NOTICE OF COMMENTS RECEIVED
Following Completion of the Public Review Period

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

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

Volume 1

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

Volume 3

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

Volume 4

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

2016 Water and Wastewater Master Servicing Plan Update
Summary of 45-Day Review Comments

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

Niagara Region

2016 Water and Wastewater Master Servicing Plan Update

HOW WE **FLOW**

Volume III - Water Master Servicing Plan Update

Final Report

June, 2017

BluePlan ENGINEERING

Table of Contents

1. INTRODUCTION

1.1 Background

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

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

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

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

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

Figure 3.1 Study Area

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

1.2 Integrated Planning Process

Niagara, as a whole, must proactively plan for and facilitate growth in order to conform with Provincial land use plans (*Places to Grow*). The Region is currently planning the best way to accommodate anticipated and targeted population and employment growth over the next 25

years. Under the umbrella “Niagara 2041” the Region will be establishing a growth strategy that will be urban in nature.

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

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

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

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

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

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

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

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

1.3 Master Servicing Plan Update Report Objectives

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

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

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

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

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

1.4 Master Servicing Plan Class EA Report Outline

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

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

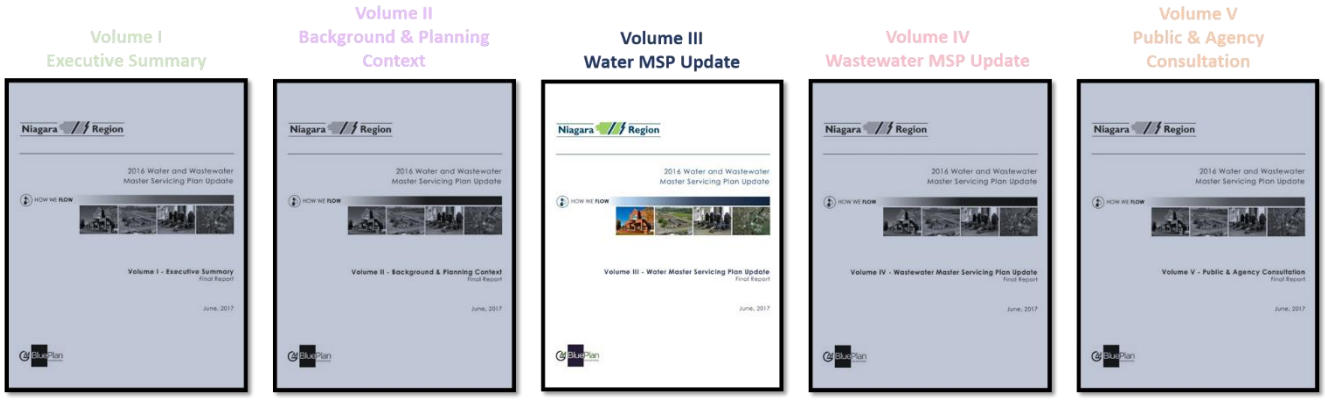


Figure 3.2 Master Servicing Plan Document Layout

Volume I – Executive Summary

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

Volume II – Background and Planning Context

Volume II details the master planning process including the Master Plan Class EA process, related studies, legislative and policy planning context, water and wastewater servicing principles and policies, population and employment growth forecasts, existing environmental and servicing conditions and future considerations.

Volume III – Water Master Servicing Plan Update and Project File

Volume III is the principle document summarizing the study objectives, approach, methodologies, technical analyses, evaluation and selection of the preferred water servicing strategy for each of the water systems. This volume contains baseline water system data and performance information. This volume documents the water servicing strategy development with detailed information on the projects and capital program associated with the preferred water servicing strategy.

Volume IV – Wastewater Master Servicing Plan Update and Project File

Volume IV is the principle document summarizing the study objectives, approach, methodologies, technical analyses, evaluation and selection of the preferred wastewater servicing strategy for each of the wastewater systems. This volume contains baseline wastewater system data and performance information. This volume documents the wastewater servicing strategy development with detailed information on the projects and capital program associated with the preferred wastewater servicing strategy.

Volume V – Public and Agency Consultation

Volume V contains all relevant documentation of the public consultation process including notices, comments and responses, and distribution information. Presentation material from all Public Information Centres (PICs) held during the process is included. Other presentation material and discussion information from workshops held with relevant agencies, approval bodies and other stakeholders are also included.

1.5 Master Servicing Plan Report Volume III

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 III has been organized into four sections as described below, outlining the general approach, methodologies, and technical analysis used to develop the preferred water servicing strategy.

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

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

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

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

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

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

2. ANALYSIS METHODOLOGY

The current analysis calculates the following:

- Total equivalent population fed by each water treatment plant at the following time horizon: 2021, 2026, 2031, 2036, 2041.
- 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 analyses are used as input to this Master Servicing Plan, which identifies the problem and opportunity and develops alternative solutions to address.

2.1 Project Assumptions

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

- Niagara Municipal Comprehensive Review 2041 growth projections were used:
  - To estimate growth related demands within the water system.
  - To spatially allocate growth demands within the individual water system.
- Institutional, industrial, and commercial growth flows were estimated using equivalent employment projections.
- Pumping station firm capacity is the firm capacity given in the latest Environmental Certificate of Approval (ECA) for each station. System capacity analysis was completed using the lesser of the ECA firm capacity or actual operational capacity as provided by Regional operational staff (if provided).
  - Where this value is not provided, for the purpose of this master plan, the firm capacity is taken as the sum of individual pump capacities with the largest pump out of service.

2.2 Demand Projections and Allocations

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

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

- A baseline growth area shapefile was provided by the Region. The growth area included all existing available vacant land supply, as well as know growth nodes and corridors.
- Traffic survey zones were overlaid with the growth area shapefile. The total traffic survey zone growth was assigned to the growth areas proportionally based on area-weighted basis.
- For traffic survey zone with no corresponding growth area shapes, all growth was assumed to be proportionally applied to existing area within the urban boundary.
- For traffic survey zones partially in the urban boundary, all growth was assumed to occur within the urban boundary with no growth outside the urban boundary.
- For traffic survey zones entirely outside the urban boundary, growth was only applied to existing service areas proportionally based on area-weighted basis or total service area within the traffic survey zone.
- The total population growth serviced by water out to 2041 will be less than the total growth presented in Table 3.1 and Table 3.2 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, topographic, and existing natural and physical features was conducted and growth was assigned to individual pressure zones based on likely service connection.
- For allocation to the InfoWater model, the growth area shapes where then allocated to the closest existing water system zone within the growth shapes previously assigned pressure zone.

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

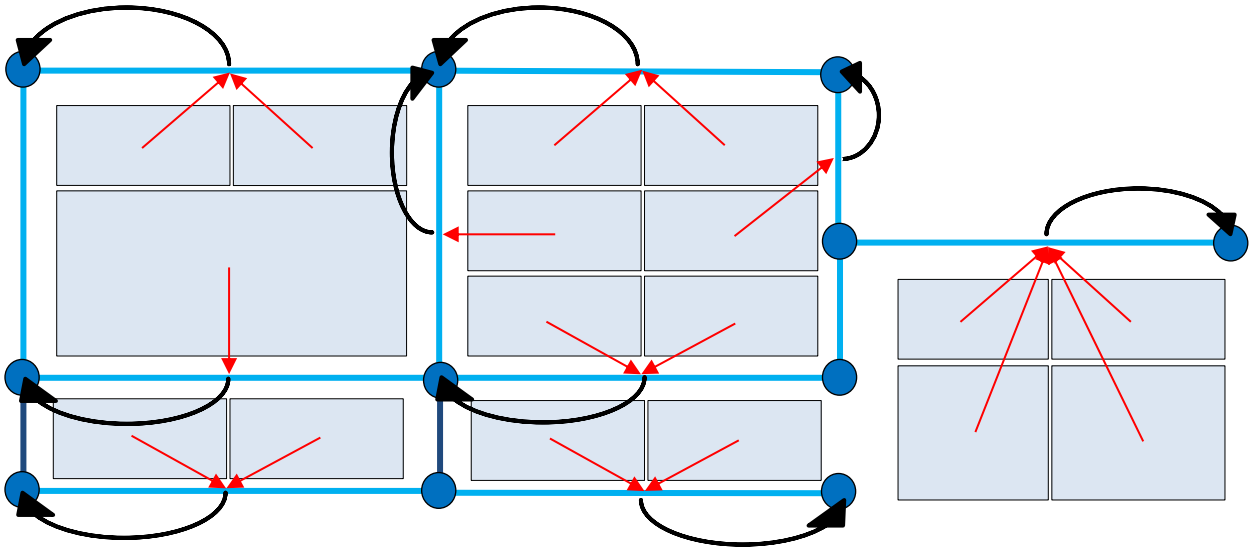


Figure 3.3 Process for Allocating System Demands

2.3 Study Area Population and Employment

Table 3.1 and Table 3.2, present the MCR projected population and employment by municipality.

Table 3.1 Municipal Comprehensive Review Population Growth by Municipality

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

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

Table 3.2 Municipal Comprehensive Review Employment Growth by Municipality

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

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

2.4 Design Criteria

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

- Residential Average Day Demand: 300 Lpcd
- Employment Average Day Demand: 300 Lped
- Maximum Day Factors: Based on rolling average for each system from last 5 years

- Residential Peak Hour Factor: 4
- Employment Peak Hour Factor: 2

2.5 Demand Projection

2.5.1 Starting Point Methodology

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

2.5.2 Growth Demand Projections

Future system demands were developed using a starting point methodology. Expected demand due to growth were added to the starting point demand to establish future demands. Example for the Fort Erie system is provided below.

2041 ADD = Baseline ADD + (2041 total equ.pop. – 2014 total equ.pop) * 300 Lpcd
17.4 MLD = 12.4 MLD + (57,832 – 41,258) * 300 Lpcd

Table 3.3 Water Demand Projections

Water System	2014 – 2041 Growth *			2014 Demands		2041 Demands	
	Growth Population	Growth Employment	Total Equivalent Growth	Average Day Demand (MLD)	Maximum Day Demand (MLD)	ADD (MLD)	MDD (MLD)
Grimsby Water Treatment Plant (WTP)	27,244	11,159	38,404	14.9	25.9	26.4	45.9
Decew WTP	53,246	25,793	79,036	60.4	93.6	84.1	130.4
Niagara Falls WTP	35,350	13,587	48,937	41.7	64.2	56.4	86.9
Fort Erie WTP	12,715	3,859	16,574	12.4	19.1	17.4	26.8
Port Colborne WTP	3,011	1,024	4,035	8.3	12.9	9.5	14.8
Welland WTP	23,484	8,473	31,958	21.7	33.2	31.3	47.9

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

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.
- 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:

- Capacity expansion will be triggered once the station's firm capacity reaches the required demands.

Once capacity expansion has been triggered, site capacity will be evaluated to determine if a new or expanded site is required. When proposing a new site for a pumping station, an allowance in building facility 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 and Climate Change (MOECC) criteria:

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

In instances where the zone's supply capacity exceeds peak hour demand, equalization storage of 15% may be considered if it supports improved system operations or energy efficiency.

2.6.4 Sizing of Watermains

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

- Local system pressures between 40 and 100 psi.
- Regional watermains pressure of at least 50 psi.

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.

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, headloss). Oversizing may be considered in areas with an excess of land supply to plan for future potential.

3. WATER SERVICING STRATEGY

3.1 Servicing Principles and Policies

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

- Health and safety;
- System reliability and security;
- Reservation of capacity for operational flexibility and level of service;
- Impacts of climate change;
- Considerations for energy use and efficiency;
- Recognition of impacts from water efficiency and conservation;
- Addressing issues related to the full lifecycle of water and wastewater services;
- A comprehensive list of general, water and wastewater policies were established. As a result from the priority policy areas, key principle and policy statements were developed as highlighted below:
- Niagara Region will endeavor to maintain sufficient reserve capacity in its water and wastewater infrastructure and facilities to provide operational flexibility and meet potential changes in servicing conditions.
- Niagara Region shall endeavor to provide reliability, redundancy and security in its water and wastewater systems with attention to high risk and critical areas
- Niagara Region shall be aware of and consider the potential impact of climate change on the planning and sizing of infrastructure.
- Niagara region shall design water and wastewater facilities with consideration to energy use.
- Niagara Region will consider levels of storage beyond MOE Guidelines where appropriate in order to provide operational flexibility, energy management and system security.

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

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

4. CAPITAL PROGRAM

4.1 Water System Recommendations Overview

A summary of the key aspects of the water servicing strategy are in Table 3.4.

Table 3.4 Water Servicing Strategy

System	Water Servicing Strategy
Grimsby	• Based on the level of growth on the system, the Grimsby Water Treatment Plant will require additional water treatment capacity. • The location of water storage to optimize pumping costs and provide equalization and emergency storage to the system has been addressed. A new storage facility to support the Grimsby and Smithville service areas has been established. The new location results in decommissioning 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 are required. • The level of growth in the Smithville area requires additional trunk watermain capacity through the network. • Additional pumping capacity is required to support the Lincoln service area growth.

