ADD)
- Historic SCADA to determine starting point average demand

Maximum Day Demand (MDD)
- Use peaking factors determined through MSPU to peak ADD
- There is a different peaking factor for each WTP system based on historic SCADA data

Peak Hour Demand (PHD)
- Diurnal curve based on historic data

Fire Flow (FF)
- MECP population-based

FUTURE FLOW PROJECTIONS

Existing Demand
- Scenarios depending on infrastructure type and design scenario (see next page

+

Growth Population Demand Contributions
- Residential, 240 L/c/d
- Employment, 270 L/e/d

The design criteria presented in this document are based on the 2021 Master Servicing Plan Update Study

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STORAGE AND PUMPING FACILITY CONSIDERATIONS

☐ **What is the complete service area of the facility?**
  - Some facilities support multiple pressure zones
  - Some pressure zones are supported by multiple facilities

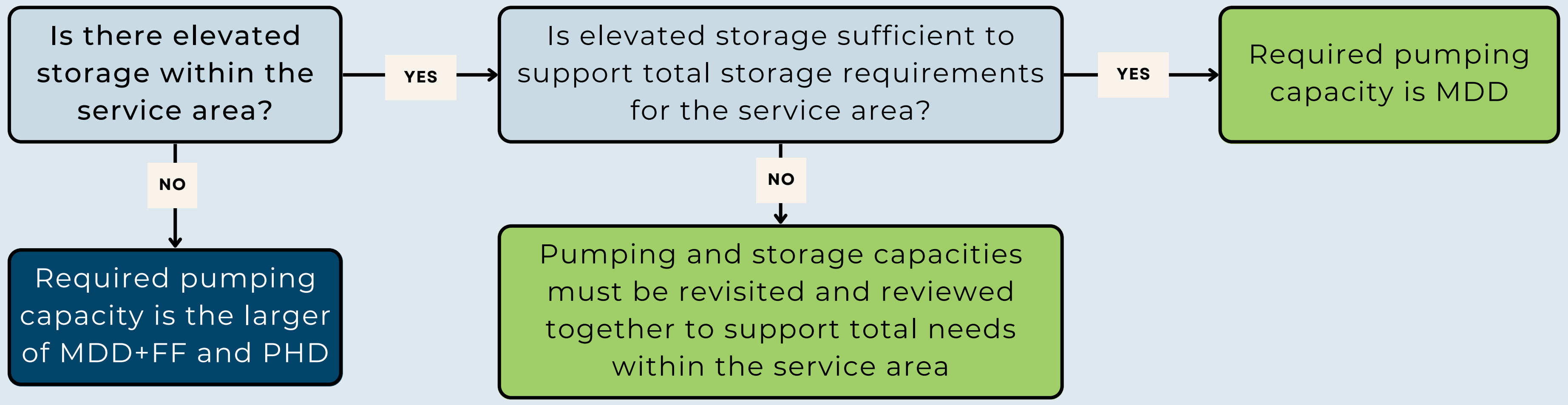
☐ **If there are storage deficits, can they be supplemented through flow transfers?**
  - Is it hydraulically and operationally feasible?

☐ **Have storage and pumping facilites been reviewed in conjunction with one another?**
  - Required pumping capacity varies based on available storage

☐ **What is the optimal HGL target for pumping and elevated storage facilities?**
  - Region strives to maximize areas within 50 - 80 psi for Regional watermains and minimum residual pressure of 30 psi at MECP population-based fire flow target

PUMPING STATION SIZING

To define design flow scenario (MDD, MDD+FF, PHD)



Is there elevated storage within the service area?

YES

Is elevated storage sufficient to support total storage requirements for the service area?

YES

Required pumping capacity is MDD

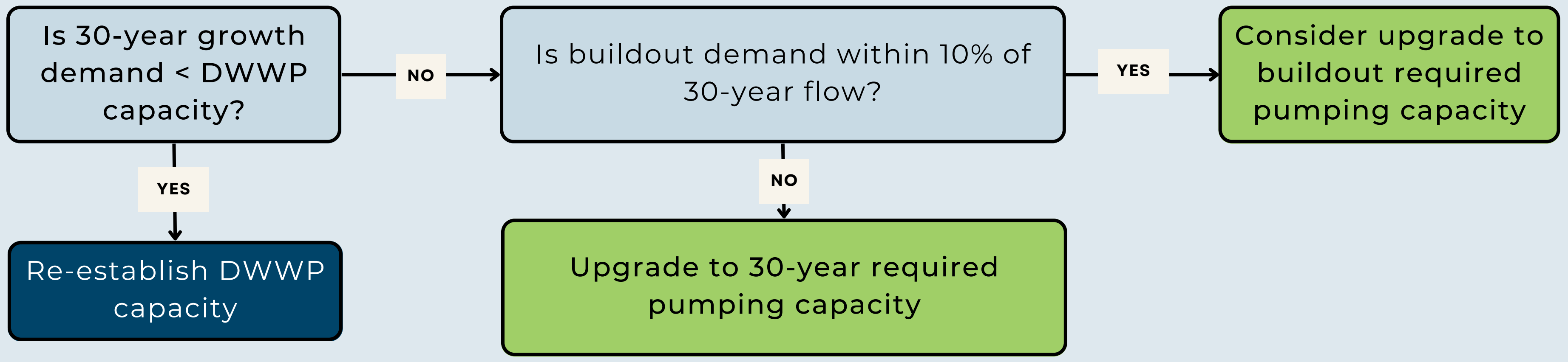
NO

Required pumping capacity is the larger of MDD+FF and PHD

NO

Pumping and storage capacities must be revisited and reviewed together to support total needs within the service area

To define design flow growth horizon (re-establish DWWP capacity, 30-year growth, buildout)



Is 30-year growth demand < DWWP capacity?

NO

Is buildout demand within 10% of 30-year flow?

YES

Consider upgrade to buildout required pumping capacity

YES

Re-establish DWWP capacity

NO

Upgrade to 30-year required pumping capacity

STORAGE SIZING

What are the system storage needs?
- System storage targets are based on MECP methodology, consistent with the 2021 Region MSPU
- Incorporate contact time storage needs at Water Treatment Plant Reservoirs
- Confirm fire flow storage strategy
- Review pumping capacity and impact on storage strategy

What timeline is considered for storage sizing?
- Is the storage sized at a minimum to support 30-year growth needs?
- What is the required storage sizing to support buildout needs?
- Is there a strategy to meet buildout needs?
- Is there opportunity for phased expansion?
- Is there a need for an alternative storage location?

TRUNK WATERMAIN SIZING

- Regional transmission mains should be sized to meet PHD and MDD+FF of maximum future service area (buildout) with a target velocity less than 1.5 m/s

E.8.6 Detailed Project Costing Sheets

The detailed project costing sheets for the recommended 2021 MSPU capital projects within the Port Colborne system are presented below.

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-D-007**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**Decommissioning of Fielden Ave Res + PS**	**VERSION:**	
PROJECT DESCRIPTION:	Decommissioning of Fielden Avenue Reservoir and Pumping Station	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 3	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	20%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Decommissioning						$1,000,000	2016 lump sum inflated
Additional Construction Costs	10%		ea.			$100,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$110,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$1,210,000**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 181,500	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$181,500**	
In House Labour/Engineering/Wages/CA	4.0%					$ 48,400	
In-house Labour/Wages Sub-Total						**$48,400**	
Project Contingency	10%					$144,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$144,000**	
Non-Refundable HST	1.76%					$27,000	
Non-Refundable HST Sub-Total						**$27,000**	
Total (2022 Dollars)						**$1,611,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$1,611,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$32,220		
Design	Design fees, Region fees for design, contract admin	13%	$209,430		
Construction	Region fees, base costs and project contingency	85%	$1,369,350		
TOTAL			**$1,611,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-002**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New trunk main to Port Colborne East side**	**VERSION:**	
PROJECT DESCRIPTION:	New trunk main to East side of Port Colborne across canal	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Rural	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	450 mm	
TOTAL LENGTH:	1640 m	
Tunnelled	730 m	45%
Open Cut	910 m	55%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	910 m	$1,071	$974,664	Existing road ROW
Pipe Construction - Tunneling			m	730 m	$6,300	$4,599,000	
Pipe Construction Uplift (Based on Area Conditions)	0%					$0	
Minor Creek Crossings			ea.	0	$206,000	$0	
Major Creek Crossings			ea.	1	$1,025,000	$1,025,000	
Road Crossings			ea.	0	$458,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,025,000	$0	
Utility Crossings			ea.	0	$458,000	$0	
Valve and Chamber			ea.	4	$40,000	$160,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$111,473	
Additional Construction Costs	15%		ea.			$1,030,521	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$790,066	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$8,691,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$86,900	
Geotechnical Sub-Total Cost						**$86,900**	
Property Requirements	1.5%					$ 130,400	
Property Requirements Sub-Total						**$130,400**	
Consultant Engineering/Design	15%					$ 1,303,700	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,303,700**	
In House Labour/Engineering/Wages/CA	3.0%					$ 260,730	
In-house Labour/Wages Sub-Total						**$260,730**	
Project Contingency	15%					$1,571,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,571,000**	
Non-Refundable HST	1.76%					$207,400	
Non-Refundable HST Sub-Total						**$207,400**	
Total (2022 Dollars)						**$12,251,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$12,251,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$245,020		
Design	Design fees, Region fees for design, contract admin	13%	$1,592,630		
Construction	Region fees, base costs and project contingency	85%	$10,413,350		
TOTAL			**$12,251,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-S-012**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New Port Colborne Elevated tank**	**VERSION:**	
PROJECT DESCRIPTION:	Twin existing Barrick Road ET to support post-2051 growth. Assuming property acquisition is required (5% for new site).	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	9.0 ML

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	9.0 ML	$1,300,000	$11,700,000	
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$1,755,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,345,500	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$14,801,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$ 148,000	
Geotechnical Sub-Total Cost						**$148,000**	
Property Requirements	5.0%					$ 740,100	New facility - acquire land near existing Barrick Road ET
Property Requirements Sub-Total						**$740,100**	
Consultant Engineering/Design	12%					$ 1,776,100	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,776,100**	
In House Labour/Engineering/Wages/CA	3.0%					$ 444,030	
In-house Labour/Wages Sub-Total						**$444,030**	
Project Contingency	15%					$2,686,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$2,686,000**	
Non-Refundable HST	1.76%					$354,700	
Non-Refundable HST Sub-Total						**$354,700**	
Total (2022 Dollars)						**$20,950,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$20,950,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$419,000		
Design	Design fees, Region fees for design, contract admin	13%	$2,723,500		
Construction	Region fees, base costs and project contingency	85%	$17,807,500		
TOTAL			**$20,950,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-ST-001
PROJECT NAME: Region Wide WTP Reservoir Volume Study
PROJECT DESCRIPTION: Study to review WTP reservoir CT volume and overall system storage

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

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

⬜ = Field has drop down
🟨 = Field must be manually populated
🟩 = Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Grimsby WTP Reservoir							
Decew WTP Reservoir							
Niagara Falls WTP Reservoir							
Welland WTP Reservoir							
Port Colborne WTP Reservoir							
Rosehill (Fort Erie) WTP Reservoir							
Additional Construction Costs	10%		ea.			$0	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$0	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$0**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ -	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$0**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$4,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$4,000**	
Non-Refundable HST	1.76%					$100	
Non-Refundable HST Sub-Total						**$100**	
Total (2022 Dollars)						**$44,000**	Rounded to nearest $1,000
Other Estimate						**$100,000**	
Chosen Estimate						**$100,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$2,000		
Design	Design fees, Region fees for design, contract admin	13%	$13,000		
Construction	Region fees, base costs and project contingency	85%	$85,000		
TOTAL			**$100,000**		

F

Regional Municipality of Niagara

Part F

WELLAND WATER SYSTEM

TABLE OF CONTENTS

List of Figures

List of Tables

F. Welland Water Treatment Plant

F.1 Existing System Overview

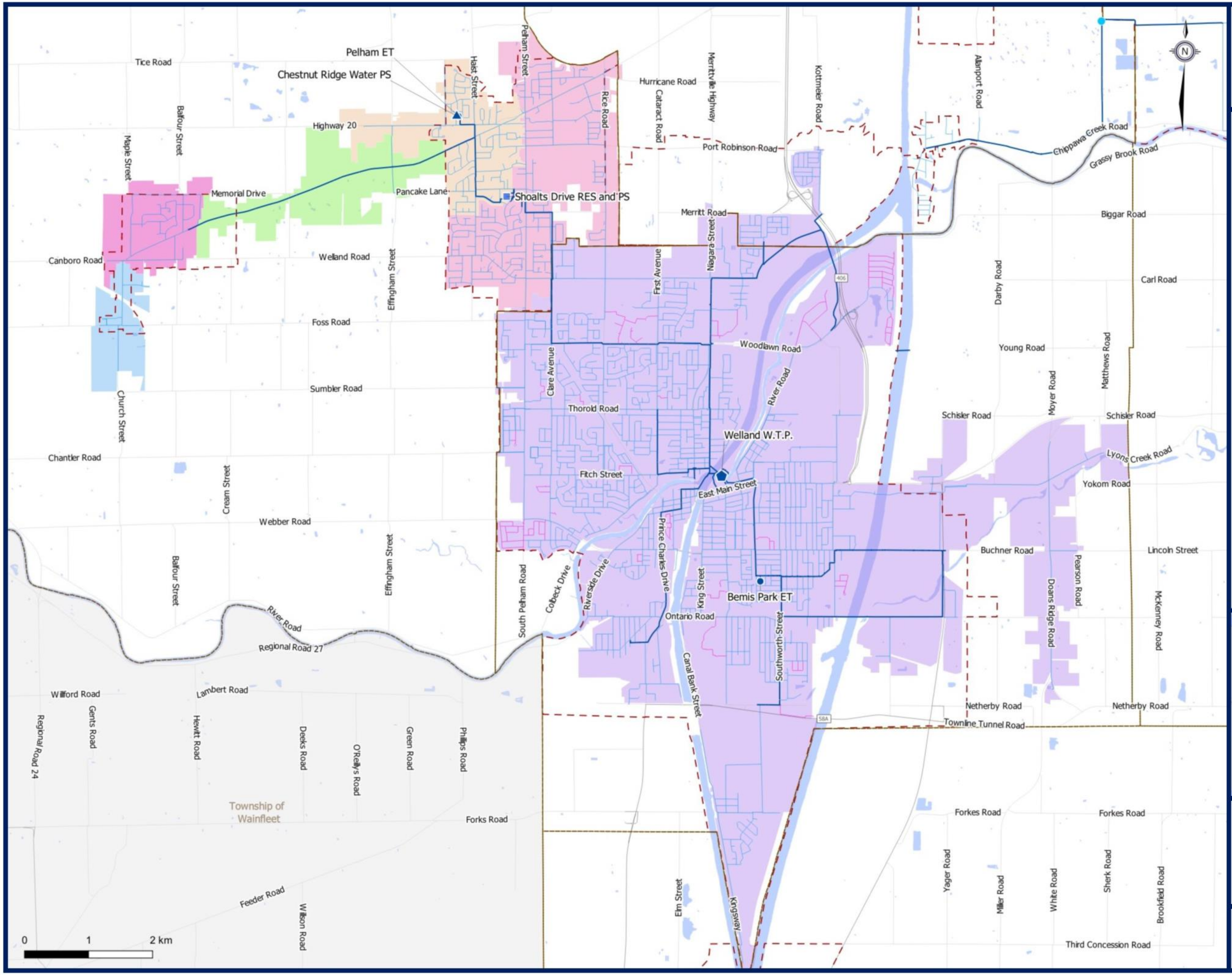
The Welland water system services the City of Welland, the Town of Pelham (Fonthill and Fenwick), and the southern part of the City of Thorold (Port Robinson West Area). The system services an existing population of 78,243 and 22,713 employees. Note that this population and employment total is based on the Region's 2021 allocation of Traffic Area Zones planning data and has been processed through the allocation methodology presented in **Volume 2** to refine the data to include only serviced populations. As such, the population and employment total may not directly match the system totals using the Region's unprocessed planning data.

The system is supplied by the Welland Water Treatment Plant, located on 4 Cross Street North in Welland. The plant is a conventional surface water treatment plant with zebra mussel control, travelling screens, coagulation, flocculation, sedimentation, filtration, and disinfection processes. Lake Erie (via the Welland Canal) serves as a source to the plant. The plant's 2019 permit lists the existing rated capacity of 65 MLD (752 L/s), however, the Region is currently undertaking to replace the existing plant and increase the rated capacity to 73 MLD (845 L/s).

The system supplies local area municipalities via a watermain network, pumping stations, and storage reservoirs. The supply area is divided into six pressure zones.

Figure 3.F.1 and **Figure 3.F.2** present an overview of the water system and a water system schematic diagram, respectively.

Through this update of the Master Servicing Plan, the Region has highlighted the need to integrate the MSPU growth-related program with the Region's sustainability program intended to address the condition and performance of the existing infrastructure. The MSPU servicing strategies are based on the need to maintain appropriate levels of service throughout the systems and acknowledges that investment will be needed to support operations, maintenance, staff, and other resources related to maintaining the existing systems and facilities in a state of good repair and performance.



Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Water Infrastructure

● Chlorine Facility
● Elevated Tank
◆ Fluoride Station
▲ Pumping Station
■ Reservoir
● Standpipe
⬟ Water Treatment Plant

— Region Mains
— Local Mains
— Private

Water Pressure Zones (HGL)

▨ 220	▨ 247	▨ 268
▨ 236	▨ 248	▨ 272

Other Features

▨ Township of Wainfleet
▨ Waterbodies
▭ Urban Area Boundary

Figure 3.F.1
Welland
Existing Water Infrastructure

BluePlan ENGINEERING

December 2022
621016-W-001
WKID: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

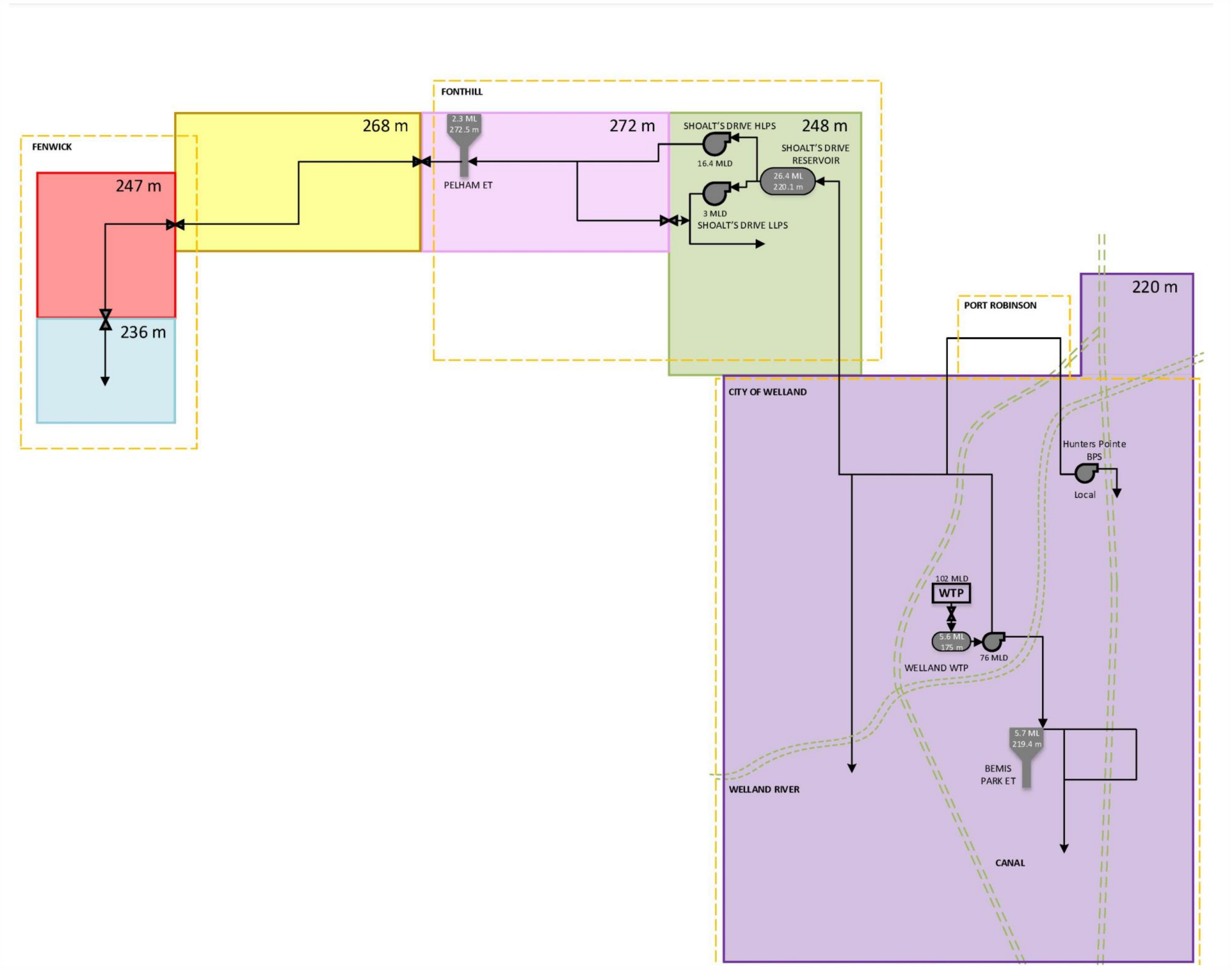


Figure 3.F.2

Welland System

Existing Water Infrastructure Schematic

GM BluePlan ENGINEERING

December 2022
621016-W-000
WKID: 26917

F.1.1 Facility Overview

Table 3.F.1 to **Table 3.F.4** present details regarding the existing water treatment plant (WTP), pump stations, and storage facilities.