Decew and Niagara Falls	• Both the Decew Water Treatment Plant and the Niagara Falls Water Treatment Plant have sufficient capacity to support growth to year 2041. • The inlet channel for the Decew Water Treatment Plant will have upgrades. This project is a shared project with OPG. • Additional feedermain capacity is required in Niagara-on-the-Lake to support water supply to the growth areas. • The storage location in Niagara Falls will be optimized with additional storage capacity provided in a new tank located in closer proximity to the growth areas in South Niagara Falls. The existing Lundy's Lane tank will be decommissioned. • Due to the amount of growth in South Niagara Falls, a new trunk water feedermain will be required to support the growth demands. • Additional feedermain capacity is required in the Port Robinson area due to growth and for trunk system connectivity.
Fort Erie	• The Rosehill Water Treatment Plant has sufficient capacity to support growth to year 2041. • 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 water 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. • Additional trunk feedermain capacity is required to support the new tank and for distribution in central Fort Erie.

Port Colborne	• The Port Colborne Water Treatment Plant has sufficient capacity to support growth to year 2041. • 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. • New Barrick Road Elevated Tank will be provided in northern Port Colborne to support the system growth and optimize water levels for the system. • The new tank will allow for decommissioning of the Fielden reservoir and pumping station as well as the King Street Elevated Tank. • Additional trunk water feedermain will be provided crossing the Canal to support growth on the East and West side of Port Colborne.
Welland	• The Welland Water Treatment Plant has sufficient capacity to support growth to year 2041. • 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. • 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 water tank at the Pelham Elevated Tank site, replacing the existing water tank, will be provided to support growth and optimize system pressures and performance in the area. • Based on growth in the north and east limits of the system, additional water feedermain capacity is required.

4.2 Capital Program

A summary of the water servicing strategy capital program with details for each project is provided in Table 3.5.

Table 3.5 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 Avenue (Fort Erie South) Elevated Tank	New Fort Erie Elevated Tank to replace the Central Avenue Elevated Tank and Stevensville Reservoir; Central Avenue Elevated Tank to be decommissioned	N/A	2022 - 2031	Fort Erie	A+	Satisfied	Storage	$ 1,979,000
W-D-002	Decommissioning of Stevensville Reservoir + Pumping Station	New Fort Erie Elevated Tank to replace the Central Avenue Elevated Tank and Stevensville Reservoir; Stevensville Reservoir and Pumping Station to be decommissioned	N/A	2022 - 2031	Fort Erie	A+	Satisfied	Storage	$ 2,913,000
W-D-003	Decommissioning of Park Road Reservoir + Pumping Station	Decommissioning of Park Road Reservoir and Pumping Station, to be replaced by new Grimsby Reservoir and additional pumping capacity at the Water Treatment Plant	N/A	2022 - 2031	Grimsby	A+	Satisfied	Storage	$ 523,000
W-D-004	Decommissioning of Lundy's Lane Elevated Tank	Lundy's Lane Elevated Tank to be decommissioned and replaced by new South Niagara Falls Elevated Tank	N/A	2032 - 2041	Niagara Falls	A+	Satisfied	Storage	$ 1,979,000
W-D-005	Decommissioning of Pelham Elevated Tank	Decommissioning of existing Pelham Elevated Tank, to be replaced by a new Elevated Tank	N/A	2022 - 2031	Pelham	A+	Satisfied	Storage	$ 1,028,000
W-D-006	Decommissioning of King Street Elevated Tank	Decommissioning of King Street Elevated Tank, to be replaced by storage at new Barrick Road Elevated Tank	N/A	2017 - 2021	Port Colborne	A+	Satisfied	Storage	$ 1,979,000
W-D-007	Decommissioning of Fielden Avenue Reservoir + Pumping Station	Decommissioning of Fielden Avenue Reservoir and Pumping Station	N/A	2032 - 2041	Port Colborne	A+	Satisfied	Storage	$ 2,913,000
W-F-001	Grimsby Water Treatment Plant Expansion	Provide an additional 15 MLD treatment, and new high lift pumping capacities to support feed to new Grimsby Reservoir	59 MLD	2022 - 2031	Grimsby	C	Separate EA Required	Treatment	$ 51,496,000
W-F-002	Decew inlet channel	New intake channel from Welland Canal to the Decew Water Treatment Plant. This will provide capacity above the current 147 MLD. Recommended in 2011 MSP	256 MLD	2017 - 2021	St. Catharines	B	Region to Satisfy EA Requirements	Treatment	$ 22,969,000
W-M-001	New trunk main in Central Fort Erie	New trunk main in Central Fort Erie	450 mm	2022 - 2031	Fort Erie	A+	Satisfied	Watermain	$ 9,479,000

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-002	New Conveyance to Port Colborne East side	New Conveyance to East side of Port Colborne across canal	450 mm	2017 - 2021	Port Colborne	A+	Satisfied	Watermain	$ 11,548,000
W-M-003	New trunk main from Welland Water Treatment Plant to North	New trunk main from Welland Water Treatment Plant to North service area	450 mm	2032 - 2041	Welland	A+	Satisfied	Watermain	$ 7,556,000
W-M-004	Upgrade trunk main from Grimsby Water Treatment Plant to Park Road	Upgrade trunk main from Grimsby Water Treatment Plant to Park Road	750 mm	2017 - 2021	Grimsby	A+	Satisfied	Watermain	$ 13,139,000
W-M-005	New trunk main from Grimsby Water Treatment Plant to New Grimsby Reservoir	New trunk main from Grimsby Water Treatment Plant to New Grimsby Reservoir	750 mm	2022 - 2031	Grimsby	B	To Be Satisfied Through Secondary Plan	Watermain	$ 42,044,000
W-M-006	New trunk main in Smithville	New trunk main in Smithville	400 mm	2022 - 2031	West Lincoln	A+	Satisfied	Watermain	$ 14,357,000
W-M-007	New trunk main from PRV to Port Robinson Chlorine Booster Pumping Station in Niagara Falls	New trunk main from PRV to Port Robinson Chlorine Booster Pumping Station in Niagara Falls	450 mm	2017 - 2021	Niagara Falls	A+	Satisfied	Watermain	$ 2,543,000
W-M-008	Trunk main from South Niagara-on-the-Lake to Virgil Elevated Tank	Trunk main from South Niagara-on-the-Lake to Virgil Elevated Tank with PRV in Niagara-on-the-Lake to supply Decew system from Niagara Falls system	600 mm	2032 - 2041	Niagara-on-the-Lake	A+	Satisfied	Watermain	$ 13,535,000
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 and to serves as connection between existing transmission network and new South Niagara Falls Elevated Tank	750 mm	2032 - 2041	Niagara Falls	A+	To Be Satisfied Through Secondary Plan	Watermain	$ 4,858,000
W-M-010	New Niagara Falls South trunk main	New Niagara Falls South trunk main to provide additional supply to new growth areas	400 mm	2032 - 2041	Niagara Falls	B	To Be Satisfied Through Secondary Plan	Watermain	$ 18,316,000
W-M-011	New trunk main to Fort Erie Elevated Tank	New trunk main to Fort Erie Elevated Tank	450 mm	2017 - 2021	Fort Erie	A+	EA Previously Completed	Watermain	$ 4,107,000
W-M-012	Upgrade watermain in Port Colborne to new Barrick Road Elevated Tank	Upgrade watermain in Port Colborne to new Barrick Road Elevated Tank	450 mm	2017 - 2021	Port Colborne	A+	Satisfied	Watermain	$ 2,185,000

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 Low Lift Pumping Station	Replace both 3 MLD low lift pumps with 6.5 MLD pumps each	75 L/s	2017 - 2021	Pelham	A+	Satisfied	Pumping	$ 3,062,000
W-P-002	Upgrade Shoalt's Drive High Lift Pumping Station	Replace all four 5.4 MLD high lift pumps with 10 MLD pumps each	347 L/s	2017 - 2021	Pelham	A+	Satisfied	Pumping	$ 7,882,000
W-P-003	Upgrade Lincoln/Grimsby Booster Pumping Station	Add third 9.5 MLD pump	110 L/s	2032 - 2041	Grimsby	A+	Satisfied	Pumping	$ 989,000
W-S-001	New Fort Erie Elevated Tank	New Fort Erie Elevated Tank to replace the Central Avenue Elevated Tank and Stevensville Reservoir	8 ML	2017 - 2021	Fort Erie	B	Satisfied (Project File Included)	Storage	$ 12,838,000
W-S-002	New Barrick Road Elevated Tank in Port Colborne	New Barrick Road Elevated Tank in Port Colborne to replace the King Street Elevated Tank	6 ML	2017 - 2021	Port Colborne	B	EA Previously Completed	Storage	$ 8,022,000
W-S-003	New Pelham Elevated Tank	New Pelham Elevated Tank to replace existing Elevated Tank	6 ML	2022 - 2031	Pelham	B	Satisfied (Project File Included)	Storage	$ 9,307,000
W-S-004	New South Niagara Falls Elevated Tank	New South Niagara Falls Elevated Tank to replace the Lundy's Lane Elevated Tank and provide additional storage	6 ML	2032 - 2041	Niagara Falls	B	To Be Satisfied Through Secondary Plan	Storage	$ 9,629,000
W-S-005	New Grimsby Reservoir	New Grimsby Reservoir to provide additional storage – already designed Includes associated connection to existing Park Road facility and associated upgrades to Park Road pump station to support interim operational configuration	15 ML	2017 - 2021	Grimsby	B	EA Previously Completed	Storage	$ 23,474,000
Total									$ **306,649,000**

PART A
GRIMSBY WATER SYSTEM

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 43,719 and 14,793 employees.[1]

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).[2]

The system supplies local area municipalities via a water main network, pumping stations, and service reservoirs. The supply area is divided into eight pressure zones.

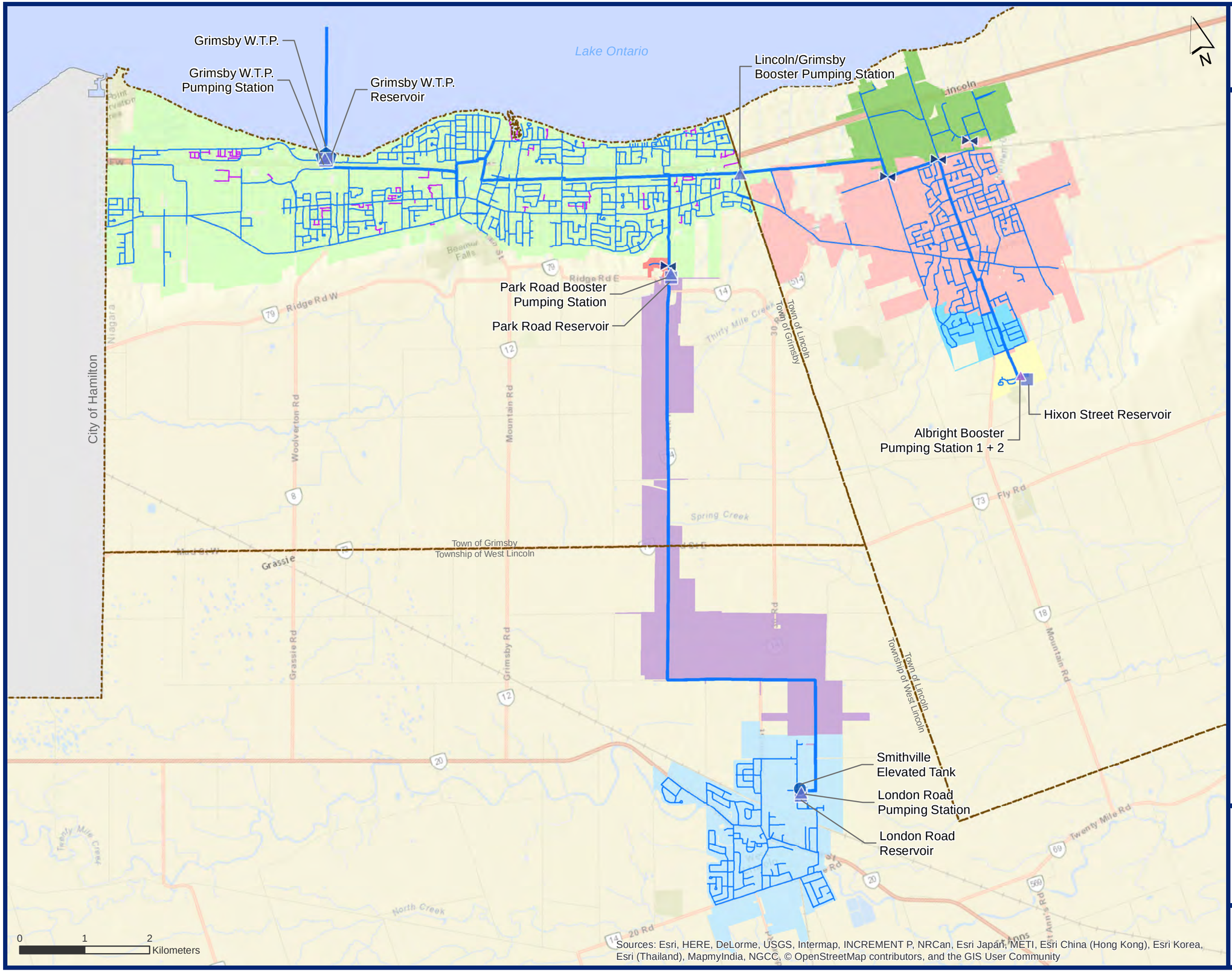
Figure 3.A.1 and Figure 3.A.2 present an overview of the water system and a water system schematic diagram, respectively.

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

[2] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-205*

Niagara Region

2016 MASTER SERVICING PLAN



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station
- Regional
- Municipal

Water Network
- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

148 163 210 225
154 193 216 239

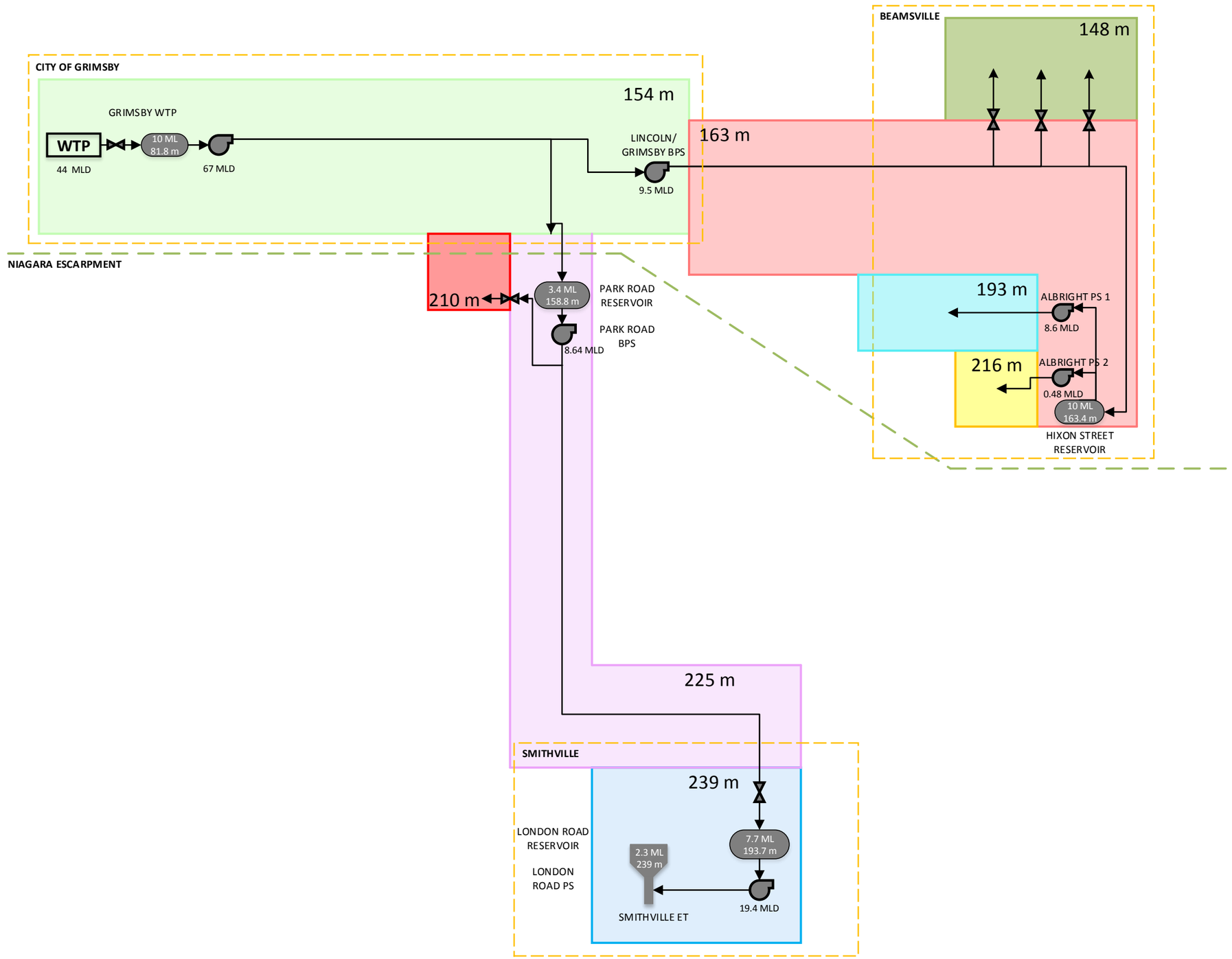
Figure 3.A.1

Existing Water System

Grimsby WTP

BluePlan Engineering

May 2017
715023-W-2-Existing Water System (Grimsby)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Grimsby WTP

EXISTING DISTRIBUTION SCHEMATIC

- WTP (RATED CAPACITY) — Water Treatment Plant
- Pumping Station (FIRM CAPACITY)
- 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

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

May 2017
Figure 3.A.2
Not to Scale

BluePlan ENGINEERING

A.1.1 Facility Overview

Table 3.A.1 Water Treatment Plant Overview

Plant Name	Grimsby Water Treatment Plant[3]
Address	300 North Service Road, Grimsby
Source Water	Lake Ontario
Rated Maximum Day Demand Capacity	44.0 MLD
Key Processes	• Zebra mussel control • Travelling screens • Coagulation • Flocculation • Sedimentation • Filtration • Disinfection

[3] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-205*

Table 3.A.2 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone)	Discharge (Pressure Zone)	Pressure Zones Supplied	Number of Pumps (Total/ Firm)	Firm Capacity (MLD)	Total Dynamic Head (m)
Grimsby Water Treatment Plant (WTP) High Lift Pumps	300 North Service Road, Grimsby	WTP	154	All	6/5	67.0	81
Park Road Booster Pumping Station	83 Park Road, Grimsby	154	225	210, 225, 239	3/2	8.6	61.4
London Road Pumping Station	6247 London Road, Smithville	225	239	239	4/3	19.4	47.9
Lincoln/ Grimsby Booster Pumping Station	10 Iroquois Trail, Grimsby	154	163	148, 163, 193, 216	2/1	9.5	15.0

Table 3.A.3 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	300 North Service Road, Grimsby	Pumped Reservoir	5.0 (10.0)*	81.8	154	All
Park Road Reservoir	83 Park Road South, Grimsby	Pumped/ Floating Reservoir	3.4	158.8	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	239
Smithville Elevated Tank	6247 London Road, Smithville	Elevated Tank	2.3	239.0	239	239
Hixon Street Reservoir	3991 Hixon Street, Beamsville	Pumped/ Floating Reservoir	10.0	163.4	148 Floating, 163 Floating, 193 Pumped, 216 Pumped	148 Floating, 163 Floating, 193 Pumped, 216 Pumped

*5.0 MLD required at water treatment plant for contact time.

Refer to Figure 3.A.1 for pumping station and storage facility locations.

A.1.2 Demands Overview

Table 3.A.4 Historic Water System Demands

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**	**1.74**
5 Year Peak	**17.0**	**30.1**	**2.15**

Table 3.A.5 Water System Maximum Day Demand Peaking Factor

Existing Service Population	43,719
Existing Service Employment	14,793
Total Service Equivalent Population	**58,512**
MOECC Peaking Factor[4]	1.75
Historic 5 Year Average Peaking Factor	1.74
Historic 5 Year Max Peaking Factor	2.15
2016 MSP Peaking Factor	**1.74**

The 2016 MSP peaking factor is the average of the peaking factors from 2011 to 2015.

[4] *Ministry of the Environment and Climate Change, 2008, Design Guidelines for Drinking-Water Systems, ISBN 978-1-4249-8517-3*

Table 3.A.6 Existing Water System Demands by Pressure Zone

Pressure Zone	Total Service Equivalent Population	2014 Average Day Demand (MLD)	2014 Maximum Day Demand (MLD)
148	3,063	0.8	1.4
154	33,827	8.7	15.1
163	11,265	2.6	4.5
193 & 216	3,163	0.6	0.9
210 & 225	663	0.2	0.4
239	6,531	2.1	3.7
Total	**58,512**	**15.0**	**26.0**

Note: Pressure zone existing equivalent population estimates were derived using the Niagara 2041 MCR traffic survey zone population allocations and are calculated to the end of 2014. [5] Localised zones (193 & 216, and 210 & 225) were consolidated because they do not contain Regional infrastructure.

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

A.2 Growth Projections

A.2.1 Population Projections and Allocations

Table 3.A.7 and Table 3.A.8 outline the existing and projected serviced population and employment by pressure zone.

Table 3.A.7 Grimsby Water Treatment Plant Existing and Projected Serviced Population by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
148	483	469	471	471	481	490	7
154	25,018	27,488	29,408	31,368	33,263	35,279	10,261
163	8,423	8,907	9,279	9,971	10,649	11,606	3,183
193 & 216	3,142	3,348	3,355	3,773	3,775	3,795	653
210 & 225	602	859	977	1,175	1,290	1,329	728
239	6,051	7,625	10,284	13,796	16,016	18,464	12,413
Total	**43,719**	**48,696**	**53,774**	**60,554**	**65,474**	**70,963**	**27,245**

Note: Population numbers may not sum due to rounding.

Table 3.A.8 Grimsby Water Treatment Plant Existing and Projected Serviced Employment by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
148	2,580	3,030	3,224	3,618	3,907	4,447	1,867
154	8,809	10,493	11,074	11,883	12,690	13,858	5,049
163	2,842	3,207	3,273	3,364	3,464	3,616	774
193 & 216	21	48	57	67	81	96	75
210 & 225	61	154	222	305	405	509	448
239	480	1,115	1,528	2,069	2,708	3,426	2,946
Total	**14,793**	**18,047**	**19,378**	**21,306**	**23,255**	**25,952**	**11,159**

Note: Population numbers may not sum due to rounding.

A.2.2 Future Demand Projections

Table 3.A.9 and Table 3.A.10 summarize the projected average and maximum system demands by pressure zone.

Table 3.A.9 Projected Water System Average Day Demands (ADD) by Pressure Zone

Pressure Zone	2021 ADD (MLD)	2026 ADD (MLD)	2031 ADD (MLD)	2036 ADD (MLD)	2041 ADD (MLD)
148	0.9	1.0	1.1	1.2	1.3
154	9.9	10.7	11.5	12.3	13.2
163	2.8	3.0	3.2	3.4	3.8
193 & 216	0.6	0.6	0.8	0.8	0.8
210 & 225	0.3	0.4	0.5	0.5	0.6
239	2.8	3.7	4.9	5.8	6.7
Total	**17.4**	**19.4**	**22.0**	**24.0**	**26.4**

Table 3.A.10 Projected Water System Maximum Day Demands (MDD) by Pressure Zone

Pressure Zone	2021 MDD (MLD)	2026 MDD (MLD)	2031 MDD (MLD)	2036 MDD (MLD)	2041 MDD (MLD)
148	1.6	1.7	1.9	2.0	2.3
154	17.2	18.5	20.0	21.4	23.1
163	4.9	5.1	5.6	6.0	6.5
193 & 216	1.0	1.0	1.3	1.3	1.3
210 & 225	0.6	0.7	0.8	0.9	1.0
239	4.8	6.4	8.6	10.1	11.7
Total	**30.1**	**33.4**	**38.2**	**41.7**	**45.9**

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

A.3.1 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 2027, and will require an upgrade within the 2041 time horizon.

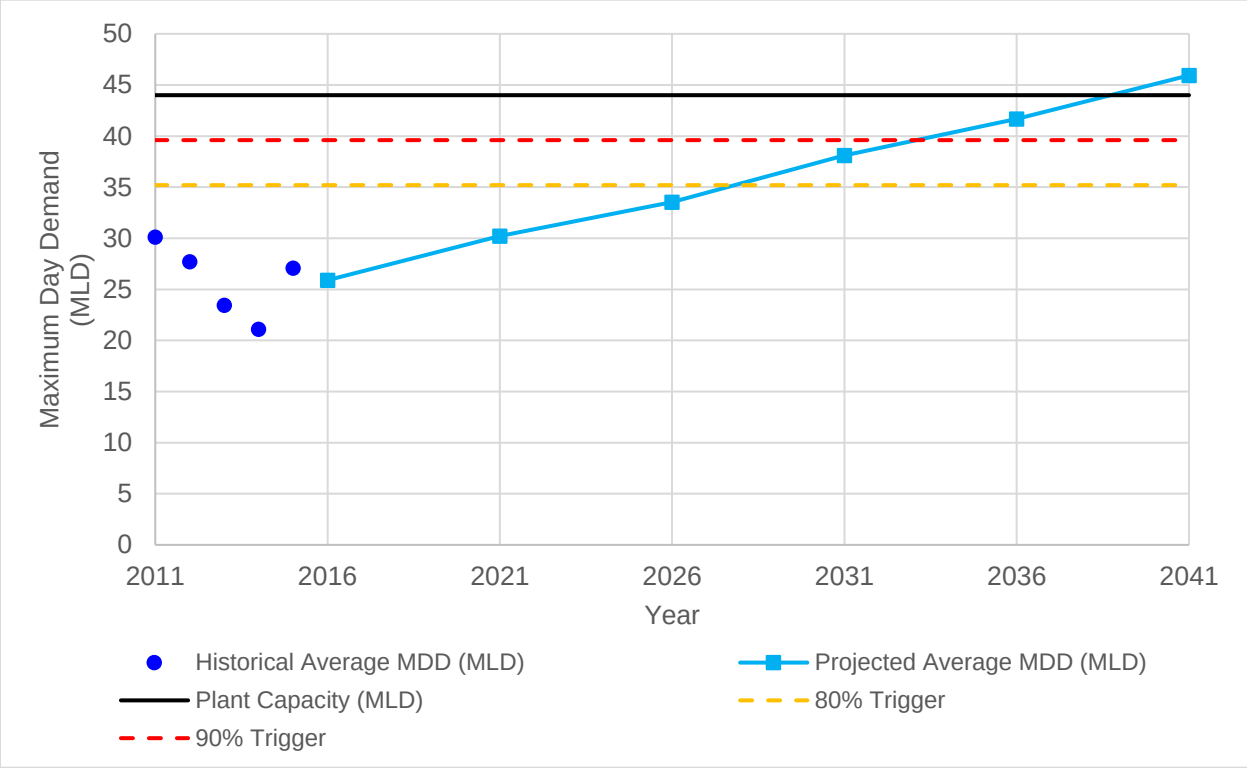


Figure 3.A.3 Projected Maximum Day Demand at Grimsby Water Treatment Plant

A.3.2 Pumping Capacity

Table 3.A.11 highlights the pumping station existing and projected capacity.