Table 3.F.1 Water Treatment Plant Overview

Plant Name	Welland Water Treatment Plant
Drinking Water Works Permit	Permit Number: 007-204 Issue Number: 7 Issued August 2, 2019
Address	4 Cross Street North, Welland, ON, L3B 5P4
Source Water	Lake Erie via Welland Canal
Rated Maximum Day Demand Capacity	73.0 MLD(1)
Key Processes	Zebra mussel control Travelling screens Coagulation Flocculation Sedimentation Filtration Disinfection

(1)Existing rated capacity is 65 MLD. Upgrades are currently ongoing to increase the rated capacity to 73 MLD, expected to be completed by 2026.

Table 3.F.2 Water Treatment Plant Water Quality Objectives

Parameters for Niagara Region Contact Time Calculation	
pH	8
Temperature (degrees C)	0.5
Required CT	49
Required Giardia Inactivation via Disinfection	0.5-log
Required Virus Inactivation via Disinfection	2-log
Minimum Free Chlorine	0.8 mg/L

* Refer to the Safe Drinking Water Act, Ontario Drinking Water Quality Standards for a comprehensive listing of water quality standards.

Table 3.F.3 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone and Facility)	Discharge (Pressure Zone)	Pressure Zones Supplied	Number of Pumps (Total/ Firm)	Installed Capacity (MLD)	Firm Capacity (MLD)	Total Dynamic Head (m)
Welland WTP High Lift	4 Cross Street North, Welland	WTP	220	All	4/3	108.8	76.0	56.0
Shoalts Drive High Lift PS	5 Shoalt's Drive, Pelham	220	272	247, 268, 272, 236	4/3	21.8	16.4	65.0
Shoalts Drive Low Lift PS[1]		220	248	248	2/1	6.0	3.0	40.0

[1] Closed pressure zone with additional supply via PRV from Zone 272.

Table 3.F.4 Storage Facilities Overview

Storage Facility	Location	Storage Type	Volume (ML)	Top Water Level (m)	Fire Supply Zones	Maximum Day Demand Supply Zones
Welland WTP Reservoir[1]	4 Cross Street North, Welland	Pumped Reservoir	5.6	175	220 Pumped	All
Bemis Elevated Tank	97 Coventry Road, Welland	Elevated Tank	5.7	219.4	220 Floating	220 Floating
Shoalt's Drive Reservoir	5 Shoalt's Drive, Pelham	Pumped/Floating Reservoir	26.4	220.1	220 Floating 248 Pumped	220 Floating 248 Pumped
Pelham Elevated Tank	181 Highway 20 West, Pelham	Elevated Tank	2.27	272.5	236 Floating 247 Floating 248 Floating 268 Floating 272 Floating	236 Floating 247 Floating 248 Floating 268 Floating 272 Floating

[1] Total WTP storage volume is 5.6 ML, however, due to contact time requirements from the MECP, the actual usable volume at the Welland WTP is calculated to be 2.3 ML under 2051 MDD and 1.4 ML under post-2051 MDD, as contact time cannot be used as system storage based on the MECP's CT requirement. Refer to **Section F.2.2** and **Volume 3 - Introduction** for additional information.

F.2 Basis for Analysis

F.2.1 Flow Criteria, Performance, and Sizing Methodology

The Niagara Region Traffic Area Zone planning data was used to estimate growth related demands within the water system and to spatially allocate growth demands within each individual system. **Table 3.F.5** presents a summary of the flow criteria, performance, and sizing methodology that was utilized. Refer to **Volume 3 – Introduction** for additional information.

The Region's per capita water demand criteria was updated based on a historic review of the previous 3-year period local billing meter records. Given that more granular data was available to complete this analysis compared to previous master plan updates, the population and employment per capita rates were differentiated, and both were reduced compared to the Region's previous per capita rate to reflect existing usage trends more closely. Further detail regarding the per capita water demands is presented in **Volume 3 – Introduction.**

In some systems, the NRW was found to be extremely high (i.e., greater than 25%). The expected NRW due to unbilled account for water is 10 to 20%. It was recommended that the local municipalities and the Region work to decrease NRW as much as possible in the long-term. Through this 2021 MSPU, a new policy has been proposed for municipalities where existing NRW is greater than 25% to attempt to decrease the future NRW to a maximum of 25%, using local area municipality programs and initiatives. The existing non-revenue water rate within Welland is 42% while the non-revenue water rate within Pelham is 7%. When projecting future 2051 and buildout flows, the existing 2021 starting point NRW was reduced to 25% of existing billed demands. Further detail regarding the non-revenue water analysis is presented in **Volume 3 – Introduction.**

Table 3.F.5 Flow Criteria, Performance and Sizing Methodology

Description			Criteria
Flow Criteria	Water Demand	Residential	240 L/c/d
		Employment	270 L/e/d
	Peaking Factor	Maximum Day	Based on historic average of maximum day peaking factors from 2016 – 2020
		Peak Hour Factor	Based on system mass balance using hourly SCADA data from 2018 – 2020
	Existing System Demands		Starting Point Methodology • Based on local billing meter records and production records to establish existing system demands • Growth demands are added to the existing system baseline using design criteria
System Performance Criteria	System Pressures		Acceptable pressure range of 40 – 100 psi • Regional objective of maximizing areas within the preferred range of 50 – 80 psi on Regional watermains
	Fire Flow		250 L/s on Regional watermains at residual pressure of 30 psi
	Velocity	Average Day	Flag areas less than 0.6 m/s minimum velocity
		MDD+FF or PHD	Flag areas greater than 1.5 m/s Trigger upgrades greater than 2 m/s
Sizing and Triggers	Plant and Facility Upgrade Triggers		• 80% trigger for plant and facility planning process (time-based trigger on a case-by-base basis) • Complete plant and facility expansions before 90% capacity is reached
	Treatment Plant Sizing		Maximum day demand
	Pumping Station Sizing		Various potential demand scenarios: • Maximum day demand (MDD) • MDD + fire flow (250 L/s or MECP) • Peak Hour Demand (PHD) Appropriate design sizing scenario depends on the configuration of the service area for the pumping station. Refer to **Volume 3 - Introduction** for further discussion.
	Watermain Sizing		Regional transmission main system for PHD and MDD + fire flow demands
	Storage Sizing		MECP methodology (A + B + C) • Refer to **Section F.2.2** for discussion regarding contact time (CT) volume requirement at WTP reservoirs

F.2.2 Water Treatment Plant Reservoir Contact Time Volume Requirement

Due to the contact time requirements from the MECP, the actual usable volume at the Welland WTP reservoir is calculated to be less than the full volume of 5.6 ML, as contact time volume cannot be used as system storage based on the MECP's CT requirement. System storage capacity is presented and discussed in **Section F.3.4**.

A conservative assumption has been made for the usable volume at all water treatment plant reservoirs. The methodology for determining required CT is outlined in the MECP's Procedure for Disinfection of Drinking Water in Ontario. Detailed methodology and sample calculations for determining the required CT volume is presented in **Volume 3 – Introduction.**

Further, it should be noted that the Region applies a safety factor of 1.2 to all CT volume calculations as an additional buffer. However, it was determined that this safety factor would be removed for the purposes of storage sizing for the Region's 2021 MSPU, as all other parameters utilized within the CT calculation provide an inherent level of conservatism (i.e., temperature of 0.5 deg C and pH of 8).

F.2.3 Population Projections and Allocations

Table 3.F.6 outlines the existing and projected serviced population and employment by pressure zone.

Table 3.F.6 Welland Water Treatment Plant Existing and Projected Serviced Population and Employment by Pressure Zone

Pressure Zone	2021 Population & Employment			2051 Population & Employment			Post 2051 Population & Employment			2021-2051 Growth		
	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Population & Employment	Population	Employment	Total
220	60,432	18,535	78,967	92,513	29,573	122,087	120,729	37,716	158,445	32,082	11,038	43,120
236	1,050	344	1,394	1,101	456	1,557	1,140	472	1,612	51	112	163
247	2,165	575	2,740	2,986	778	3,764	3,280	809	4,089	822	203	1,025
248	9,506	2,001	11,507	15,710	3,611	19,321	16,788	3,738	20,527	6,204	1,610	7,813
268	941	348	1,288	1,914	445	2,359	2,293	461	2,754	974	97	1,071
272	4,151	910	5,061	5,687	1,346	7,033	5,909	1,397	7,306	1,537	436	1,972
Total	**78,243**	**22,713**	**100,956**	**119,912**	**36,209**	**156,120**	**150,140**	**44,594**	**194,734**	**41,668**	**13,496**	**55,164**

Note: Population numbers may not sum due to rounding.

F.3 Existing System Performance

F.3.1 Starting Point Demands and Performance

The starting point demand and maximum day peaking factor for the Welland WTP was calculated using historic SCADA production data. Ten years of data (2011 to 2020) was reviewed to provide historical context and assess overall long-term trends; however, the most recent five years of data was used to determine the maximum day demand peaking factor. **Table 3.F.7** presents the historic water demand and water system maximum day peaking analysis. Based on the historic analysis, the Welland WTP system has an existing average demand of 22.6 MLD and system peaking factor of 1.49.

Table 3.F.7 Historic Water Demand

Year	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Maximum Day Demand Peaking Factor
2011	22.2	35.0	1.58
2012	24.4	41.0	1.68
2013	20.7	30.6	1.48
2014	20.7	30.0	1.45
2015	20.5	30.0	1.46
5-Year Average	*21.7*	*33.3*	*1.5*
5-Year Peak	*24.4*	*41.0*	*1.7*
2016	21.9	33.4	1.53
2017	21.5	31.0	1.44
2018	22.5	35.8	1.59
2019	22.5	32.4	1.44
2020	24.7	36.4	1.47
5-Year Average	**22.6**	**33.8**	**1.49**
5-Year Peak	*24.7*	*36.4*	*1.59*
10-Year Average	*22.2*	*33.5*	*1.51*
10-Year Peak	*24.7*	*41.0*	*1.68*
MECP Peaking Factor (Existing)	**1.65**		
MECP Peaking Factor (2041)	**1.65**		

Local billing meter records were provided by the local area municipalities for the years of 2018 – 2020. Using this more granular data, along with Region billing meter data, system non-revenue water was calculated for each municipality, as well as system demands for each pressure zone. To estimate future system demands, the projected residential and employment growth populations were then converted to expected flows using the criteria presented in **Table 3.F.5.** Existing and future water system demands by pressure zone are presented in **Table 3.F.8**.

Table 3.F.8 Existing and Future Water System Demands by Pressure Zone

Pressure Zone	2021 Demand		2021 to 2051 Growth Demand		2051 Demand (Existing + Growth)		2051 Demand With NRW Reduction (Existing + Growth) (1)		Post 2051 Demand (Existing + Growth)		Post 2051 Demand With NRW Reduction (Existing + Growth)(1)	
	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Average Day Demand (MLD)	Maximum Day Demand (MLD)
220	22.3	29.1	10.7	16.0	33.0	45.1	29.1	41.2	42.0	58.5	38.1	54.6
236	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2
247	0.4	0.5	0.3	0.4	0.6	0.9	0.6	0.9	0.7	1.0	0.7	1.0
248	2.1	3.1	1.9	2.9	4.0	5.9	4.0	5.9	4.3	6.4	4.3	6.4
268	0.1	0.2	0.3	0.4	0.4	0.6	0.4	0.6	0.5	0.7	0.5	0.7
272	1.1	1.6	0.5	0.7	1.6	2.3	1.6	2.3	1.6	2.4	1.6	2.4
Total	**26.1**	**34.7**	**13.6**	**20.4**	**39.7**	**55.0**	**35.9**	**51.2**	**49.2**	**69.3**	**45.4**	**65.4**

(1)Non-revenue water (NRW) adjustments were made within systems where existing NRW was higher than 25%. Assumption was made that the starting point NRW would be reduced to less than 25% for those systems when analysing 2051 and post-2051 scenarios.

F.3.2 Treatment Plant Capacity

Figure 3.F.3 shows the projected future demands at the Welland Water Treatment Plant. The plant has surplus capacity to support growth and will not reach 80% capacity within the 2051-time horizon.

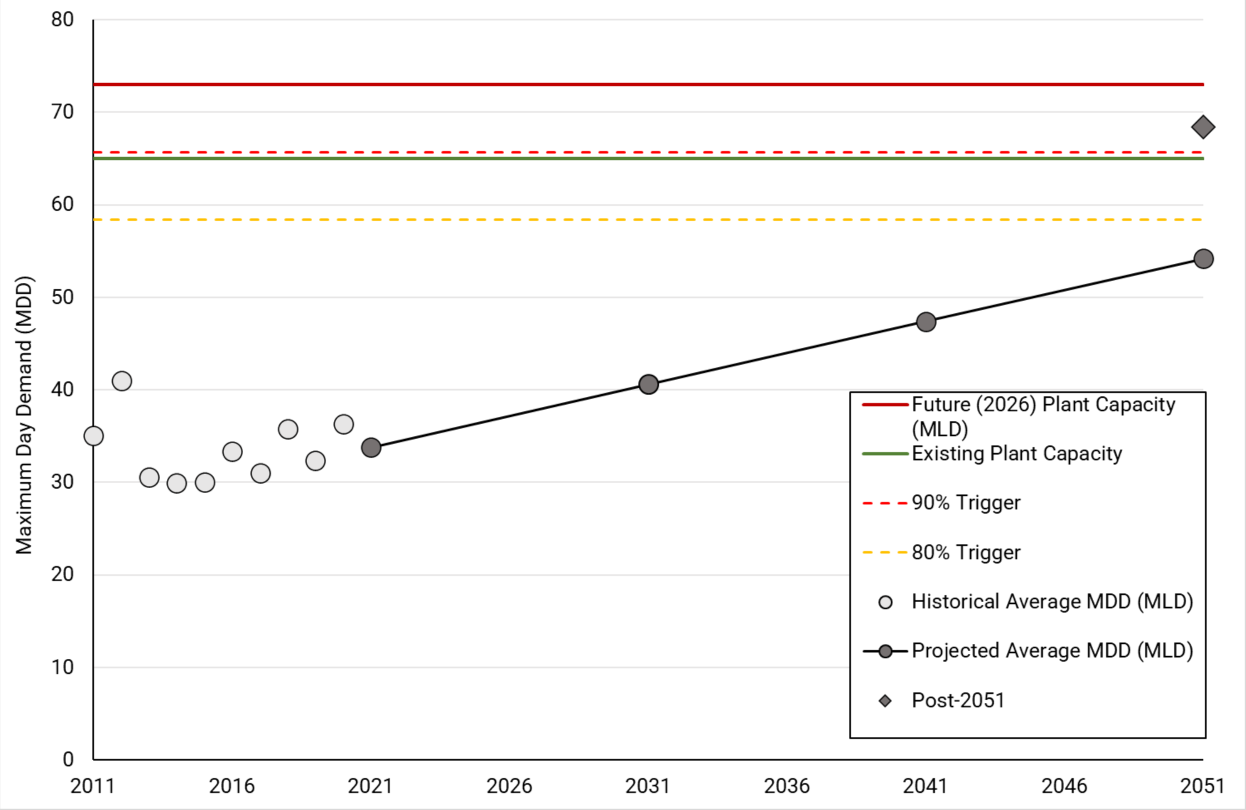


Figure 3.F.3 Projected Maximum Day Demand at Welland Water Treatment Plant

F.3.3 Pumping Capacity

Table 3.F.9 highlights the pumping station existing and projected capacity. As presented in **Section F.2.1**, there are various potential demand scenarios for pumping station capacity sizing depending on system configuration and available storage type and volume. As such, the design condition has been specified in the table below (i.e., maximum day demand, peak hour demand, or maximum day demand + fire flow), along with the 2021, 2051, and post-2051 design flows which correspond to the design condition for each respective pump station.

There is sufficient overall pumping capacity to support existing and future demands at the Welland WTP. As the available fire storage at the Pelham ET is not sufficient to support existing or future fire storage needs, the design condition for the Shoalt's Drive High Lift PS is MDD + fire flow. As such, there is a pumping deficit at the Shoalt's Drive High Lift PS of 7.7 MLD under existing demands and a projected deficit of 9.3 MLD in 2051 and 9.6 MLD post-2051. The

Shoalt’s Drive Low Lift Pumping Station has a projected deficit of 2.9 MLD in 2051 and 3.4 MLD post-2051.

Table 3.F.9 System Pumping Station Performance

Pump Station	Firm Capacity (MLD)	Pressure Zones Supplied	Design Condition	2021 Maximum Day Demand (MLD)	2021 Design Flow (MLD)	2021 Surplus/ Deficit (MLD)	2051 Maximum Day Demand (MLD)	2051 Design Flow (MLD)	2051 Surplus/ Deficit (MLD)	Post-2051 Maximum Day Demand (MLD)	Post-2051 Design Flow (MLD)	Post-2051 Surplus/ Deficit (MLD)
Welland WTP/ High Lift PS	76.0	All	MDD	34.7	34.7	41.3	51.2	51.2	24.8	65.4	65.4	10.6
Shoalt's Drive High Lift PS	16.4	236, 247, 268, 272	MDD + Fire	2.5	24.1	-7.7	4.0	25.6	-9.3	4.4	26.0	-9.6
Shoalt's Drive Low Lift PS	3.0	248	MDD	3.1	3.1	0.0	5.9	5.9	-2.9	6.4	6.4	-3.4

F.3.4 Storage Capacity

Using the MECP methodology for CT volume calculations and the corresponding MDD for each planning horizon, the required CT volume at the Welland WTP reservoir is 3.1 ML under 2051 MDD, and 4.0 ML under post-2051 MDD. As such, the remaining usable volume for system storage utilization at the Welland WTP reservoir is 2.5 ML under 2051 MDD, and 1.6 ML under post-2051 MDD. As a conservative assumption the 2051 MDD volume was utilized for the existing system capacity utilization table. **Table 3.F.10** presents the available system storage at the Welland WTP under various demand scenarios.

Table 3.F.10 Available System Storage at the Welland WTP under 2051 MDD, Post-2051 MDD, and at MDWL Capacity

Welland WTP	2051 MDD	Post-2051 MDD	At MDWL Capacity
Minimum Reservoir Out/Treated Free Chlorine (mg/L)	0.8	0.8	0.8
Maximum Ph	8	8	8
Minimum Temperature (deg. C)	0.5	0.5	0.5
Reservoir Volume (ML)	6	6	6
Reservoir Baffle Factor	0.7	0.7	0.7
MDD (ML/D)	51.2	65.4	73.0
$CT_{required}$	49	49	49
Safety Factor	1	1	1
CT_{actual}	49	49	49
T_{10}	61.3	61.3	61.3
Reservoir Retention Time (min)	87.5	87.5	87.5
Min Volume Needed (ML)	3.1	4.0	4.4
Minimum Reservoir Level (%)	0.6	0.7	0.8
Storage Volume Available (ML)	**2.5**	**1.6**	**1.2**

Table 3.F.11 highlights the storage existing and projected capacity. The Region has recently completed the Pelham ET Environmental Assessment that recommended the existing Pelham ET be replaced with a new 6 ML ET; this recommendation has been incorporated into the storage analysis.