Table 3.A.11 System Pumping Station Performance

Pump Station	Pressure Zones Supplied	Total Effective Capacity (MLD)	Existing Maximum Day Demand (MLD)	2041 Maximum Day Demand (MLD)	2041 Surplus/ Deficit (MLD)
Grimsby Water Treatment Plant/ High Lift Pumping Station	All	67.0	25.9	45.9	21.1
Park Road Booster Pumping Station	210, 225, 239	8.6	4.1	12.7	-4.1
Smithville Pumping Station	239	19.4	3.7	11.7	7.7
Lincoln/ Grimsby Booster Pumping Station	148, 163, 193, 216	9.5	6.7	10.2	-0.7

The Park Road Booster Pumping Station and Lincoln/Grimsby Booster Pumping Station have a future pumping deficit.

A.3.3 Storage Capacity

Table 3.A.12 highlight the storage existing and projected capacity.

Table 3.A.12 System Storage Capacities

Pressure Zones Supplied	Storage	Existing Total Available Storage (ML)	2041 Total Available Storage (ML)	Existing Required Storage (ML)	2041 Required Storage (ML)	2041 Surplus/ Deficit (ML)
154, 210, & 225	Grimsby Water Treatment Plant Reservoir Park Road Reservoir[1] New Grimsby Reservoir[2]	8.4	20.0	13.2	17.7	2.3
239	London Road Reservoir Smithville Elevated Tank	10.0	10.0	3.4	9.5	0.5
148, 163, 193, & 216	Hixon Street Reservoir	10.0	10.0	6.7	9.5	0.5

[1] To be decommissioned pre-2041; volume is not included in 2041 Total Available Storage.
[2] Planned works to be online pre-2041; volume is not included in existing Total Available Storage.

The 154, 210, and 225 pressure zones have an existing storage deficit, which is overcome by the addition of the new Grimsby Reservoir (design underway), resulting in surplus storage projected for 2041.

Figure 3.A.4 through Figure 3.A.7 show the 5-day MDD storage performance of the existing infrastructure for existing and 2041 demands.

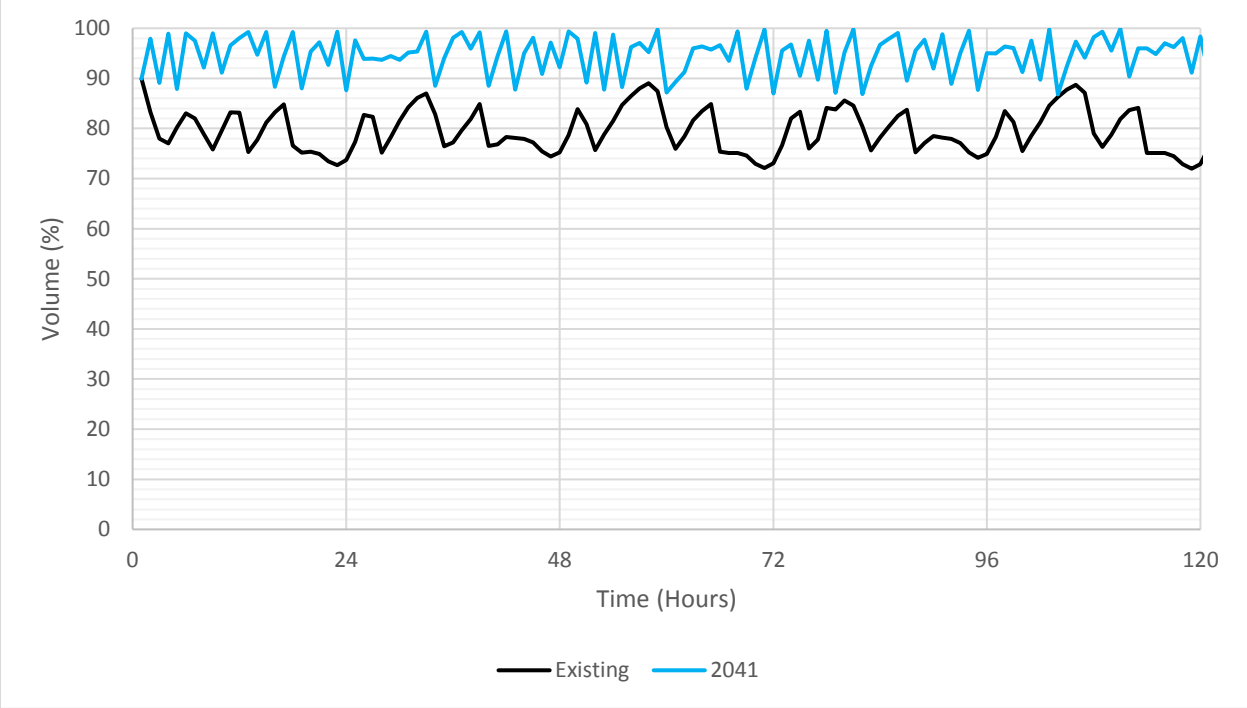


Figure 3.A.4 5-Day Maximum Day Demand Storage Performance – Park Road Reservoir

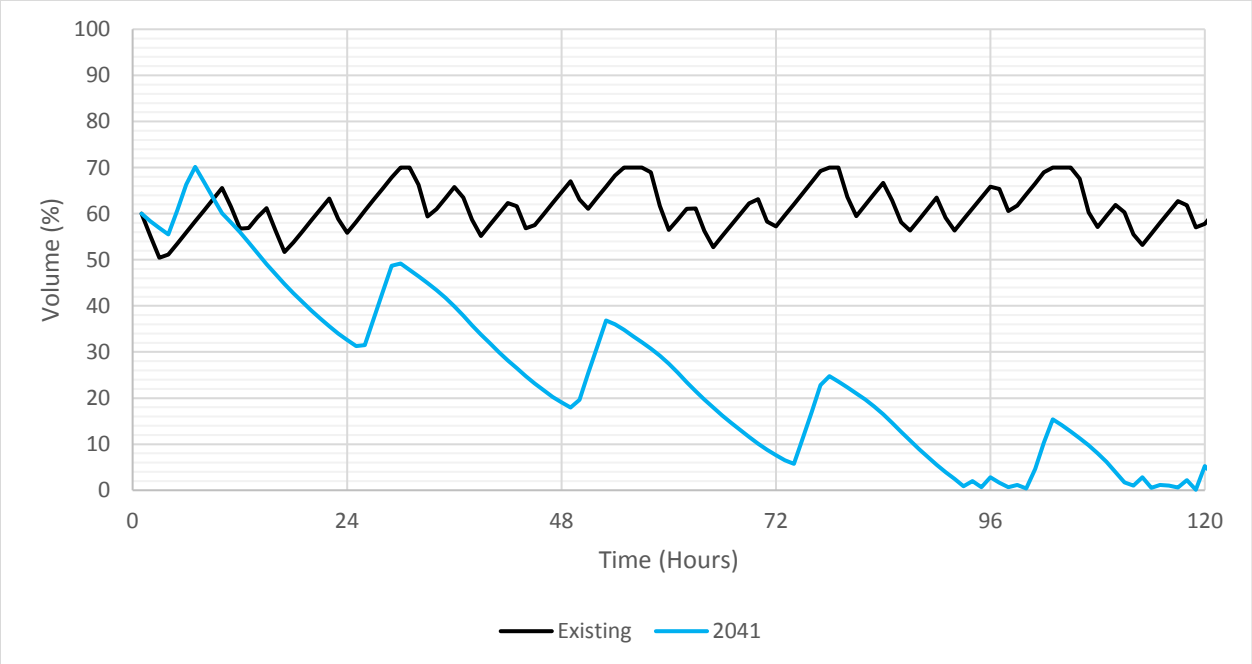


Figure 3.A.5 5-Day MDD Storage Performance – London Road Reservoir

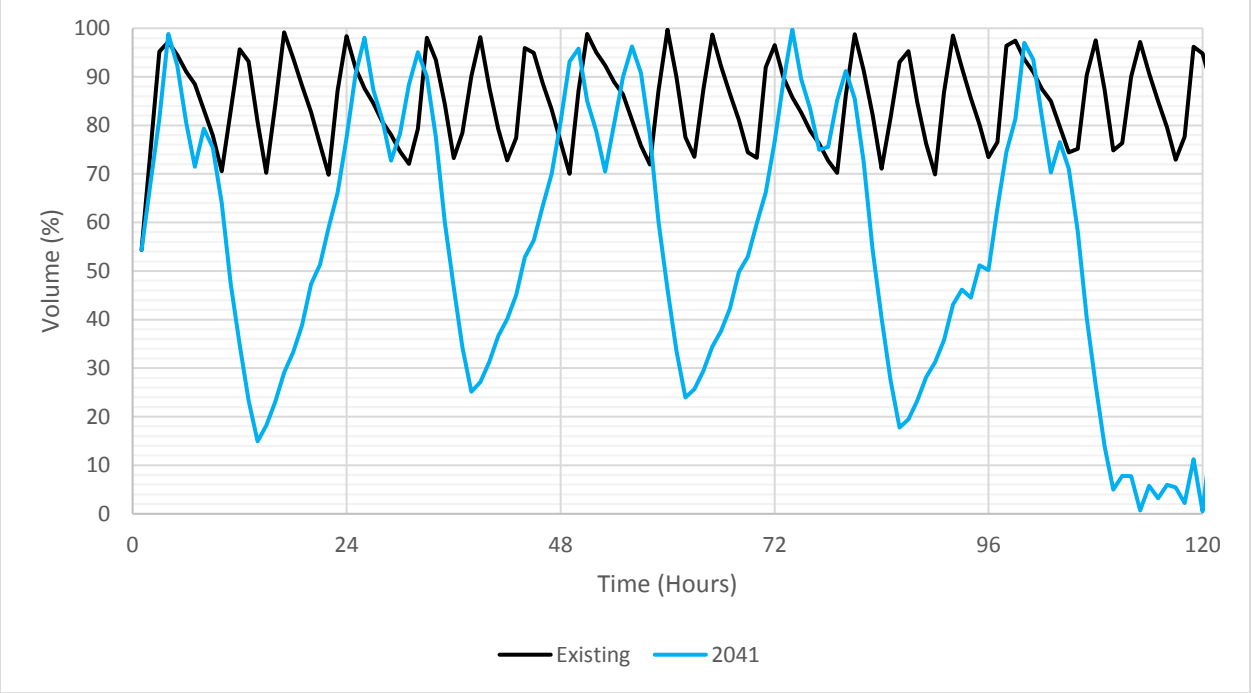


Figure 3.A.6 5-Day MDD Storage Performance – Smithville Elevated Tank

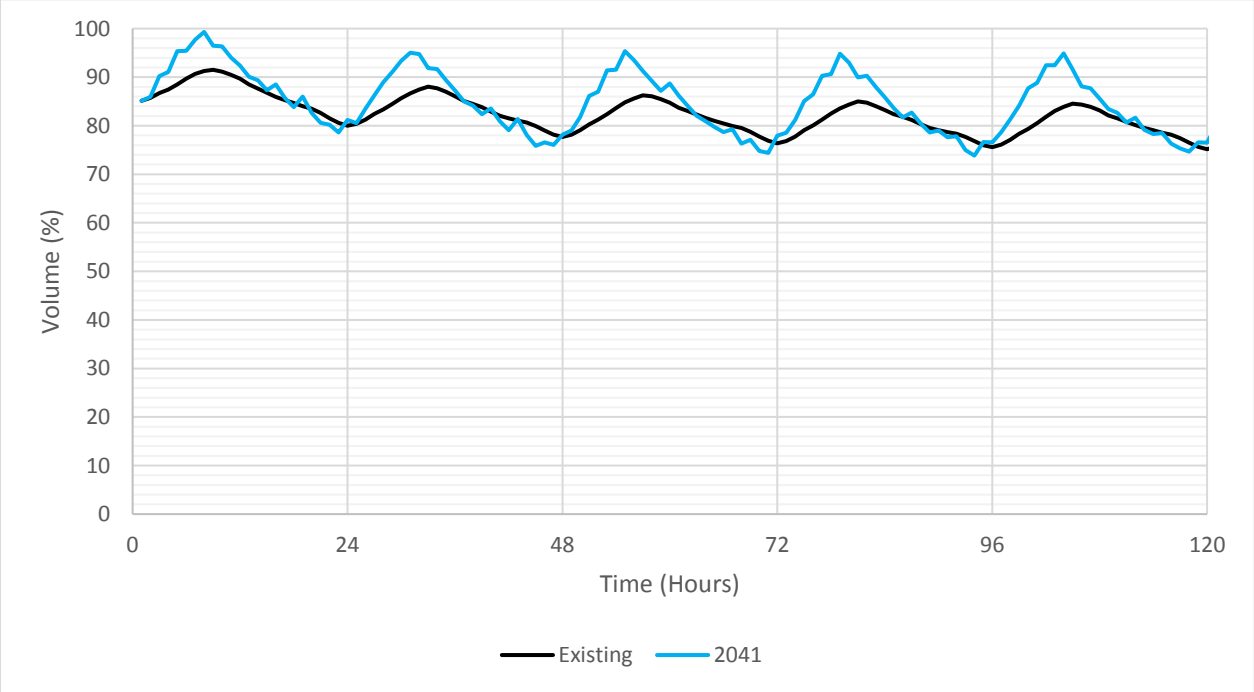


Figure 3.A.7 5-Day MDD Storage Performance – Hixon Street Reservoir

A.3.4 System Pressures and Fire Flows

Figure 3.A.8 to Figure 3.A.11 present the existing and projected 2041 system performance, based on existing system configuration and capacities.

Grimsby W.T.P.

Grimsby W.T.P. Pumping Station

Grimsby W.T.P. Reservoir

Lake Ontario

Lincoln/Grimsby Booster Pumping Station

Park Road Booster Pumping Station

Park Road Reservoir

Hixon Street Reservoir

Albright Booster Pumping Station 1 + 2

Smithville Elevated Tank

London Road Pumping Station

London Road Reservoir

City of Hamilton

Town of Grimsby
Township of West Lincoln

Town of Lincoln
Township of West Lincoln

Ridge Rd W

Ridge Rd E

Woolverton Rd

Mountain Rd

Grassie Rd

Grimsby Rd

Fly Rd

20 Rd

Twenty Mile Rd

Spring Creek

Thirty Mile Creek

North Creek

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

148 163 210 225
154 193 216 239

Minimum Pressure (psi)

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

Figure 3.A.8

Existing Maximum Day Demand Pressure

Grimsby WTP

BluePlan Engineering

May 2017
715023-W-4-Existing Pressure (Grimsby)
NAD 1983 UTM Zone 17N

Grimsby W.T.P.

Grimsby W.T.P. Pumping Station

Grimsby W.T.P. Reservoir

Lake Ontario

Lincoln/Grimsby Booster Pumping Station

Park Road Booster Pumping Station

Park Road Reservoir

Hixon Street Reservoir

Albright Booster Pumping Station 1 + 2

Smithville Elevated Tank

London Road Pumping Station

London Road Reservoir

City of Hamilton

Town of Grimsby
Township of West Lincoln

Town of Lincoln
Township of West Lincoln

Ridge Rd W

Ridge Rd E

Woolverton Rd

Mountain Rd

Grassie Rd

Grimsby Rd

Fly Rd

20 Rd

Twenty Mile Rd

Spring Creek

Thirty Mile Creek

Twenty Mile Creek

North Creek

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

148 163 210 225
154 193 216 239

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

Figure 3.A.9

Existing System Fire Flow

Grimsby WTP

BluePlan Engineering

May 2017
715023-W-6-Existing Fire Flow (Grimsby)
NAD 1983 UTM Zone 17N

Grimsby W.T.P.

Grimsby W.T.P. Pumping Station

Grimsby W.T.P. Reservoir

Lake Ontario

Lincoln/Grimsby Booster Pumping Station

Park Road Booster Pumping Station

Park Road Reservoir

Hixon Street Reservoir

Albright Booster Pumping Station 1 + 2

Smithville Elevated Tank

London Road Pumping Station

London Road Reservoir

City of Hamilton

Town of Grimsby
Township of West Lincoln

Town of Lincoln
Township of West Lincoln

Ridge Rd W

Ridge Rd E

Woolverton Rd

Mountain Rd

Grassie Rd

Grimsby Rd

Fly Rd

Twenty Mile Rd

Spring Creek

Thirty Mile Creek

Twenty Mile Creek

North Creek

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

148 163 210 225
154 193 216 239

Minimum Pressure (psi)

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

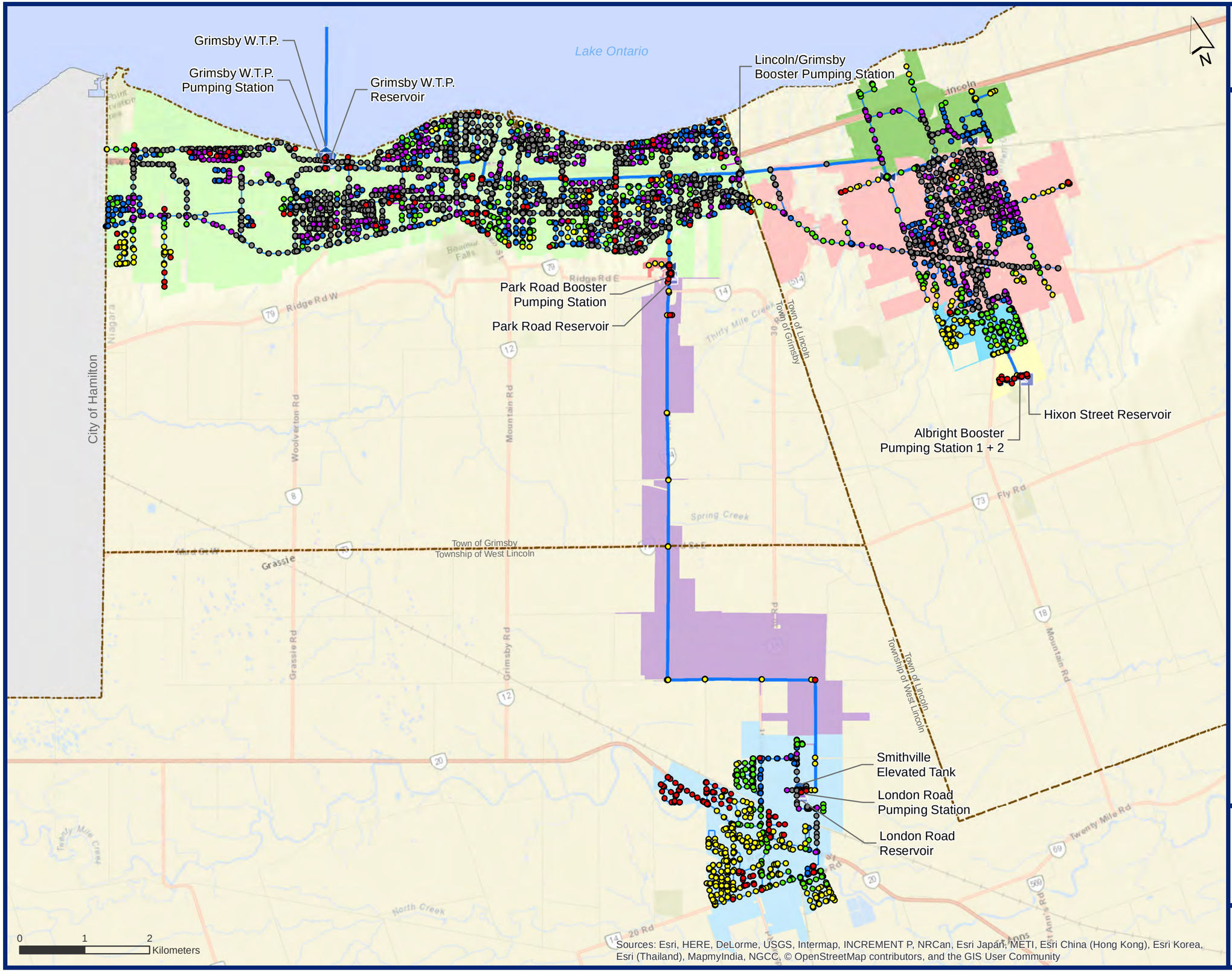
Figure 3.A.10

2041 Maximum Day Demand Pressure

Grimsby WTP

BluePlan Engineering Inc

May 2017
715023-W-5-2041 Pressure (Grimsby)
NAD 1983 UTM Zone 17N



Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

148 163 210 225
154 193 216 239

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

Figure 3.A.11

2041 System Fire Flow

Grimsby WTP

BluePlan Engineering

May 2017
715023-W-7-2041 Fire Flow (Grimsby)
NAD 1983 UTM Zone 17N

A.3.5 Water Age and Watermain Capacity

Figure 3.A.12 represents the sampled chlorine residual (mg/L) versus the modelled water system age at each sample location.

The 90th percentile trend line represents the chlorine residual achieved by the bottom 10% of samples at a location, meaning that 90% of the samples taken at that location were above the 90th percentile trend line. Similarly, the 99th percentile trend line represents the chlorine residual achieved by the bottom 1% of samples at a location, meaning that 99% of the samples taken at that location were above the 99th percentile trend line. It is assumed that <10 days is required to maintain the 0.25 mg/L chlorine residual objective.

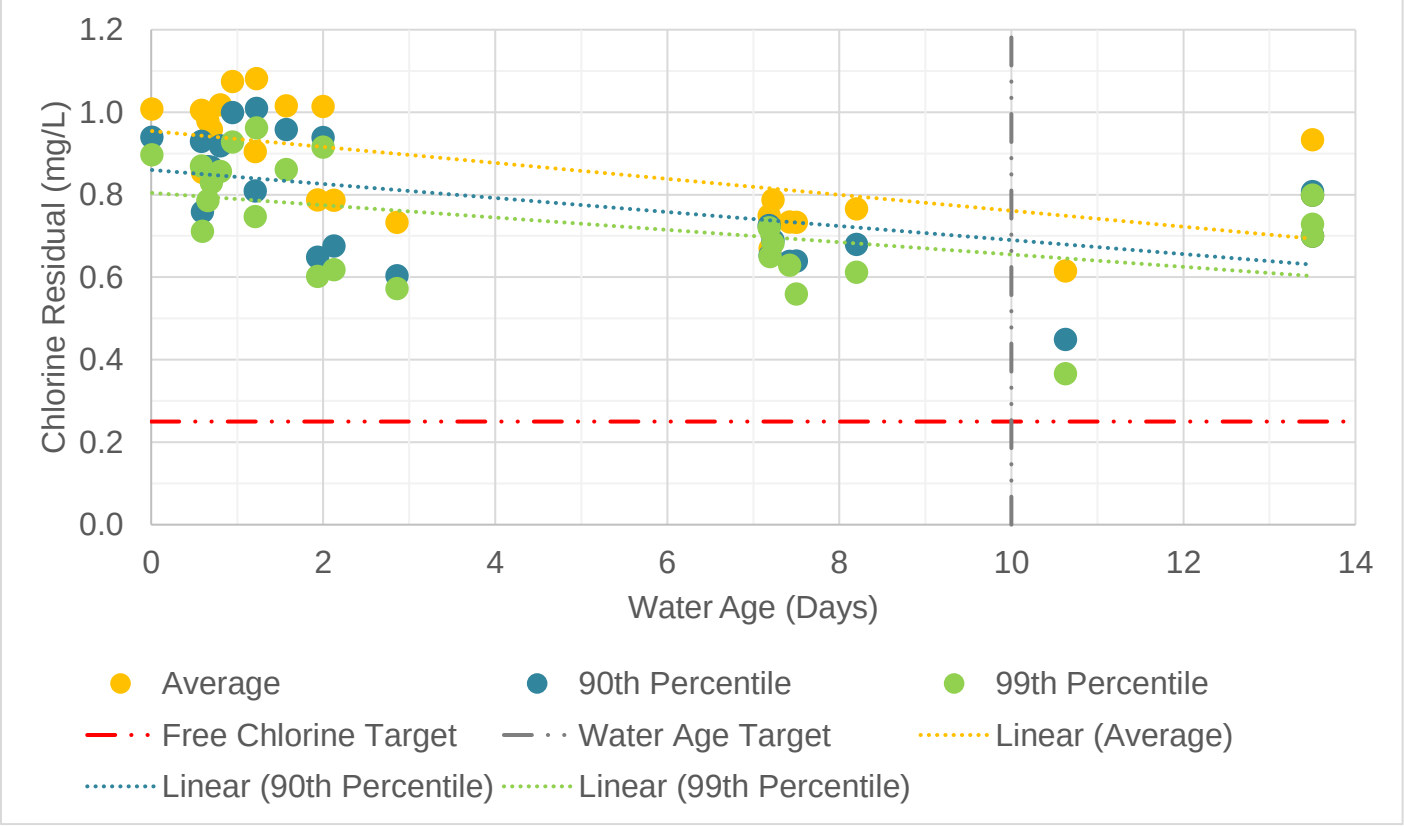


Figure 3.A.12 Existing Chlorine Residual vs Water System Age

Figure 3.A.13 shows the modelled water age throughout the system. Figure 3.A.14 shows the existing watermain capacity in the system as maximum head loss (m/km).

Grimsby W.T.P.

Grimsby W.T.P. Pumping Station

Grimsby W.T.P. Reservoir

Lake Ontario

Lincoln/Grimsby Booster Pumping Station

Park Road Booster Pumping Station

Park Road Reservoir

Hixon Street Reservoir

Albright Booster Pumping Station 1 + 2

Smithville Elevated Tank

London Road Pumping Station

London Road Reservoir

City of Hamilton

Town of Grimsby
Township of West Lincoln

Town of Lincoln
Township of West Lincoln

Ridge Rd W

Ridge Rd E

Woolverton Rd

Mountain Rd

Grassie Rd

Grimsby Rd

Fly Rd

Twenty Mile Rd

Spring Creek

Thirty Mile Creek

Twenty Mile Creek

North Creek

0 1 2 Kilometers

N

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

148 163 210 225
154 193 216 239

Water Age (Days)

- < 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- < 8

Figure 3.A.13

Water Age

Grimsby WTP

BluePlan Engineering

May 2017
715023-W-8-Water Age (Grimsby)
NAD 1983 UTM Zone 17N

Grimsby W.T.P.