Table 3.F.11 System Storage Capacities

Storage	Fire Supply Zones	MDD Supply Zones	2021 Rated Capacity (ML)	2051 Rated Capacity (ML)	Post 2051 Rated Capacity (ML)	2021 Total Available Storage (ML)	Existing Required Storage	Existing Surplus/ Deficit (ML)	2051 Total Available Storage (ML)	2051 Required Storage (ML)	2051 Surplus/ Deficit (ML)	Post 2051 Total Available Storage (ML)	Post 2051 Required Storage (ML)	Post 2051 Surplus/ Deficit (ML)
Welland WTP Reservoir[1]	220 Pumped	220	2.50[3]	2.50	1.64	8.2	20.3	-12.1	8.2	24.9	-16.7	7.3	29.3	-21.9
Bemis Elevated Tank	220 Floating	220	5.7	5.7	5.7									
Shoalt's Drive Reservoir	220 Floating, 248 Pumped	220, 248	26.4	26.4	26.4	26.4	-	26.4	26.4	-	26.4	26.4	-	26.4
Pelham Elevated Tank[2]	236 Floating, 247 Floating, 248 Floating, 268 Floating, 272 Floating	236, 247, 268, 272	2.27	6	6	2.3	6.6	-4.3	6.0	9.4	-3.4	6.0	10.3	-4.3
						Overall Existing Storage Surplus		**10.0**	**Overall 2051 Storage Surplus**		**6.2**	**Overall Post-2051 Storage Surplus**		**0.1**

[1] Refer to **Section F.2.2** for discussion on contact time volume requirements at the WTP reservoir

[2] 6 ML replacement Pelham ET is currently under design, to be commissioned after 2021, volume updated to reflect new ET in 2051 and post-2051

[3] 2051 MDD volume was utilized for the existing system capacity utilization table (conservative assumption)

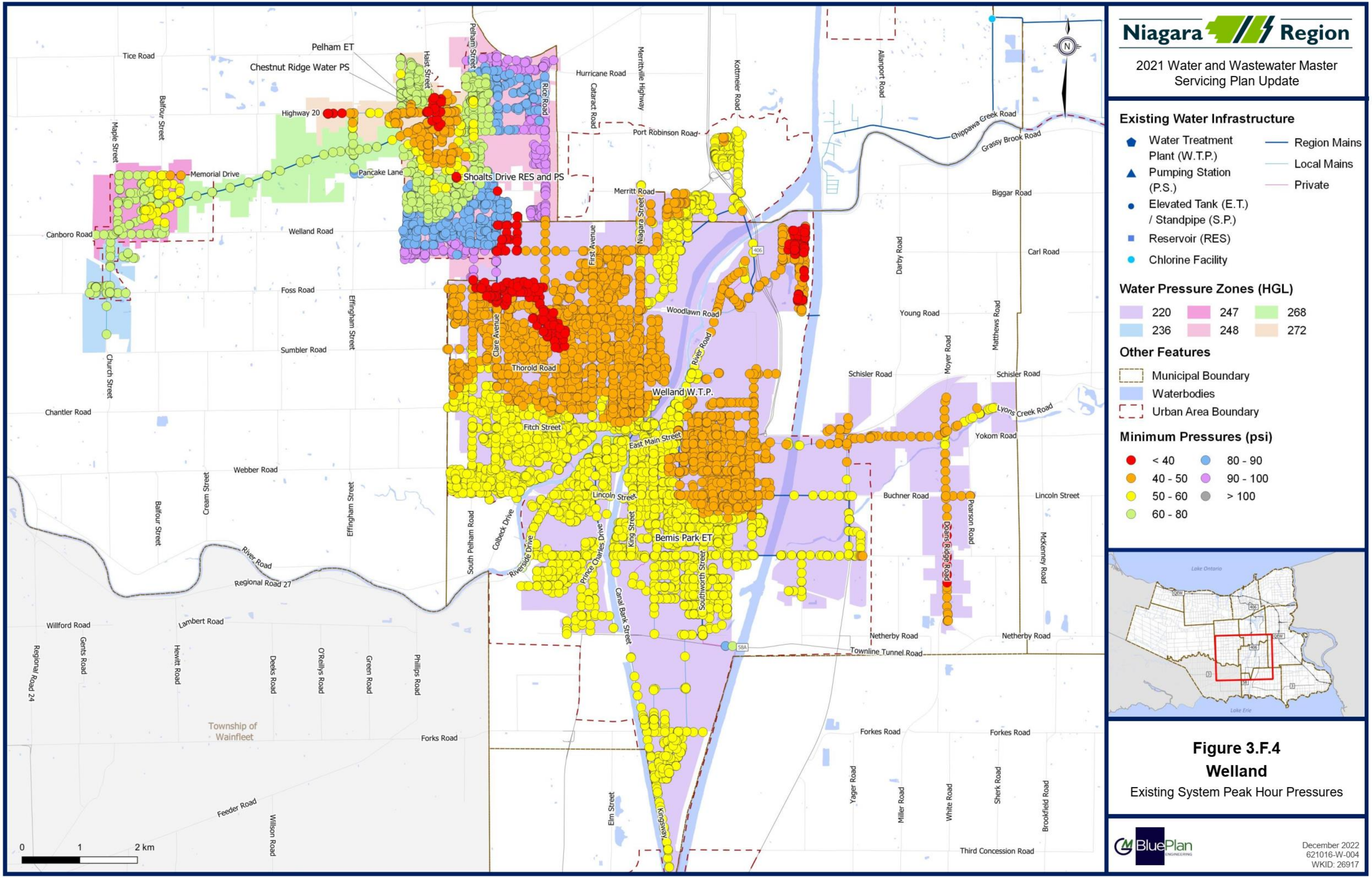
It should be noted that there are multiple storage facilities that support storage needs for the pressure zone 220 in Welland. One of those storage facilities is the Shoalt's Drive Reservoir, which is an in-ground reservoir providing floating storage to the pressure zone 220, while also providing pumped storage to the pressure zones in Pelham via the Shoalt's Drive High and Low Lift Pumping Stations. Due to the interdependencies of storage and pumping within the Welland system, the Shoalt's Reservoir has been presented as a standalone element, which can contribute storage capacity to all zones via gravity or pumping. As such, the system storage should be assessed on an overall system basis rather than by subzones. Overall, there is sufficient storage within the Welland system to support existing demands and projected demands to 2051, with a slight overall system surplus of 0.1 ML projected in the post-2051 scenario.

F.3.5 System Pressures and Fire Flows

Figure 3.F.4 to **Figure 3.F.5** present the existing system performance, based on existing system configuration and capacities.

In general, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. Low pressures, less than 40 psi under maximum day demands, are experienced in the northwest area of Welland and around the existing Pelham ET due to higher ground elevation. Low pressures in the Hunter's Pointe area have been addressed through the City's new local booster pumping station.

The Region's target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for critical system areas. The fire flow target is not met on the transmission main in Pelham along Canboro Road from Fonthill to Fenwick (pressure zone 272 to pressure zone 247). This watermain is a long dead-end watermain which would require looping to improve available fire flow, and Fenwick is predominately a residential community with lower local fire flow needs.



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2021 Water and Wastewater Master Servicing Plan Update

Figure 3.F.4
Welland
Existing System Peak Hour Pressures

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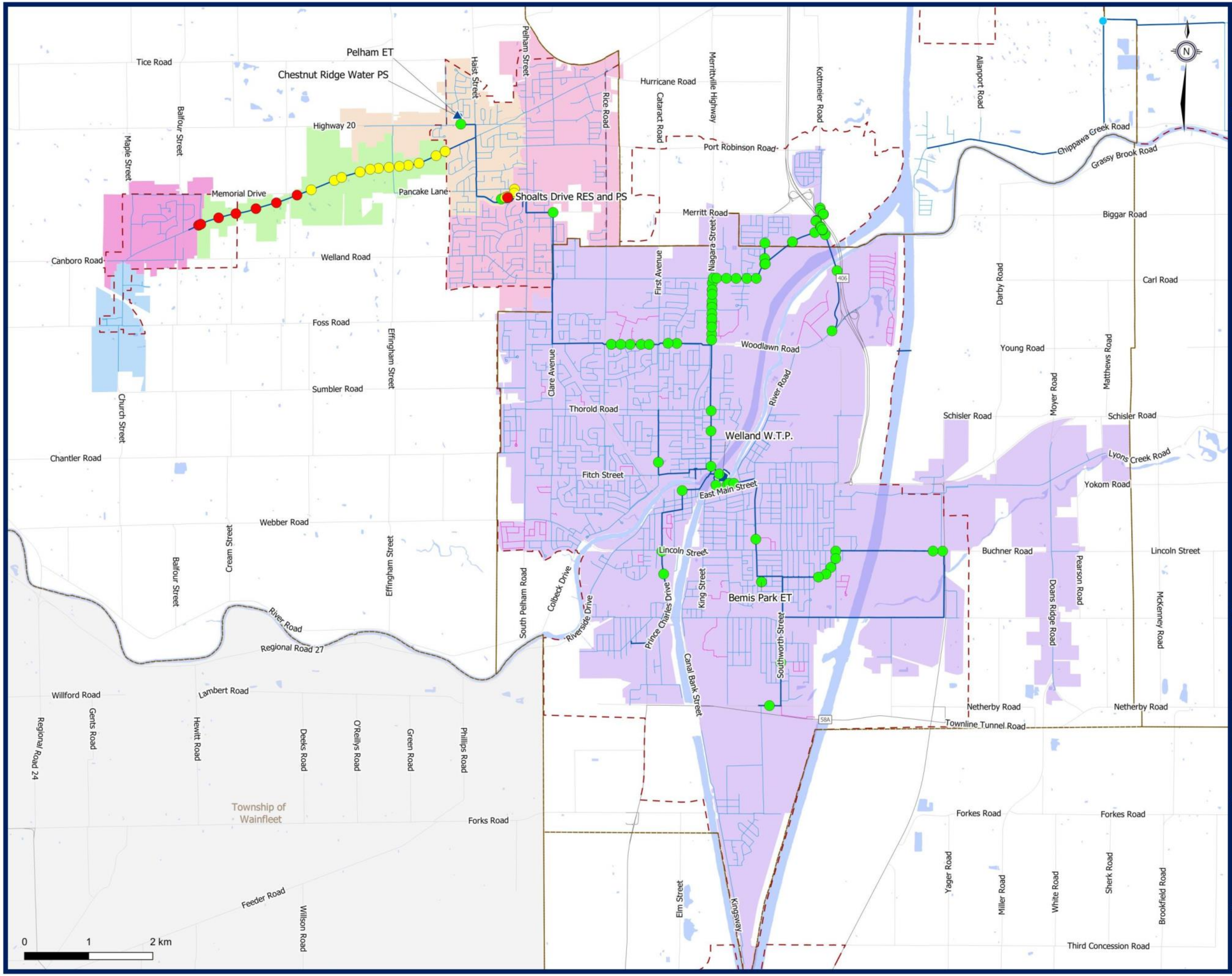

Existing Water Infrastructure

- ⬟ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- ● Elevated Tank (E.T.) / Standpipe (S.P.)
- ■ Reservoir (RES)
- ● Chlorine Facility
- — Region Mains
- — Local Mains
- — Private

Water Pressure Zones (HGL)

220	247	268
236	248	272

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Regional Mains Available Fire Flow (L/s) - 30 psi Residual Pressure

- 🟥 < 125
- 🟩 > 250
- 🟨 125 - 250

Figure 3.F.5
Welland

Existing System Fire Flows

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F.3.6 Water Age and Watermain Capacity

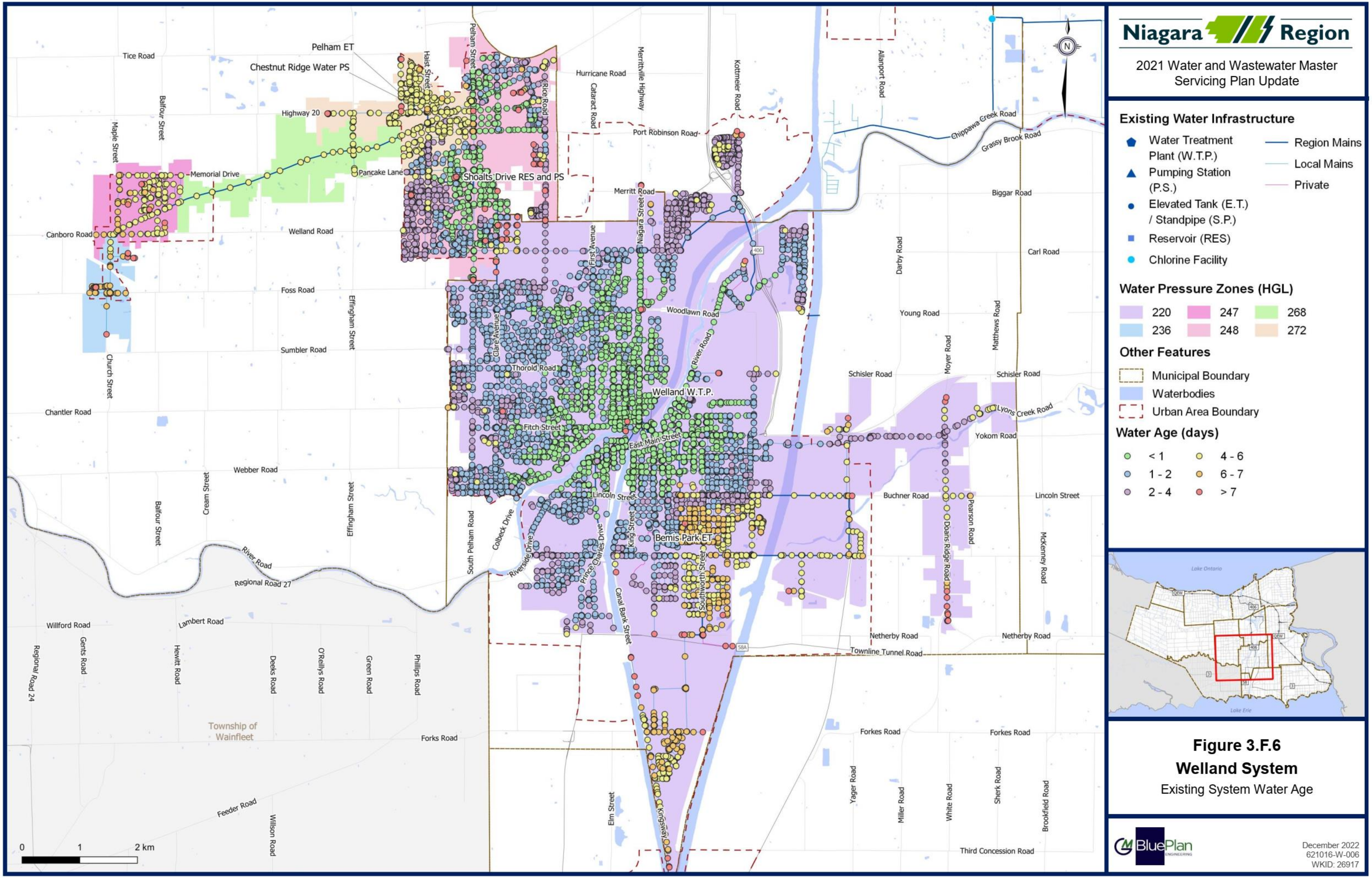
Using the baseline system model, water age scenarios were created to identify average system water age. Using the Drinking Water Works Permits for each system, the locations of rechlorination facilities were identified. Water age was reset to zero at these facilities for the water age model scenario. Water age is typically used as a proxy indicator for water quality, however, the exact correlation between water age and water quality can be highly variable depending on the source water quality, the distribution system material, and the secondary disinfectant that is used. A common threshold used within water system age is to flag areas where water age is greater than 7 days.

Figure 3.F.6 presents the existing system water age. Watermain velocities less than 0.6 m/s or greater than 1.5 m/s have been flagged and are shown in **Figure 3.F.7**.

In general, maximum water age is less than 7 days within the Welland water system, except for the following areas:

- The transmission main in Welland east of the canal on Ridge Road and Buchner Road, where the increase is due to the volume of water turnover relative to the existing demands, which will be improved as development continues in the area; and,
- Local dead-end watermains.

In general, watermain velocity is less than 2 m/s, however there are many Regional watermains which experience velocities less than 0.6 m/s.



2021 Water and Wastewater Master Servicing Plan Update

Figure 3.F.6
Welland System
Existing System Water Age

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621016-W-006
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2021 Water and Wastewater Master Servicing Plan Update

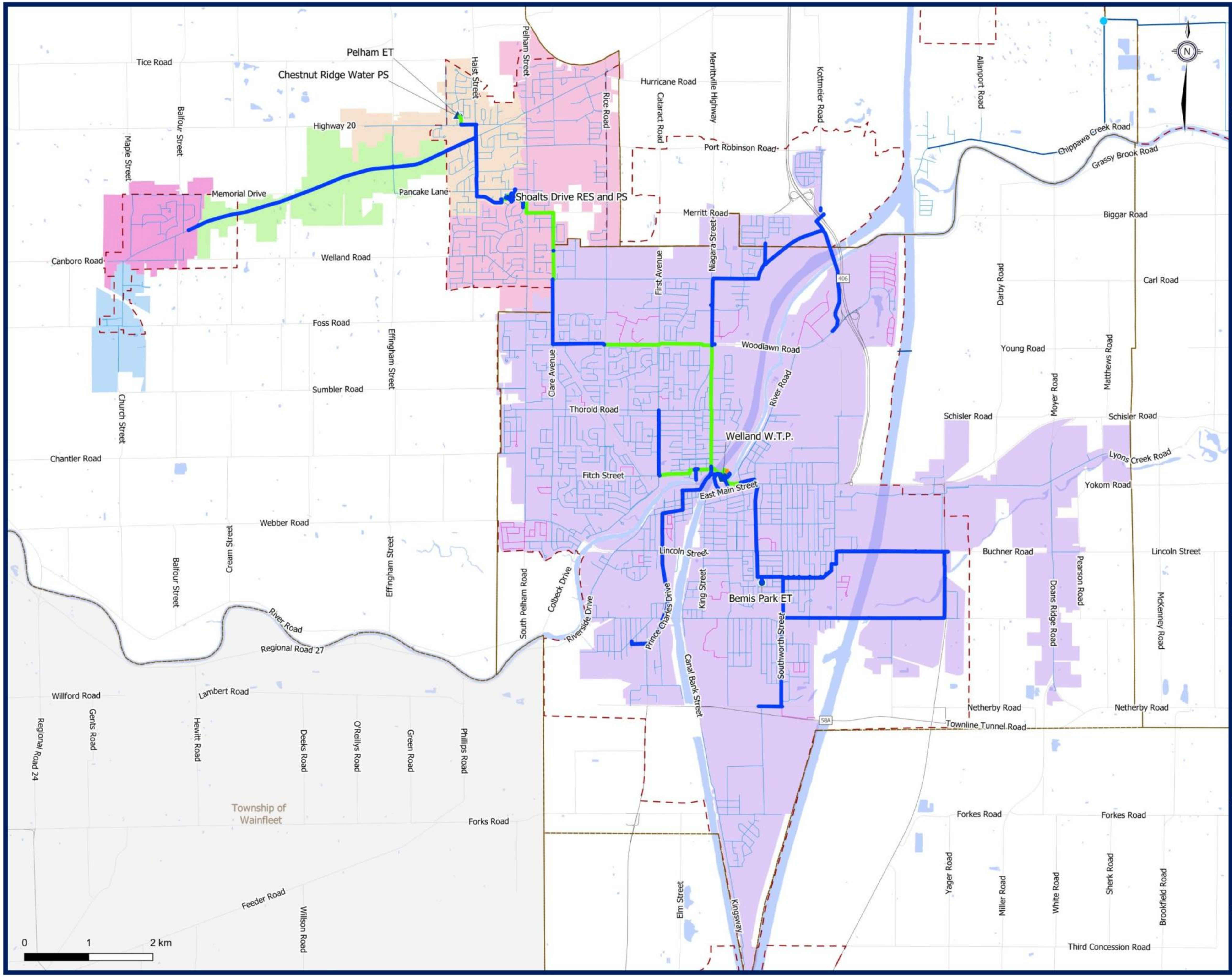

Figure 3.F.7
Welland System
Existing System Watermain Velocity

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December 2022
621016-W-007
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F.4 System Opportunities and Constraints

Figure 3.F.8 highlights the existing opportunities and constraints.

F.4.1 Welland Water Treatment Plant

- The current rated MDD capacity is 65 MLD with currently ongoing upgrades to bring the rated MDD capacity up to 73 MLD.
- The existing demand is 34.7 MLD, the projected 2051 MDD is 51.2 MLD, which is below 80% of the water treatment plant rated capacity. As such, the water treatment plant has surplus capacity to accommodate growth beyond 2051.
- The projected post-2051 MDD is 64.5 MLD.

F.4.2 Welland System

- Welland has surplus existing and future pumping and storage capacity.
- There are localized low pressure areas in northwest and northeast Welland under Peak Hour conditions. The City of Welland has constructed the City-owned and -operated Hunters Pointe pump station to support pressures in Hunter's Pointe.
- Under peak demand conditions, there is operational difficulty filling the Shoalt's Drive Reservoir due to the difference in the top water level between the Bemis ET and Shoalt's Drive Reservoir and restricted transmission capacity. To overcome this restriction the operations group temporally isolates of the Bemis Elevated Tank, thereby directing more flow to the Shoalt's Drive Reservoir.
- The existing Bemis ET is a multi-legged ET that does not meet current seismic standards. The Region has intentions to replace all multi-legged ETs, including the Bemis ET, in the near future. The future replacement of the Bemis ET presents an opportunity to optimize Welland system pressure, storage, and operation.

F.4.3 Pelham System

- The Shoalt's Drive High Lift Pumping Station has an existing and future pumping deficit.
- The Shoalt's Drive Low Lift Pumping Station has a future pumping deficit. Growth in Pelham will minimize the total available capacity that can be transferred through the PRVs.
- The existing Pelham Elevated Tank has a storage deficit which is currently supported through pumped transfers from the Shoalt's Drive Reservoir and High Lift Pumps. A storage upgrade was recommended through the previous master plan which has been carried forward.
- The Schedule B EA for a new 6 ML Pelham ET has been completed and is currently under design.
- There are existing pressure and fire flow capacity limitations within the 272 Pressure Zone. These capacity limitations are primarily the result of localized system dead-ends and small watermain diameters in the distribution network.

F.4.4 Thorold – Port Robinson Area System

- New feedermain is required to support large growth area.

F.4.5 System Security of Supply & Interconnections

- There is a single feedermain to North Welland and the Shoalt's Drive Reservoir.
- There is a single feedermain to Fenwick.
- There is a single feedermain to Dain City.