Grimsby W.T.P. Pumping Station

Grimsby W.T.P. Reservoir

Lake Ontario

Lincoln/Grimsby Booster Pumping Station

Park Road Booster Pumping Station

Park Road Reservoir

Hixon Street Reservoir

Albright Booster Pumping Station 1 + 2

Smithville Elevated Tank

London Road Pumping Station

London Road Reservoir

City of Hamilton

Town of Grimsby
Township of West Lincoln

Town of Lincoln
Township of West Lincoln

Ridge Rd W

Ridge Rd E

Woolverton Rd

Mountain Rd

Grassie Rd

Grimsby Rd

Fly Rd

Twenty Mile Rd

20 Rd

Spring Creek

Thirty Mile Creek

Twenty Mile Creek

North Creek

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

148 163 210 225
154 193 216 239

Watermain Headloss (m/km)

- < 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4

Figure 3.A.14

Watermain Capacity

Grimsby WTP

BluePlan Engineering

May 2017
715023-W-9-Watermain Capacity (Grimsby)
NAD 1983 UTM Zone 17N

A.4 System Opportunities and Constraints

Figure 3.A.15 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 26.0 MLD. The plant has limited capacity in the future, with the capacity upgrades required to support the projected 2041 MDD to 46.0 MLD.

A.4.2 Grimsby System

- Grimsby has an existing storage deficit of 4.8 MLD, however, currently planned New Grimsby Reservoir is expected to address existing and projected storage needs.
- Significant portions of the Grimsby system experience high pressures (>100 psi), near Lake Ontario.

A.4.3 Smithville System

- Smithville has sufficient pumping and storage capacity within the zone, as well as adequate fire flow and pressure capacity.
- Additional conveyance is required to support 2041 peak hour pressure and fire flows.

A.4.4 Lincoln System

- Projected 2041 growth is expected to exceed the Lincoln/Grimsby Booster Pumping Station capacity.
- There is sufficient fire flow and storage at the Hixon Reservoir to support 2041 growth within Lincoln.
- Portions of the Beamsville system experience high pressures (>100 psi).

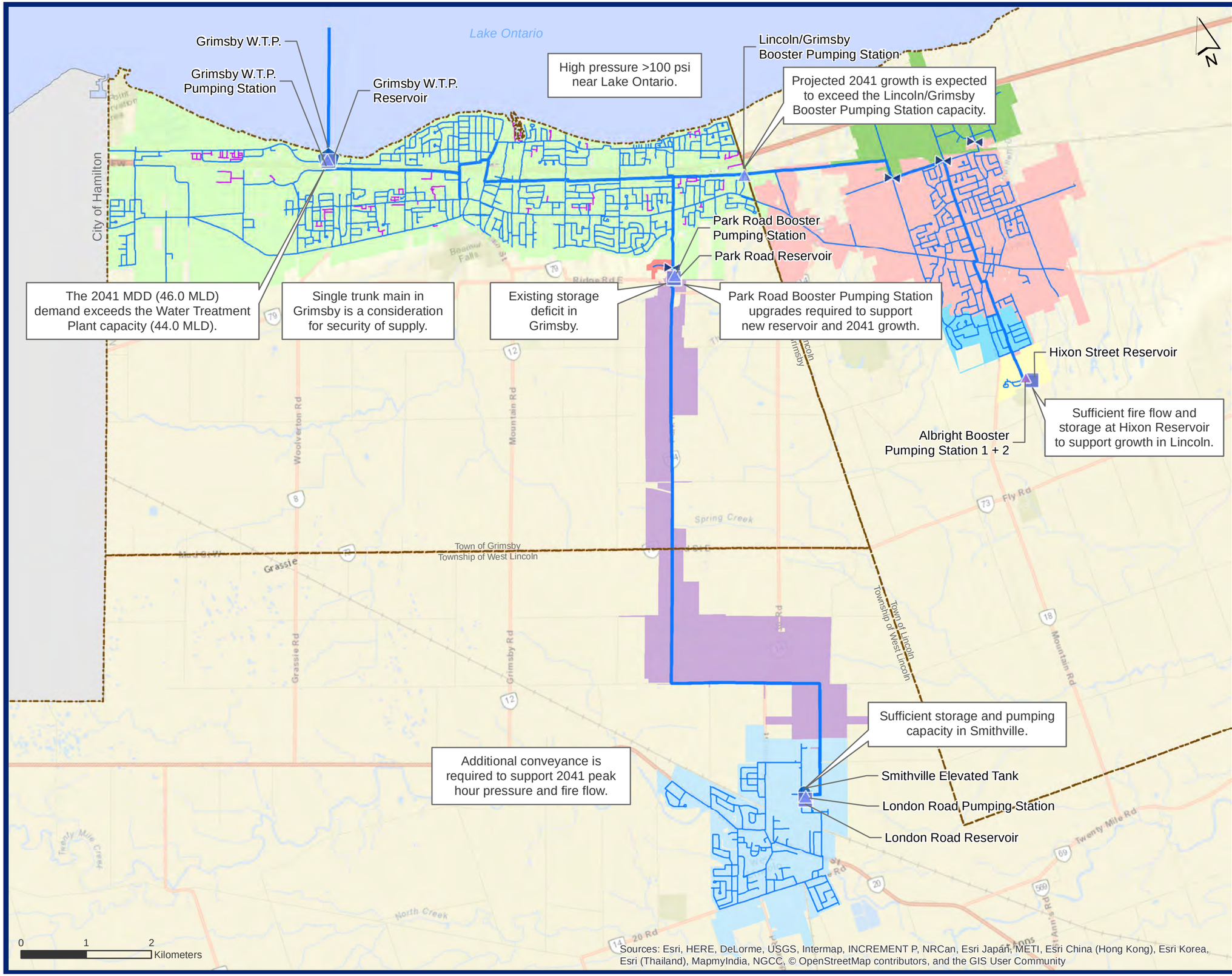
A.4.5 System Security of Supply & Interconnections

- The Park Road Booster Pumping Station, which transfers water from Grimsby to Smithville does not have sufficient capacity to support 2041 growth flows. Further, the new Grimsby Reservoir, and new operational configuration, is expected to further increase demands on the Park Road Booster Pumping Station

- The Grimsby water system consists of a single spine trunk, with a single trunk watermain interconnecting all major components of the water system.

Niagara Region

2016 MASTER SERVICING PLAN



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

148 163 210 225
154 193 216 239

Figure 3.A.15
System Opportunities and Constraints
Grimsby WTP

BluePlan Engineering

May 2017
715023-W-3-Opportunities and Constraints (Grimsby)
NAD 1983 UTM Zone 17N

A.5 Assessment of Alternatives

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

- Baseline (No Changes)
- Capacity Upgrades
- New Trunk Conveyance & Storage Operations Strategy

All alternatives include:

- A new trunk main in Smithville to support growth to the north, east, and south of Smithville.
- Construction of the new Grimsby Reservoir and supporting trunk watermain and PRV to support back feed to the Grimsby system.

Identified high pressure issues can be address through changes within the local distribution system through either the creation of new pressure zones or adjustments to existing zone boundaries.

A.5.1 Alternative 1 – Capacity Upgrades

Alternative 1, highlighted in Figure 3.A.16 generally maintains the existing system configuration, with upgrades to existing facilities as required to support growth. Under this configuration, the existing single trunk network would be maintained. This alternative would address pumping capacity issues within the system. Security of supply issues remain in Grimsby.

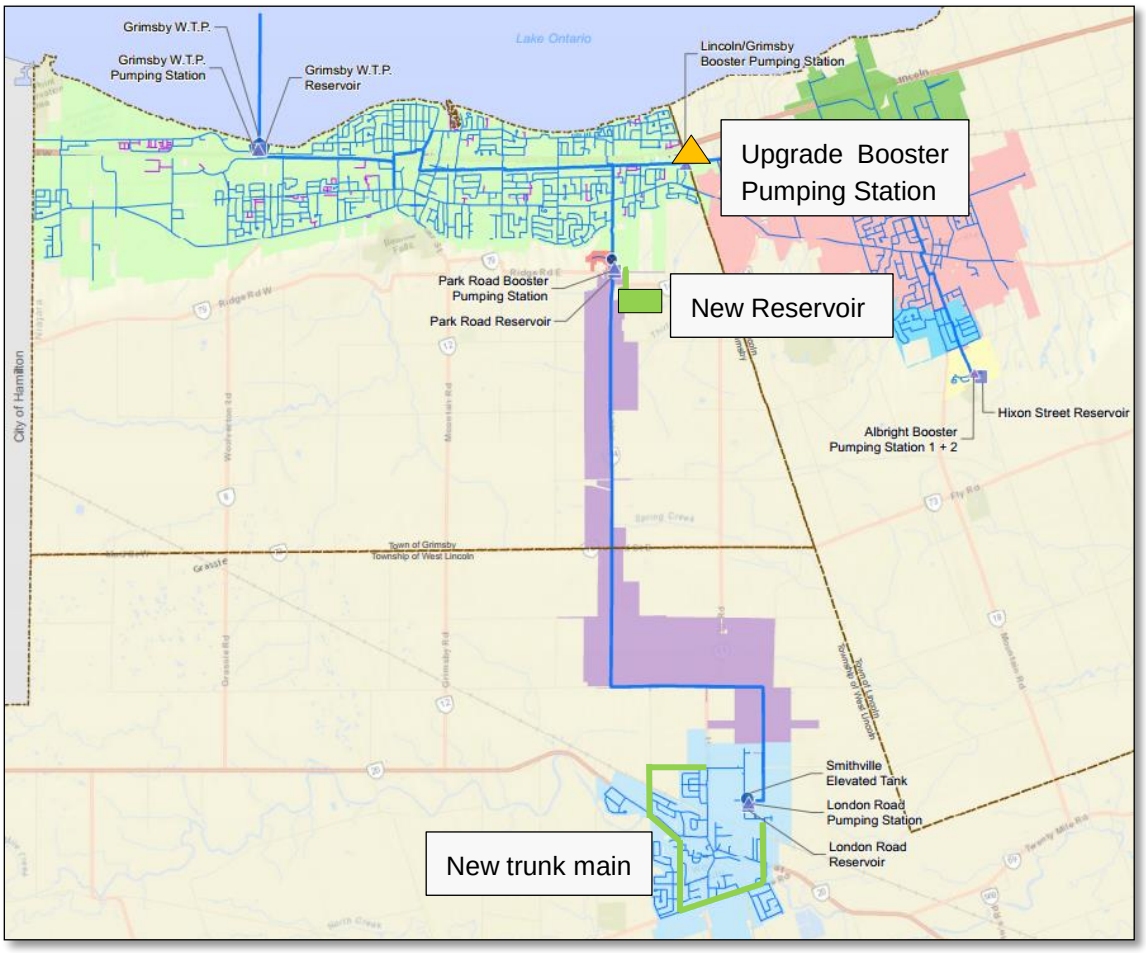


Figure 3.A.16 Alternative 1 – Capacity Upgrades

A.5.2 Alternative 2 – New Trunk Conveyance & Storage Operations Strategy

Alternative 2, highlighted in Figure 3.A.17, consists of a new dedicated feed from the Grimsby Water Treatment Plant to the new Grimsby Reservoir. This configuration would require an overall re-configuration of system operations, but would allow for the decommissioning of some existing facilities and a more efficient operation of the overall system, while providing increased security of supply. This alternative also includes upgrades to existing facilities as required to support growth.

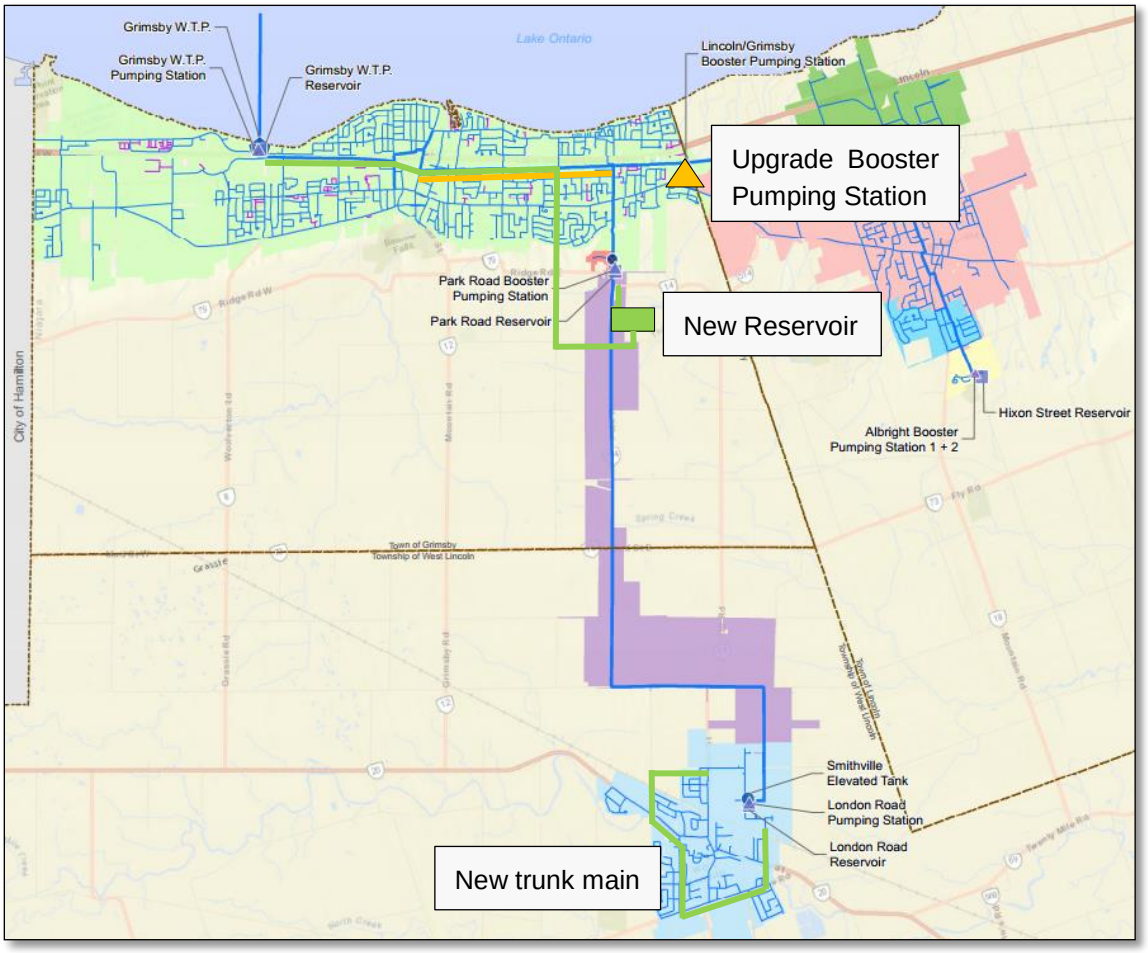


Figure 3.A.17 Alternative 2 – New Trunk Conveyance & Storage Operations Strategy

A.5.3 Alternatives Evaluation

Alternative 2 – New Trunk Conveyance & Storage Operations Strategy is the preferred servicing strategy as:

- Baseline strategy does not satisfy the future servicing needs of the water system
- Alternative 2 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 the Grimsby Water Treatment Plant and primary system storage.
    - Improved turnover rate within the new reservoir leading to improved water quality within the system.
    - Increased capacity within the Grimsby transmission and distribution system allowing for additional localized growth without triggering additional upgrades.
    - Increased capacity within the Grimsby transmission and distribution system may provide additional operational capacity to the Lincoln/Grimsby Booster Pumping Station, potentially delaying the timing of required capacity upgrades.
- Alternative 2 also allows for a general simplification of system operations and the decommissioning of the Park Road Booster Pumping Station; eliminating the needs for major upgrades and long-term maintenance needs.

A.6 Preferred Servicing Strategy

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

- Based on the level of growth on the system, the Grimsby Water Treatment Plant will require additional water treatment capacity.
- The location of water storage to optimize pumping costs and provide equalization and emergency storage to the system has been addressed. A new storage facility to support the Grimsby and Smithville service areas has been established. The new location results in decommissioning 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 are required.
- The level of growth in the Smithville area requires additional trunk watermain capacity through the network.
- Additional pumping capacity is required to support the Lincoln service area growth.

Figure 3.A.18 and Figure 3.A.19 show the preferred servicing strategy and schematic, consisting of:

A.6.1 Treatment Plant

Provide an additional 15 MLD of treatment capacity at the water treatment plant, with new high lift pumping capacities to support feed to new Grimsby reservoir top water level.

A.6.2 Storage

A new 15 ML reservoir is to be 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:

- Temporary upgrades to the Park Road Booster Pumping Station prior to construction of the new trunk mains from the Grimsby Water Treatment Plant to Park Road Booster Pumping Station is required to support interim operation of the Reservoir.
- New 750 mm trunk watermain from the new reservoir to the new PRV located at the exiting 500 mm trunk watermain upstream of the existing Park Road Reservoir.

A.6.3 Pumping

The Lincoln/Grimsby Booster Pumping Station will be upgraded with the addition of a third 9.5 MLD pump to support growth.

A.6.4 Decommissioning of Existing Facilities

Decommissioning of the existing Park Road Reservoir and Park Road Booster Pumping Station will follow the addition of the new Grimsby Water Treatment Plant to Park Road Booster Pumping Station trunk mains to support the new operational strategy.

A.6.5 Trunk Watermain

- New 750 mm watermain connection from Murray Street to Elizabeth Street (design already underway 2016 RFP-43).
- Replace the existing 500 mm watermain with a 750 mm watermain from the Grimsby Water Treatment Plant to Park Road (design already underway 2016 RFP-43).
- New backfeed from new Grimsby Reservoir to existing Park Road Reservoir and Booster Pumping Station (design already underway 2016 RFP-43).
- New 750 mm watermain from the Grimsby Water Treatment Plant to the Park Road Reservoir.
- New 400 mm trunk main in Smithville.

A.6.6 Project Implementation and Considerations

Special project implementation and considerations for the preferred servicing strategy consist of:

- Timing of the new watermain from the Grimsby Water Treatment Plant to the New Grimsby Reservoir needs to be coordinated with the proposed Grimsby Water Treatment Plant upgrades, as Water Treatment Plant High Lift Pump upgrades are needed to support the use of the new watermain.
- New Grimsby Reservoir will be completed ahead of Grimsby Water Treatment Plant upgrade and new trunk main; as such, interim upgrades to Park Road Booster Pumping Station are needed to support interim operation of the New Grimsby Reservoir (Note: Upgrades to Park Road Booster Pumping Station are included in the New Grimsby Reservoir project in the capital program).

- New Smithville trunk main will be triggered by growth and local distribution system needs. The new trunk main loop could be completed in phases depending on location and timing of growth.

A.7 Capital Program

Table 3.A.13 summarizes the recommended project costing, implementation schedule and Class EA requirements.

A.7.1 Schedule B Project Files

Project W-S-005 (New Grimsby Reservoir) Municipal Class Schedule B Environmental Assessment has been previously completed and design is underway.

Project W-M-005 (New Trunk Watermain from Grimsby WTP to new Grimsby Reservoir) represents a significant new watermain with multiple major crossings of major infrastructure, escarpment crossing, and other complexities. Provisional alignment included for costing; however, comprehensive Municipal Class Schedule B Environmental Assessment including conceptual design is recommended to identify final alignment.

Niagara Region

2016 MASTER SERVICING PLAN

MSP Water Projects

- Treatment Plant
- Reservoir
- Pumping Station
- Elevated Tank
- Watermain Projects

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station
- Regional
- Municipal

Water Network
- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

148 163 210 225
154 193 216 239

Grimsby W.T.P. Reservoir
Grimsby W.T.P. Pumping Station
Grimsby W.T.P.
Lincoln/Grimsby Booster Pumping Station
W-P-003
W-M-004
W-F-001
W-M-005
W-D-003
Park Road Reservoir
Park Booster Pumping Station
W-S-005
Hixon Street Reservoir
Albright Booster Pumping Station 1 + 2
Smithville Elevated Tank
London Road Reservoir
London Road Pumping Station
W-M-006

Lake Ontario
City of Hamilton
Town of Grimsby
Township of West Lincoln
Town of Lincoln
Lincoln
Beamsville
Ridge Rd W
Mud St W
Mud St E
Grassie Rd
Woolverton Rd
Mountain Rd
Grimsby Rd
Park Rd S
Fly Rd
Twenty Mile Rd
Spring Creek
North Creek
Twenty Mile Creek

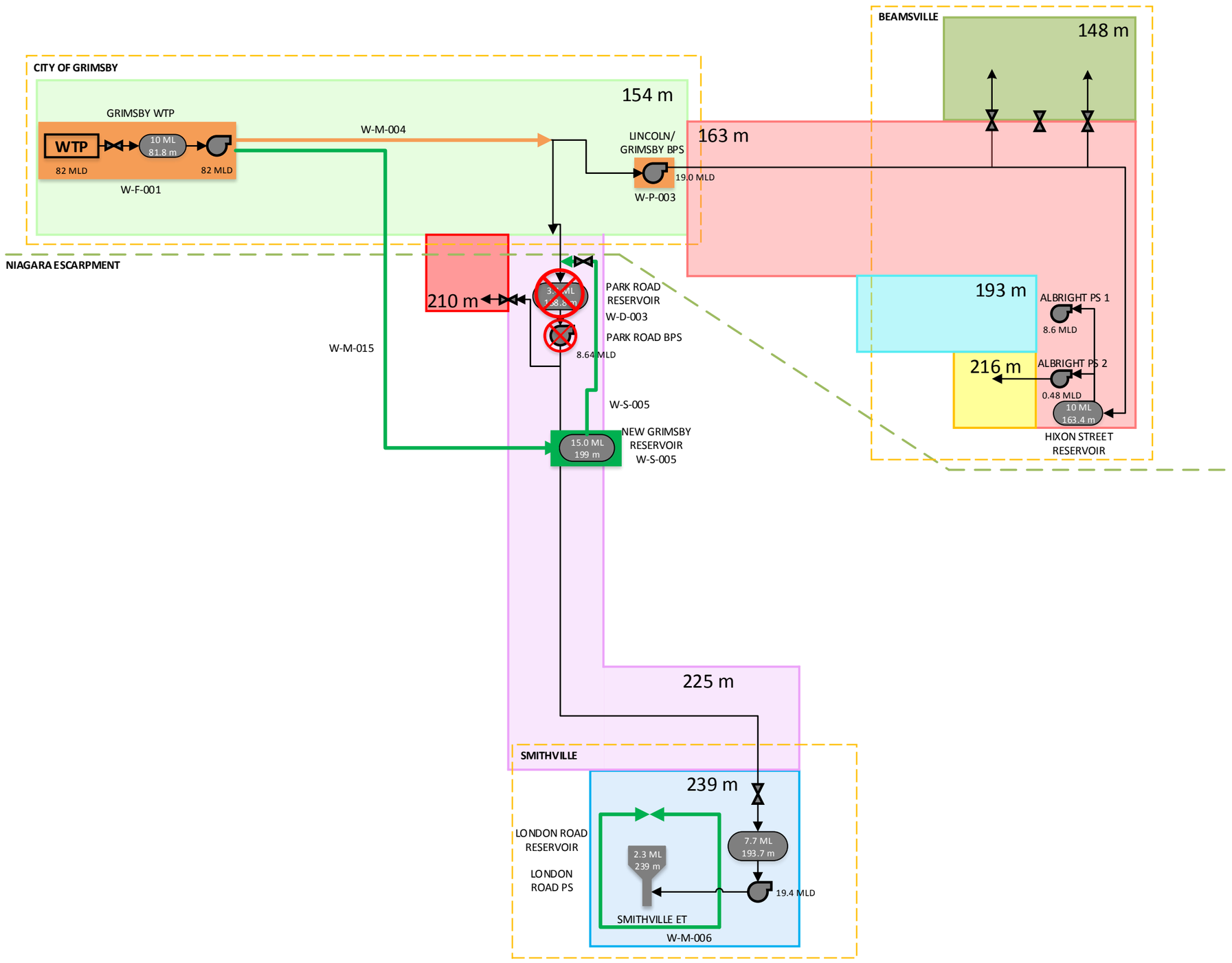
0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 3.A.18
Preferred Water Strategy
Grimsby WTP

BluePlan Engineering

May 2017
715023-WW-6-Capital Projects (Grimsby)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Grimsby WTP

2041 DISTRIBUTION SCHEMATIC

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

Pressure Zone

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

May 2017
Figure 3.A.19
Not to Scale

BluePlan ENGINEERING

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 + Pumping Station	Decommissioning of Park Road Reservoir and Pumping Station, to be replaced by new Grimsby Reservoir and additional pumping capacity at the Water Treatment Plant	N/A	2022 - 2031	Grimsby	A+	Satisfied	Storage	$ 523,000
W-F-001	Grimsby Water Treatment Plant Expansion	Provide an additional 15 MLD treatment, and new high lift pumping capacities to support feed to new Grimsby Reservoir	15 MLD	2022 - 2031	Grimsby	C	Separate EA Required	Treatment	$ 51,496,000
W-M-004	Upgrade trunk main from Grimsby Water Treatment Plant to Park Road	Upgrade trunk main from Grimsby Water Treatment Plant to Park Road	750 mm	2017 - 2021	Grimsby	A+	Satisfied	Watermain	$ 13,139,000
W-M-005	New trunk main from Grimsby Water Treatment Plant to New Grimsby Reservoir	New trunk main from Grimsby Water Treatment Plant to New Grimsby Reservoir	750 mm	2022 - 2031	Grimsby	B	To Be Satisfied Through Secondary Plan	Watermain	$ 42,044,000
W-M-006	New trunk main in Smithville	New trunk main in Smithville	400 mm	2022 - 2031	West Lincoln	A+	Satisfied	Watermain	$ 14,357,000
W-P-003	Upgrade Lincoln/Grimsby Booster Pumping Station	Add third 9.5 MLD pump	110 L/s	2032 - 2041	Grimsby	A+	Satisfied	Pumping	$ 989,000
W-S-005	New Grimsby Reservoir	New Grimsby Reservoir to provide additional storage – already designed Includes associated connection to existing Park Road facility and associated upgrades to Park Road pump station to support interim operational configuration	15 ML	2017 - 2021	Grimsby	B	EA Previously Completed	Storage	$ 23,474,000
Total									**$146,022,000**