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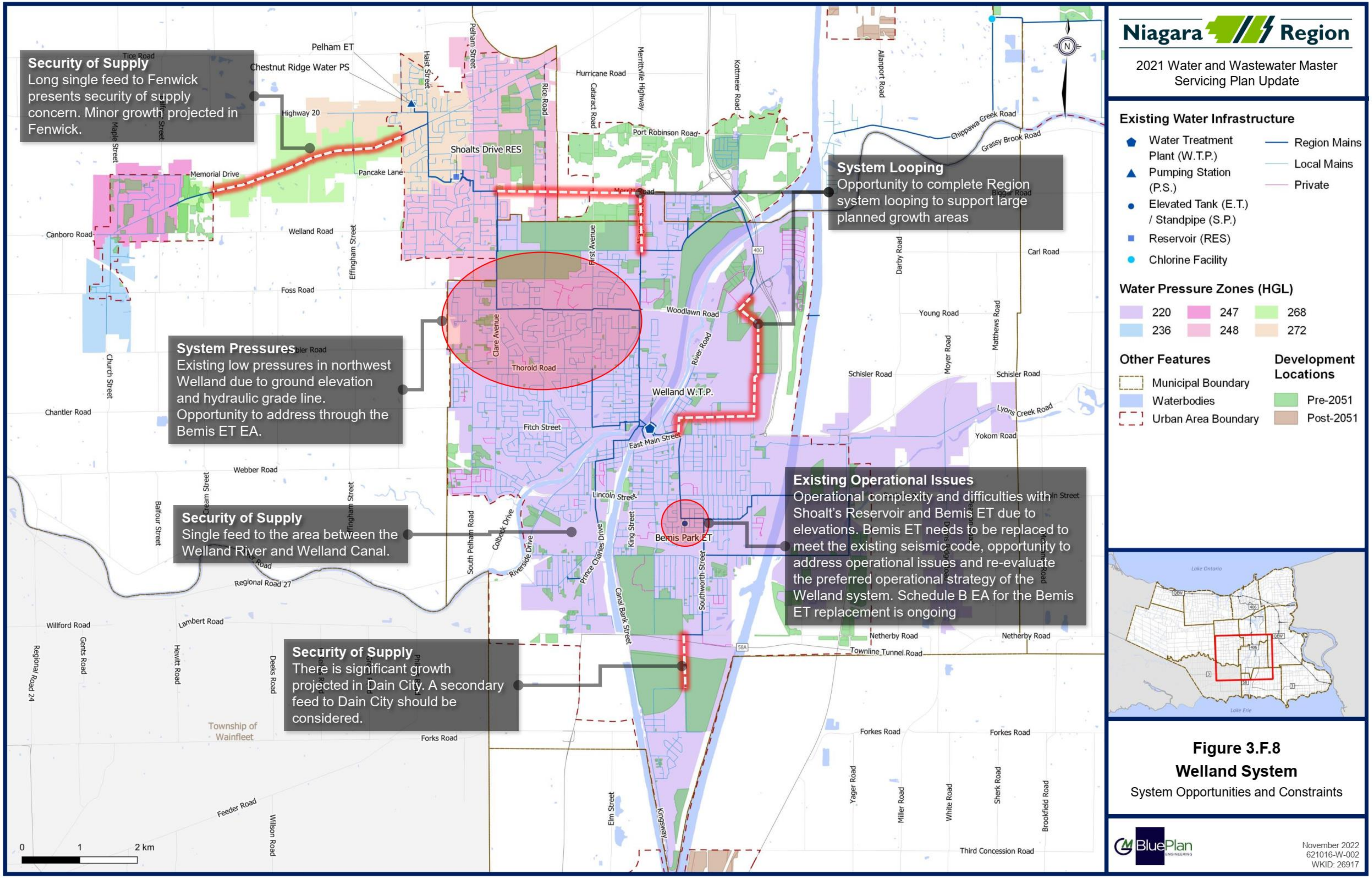

Security of Supply
Long single feed to Fenwick presents security of supply concern. Minor growth projected in Fenwick.

System Looping
Opportunity to complete Region system looping to support large planned growth areas

System Pressures
Existing low pressures in northwest Welland due to ground elevation and hydraulic grade line. Opportunity to address through the Bemis ET EA.

Security of Supply
Single feed to the area between the Welland River and Welland Canal.

Existing Operational Issues
Operational complexity and difficulties with Shoalt's Reservoir and Bemis ET due to elevations. Bemis ET needs to be replaced to meet the existing seismic code, opportunity to address operational issues and re-evaluate the preferred operational strategy of the Welland system. Schedule B EA for the Bemis ET replacement is ongoing

Security of Supply
There is significant growth projected in Dain City. A secondary feed to Dain City should be considered.

Figure 3.F.8
Welland System
System Opportunities and Constraints

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November 2022
621016-W-002
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F.5 Assessment of Alternatives

Replacement of the existing Pelham ET with a larger volume to support growth was recommended through the 2016 Master Servicing Plan Update. This project has been carried forward since the 2016 MSPU. The Schedule B EA has been completed, confirming the ET volume and new location. Through this EA, additional related watermain projects were also identified to be required. All projects related to the Pelham ET which were identified through the EA have been carried forward to the recommendations of the 2021 MSPU, which includes the following projects:

- New Pelham ET,
- New dedicated transmission main from Shoalt’s Drive High Lift Pump Station to the new Pelham ET,
- New feedermain from the new Pelham ET to Highway 20 and Haist Avenue, and
- Decommissioning of the existing Pelham ET.

The Bemis Elevated Tank Environmental Assessment is currently ongoing (end of 2023 completion target) and was triggered through state of good repair needs (replacement of multi-legged tanks to meet seismic code). Through the Bemis ET EA, several options will be considered with the objective of improving overall system performance and operations, including increased ET volume, different system locations, and increased HGL of the Welland system. Each option has the potential for varying impacts on other facilities (i.e., Welland WTP, Shoalt’s Drive Reservoir and High Lift and Low Lift Pumping Stations, need for transmission mains). For the purposes of the 2021 MSPU, placeholder projects have been included in the capital program which represent a reasonable middle ground for the potential options that will be considered through the EA. This strategy is subject to change through the EA and the preferred strategy determined through the Bemis ET EA will supersede the recommendations of the 2021 MSPU with respect to the Welland operating strategy. The placeholder projects included within the 2021 MSPU are as follows:

- Increase the operation HGL of the Welland pressure zone to 318 m or higher,
- Decommissioning of one 10 ML cell at the Shoalt’s Drive Reservoir,
- Pump upgrades at the Shoalt’s Low Lift Pumping Station to backfeed Welland,
- New pumps at the Welland WTP to support an increased HGL within the Welland system, and
- New larger Bemis ET at the same location.

In consultation with the Region, several watermain projects near the Welland WTP were identified as being planned and required to support existing system conveyance but would also provide benefit to future users. These projects have been included in the recommendations of the 2021 MSPU and consist of:

- Twinning of the transmission main across the Welland Canal at the Welland WTP,

- New feedermain on Merritt Street from Aqueduct Street to Niagara Street, and
- New feedermain on Niagara Street from Mill Street to Riverbank Street.

To address existing and growth-related capacity needs, the following servicing alternatives were evaluated:

- Baseline (No Changes),
- Minimize Watermain Upgrades,
- Security of Supply and Maximum System Looping, and
- Hybrid (combination of other options).

All alternatives include:

- Projects as listed previously, related to:
    - Bemis ET strategy,
    - Pelham ET, and
    - Feedermains near the Welland WTP.
- Pump upgrades at the Shoalt's High Lift Pumping Station to address existing and future pumping capacity deficits.

F.5.1 Alternative 1 – Minimize Watermain Upgrades

Alternative 1, highlighted in **Figure 3.F.9**, includes a new feedermain on Humberstone Road to allow for a second watermain connection to Dain City to address security supply. This alternative does not include a Region transmission main to address security of supply in Fenwick. There is an opportunity for the Town to install a secondary feed to Welland Road to address security of supply concerns. This would be a Town-owned watermain due to the smaller diameter required and the pressure zones are compatible for direct connection (247 m and 248 m).

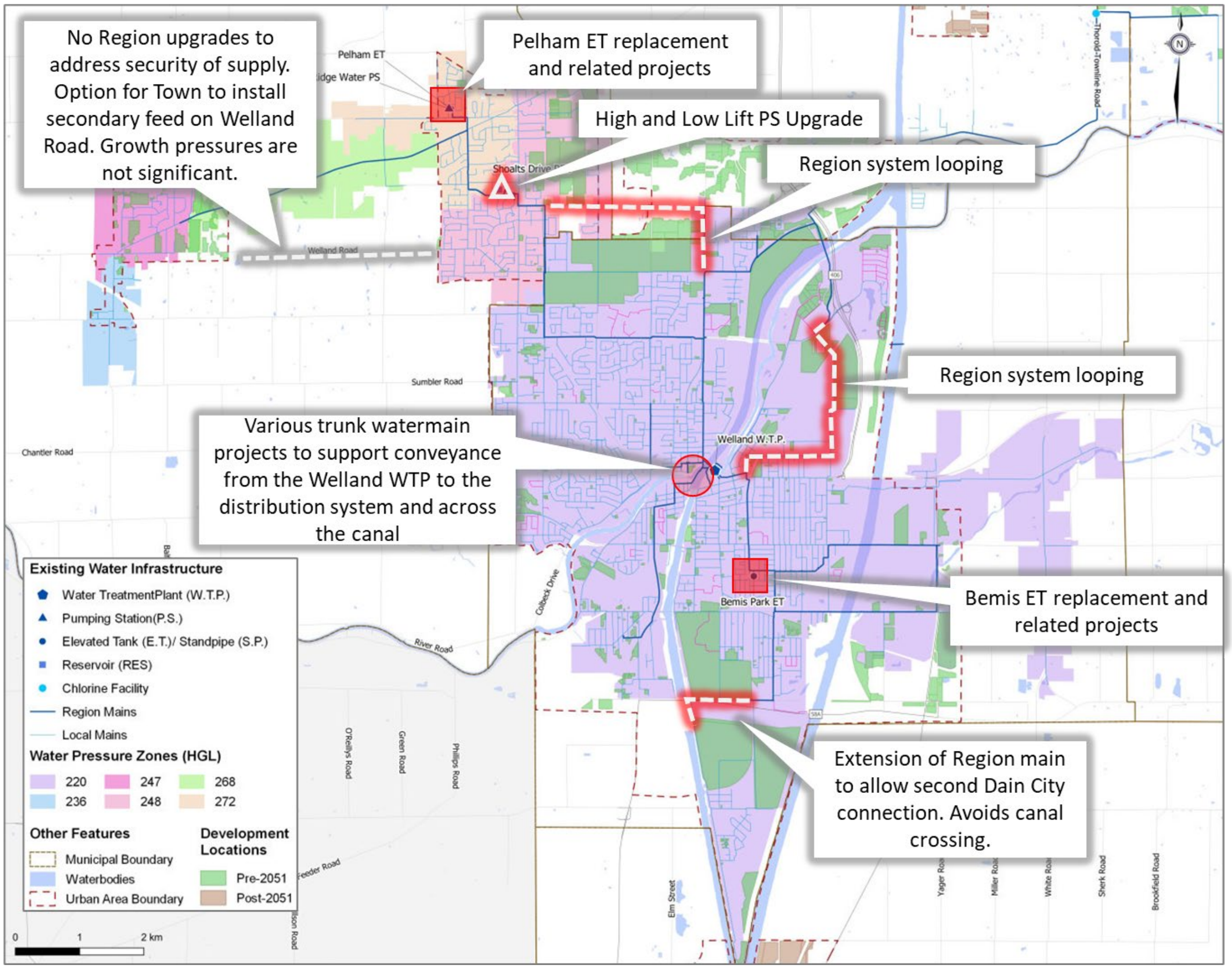

Figure 3.F.9 Alternative 1– Minimize Watermain Upgrades

F.5.2 Alternative 2 – Security of Supply and Maximum System Looping

Alternative 2, highlighted in **Figure 3.F.10**, includes a new feedermain in southwest Welland along Humberstone Road and Prince Charles Drive South. This feedermain would serve to complete the Regional watermain loop and would allow for a second connection to Dain City to support the significant planned growth in the area. This alternative also includes a new transmission main connecting Fonthill and Fenwick to address security of supply to Fenwick. This transmission main would additionally require PRV chamber due to the difference in HGL between pressure zone 272 in Fonthill and pressure zone 247 in Fenwick.

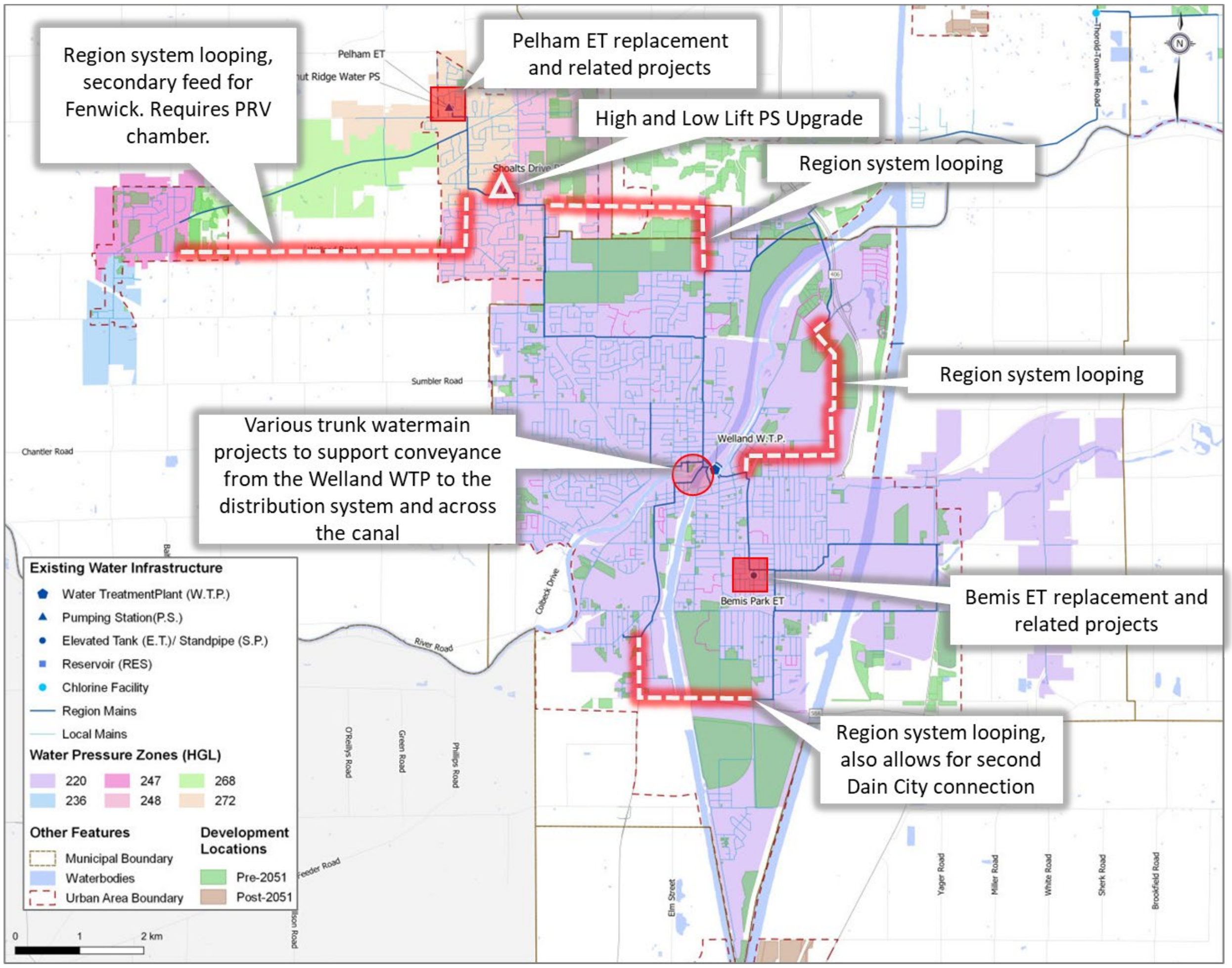

Figure 3.F.10 Alternative 2 – Security of Supply and Maximum System Looping

F.5.3 Alternative 3 – Hybrid Option

Alternative 3, highlighted in **Figure 3.F.11**, is a combination of Alternatives 1 and 2.

This alternative does not include a Region transmission main to address security of supply in Fenwick. There is an opportunity for the Town to install a secondary feed to Welland Road to address security of supply concerns. This would be a Town-owned watermain due to the smaller diameter required, and the pressure zones are compatible for direct connection (247 m and 248 m).

This alternative also includes a new feedermain in southwest Welland along Humberstone Road and Prince Charles Drive South. This feedermain would serve to complete the Regional watermain loop and allowing for a second connection to Dain City to support the significant planned growth in the area.

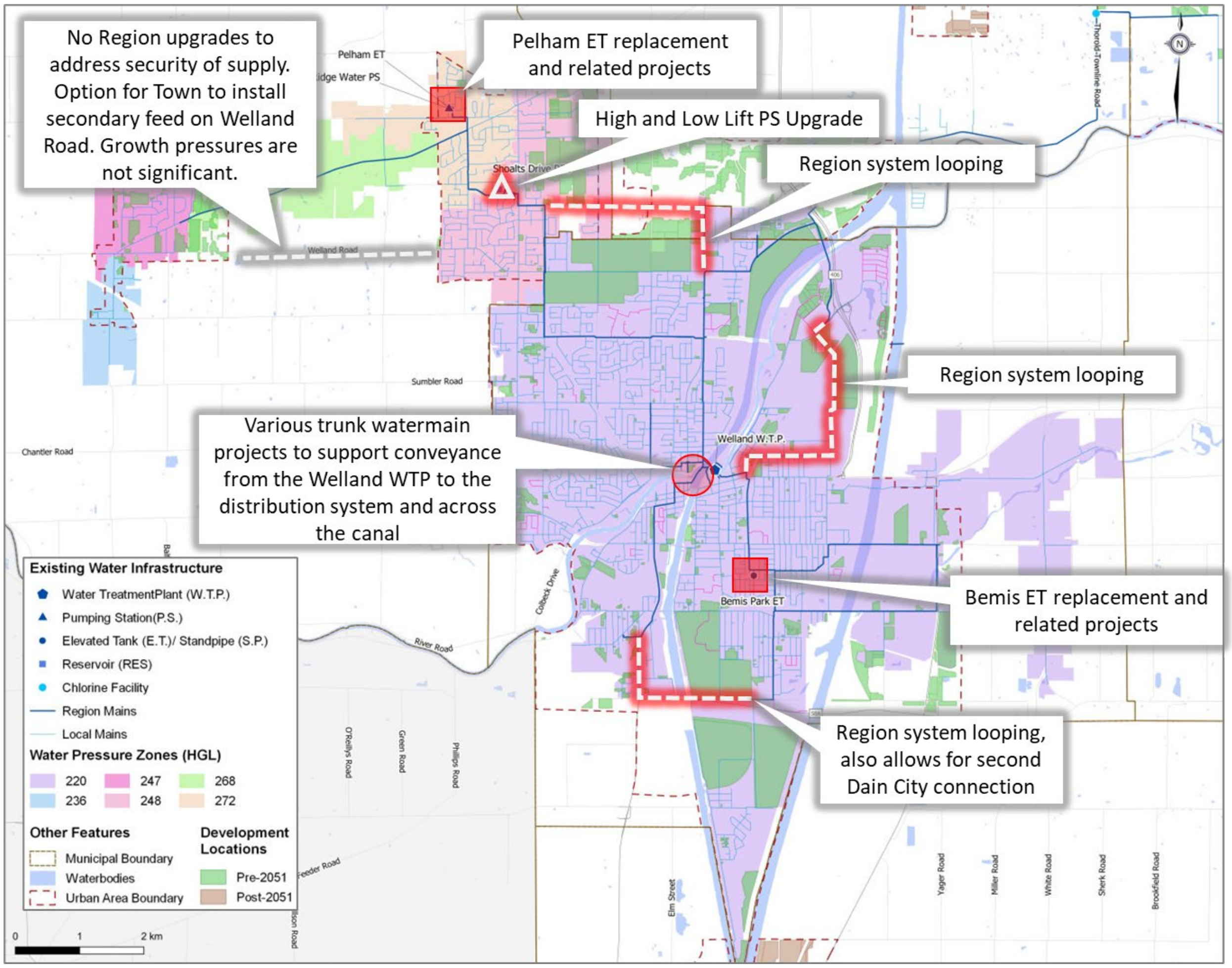

Figure 3.F.11 Alternative 3 – Hybrid Option

F.5.4 Alternatives Evaluation

Alternative 3 – Hybrid Option is the preferred servicing strategy as:

- Baseline strategy does not satisfy the existing or future servicing needs of the water system;
- Alternative 3 allows for:
    - Increased security of supply to North Welland with the addition of a new alternate connection from the water treatment plant to the north, allowing for improved capacity within the new growth area;
    - Increase security of supply to southwest Welland and Dain City with the addition of a new feedermain to complete the Regional watermain loop;
    - Additional system looping supporting growth within Port Robinson West with the addition of a new feedermain; and,
- A Regional transmission main connection to address security of supply in Fenwick is not recommended for the following reasons:
    - Due to the location of the existing Regional watermains in Fonthill, a new PRV chamber would be required to support the watermain, but would not be required with the construction of a Town-owned main;
    - The required size of the secondary connection would 300 mm or smaller, which is smaller than typical Region-owned watermains (except for legacy watermain ownership issues);
    - There is minimal growth planned within Fenwick; and,
    - Existing land use within Fenwick is predominately residential, resulting in a lower fire flow requirement than the Region’s target for transmission mains.

Table 3.F.12 Comparison of Alternatives

Category	Alternative 1	Alternative 2	Alternative 3 (Preferred)
Description	Minimize Watermain Upgrades	Security of Supply and Maximum System Looping	Hybrid Option
Upgrades	• Upgrades common to all alternatives ○ Bemis ET and associated upgrades ○ Pelham ET and associated upgrades ○ Feedermain projects near the Welland WTP ○ Pumping upgrades at Shoalt's Drive High Lift PS • 1.3 km new 400 mm watermain on Humberstone Road and Canal Bank Street (Dain City secondary feed)	• Upgrades common to all alternatives ○ Bemis ET and associated upgrades ○ Pelham ET and associated upgrades ○ Feedermain projects near the Welland WTP ○ Pumping upgrades at Shoalt's Drive High Lift PS • 2.7 km new 400 mm watermain on Humberstone Road and Prince Charles Drive South (Dain City secondary feed and system looping) • 5.5 km new 300 mm watermain on Haist Street and Welland Road (Fenwick secondary feed)	• Upgrades common to all alternatives ○ Bemis ET and associated upgrades ○ Pelham ET and associated upgrades ○ Feedermain projects near the Welland WTP ○ Pumping upgrades at Shoalt's Drive High Lift PS • 2.7 km new 400 mm watermain on Humberstone Road and Prince Charles Drive South (Dain City secondary feed and system looping)
Advantages	• Helps to address single Dain City feed with a shorter watermain compared to Alternative 2, however, single point of failure to Dain City remains on single Regional watermain Southworth Street	• Addresses security of supply to Dain City and southwest Welland • Addresses security of supply to Fenwick •	• Addresses security of supply to Dain City and southwest Welland • Improves Regional watermain system looping
Disadvantages	• Does not address security of supply to Fenwick, however, the option remains to address the concern with a Town-owned watermain which would be more suitable for the area and the system • Does not address security of supply to Dain City or Southwest Welland	• Region transmission main from Fonthill to Fenwick requires a PRV chamber • Large cost for new transmission main from Fonthill to Fenwick with limited benefit for a low priority growth area, potential to increase water age in Fenwick	• Does not address security of supply to Fenwick, however, the option remains to address the concern with a Town-owned watermain which would be more suitable for the area and the system

F.6 Preferred Servicing Strategy

The following is a summary of the Welland water servicing strategy:

- The Welland Water Treatment Plant has sufficient capacity to support growth to year 2051;
- The components of the Welland water strategy are focused on providing additional storage for the growth in the area while optimizing the storage/pumping relationship to reduce long term lifecycle costs;
- The operating strategy within the Welland zone will likely be adjusted, with the final preferred strategy being determined in the separate Bemis ET Schedule B EA.;
  - As part of the 2021 MSPU, placeholder projects have been assumed, with the understanding that the Bemis ET EA will refine and recommend the preferred strategy;
- Both sets of pumps in the Shoalt's Drive Pumping Station for the higher and lower pressure zones will be upgraded to support growth;
- A new Pelham ET will replace the existing Pelham ET in a different location, which was determined through the separate Pelham ET Schedule B EA. The new ET will have a larger volume and increased height, to support growth and optimize system pressures and performance in the area;
  - The Pelham ET EA also identified transmission main and feedermain upgrades required to support the operations of the new ET
- Additional feedermain capacity is required to support growth and address security of supply in the following areas:
  - Port Robinson West
  - From the Welland WTP to northeast Welland
  - Dain City and southwest Welland
  - Across the canal from the Welland WTP to Merritt Street and Niagara Street
  - On Niagara Street from Mill Street to Riverbank Street.

Figure 3.F.16 and **Figure 3.F.17** show the preferred servicing strategy and schematic.

F.6.1 Treatment Plant Works

- A capacity upgrade project is currently ongoing to increase the rated capacity from 65 MLD to 73 MLD
- The upgraded capacity is sufficient to support growth demands in Welland to at least 2051

F.6.2 Storage

- A new 6.0 ML elevated tank is to be built in Pelham to replace the existing Pelham Elevated Tank at a new site on Lookout Street, north of Marlene Stewart Drive

- A new 12.0 ML elevated tank recommended in Welland to replace the existing Bemis Elevated Tank
    - Assumed to be replaced at the same site, the ultimate preferred location will be determined through the Bemis ET EA

F.6.3 Pumping

- All four (4) existing 5.4 MLD pumps will be replaced with 8 MLD pumps at the Shoalt's Drive High Lift Pumping Station.
- Replace both (2) existing 3.0 MLD pumps with 20.5 MLD pumps and add a third 20.5 MLD pump at the Shoalt's Drive Low Lift Pumping Station, to be confirmed through Bemis ET EA
- New high lift pumps at the Welland WTP to support increased HGL, to be finalized through the Bemis ET EA

F.6.4 Decommissioning of Existing Facilities

- The Pelham Elevated Tank will be decommissioned following the completion of the new replacement Pelham ET, upgrades at Shoalt's Drive High and Low Lift Pumping Stations, and associated watermains
- The Bemis Elevated Tank will be decommissioned following the completion of the new replacement Bemis ET and associated upgrades, to be finalized through the Bemis ET EA
- A 10.0 ML cell at the Shoalt's Reservoir will be placed into standby and remain available for future re-commissioning if required, to support the updated Welland operating strategy, to be finalized through the Bemis ET EA

F.6.5 Regional Watermains

- New 600 mm feedermain in southwest Welland on Humberstone Road and Prince Charles Drive to complete Region system looping and allow for a secondary connection to Dain City
- New 450 mm feedermain in northwest Welland to support new growth areas in Port Robinson West
- New 450 mm feedermain from Welland Water Treatment Plant to north service area and complete Region system looping
- New 900 mm transmission main across the Welland Canal from the Welland WTP to Merritt Street and Aqueduct Street to support security of supply and additional conveyance out of the WTP
- New 600 mm feedermain on Merritt Street from Aqueduct Street to Niagara Street
- New 600 mm feedermain on Niagara Street from Mill Street to Riverbank Street (transportation EA is ongoing to replace the Niagara Street bridge over the Welland River)

- New 400 mm dedicated transmission main from Shoalt's High Lift Pumping Station to the new Pelham ET
- New 400 mm feedermain from the new Pelham ET to Highway 20 and Haist Avenue
- New 400 mm dedicated transmission main from Welland WTP to new Bemis ET, to be finalized through the Bemis ET EA

F.6.6 Studies and Programs

- The City of Welland, in coordination with the Region, should implement a targeted non-revenue water reduction program to address existing high non-revenue water rates; further details are provided in **Section F.8.3**.
- Region-wide WTP reservoir volume study to review CT volume and overall system storage

F.6.7 Future System Performance

Figure 3.F.12 to **Figure 3.F.15** present the future system performance, based on the preferred servicing strategy configuration and capacities.

In general, minimum system pressures fall within the acceptable pressure range of 40 to 100 psi under maximum day demand. It should be noted that the final optimal and preferred HGL for the Welland Pressure Zone 220 will be reviewed and finalized through the Bemis Elevated Tank EA, which is currently ongoing. This map assumes

The Region's target of 250 L/s fire flow at 30 psi residual pressure on Regional watermains is met for critical system areas. The fire flow target is not met on the transmission main in Pelham along Canboro Road from Fonthill to Fenwick (pressure zone 272 to pressure zone 247). This watermain is a long dead-end watermain which would require looping to improve available fire flow, and Fenwick is predominately a residential community with lower local fire flow needs.

In general, maximum water age is less than 7 days within the Welland water system, except for the following areas:

- The transmission main in Welland east of the canal on Ridge Road and Buchner Road, where the increase is due to the volume of water turnover relative to the existing demands, which will be improved as development continues in the area; and,
- Local dead-end watermains.

In general, watermain velocity is less than 2 m/s, however there are many Regional watermains which experience velocities less than 0.6 m/s.

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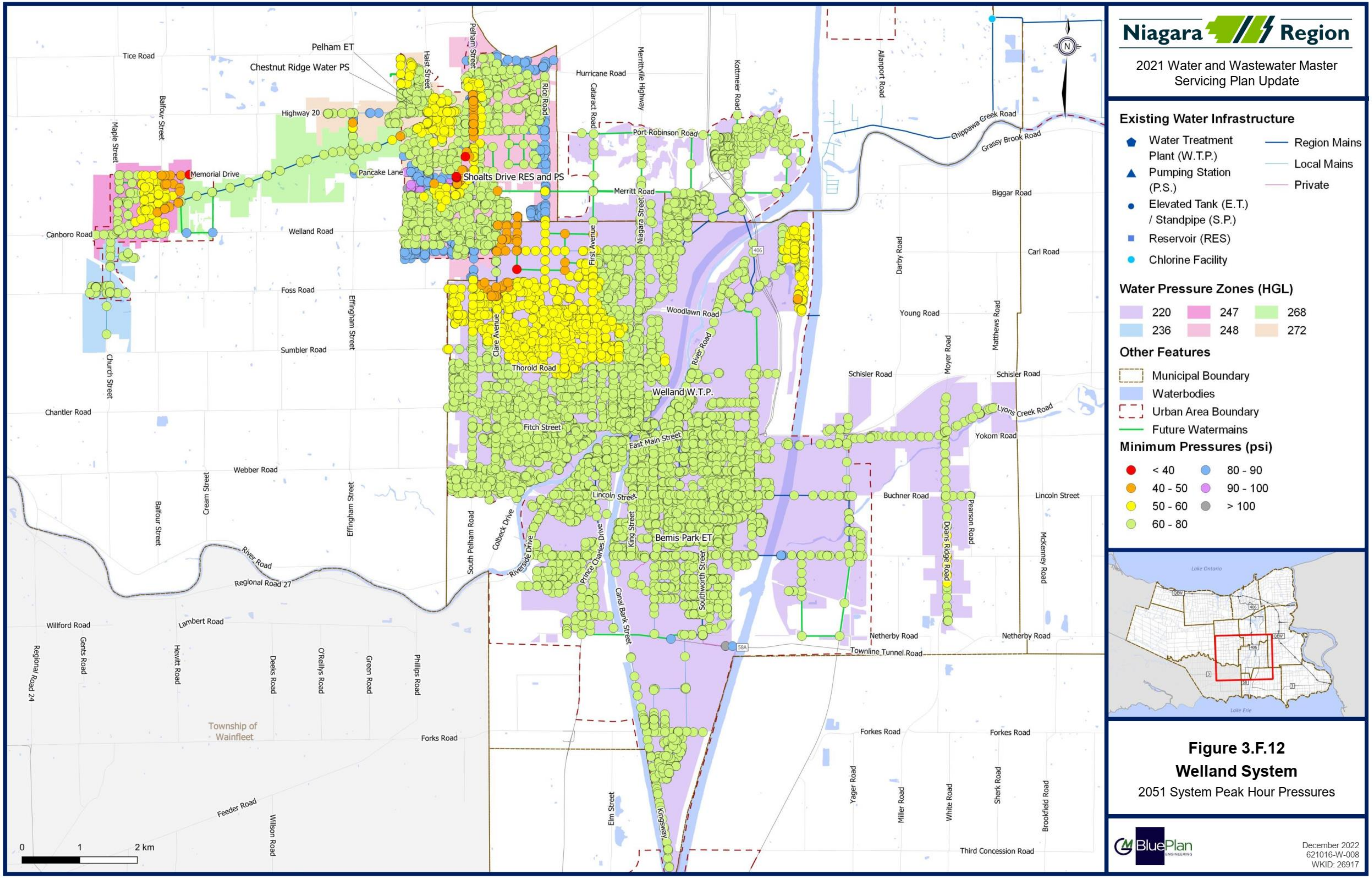
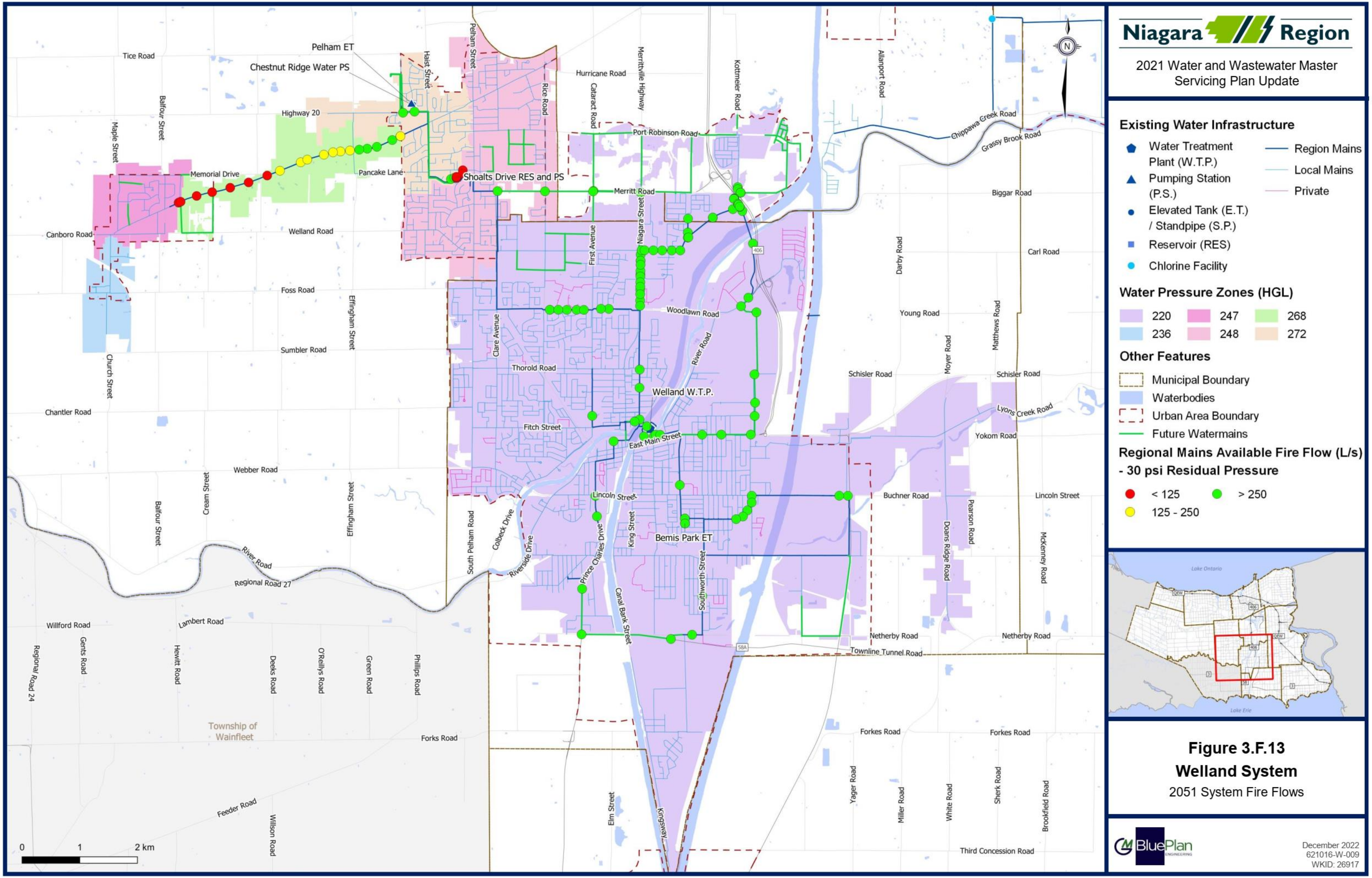


Figure 3.F.12
Welland System

2051 System Peak Hour Pressures

BluePlan ENGINEERING

December 2022
621016-W-008
WKID: 26917



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Existing Water Infrastructure

- Water Treatment Plant (W.T.P.)
- Pumping Station (P.S.)
- Elevated Tank (E.T.) / Standpipe (S.P.)
- Reservoir (RES)
- Chlorine Facility
- Region Mains
- Local Mains
- Private

Water Pressure Zones (HGL)

220	247	268
236	248	272

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary
- Future Watermains

Regional Mains Available Fire Flow (L/s) - 30 psi Residual Pressure

- < 125
- > 250
- 125 - 250

Figure 3.F.13
Welland System

2051 System Fire Flows

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December 2022
621016-W-009
WKID: 26917

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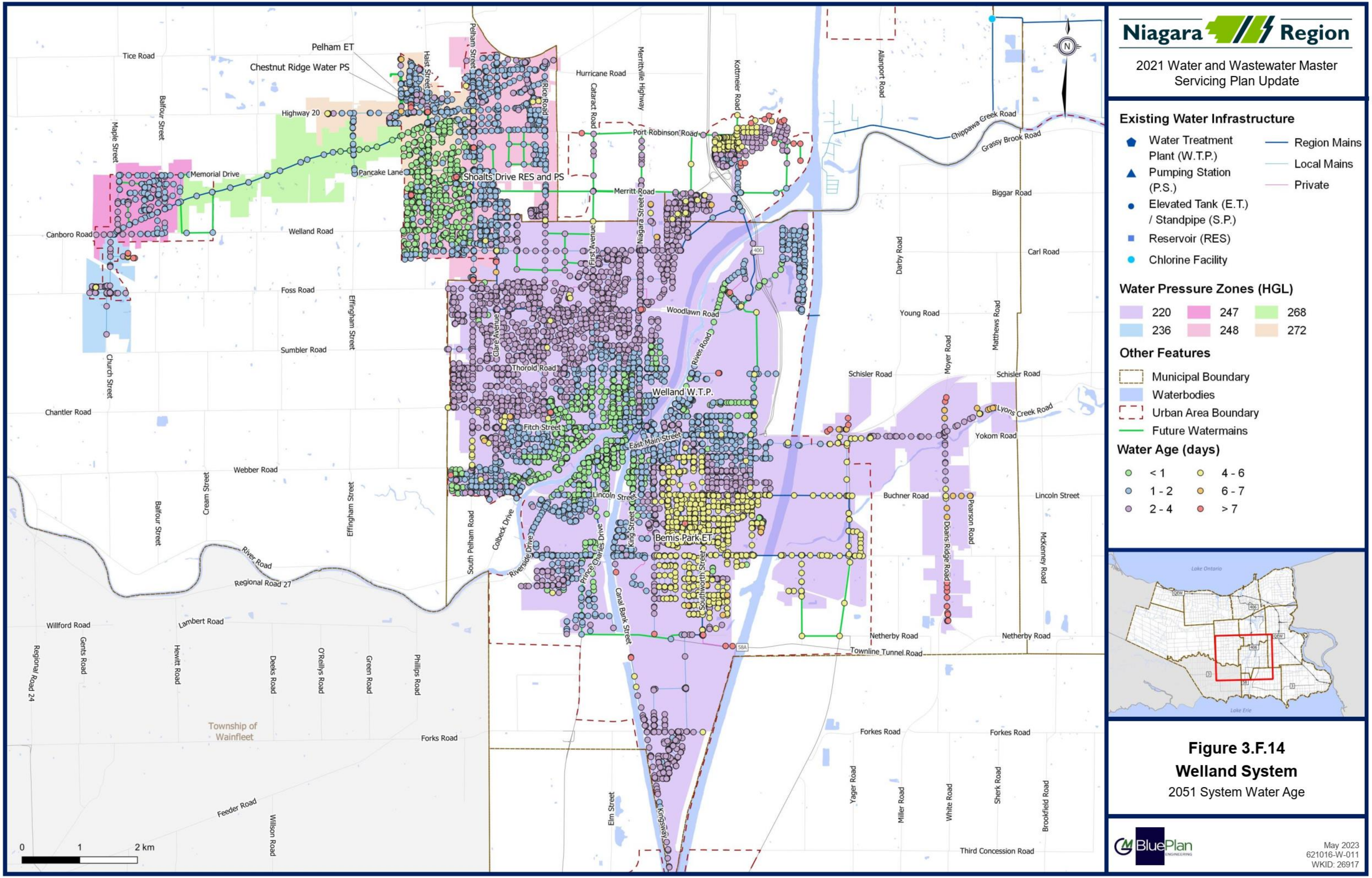

Figure 3.F.14
Welland System
2051 System Water Age

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May 2023
621016-W-011
WKID: 26917

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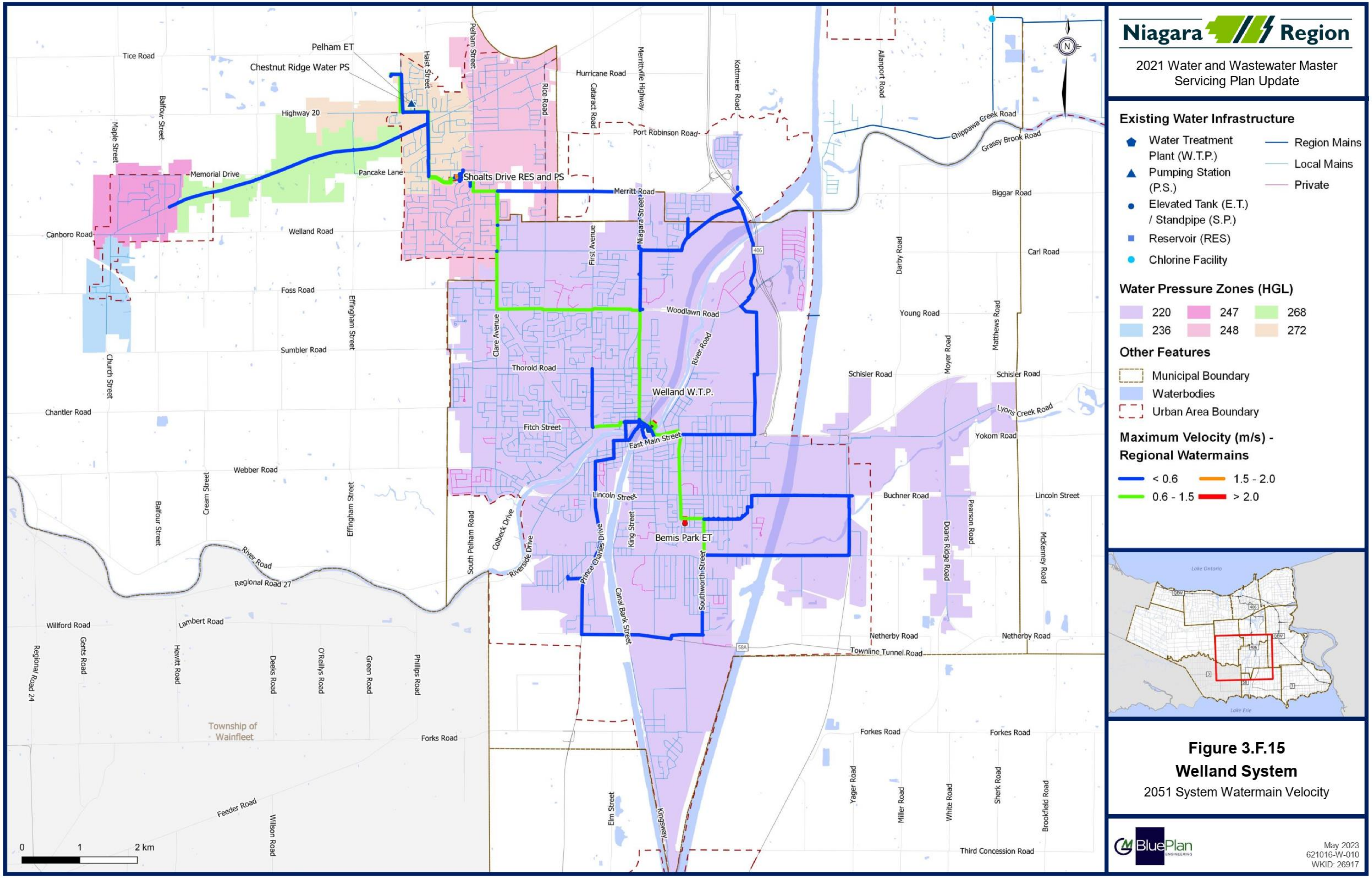


Figure 3.F.15
Welland System
2051 System Watermain Velocity

BluePlan ENGINEERING

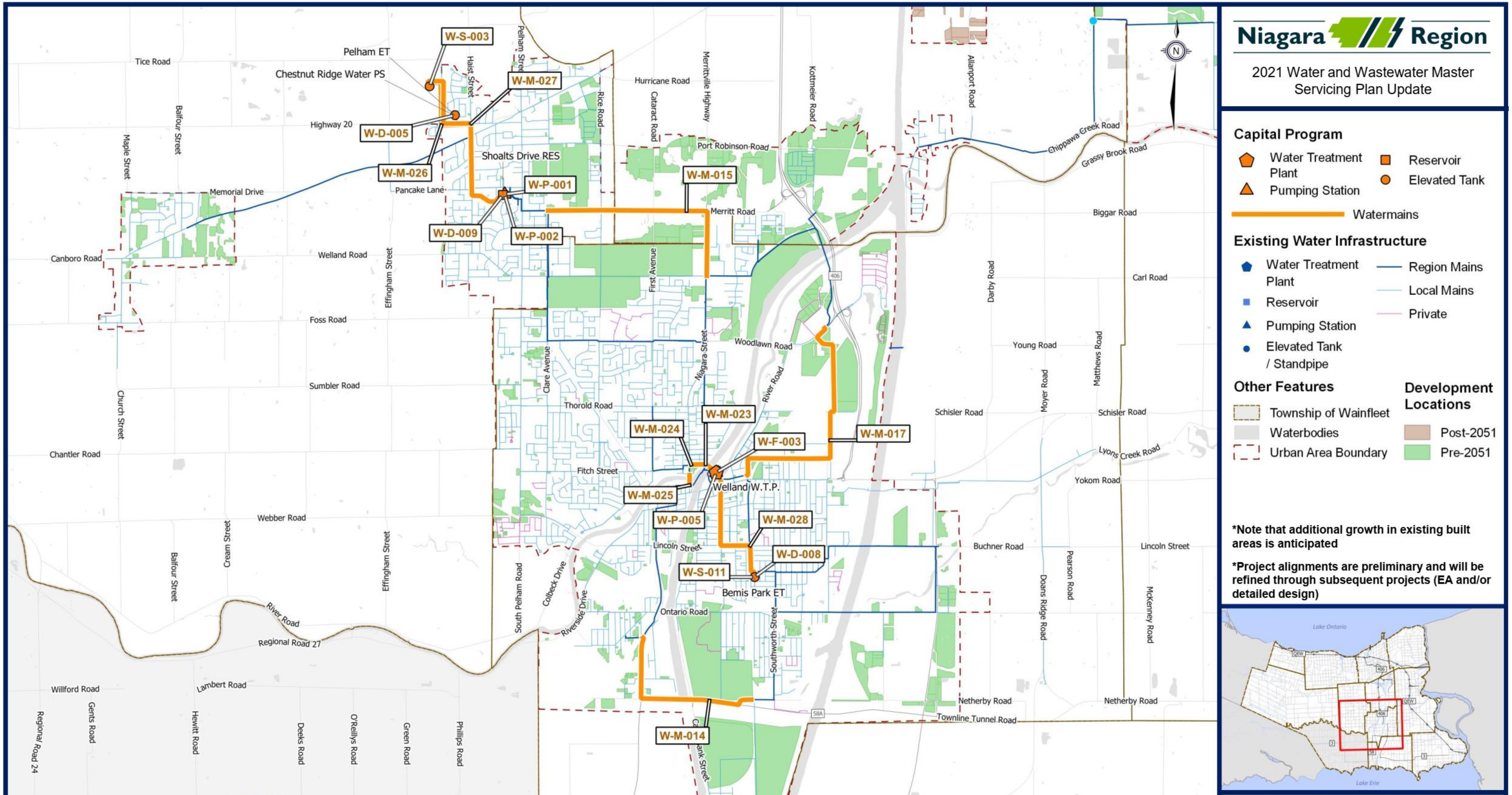
May 2023
621016-W-010
WKID: 26917

F.7 Capital Program

Figure 3.F.16 and **Figure 3.F.17** present the preferred servicing strategy map and schematic. **Table 3.F.13** summarizes the recommended project costing, implementation schedule and Class EA requirements. Individual detailed project costing sheets are presented in **Section F.8.6**.

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update



*Note that additional growth in existing built areas is anticipated

*Project alignments are preliminary and will be refined through subsequent projects (EA and/or detailed design)

Figure 3.F.16

Welland

Preferred Water Servicing Strategy

GM BluePlan ENGINEERING

December 2022
620126-W-013
WKID: 26917

2021 Water and Wastewater Master Servicing Plan Update

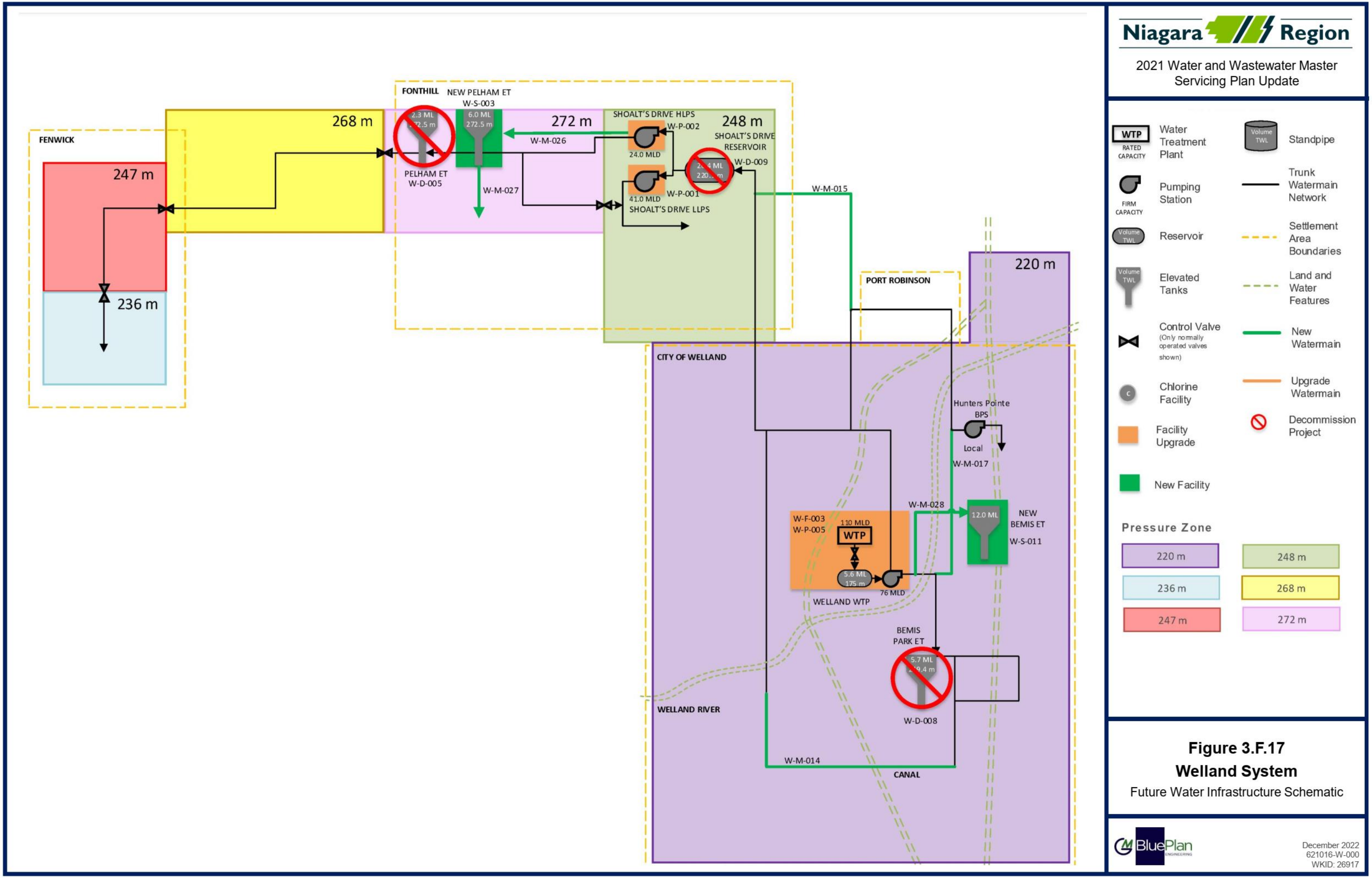


Figure 3.F.17
Welland System
Future Water Infrastructure Schematic

Table 3.F.13 Summary of Welland Water 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 ($)
W-D-005	Decommissioning of Pelham ET	Decommissioning of existing Pelham ET, to be replaced by a new ET	N/A	2027-2031	Pelham	A+	N/A	Storage	$1,290,000
W-D-008	Decommissioning of Bemis Elevated Tank	Decommissioning of Bemis Elevated Tank to be replaced with a new elevated tank	N/A	2027-2031	Welland	A+	N/A	Storage	$823,000
W-D-009	Decommissioning of one Shoalt's Reservoir Cell	Decommissioning of one Shoalt's Reservoir Cell. Placeholder project - to be confirmed through Bemis Elevated Tank Environmental Assessment	N/A	2032-2041	Welland	A+	N/A	Storage	$512,000
W-F-003	Welland WTP Replacement	Replacement of existing Welland WTP with 73 MLD in approximately same location.	73 MLD	2027-2031	Welland	B	Satisfied (separate study)	Treatment	$160,000,000
W-M-014	New feedermain in southwest Welland	New feedermain on Humberstone Road and Prince Charles Drive. Allows for secondary connection for Dain City (significant projected growth) and closes the Region's feedermain loop across the canal. Include for coordination on potential Regional interconnection with City's planned new watermain on Canal Bank Street.	600 mm	2027-2031	Welland	A+	N/A	Watermain	$8,867,000
W-M-015	New feedermain in northwest Welland	New feedermain in northwest Welland to service growth areas. Watermain on Merritt Road and Merrittville Highway	450 mm	2032-2041	Welland	A+	N/A	Watermain	$6,520,000
W-M-017	New feedermain from Welland WTP to North	New feedermain from Welland WTP to North service area. Preliminary alignment along Ross Street, McMaster Avenue, Major Street, Atlas Avenue, Brown Road, Woodlawn Road	450 mm	2032-2041	Welland	A+	N/A	Watermain	$9,346,000
W-M-023	Twinning of transmission main across the Welland Canal at the Welland WTP	Construction of new 900mm HDPE watermain across Welland Canal to Merritt Street and Aqueduct Street.	900 mm	2022-2026	Welland	A+	N/A	Watermain	$6,848,000
W-M-024	New feedermain on Merritt Street from Aqueduct Street to Niagara Street	New feedermain on Merritt Street from Aqueduct Street to Niagara Street. Part of the Welland canal transmission main twinning project (W-M-023)	600 mm	2022-2026	Welland	A+	N/A	Watermain	$932,000
W-M-025	New feedermain on Niagara Street from Mill Street to Riverbank Street	New feedermain on Niagara Street from Mill Street to Riverbank Street. EA is undergoing with Transportation project to replace Niagara Street bridge over Welland River	600 mm	2022-2026	Welland	A+	N/A	Watermain	$832,000
W-M-026	New dedicated transmission main from Shoalt's HLPS to Pelham ET	New dedicated transmission main from Shoalt's HLPS to the new Pelham elevated tank. Alignment provided by the Region through the Pelham ET EA.	400 mm	2027-2031	Welland	A+	N/A	Watermain	$6,655,000
W-M-027	New feedermain from Pelham ET to Highway 20 and Haist Avenue	New feedermain from Pelham ET to Highway 20 and Haist Avenue. Alignment provided by the Region through the Pelham ET EA.	400 mm	2027-2031	Welland	A+	N/A	Watermain	$4,208,000
W-M-028	New dedicated feedermain from Welland WTP to existing Bemis ET	New dedicated feedermain from Welland WTP to existing Bemis ET. Placeholder project - preferred size and alignment to be determined through the Bemis ET EA.	400 mm	2027-2031	Welland	A+	N/A	Watermain	$4,466,000

Master Plan ID	Name	Description	Size / Capacity	Year in Service	Municipality	Class EA Schedule	Class EA Status	Project Type	Total Component Estimated Cost ($)
W-P-001	Upgrade Shoalt's Drive LLPS	Replace existing 3 MLD low lift pumps with three 20.5 MLD pumps (41 MLD/474 L/s firm capacity to support 2051 required capacity in Welland, total station capacity of 61.5 MLD/712 L/s). Placeholder project - to be confirmed through Bemis Elevated Tank Environmental Assessment	475 L/s	2027-2031	Welland	A	N/A	Pumping	$6,868,000
W-P-002	Upgrade Shoalt's Drive HLPS	Replace all four 5.4 MLD high lift pumps with four 8 MLD pumps (24 MLD/278 L/s firm capacity to support MDD plus MECP fire flow for 2051 and post-2051, total station capacity of 32 MLD/370 L/s)	278 L/s	2027-2031	Welland	A	N/A	Pumping	$6,868,000
W-P-005	New HLP at Welland to support increased HGL	New separate set of high lift pumps at Welland WTP to support potential increase in hydraulic grade line (same capacity as existing pumps, but increased head). Placeholder project - to be confirmed through Bemis Elevated Tank Environmental Assessment	880 L/s	2027-2031	Welland	A+	N/A	Pumping	$13,620,000
W-S-003	New Pelham ET	New Pelham ET to replace existing ET. Assuming property acquisition is required (5% for new site).	6 ML	2027-2031	Pelham	B	Satisfied (separate study)	Storage	$14,313,000
W-S-011	Replace Bemis Elevated Tank	Replace Bemis Elevated Tank - Sizing to be confirmed through Bemis Elevated Tank Environmental Assessment	12 ML	2027-2031	Welland	B	Ongoing (separate study)	Storage	$26,547,000
W-ST-001[1]	Region Wide WTP Reservoir Volume Study	Study to review WTP reservoir CT volume and overall system storage	-	2022-2026	Region-Wide	A+	N/A	Storage	-
								Total	**$279,515,000**

[1] Project cost not included in subtotal as it is a Region-wide project

F.8 Project Implementation and Considerations

F.8.1 10-Year Program Sequencing

The recommended year in service for the capital projects is presented in **Section F.6.7**. Special project implementation and considerations for the preferred servicing strategy consist of:

- The Shoalt's Drive High Lift Pumping Station upgrade should be completed prior to the completion of the new Pelham ET;
- The new Pelham ET and Bemis ET should be completed prior to the decommissioning of their respective existing ETs;
- Watermains associated with new ET construction should be completed prior to the completion of the ETs (i.e., dedicated transmission mains); and,
- New high lift pumps at the Welland WTP to support the increased HGL within Welland should be completed prior to the completion of the new Bemis ET.

It is understood that the timing for the recommended projects may be subject to change due to a variety of external factors such as overall balancing of the Region's capital budget, changes to growth projections, and other unforeseen circumstances. Further, projects related to the updated strategy recommended within the Bemis ET EA should follow the updated implementation requirements as outlined in the Bemis ET EA (i.e., 2021 MSPU implementation and project details to be superseded by the EA). As such, **Table 3.F.14** presents the preferred priority of the projects within the first 10-years of the capital program.

Table 3.F.14 First 10-Years Project Sequencing

Master Plan ID	Name	In Service Period	Project Sequencing
W-M-023	Twinning of transmission main across the Welland Canal at the Welland WTP	2022-2026	1
W-M-024	New feedermain on Merritt Street from Aqueduct Street to Niagara Street	2022-2026	1
W-M-025	New feedermain on Niagara Street from Mill Street to Riverbank Street	2022-2026	1
W-F-003	Welland WTP Phase 2 - Capacity Expansion	2027-2031	2
W-M-026	New dedicated transmission main from Shoalt's HLPS to Pelham ET	2027-2031	3
W-M-027	New feedermain from Pelham ET to Highway 20 and Haist Avenue	2027-2031	3
W-M-014	New feedermain in southwest Welland	2027-2031	3
W-P-002**(1)**	Upgrade Shoalt's Drive HLPS	2027-2031	3
W-S-003	New Pelham ET	2027-2031	4
W-M-028(1)	New dedicated transmission main from Welland WTP to existing Bemis ET	2027-2031	5
W-P-005(1)	New HLP at Welland to support increased HGL	2027-2031	5
W-S-011(1)	Replace Bemis Elevated Tank	2027-2031	6
W-D-005	Decommissioning of Pelham ET	2027-2031	7
W-D-008(1)	Decommissioning of Bemis Elevated Tank	2027-2031	7
W-P-001(1)	Upgrade Shoalt's Drive LLPS	2027-2031	7

(1) These projects are related to the updated Welland operational strategy that will be revised and updated within the Bemis ET EA. Project implementation and schedule for these projects should follow the updated implementation requirements as outlined in the Bemis ET EA (i.e., 2021 MSPU implementation and project details to be superseded by the EA)

F.8.2 EA Requirements and Studies

The following summarizes the status of EA requirements for recommended capital projects which will require Schedule B or C EAs.

- **EA has been satisfied through previous projects:**
    - W-F-003 (Welland WTP Phase 2 – Capacity Expansion) Schedule B
    - W-S-003 (New Pelham ET) Schedule B
- **Currently ongoing separate EA studies:**
    - W-S-011 (Replace Bemis Elevated Tank) Schedule B (will impact other related projects within the 2021 MSPU)

F.8.3 Region-Wide Projects and Collaboration with Local Area Municipalities

As part of the recommended capital program, it is recommended that the Region complete a WTP reservoir volume study across all WTP facilities to review CT volume and overall system storage. The intent of this study is to gain a clearer understanding of storage limitations at WTP facilities and how much usable volume can be accounted for within the system storage calculations.

Acknowledging that the overall water systems are jointly owned and operated by the Region and local area municipalities (LAM), the continued operation and expansion of the water systems to support existing users and accommodate projected growth relies upon the cooperation of the upper and lower tier municipalities. Major updates and adjustments to planning projections should be continued to be communicated as this may affect project details such as trigger timelines and design capacities, which is discussed further in **Section F.8.5**.

One initiative that will be predominately driven by the LAMs is NRW reduction. While NRW reduction programs should be completed in all municipalities, this 2021 MSPU assumes that the municipalities currently experiencing NRW rates greater than 25% will put specific focus on reducing NRW. The 2021 MSPU utilized an assumption of NRW reduction to at least 25% by 2051, however, municipality-specific targets can be reviewed by the LAMs. The existing NRW rate in Welland is 42%, which is significantly higher than the average NRW noted in other LAMs, and 7% in Pelham. The program activities may include but are not limited to:

- Enhancement to the water metering program including:
    - Meter replacement program
    - Re-time monitoring of large water users
- Leak detection program for watermains,
- Watermain replacement program,
- Improved tracking of unbilled authorized users and development of demand reduction strategies:
    - Fire department
    - Watermain flushing
    - Facility usage,
- Development of bulk water user strategy and potential construction of additional bulk water station, and
- Improved monitoring and enforcement of new construction water uses.

F.8.4 Sustainability Projects

It is important to recognize that the 2021 MSPU servicing strategies identify new infrastructure to service the additional growth out to year 2051 but these strategies are built by extending infrastructure from the existing systems and leveraging the existing Region infrastructure in place. It is essential that the existing infrastructure is maintained in good condition and performance to support servicing growth.

The Region continually establishes and implements a sustainability program that addresses priority projects to ensure the existing infrastructure is in a state-of-good-repair and continues to perform and meet the intended level of services.

Independent of the 2021 MSPU, the Region has completed a sustainability program analysis to identify the projects on a yearly basis, with focus on a 10 year program, to address the sustainability needs. This Sustainability Capital Plan is first developed to demonstrate the total investment needs and may identify a level of investment and implementation exceeding Region resources. The next steps for the Sustainability Capital Plan will be the development of the Financial Plan for existing Water and Wastewater assets which is anticipated to be completed in 2024. It should be noted that the Sustainability Capital Plan represents investment required over and above the growth-related 2021 MSPU program.

The 2021 MSPU undertook a process to review the Sustainability Program in conjunction with the growth-related program to eliminate duplicate projects and to align the timing of both growth and sustainability needs where appropriate in order to create efficiencies. This review was focused on the Sustainability Program for the next 10 years with the best information available at the time of this study.

The review process for integration of the MSPU program and the sustainability program was essential to demonstrate several key findings:

- There is opportunity to align growth and sustainability projects to bring efficiencies in costs and delivery;
- When planning and costing new infrastructure, lifecycle principles and costs must be considered. Existing and future infrastructure will have future service life replacements (i.e., pumps, electrical, roof, security upgrades at varying intervals from 5 – 40 years);
- Without maintenance of the existing infrastructure in a state of good repair and performance, there is risk that the growth-related program may not achieve desired capacities, timing, or level of service;
- There is also risk that implementing the growth-related program could have a negative impact on the level of service within the existing systems for the existing users; and,
- There are some major projects already considered under the sustainability program that are essential to the growth-related program such as the Welland WTP and WWTP.

The 2021 MSPU growth capital program focuses on the infrastructure needs to support growth and all the projects build upon the Region’s existing water systems. It is imperative that the Region’s sustainability capital program continues to be completed as needed alongside the recommended 2021 MSPU growth capital program to ensure that the existing system is operating at expected capacities and reliability such that it can support the recommended growth projects.

The sustainability projects consist of Region-wide projects and programs including but not limited to: replacement programs for boilers, water valves, generators, watermains, master meters, GAC, process piping, process electrical, process instrumentation. Welland system specific projects include:

- Welland WTP – Phase 3 Demolition

F.8.5 Project Implementation Flow Chart

The recommended design capacities within the capital program are based on the best available information at the time of analysis, including existing system demands, facility capacities, and projected growth. It is understood that this data is not static and often changes over the years between the regular updates of the Region’s Master Plan. Design assumptions should be revisited before initiation of projects to reconfirm the appropriate design capacities, along with identification of any associated or dependent projects which can be combined or staged to optimize implementation efficiency and cost, and/or system operation.

To support the Region’s process in implementing all recommended 2021 MSPU capital projects, the following flow chart has been developed for the water system. This flow chart document is intended to be a reference resource for the Region and should be treated as a guideline to support existing internal Region processes in project implementation, as shown in **Figure 3.F.18.**

WATER PROJECT IMPLEMENTATION

The intent of this document is to support the Region in confirming the scope of work for water infrastructure projects.

CONFIRM PROJECT SCOPE

To define Terms of Reference

☐ **What triggered this project?**
- Known development growth
- Forecasted growth
- Sustainability needs

☐ **Are there related or dependent projects that should be identified for streamlining opportunities or for project phasing?**
- Are there projects that need to be completed before this project?
- Are there projects within the same alignment or project area that could be combined (e.g., growth projects, wastewater, stormwater, corridor planning, sustainability projects, etc.)
- If there are related projects, could the project timing be adjusted to combine or stage projects more efficiently?

☐ **What is the project EA Schedule and status?**

☐ **Are there historic or ongoing operational issues in the project area?**
- Confirm with Regional and LAM operations and maintenance groups
- i.e. historic watermain breaks, water quality or pressure complaints, work order history, etc.

☐ **Are there any data gaps that should be incorporated into the Terms of Reference?**
- Refer to the Required Data section below for details
- How much does the project timeline and budget need to change to allow for the data collection?

☐ **Have the planning projections been updated to the best available information?**
- Consultation with Region and LAM planning groups to confirm planning projection
- Are projected needs for the project in place? Is actual growth in line with projected growth?)

☐ **Should the project be deferred until identified related works are completed?**

REQUIRED DATA

To support terms of reference and detailed design

☐ **Recently completed EA or servicing study**
(for growth triggered projects)

☐ **Historic demand records**
- Within the last 3 years
- Ideally one full year of SCADA records including facility demands, flow, and pressure records

☐ **Existing system hydrant testing or system pressure data to identify/verify existing system issues**

☐ **Asset inventory and condition assessment**
- All asset classes within the infrastructure type (watermain, storage, pumping, or treatment facility)
- Within the last 5 years
- Can be part of project scope if the data is not available and would not significantly alter project scope

☐ **Service area growth potential to confirm projected population and demands**
- Consultation with Region and LAM planning groups within the past year
- Growth information for 30-year horizon and beyond (maximum service area)
  - Population, jobs, land use, area
  - Current inventory of development areas with associated development status

IF THE REQUIRED DATA IS NOT AVAILABLE AND IF IT HAS THE POTENTIAL TO SIGNIFICANTLY ALTER SCOPE OF THE DESIGN, IT IS STRONGLY RECOMMENDED THAT THE APPROPRIATE DATA COLLECTION AND FIELD INVESTIGATION BE COMPLETED PRIOR TO PROCEEDING WITH DESIGN. ALTERNATIVELY, WHERE FEASIBLE, DATA COLLECTION SHOULD BE INCLUDED IN THE PROJECT SCOPE AND INTEGRATED INTO THE DESIGN PROCESS.

FLOW PROJECTIONS

To determine infrastructure capacity needs

EXISTING FLOWS

Average Day Demand (ADD)
- Historic SCADA to determine starting point average demand

Maximum Day Demand (MDD)
- Use peaking factors determined through MSPU to peak ADD
- There is a different peaking factor for each WTP system based on historic SCADA data

Peak Hour Demand (PHD)
- Diurnal curve based on historic data

Fire Flow (FF)
- MECP population-based

FUTURE FLOW PROJECTIONS

Existing Demand
- Scenarios depending on infrastructure type and design scenario (see next page

+

Growth Population Demand Contributions
- Residential, 240 L/c/d
- Employment, 270 L/e/d

The design criteria presented in this document are based on the 2021 Master Servicing Plan Update Study

STORAGE AND PUMPING FACILITY CONSIDERATIONS

☐ What is the complete service area of the facility?
  - Some facilities support multiple pressure zones
  - Some pressure zones are supported by multiple facilities

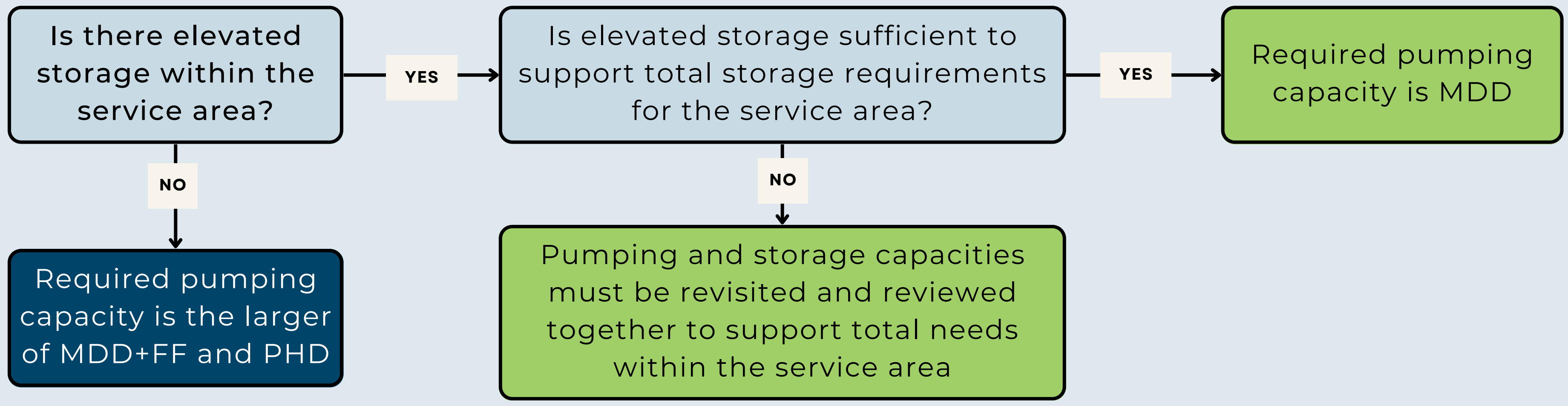
☐ If there are storage deficits, can they be supplemented through flow transfers?
  - Is it hydraulically and operationally feasible?

☐ Have storage and pumping facilites been reviewed in conjunction with one another?
  - Required pumping capacity varies based on available storage

☐ What is the optimal HGL target for pumping and elevated storage facilities?
  - Region strives to maximize areas within 50 - 80 psi for Regional watermains and minimum residual pressure of 30 psi at MECP population-based fire flow target

PUMPING STATION SIZING

To define design flow scenario (MDD, MDD+FF, PHD)



Is there elevated storage within the service area?

YES

Is elevated storage sufficient to support total storage requirements for the service area?

YES

Required pumping capacity is MDD

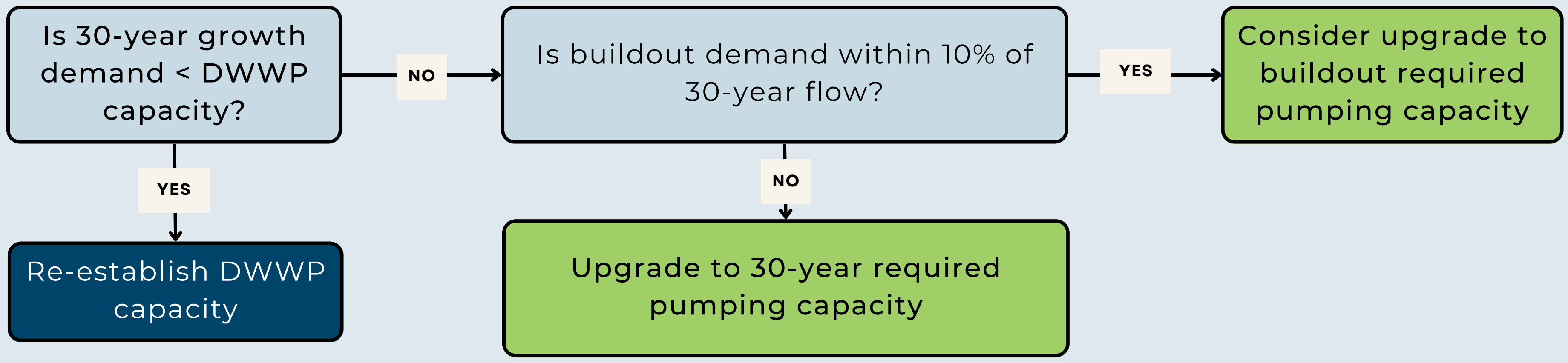
NO

Required pumping capacity is the larger of MDD+FF and PHD

NO

Pumping and storage capacities must be revisited and reviewed together to support total needs within the service area

To define design flow growth horizon (re-establish DWWP capacity, 30-year growth, buildout)



Is 30-year growth demand < DWWP capacity?

NO

Is buildout demand within 10% of 30-year flow?

YES

Consider upgrade to buildout required pumping capacity

YES

Re-establish DWWP capacity

NO

Upgrade to 30-year required pumping capacity

STORAGE SIZING

What are the system storage needs?

- System storage targets are based on MECP methodology, consistent with the 2021 Region MSPU
- Incorporate contact time storage needs at Water Treatment Plant Reservoirs
- Confirm fire flow storage strategy
- Review pumping capacity and impact on storage strategy

What timeline is considered for storage sizing?

- Is the storage sized at a minimum to support 30-year growth needs?
- What is the required storage sizing to support buildout needs?
- Is there a strategy to meet buildout needs?
- Is there opportunity for phased expansion?
- Is there a need for an alternative storage location?

TRUNK WATERMAIN SIZING

- Regional transmission mains should be sized to meet PHD and MDD+FF of maximum future service area (buildout) with a target velocity less than 1.5 m/s

F.8.6 Detailed Project Costing Sheets

The detailed project costing sheets for the recommended 2021 MSPU capital projects within the Welland system are presented below.

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-D-005**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**Decommissioning of Pelham ET**	**VERSION:**	
PROJECT DESCRIPTION:	Decommissioning of existing Pelham ET, to be replaced by a new ET	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 3	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	20%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Decommissioning						$800,000	2016 lump sum inflated
Additional Construction Costs	10%		ea.			$80,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$88,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$968,000**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 145,200	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$145,200**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$115,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$115,000**	
Non-Refundable HST	1.76%					$21,600	
Non-Refundable HST Sub-Total						**$21,600**	
Total (2022 Dollars)						**$1,290,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$1,290,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$25,800		
Design	Design fees, Region fees for design, contract admin	13%	$167,700		
Construction	Region fees, base costs and project contingency	85%	$1,096,500		
TOTAL			**$1,290,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: **W-D-008**
PROJECT NAME: **Decommissioning of Bemis Elevated Tank**
PROJECT DESCRIPTION: Decommissioning of Bemis Elevated Tank to be replaced with a new elevated tank

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

Class Estimate Type:	Class 3	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	20%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Decommissioning						$500,000	
Additional Construction Costs	10%		ea.			$50,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$55,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$605,000**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 90,800	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$90,800**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$74,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$74,000**	
Non-Refundable HST	1.76%					$13,500	
Non-Refundable HST Sub-Total						**$13,500**	
Total (2022 Dollars)						**$823,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$823,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$16,460		
Design	Design fees, Region fees for design, contract admin	13%	$106,990		
Construction	Region fees, base costs and project contingency	85%	$699,550		
TOTAL			**$823,000**		

PROJECT NO.: W-D-009
PROJECT NAME: Decommissioning of one Shoalt's Reservoir Cell
PROJECT DESCRIPTION: Decommissioning of one Shoalt's Reservoir Cell. Placeholder project - to be confirmed through Bemis Elevated Tank Environmental Assessment

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

Class Estimate Type:	Class 3	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	20%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Decommissioning						$300,000	
Additional Construction Costs	10%		ea.			$30,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$33,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$363,000**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 54,500	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$54,500**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$46,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$46,000**	
Non-Refundable HST	1.76%					$8,200	
Non-Refundable HST Sub-Total						**$8,200**	
Total (2022 Dollars)						**$512,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$512,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$10,240		
Design	Design fees, Region fees for design, contract admin	13%	$66,560		
Construction	Region fees, base costs and project contingency	85%	$435,200		
TOTAL			$512,000		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-F-003
PROJECT NAME: Welland WTP Phase 2 - Capacity Expansion
PROJECT DESCRIPTION: Expand capacity from 65 MLD to 73 MLD. Plant will be expandable to 102.3 MLD

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	8 MLD

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			MLD	8 MLD	$2,000,000	$16,000,000	
Related Works (Electrical, MCC, Generators, etc)	30%					$0	
Additional Construction Costs	15%		ea.			$2,400,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,840,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$20,240,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$202,400	
Geotechnical Sub-Total Cost						**$202,400**	
Property Requirements	1.5%						Confirm existing site can accommodate expansion
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	12%					$ 2,428,800	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$2,428,800**	
In House Labour/Engineering/Wages/CA	2.5%					$ 506,000	
In-house Labour/Wages Sub-Total						**$506,000**	
Project Contingency	15%					$3,507,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$3,507,000**	
Non-Refundable HST	1.76%					$464,300	
Non-Refundable HST Sub-Total						**$464,300**	
Total (2022 Dollars)						**$27,349,000**	Rounded to nearest $1,000
Other Estimate						**$80,000,000**	
Chosen Estimate						**$80,000,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$1,600,000		
Design	Design fees, Region fees for design, contract admin	13%	$10,400,000		
Construction	Region fees, base costs and project contingency	85%	$68,000,000		
TOTAL			**$80,000,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-M-014

PROJECT NAME: New trunk main in southwest Welland

PROJECT DESCRIPTION: New trunk main on Humberstone Road and Prince Charles Drive. Allows for secondary connection for Dain City (significant projected growth) and closes the Region's trunk main loop across the canal. Include for coordination on potential Regional interconnection with City's

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	600 mm	
TOTAL LENGTH:	2770 m	
Tunnelled	0 m	0%
Open Cut	2770 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	2770 m	$1,439	$3,985,402	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	20%					$797,080	
Minor Creek Crossings			ea.	0	$236,000	$0	
Major Creek Crossings			ea.	0	$1,055,000	$0	
Road Crossings			ea.	0	$488,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,055,000	$0	
Utility Crossings			ea.	0	$488,000	$0	
Valve and Chamber			ea.	2	$55,000	$110,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$79,708	
Additional Construction Costs	15%		ea.			$745,829	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$571,802	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$6,290,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$62,900	
Geotechnical Sub-Total Cost						**$62,900**	
Property Requirements	1.5%					$ 94,400	
Property Requirements Sub-Total						**$94,400**	
Consultant Engineering/Design	15%					$ 943,500	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$943,500**	
In House Labour/Engineering/Wages/CA	3%					$ 188,700	
In-house Labour/Wages Sub-Total						**$188,700**	
Project Contingency	15%					$1,137,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,137,000**	
Non-Refundable HST	1.76%					$150,100	
Non-Refundable HST Sub-Total						**$150,100**	
Total (2022 Dollars)						**$8,867,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$8,867,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$177,340		
Design	Design fees, Region fees for design, contract admin	13%	$1,152,710		
Construction	Region fees, base costs and project contingency	85%	$7,536,950		
TOTAL			$8,867,000		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-015**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New trunk main in northwest Welland**	**VERSION:**	
PROJECT DESCRIPTION:	New trunk main in northwest Welland to service growth areas. Watermain on Merritt Road and Merrittville Highway	**DATE UPDATED:**	
		UPDATED BY:	

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

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	450 mm	
TOTAL LENGTH:	3570 m	
Tunnelled	0 m	0%
Open Cut	3570 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	3570 m	$1,071	$3,823,680	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	0%					$0	
Minor Creek Crossings			ea.	0	$206,000	$0	
Major Creek Crossings			ea.	0	$1,025,000	$0	
Road Crossings			ea.	0	$458,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,025,000	$0	
Utility Crossings			ea.	0	$458,000	$0	
Valve and Chamber			ea.	2	$40,000	$80,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$76,474	
Additional Construction Costs	10%		ea.			$398,015	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$437,817	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$4,816,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$48,200	
Geotechnical Sub-Total Cost						**$48,200**	
Property Requirements	1.0%					$ 48,200	
Property Requirements Sub-Total						**$48,200**	
Consultant Engineering/Design	15%					$ 722,400	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$722,400**	
In House Labour/Engineering/Wages/CA	4.0%					$ 192,640	
In-house Labour/Wages Sub-Total						**$192,640**	
Project Contingency	10%					$583,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$583,000**	
Non-Refundable HST	1.76%					$109,400	
Non-Refundable HST Sub-Total						**$109,400**	
Total (2022 Dollars)						**$6,520,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$6,520,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$130,400		
Design	Design fees, Region fees for design, contract admin	13%	$847,600		
Construction	Region fees, base costs and project contingency	85%	$5,542,000		
TOTAL			$6,520,000		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-017**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New trunk main from Welland WTP to North**	**VERSION:**	
PROJECT DESCRIPTION:	New trunk main from Welland WTP to North service area. Preliminary alignment along Ross Street, McMaster Avenue, Major Street, Atlas Avenue, Brown Road, Woodlawn Road	**DATE UPDATED:**	
		UPDATED BY:	

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

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	450 mm	
TOTAL LENGTH:	3930 m	
Tunnelled	0 m	0%
Open Cut	3930 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	3930 m	$1,071	$4,209,262	Existing road ROW
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	20%					$841,852	
Minor Creek Crossings			ea.	0	$206,000	$0	
Major Creek Crossings			ea.	0	$1,025,000	$0	
Road Crossings			ea.	0	$458,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,025,000	$0	
Utility Crossings			ea.	1	$458,000	$458,000	CN Rail Crossing
Valve and Chamber			ea.	4	$40,000	$160,000	Major connections
Updated Soils Regulation Uplift	2%					$84,185	
Additional Construction Costs	10%		ea.			$575,330	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$632,863	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$6,961,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$69,600	
Geotechnical Sub-Total Cost						**$69,600**	
Property Requirements	1.0%					$ 69,600	
Property Requirements Sub-Total						**$69,600**	
Consultant Engineering/Design	15%					$ 1,044,200	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,044,200**	
In House Labour/Engineering/Wages/CA	3.0%					$ 208,830	
In-house Labour/Wages Sub-Total						**$208,830**	
Project Contingency	10%					$835,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$835,000**	
Non-Refundable HST	1.76%					$158,000	
Non-Refundable HST Sub-Total						**$158,000**	
Total (2022 Dollars)						**$9,346,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$9,346,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$186,920		
Design	Design fees, Region fees for design, contract admin	13%	$1,214,980		
Construction	Region fees, base costs and project contingency	85%	$7,944,100		
TOTAL			**$9,346,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-M-023**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**Twinning of transmission main across the Welland Canal at the Welland WTP**	**VERSION:**	
PROJECT DESCRIPTION:	Construction of new 900mm HDPE watermain across Welland Canal to Merritt Street and Aqueduct Street.	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	900 mm	
TOTAL LENGTH:	180 m	
Tunnelled	180 m	100%
Open Cut		0%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	0 m	$2,172	$0	
Pipe Construction - Tunneling			m	180 m	$9,800	$1,764,000	
Pipe Construction Uplift (Based on Area Conditions)	20%					$0	
Minor Creek Crossings			ea.	0	$376,000	$0	
Major Creek Crossings			ea.	1	$1,650,000	$1,650,000	Welland River Crossing
Road Crossings			ea.	0	$768,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,650,000	$0	
Utility Crossings			ea.	0	$768,000	$0	
Valve and Chamber			ea.	4	$90,000	$360,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$35,280	
Additional Construction Costs	15%		ea.			$571,392	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$438,067	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$4,819,000**	**Region estimate 4.3M (keep our slightly conservative estimate)**
Geotechnical / Hydrogeological / Materials	1.0%					$48,200	
Geotechnical Sub-Total Cost						**$48,200**	
Property Requirements	1.5%					$ 72,300	
Property Requirements Sub-Total						**$72,300**	
Consultant Engineering/Design	15%					$ 722,900	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$722,900**	
In House Labour/Engineering/Wages/CA	4.0%					$ 192,760	
In-house Labour/Wages Sub-Total						**$192,760**	
Project Contingency	15%					$878,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$878,000**	
Non-Refundable HST	1.76%					$115,100	
Non-Refundable HST Sub-Total						**$115,100**	
Total (2022 Dollars)						**$6,848,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$6,848,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$136,960		
Design	Design fees, Region fees for design, contract admin	13%	$890,240		
Construction	Region fees, base costs and project contingency	85%	$5,820,800		
TOTAL			**$6,848,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-M-024

PROJECT NAME: New trunk main on Merritt Street from Aqueduct Street to Niagara Street

PROJECT DESCRIPTION: New trunk main on Merritt Street from Aqueduct Street to Niagara Street. Part of the Welland canal transmission main twinning project (W-M-023)

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	600 mm	
TOTAL LENGTH:	210 m	
Tunnelled		0%
Open Cut	210 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	210 m	$1,439	$302,142	
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	30%					$90,643	
Minor Creek Crossings			ea.	0	$236,000	$0	
Major Creek Crossings			ea.	0	$1,055,000	$0	
Road Crossings			ea.	0	$488,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,055,000	$0	
Utility Crossings			ea.	0	$488,000	$0	
Valve and Chamber			ea.	2	$55,000	$110,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$6,043	
Additional Construction Costs	15%		ea.			$76,324	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$58,515	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$644,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$6,400	
Geotechnical Sub-Total Cost						**$6,400**	
Property Requirements	1.5%					$ 9,700	
Property Requirements Sub-Total						**$9,700**	
Consultant Engineering/Design	15%					$ 96,600	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$96,600**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	15%					$120,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$120,000**	
Non-Refundable HST	1.76%					$15,400	
Non-Refundable HST Sub-Total						**$15,400**	
Total (2022 Dollars)						**$932,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$932,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$18,640		
Design	Design fees, Region fees for design, contract admin	13%	$121,160		
Construction	Region fees, base costs and project contingency	85%	$792,200		
TOTAL			**$932,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-M-025

PROJECT NAME: New trunk main on Niagara Street from Mill Street to Riverbank Street

PROJECT DESCRIPTION: New trunk main on Niagara Street from Mill Street to Riverbank Street. EA is undergoing with Transportation project to replace Niagara Street bridge over Welland River

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	High	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	50%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:		600 mm	
TOTAL LENGTH:		160 m	
	Tunnelled	0 m	0%
	Open Cut	160 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	160 m	$1,439	$230,204	Assume hung watermain
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	20%					$46,041	
Minor Creek Crossings			ea.	0	$236,000	$0	
Major Creek Crossings			ea.	0	$1,055,000	$0	
Road Crossings			ea.	0	$488,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,055,000	$0	
Utility Crossings			ea.	0	$488,000	$0	
Valve and Chamber			ea.	2	$55,000	$110,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$4,604	
Additional Construction Costs	20%		ea.			$78,170	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$46,902	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$516,000**	
Geotechnical / Hydrogeological / Materials	2.0%					$10,300	
Geotechnical Sub-Total Cost						**$10,300**	
Property Requirements	2.0%					$ 10,300	
Property Requirements Sub-Total						**$10,300**	
Consultant Engineering/Design	15%					$ 77,400	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$77,400**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	25%					$164,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$164,000**	
Non-Refundable HST	1.76%					$13,700	
Non-Refundable HST Sub-Total						**$13,700**	
Total (2022 Dollars)						**$832,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$832,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$16,640		
Design	Design fees, Region fees for design, contract admin	13%	$108,160		
Construction	Region fees, base costs and project contingency	85%	$707,200		
TOTAL			**$832,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-M-026

PROJECT NAME: **New dedicated trunk main from Shoalt's HLPS to Pelham ET**

PROJECT DESCRIPTION: New dedicated trunk main from Shoalt's HLPS to the new Pelham elevated tank. Alignment provided by the Region through the Pelham ET EA.

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:		400 mm	
TOTAL LENGTH:		3070 m	
	Tunnelled	0 m	0%
	Open Cut	3070 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	3070 m	$970	$2,977,271	
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	20%					$595,454	
Minor Creek Crossings			ea.	0	$196,000	$0	
Major Creek Crossings			ea.	0	$1,015,000	$0	
Road Crossings			ea.	0	$448,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,015,000	$0	
Utility Crossings			ea.	0	$448,000	$0	
Valve and Chamber			ea.	2	$35,000	$70,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$59,545	
Additional Construction Costs	15%		ea.			$555,341	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$425,761	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$4,683,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$46,800	
Geotechnical Sub-Total Cost						**$46,800**	
Property Requirements	1.5%					$ 70,200	
Property Requirements Sub-Total						**$70,200**	
Consultant Engineering/Design	15%					$ 702,500	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$702,500**	
In House Labour/Engineering/Wages/CA	4.0%					$ 187,320	
In-house Labour/Wages Sub-Total						**$187,320**	
Project Contingency	15%					$853,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$853,000**	
Non-Refundable HST	1.76%					$111,900	
Non-Refundable HST Sub-Total						**$111,900**	
Total (2022 Dollars)						**$6,655,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$6,655,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$133,100		
Design	Design fees, Region fees for design, contract admin	13%	$865,150		
Construction	Region fees, base costs and project contingency	85%	$5,656,750		
TOTAL			**$6,655,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: **W-M-027**

PROJECT NAME: **New trunk main from Pelham ET to Highway 20 and Haist Avenue**

PROJECT DESCRIPTION: New trunk main from Pelham ET to Highway 20 and Haist Avenue. Alignment provided by the Region through the Pelham ET EA.

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED DIAMETER:	400 mm	
TOTAL LENGTH:	1480 m	
Tunnelled	0 m	0%
Open Cut	1480 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	1480 m	$970	$1,435,297	
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	20%					$287,059	
Minor Creek Crossings			ea.	0	$196,000	$0	
Major Creek Crossings			ea.	0	$1,015,000	$0	
PRV Chamber			ea.	1	$450,000	$450,000	One PRV chamber at Highway 20 and Haist Avenue
Major Road Crossings (Highway)			ea.	0	$1,015,000	$0	
Utility Crossings			ea.	0	$448,000	$0	
Valve and Chamber			ea.	4	$35,000	$140,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$28,706	
Additional Construction Costs	15%		ea.			$351,159	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$269,222	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$2,961,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$29,600	
Geotechnical Sub-Total Cost						**$29,600**	
Property Requirements	1.5%					$ 44,400	
Property Requirements Sub-Total						**$44,400**	
Consultant Engineering/Design	15%					$ 444,200	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$444,200**	
In House Labour/Engineering/Wages/CA	4.0%					$ 118,440	
In-house Labour/Wages Sub-Total						**$118,440**	
Project Contingency	15%					$540,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$540,000**	
Non-Refundable HST	1.76%					$70,700	
Non-Refundable HST Sub-Total						**$70,700**	
Total (2022 Dollars)						**$4,208,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$4,208,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$84,160		
Design	Design fees, Region fees for design, contract admin	13%	$547,040		
Construction	Region fees, base costs and project contingency	85%	$3,576,800		
TOTAL			**$4,208,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-M-028

PROJECT NAME: **New dedicated feedermain from Welland WTP to existing Bemis ET**

PROJECT DESCRIPTION: New dedicated feedermain from Welland WTP to existing Bemis ET. Placeholder project - preferred size and alignment to be determined through the Bemis ET EA.

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨ = Field has drop down

🟨 = Field must be manually populated

🟩 = Field auto-filled based on project details

PROPOSED DIAMETER:		400 mm	
TOTAL LENGTH:		2040 m	
	Tunnelled	0 m	0%
	Open Cut	2040 m	100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	2040 m	$970	$1,978,382	
Pipe Construction - Tunneling			m	0 m	$6,300	$0	
Pipe Construction Uplift (Based on Area Conditions)	20%					$395,676	
Minor Creek Crossings			ea.	0	$196,000	$0	
Major Creek Crossings			ea.	0	$1,015,000	$0	
PRV Chamber			ea.	0	$450,000	$0	
Major Road Crossings (Highway)			ea.	0	$1,015,000	$0	
Utility Crossings			ea.	0	$448,000	$0	
Valve and Chamber			ea.	2	$35,000	$70,000	2 valves minimum
Updated Soils Regulation Uplift	2%					$39,568	
Additional Construction Costs	15%		ea.			$372,544	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$285,617	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$3,142,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$31,400	
Geotechnical Sub-Total Cost						**$31,400**	
Property Requirements	1.5%					$ 47,100	
Property Requirements Sub-Total						**$47,100**	
Consultant Engineering/Design	15%					$ 471,300	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$471,300**	
In House Labour/Engineering/Wages/CA	4.0%					$ 125,680	
In-house Labour/Wages Sub-Total						**$125,680**	
Project Contingency	15%					$573,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$573,000**	
Non-Refundable HST	1.76%					$75,100	
Non-Refundable HST Sub-Total						**$75,100**	
Total (2022 Dollars)						**$4,466,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$4,466,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$89,320		
Design	Design fees, Region fees for design, contract admin	13%	$580,580		
Construction	Region fees, base costs and project contingency	85%	$3,796,100		
TOTAL			**$4,466,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: **W-P-001**

PROJECT NAME: **Upgrade Shoalt's Drive LLPS**

PROJECT DESCRIPTION: Replace existing 3 MLD low lift pumps with three 20.5 MLD pumps (41 MLD/474 L/s firm capacity to support 2051 required capacity in Welland, total station capacity of 61.5 MLD/712 L/s). Placeholder project - to be confirmed through Bemis Elevated Tank Environmental

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

Existing Rated Capacity (MLD) 3.02

PROPOSED FIRM CAPACITY	475 L/s	
2051 Required Capacity	41.2 MLD	Zone 220 MDD
Post-2051 Required Capacity	54.6 MLD	Zone 220 MDD

CLASS EA REQUIREMENTS:	A
CONSTRUCTION ASSUMPTION:	Other

Pump	Existing (MLD)	Future (MLD)
1	3.02	20.5
2	3.02	20.5
3		20.5

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	475 L/s	$15,816	$3,000,000	3 pumps at $1,000,000 each
Related Works (Electrical, MCC, Generators, etc)	30%					$900,000	
Additional Construction Costs	15%		ea.			$585,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$448,500	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$4,934,000**	
Geotechnical / Hydrogeological / Materials	1.0%						Existing site
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.5%						Pump upgrades within existing station
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 740,100	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$740,100**	
In House Labour/Engineering/Wages/CA	4.0%					$ 197,360	
In-house Labour/Wages Sub-Total						**$197,360**	
Project Contingency	15%					$881,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$881,000**	
Non-Refundable HST	1.76%					$115,400	
Non-Refundable HST Sub-Total						**$115,400**	
Total (2022 Dollars)						**$6,868,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$6,868,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$137,360		
Design	Design fees, Region fees for design, contract admin	13%	$892,840		
Construction	Region fees, base costs and project contingency	85%	$5,837,800		
TOTAL			**$6,868,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-P-002**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**Upgrade Shoalt's Drive HLPS**	**VERSION:**	
PROJECT DESCRIPTION:	Replace all four 5.4 MLD high lift pumps with four 8 MLD pumps (24 MLD/278 L/s firm capacity to support MDD plus MECP fire flow for 2051 and post-2051, total station capacity of 32 MLD/370 L/s)	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED FIRM CAPACITY	278 L/s	
2051 Required Capacity	23.4 MLD	MDD+MECP FF
Post-2051 Required Capacity	23.8 MLD	MDD+MECP FF

CLASS EA REQUIREMENTS:	A
CONSTRUCTION ASSUMPTION:	Other

Existing Rated Capacity (MLD) 16.35

Pump	Existing (MLD)	Future (MLD)
1	5.45	8
2	5.45	8
3	5.45	8
4	5.45	8

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	278 L/s	$15,816	$3,000,000	4 pumps at $750,000 each
Related Works (Electrical, MCC, Generators, etc)	30%					$900,000	
Additional Construction Costs	15%		ea.			$585,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$448,500	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$4,934,000**	
Geotechnical / Hydrogeological / Materials	1.0%						Existing site
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.5%						Pump upgrades within existing station
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 740,100	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$740,100**	
In House Labour/Engineering/Wages/CA	4.0%					$ 197,360	
In-house Labour/Wages Sub-Total						**$197,360**	
Project Contingency	15%					$881,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$881,000**	
Non-Refundable HST	1.76%					$115,400	
Non-Refundable HST Sub-Total						**$115,400**	
Total (2022 Dollars)						**$6,868,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$6,868,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$137,360		
Design	Design fees, Region fees for design, contract admin	13%	$892,840		
Construction	Region fees, base costs and project contingency	85%	$5,837,800		
TOTAL			**$6,868,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.:	**W-P-005**	**CAPITAL BUDGET YEAR:**	
PROJECT NAME:	**New HLP at Welland to support increased HGL**	**VERSION:**	
PROJECT DESCRIPTION:	New separate set of high lift pumps at Welland WTP to support potential increase in hydraulic grade line (same capacity as existing pumps, but increased head). Placeholder project - to be confirmed through Bemis Elevated Tank Environmental Assessment	**DATE UPDATED:**	
		UPDATED BY:	

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy	
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy	
Accuracy Range:	40%		
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration	

⬜	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED FIRM CAPACITY	880 L/s	
2051 Required Capacity	41.2 MLD	MDD (Welland zone only)
Post-2051 Required Capacity	54.6 MLD	MDD (Welland zone only)

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

Existing Rated Capacity (MLD) 76.00

Pump	Existing (MLD)	Future (MLD)
1	21.6	21.6
2	21.6	21.6
3	32.8	32.8
4	32.8	32.8

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	880 L/s	$13,383	$6,000,000	4 pumps at $1.5M each
Related Works (Electrical, MCC, Generators, etc)	30%					$1,800,000	
Additional Construction Costs	15%		ea.			$1,170,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$897,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$9,867,000**	
Geotechnical / Hydrogeological / Materials	1.0%						Existing site
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.5%						Existing site
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ 1,480,100	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,480,100**	
In House Labour/Engineering/Wages/CA	3%					$ 296,010	
In-house Labour/Wages Sub-Total						**$296,010**	
Project Contingency	15%					$1,746,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,746,000**	
Non-Refundable HST	1.76%					$230,400	
Non-Refundable HST Sub-Total						**$230,400**	
Total (2022 Dollars)						**$13,620,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$13,620,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$272,400		
Design	Design fees, Region fees for design, contract admin	13%	$1,770,600		
Construction	Region fees, base costs and project contingency	85%	$11,577,000		
TOTAL			**$13,620,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-S-003

PROJECT NAME: New Pelham ET

PROJECT DESCRIPTION: New Pelham ET to replace existing ET. Assuming property acquisition is required (5% for new site).

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	6.0 ML

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	6 ML	$1,300,000	$7,800,000	
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$1,170,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$897,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$9,867,000**	
Geotechnical / Hydrogeological / Materials	1.0%					$98,700	
Geotechnical Sub-Total Cost						**$98,700**	
Property Requirements	5.0%					$ 493,400	5% for new facility
Property Requirements Sub-Total						**$493,400**	
Consultant Engineering/Design	15%					$ 1,480,100	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$1,480,100**	
In House Labour/Engineering/Wages/CA	3.0%					$ 296,010	
In-house Labour/Wages Sub-Total						**$296,010**	
Project Contingency	15%					$1,835,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$1,835,000**	
Non-Refundable HST	1.76%					$242,400	
Non-Refundable HST Sub-Total						**$242,400**	
Total (2022 Dollars)						**$14,313,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$14,313,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$286,260		
Design	Design fees, Region fees for design, contract admin	13%	$1,860,690		
Construction	Region fees, base costs and project contingency	85%	$12,166,050		
TOTAL			**$14,313,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-S-011

PROJECT NAME: Replace Bemis Elevated Tank

PROJECT DESCRIPTION: Replace Bemis Elevated Tank - Sizing to be confirmed through Bemis Elevated Tank Environmental Assessment

CAPITAL BUDGET YEAR:

VERSION:

DATE UPDATED:

UPDATED BY:

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	40%	
Area Condition:	Suburban	Area Condition uplifts unit cost and restoration

▨	= Field has drop down
🟨	= Field must be manually populated
🟩	= Field auto-filled based on project details

PROPOSED CAPACITY	12.0 ML

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	12.0 ML	$1,300,000	$15,600,000	
Related Works (Electrical, MCC, Generators, etc)	0%					$0	
Additional Construction Costs	15%		ea.			$2,340,000	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$1,794,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$19,734,000**	
Geotechnical / Hydrogeological / Materials	1.0%						Assume replacement at existing site - to be confirmed through EA
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.5%						Assume replacement at existing site - to be confirmed through EA
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	12%					$ 2,368,100	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$2,368,100**	
In House Labour/Engineering/Wages/CA	3.0%					$ 592,020	
In-house Labour/Wages Sub-Total						**$592,020**	
Project Contingency	15%					$3,404,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$3,404,000**	
Non-Refundable HST	1.76%					$448,900	
Non-Refundable HST Sub-Total						**$448,900**	
Total (2022 Dollars)						**$26,547,000**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**$26,547,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$530,940		
Design	Design fees, Region fees for design, contract admin	13%	$3,451,110		
Construction	Region fees, base costs and project contingency	85%	$22,564,950		
TOTAL			**$26,547,000**		

NIAGARA REGION
WATER AND WASTEWATER MASTER SERVICING PLAN
PROJECT TRACKING AND COSTING SHEET

PROJECT NO.: W-ST-001
PROJECT NAME: Region Wide WTP Reservoir Volume Study
PROJECT DESCRIPTION: Study to review WTP reservoir CT volume and overall system storage

CAPITAL BUDGET YEAR:
VERSION:
DATE UPDATED:
UPDATED BY:

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

▨ = Field has drop down
🟨 = Field must be manually populated
🟩 = Field auto-filled based on project details

PROPOSED CAPACITY	N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Grimsby WTP Reservoir							
Decew WTP Reservoir							
Niagara Falls WTP Reservoir							
Welland WTP Reservoir							
Port Colborne WTP Reservoir							
Rosehill (Fort Erie) WTP Reservoir							
Additional Construction Costs	10%		ea.			$0	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			$0	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**$0**	
Geotechnical / Hydrogeological / Materials	1.0%						
Geotechnical Sub-Total Cost						**$0**	
Property Requirements	1.0%						
Property Requirements Sub-Total						**$0**	
Consultant Engineering/Design	15%					$ -	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**$0**	
In House Labour/Engineering/Wages/CA	4.0%					$ 40,000	
In-house Labour/Wages Sub-Total						**$40,000**	
Project Contingency	10%					$4,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**$4,000**	
Non-Refundable HST	1.76%					$100	
Non-Refundable HST Sub-Total						**$100**	
Total (2022 Dollars)						**$44,000**	Rounded to nearest $1,000
Other Estimate						**$100,000**	
Chosen Estimate						**$100,000**	**2022 Estimate**

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

PROJECT COMPONENT	PROJECT COMPONENT DESCRIPTION	PERCENTAGE	TOTAL	YEAR	COMMENTS
Study	Feasibility study, EA	2%	$2,000		
Design	Design fees, Region fees for design, contract admin	13%	$13,000		
Construction	Region fees, base costs and project contingency	85%	$85,000		
TOTAL			**$100,000**		