PART B
DECEW WATER SYSTEM

B. DECEW WATER TREATMENT PLANT

B.1 Existing System Overview

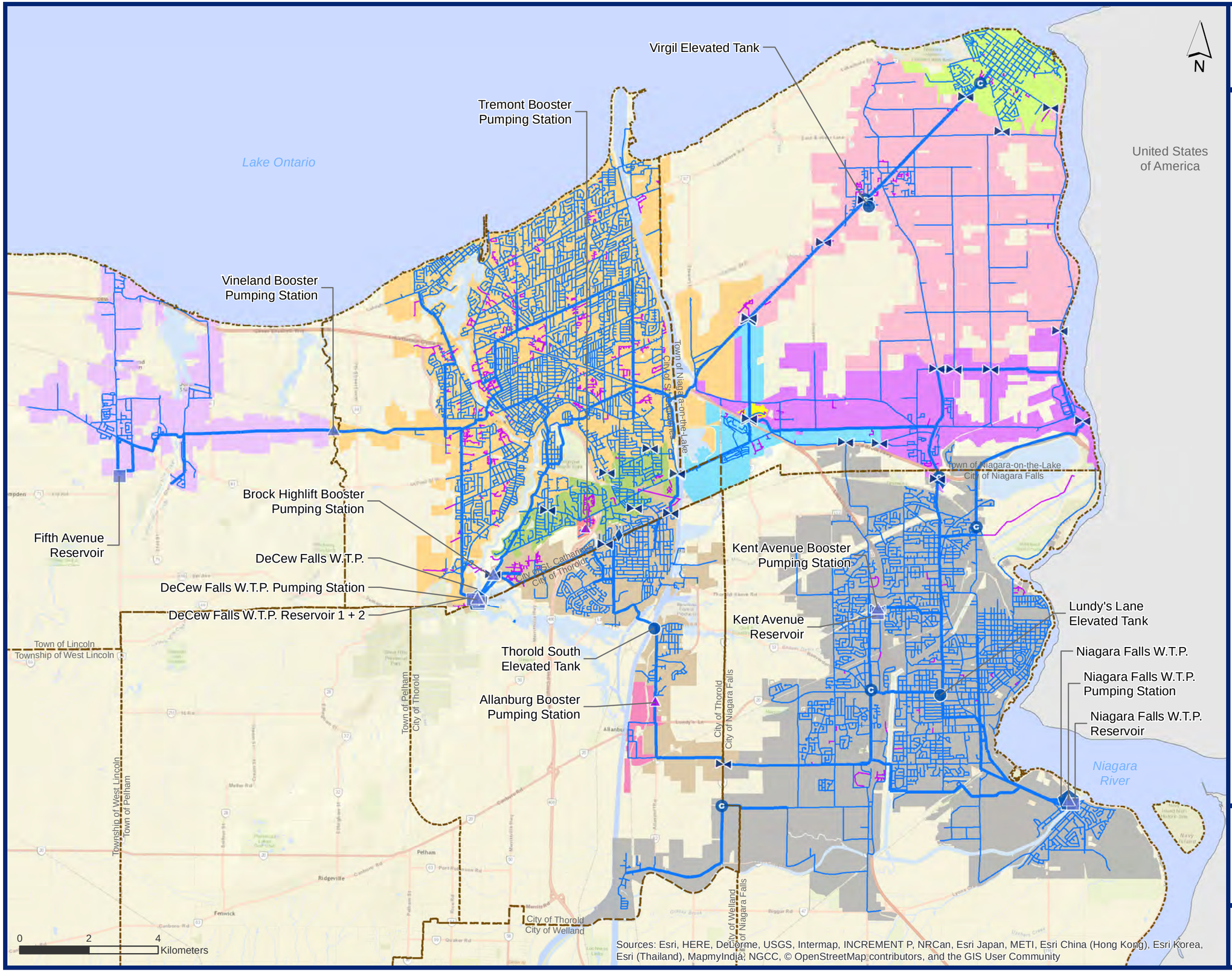
The Decew water system services the City of St. Catharines, the parts of Thorold, the Vineland area in Lincoln, and Niagara-on-the-Lake. The system is interconnected with the Niagara Falls water system. The system services an existing population of 170,312 and 80,412 employees.[1]

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).[2]

The system supplies local area municipalities via a water main network, pumping stations, and service 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.

[1] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*
[2] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-202*



Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Figure 3.B.1

Existing Water System

DeCew Falls WTP

BluePlan Engineering

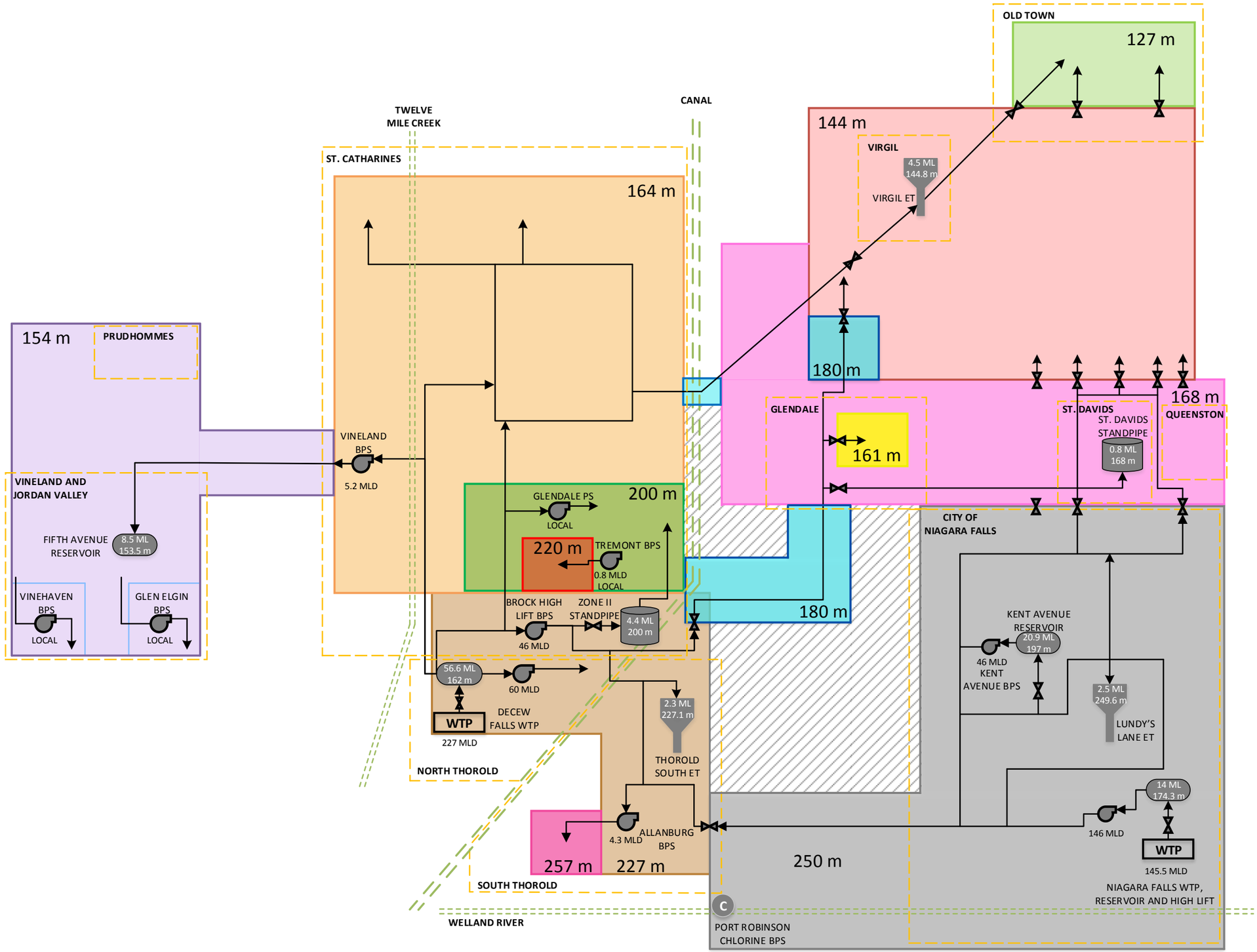
May 2017
715023-W-2-Existing Water System (DCNF)
NAD 1983 UTM Zone 17N

Niagara Region

2016 Master Servicing Plan

Niagara Falls WTP and Decew WTP

EXISTING DISTRIBUTION SCHEMATIC



- WTP (RATED CAPACITY) — Water Treatment Plant
- Pumping Station (FIRM CAPACITY)
- 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	180 m
144 m	200 m
154 m	220 m
161 m	227 m
164 m	250 m
168 m	257 m

May 2017
Figure 3.B.2
Not to Scale

BluePlan ENGINEERING

B.1.1 Facility Overview

Table 3.B.1 Water Treatment Plant Overview

Plant Name	Decew Water Treatment Plant[3]
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

[3] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-202*

Table 3.B.2 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone)	Discharge (Pressure Zone)	Pressure Zones Supplied	Number of Pumps (Total/ Firm)	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, 200, 220, 227, 257	4/3	60.0	76.2
Decew Water Treatment Plant Gravity Feed*		WTP	164	127, 144, 154, 164, 200, 220	N/A	131.6	N/A
Brock High Lift Booster Pumping Station	500 Glenridge Avenue, St. Catharines	Decew WTP High Lift	164	161, 168, 180, 200, 220, 227, 257	3/2	46.0	67.0
Vineland Booster Pumping Station	1855 Fourth Avenue, St. Catharines	Decew WTP High Lift	154	154	3/2	13.3	52.0

* Capacity based on 2 m/s watermain velocity.

Table 3.B.3 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	2700 Decew Road, St. Catharines	Floating/ Gravity Reservoir	18.6	162.0	164	164
Decew Water Treatment Plant Reservoir 2	2700 Decew Road, St. Catharines	Reservoir	38.0	162.0	164	164
St. David's Standpipe	St. Paul Avenue, St. David's	Standpipe	0.8	168.0	127, 144, 168	127, 144, 168
Fifth Avenue Reservoir	3390 Fifth Avenue, Vineland	Pumped Reservoir	8.5	153.5	154	154
Thorold South Elevated Tank	105 Allanburg Road, Thorold	Elevated Tank	2.3	227.1	161, 180, 227, 257	161, 180, 227, 257
Zone 2 Standpipe	5 Allanburg Road, Thorold	Standpipe	4.4	200.3	200, 220	200, 220
Virgil Elevated Tank	11 Walker Street, Virgil	Elevated Tank	4.5	144.8	127, 144, 168	127, 144, 168

Refer to Figure 3.B.1 for pumping station and storage facility locations.

B.1.2 Demands Overview

Table 3.B.4 Historic Water System Demands

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***	***1.55***
5 Year Peak	***54.5***	***93.3***	***1.75***

Table 3.B.5 Water System Maximum Day Peaking Factor

Existing Service Population	170,312
Existing Service Employment	80,412
Total Service Equivalent Population	**250,724**
MOECC Peaking Factor[4]	1.50
Historic 5 Year Average Peaking Factor	1.55
Historic 5 Year Max Peaking Factor	1.75
2016 MSP Peaking Factor	**1.55**

The 2016 MSP peaking factor is the average of the peaking factors from 2011 to 2015.

[4] *Ministry of the Environment and Climate Change, 2008, Design Guidelines for Drinking-Water Systems, ISBN 978-1-4249-8517-3*

Table 3.B.6 Existing Water System Demands by Pressure Zone

Pressure Zone	Total Service Equivalent Population	2014 Average Day Demand (MLD)	2014 Maximum Day Demand (MLD)
127	8,186	3.5	5.5
144	9,320	4.7	7.3
154	10,725	2.7	4.2
161 & 180	5,747	0.9	1.4
164	166,379	33.3	51.6
168	4,772	3.5	5.5
200 & 220	16,703	3.3	5.1
227 & 257	28,892	8.4	13.0
Total	**250,724**	**60.3**	**93.6**

Pressure zone existing equivalent population estimates were derived using the Niagara 2041 MCR traffic survey zone population allocations and are calculated to the end of 2014. [5] Localised zones (161 & 180, 200 & 220, and 227 & 257) were consolidated because they do not contain Regional infrastructure.

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

B.2 Growth Projections

B.2.1 Population Projections and Allocations

Table 3.B.7 and Table 3.B.8 outline the existing and projected serviced population and employment by pressure zone.

Table 3.B.7 Decew Water Treatment Plant Existing and Projected Serviced Population by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
127	5,118	5,775	6,332	6,759	6,998	7,315	2,197
144	6,107	6,611	7,674	8,337	8,748	9,059	2,952
154	7,550	8,311	9,288	9,680	10,794	11,336	3,787
161 & 180	1,689	3,394	3,397	3,632	4,646	5,596	3,908
164	117,890	120,379	125,327	132,056	140,286	146,563	28,673
168	2,273	2,553	3,156	3,793	4,341	4,817	2,543
200 & 220	11,376	11,598	12,241	13,342	13,979	14,676	3,300
227 & 257	18,309	18,508	19,078	20,427	22,923	24,196	5,691
Total	**170,312**	**177,129**	**186,493**	**198,026**	**212,715**	**223,558**	**53,246**

Note: Population numbers may not sum due to rounding.

Table 3.B.8 Decew Water Treatment Plant Existing and Projected Serviced Employment by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
127	3,068	3,368	3,436	3,493	3,562	3,657	589
144	3,213	3,736	3,901	4,056	4,244	4,495	1,282
154	3,175	3,380	3,446	3,526	3,623	3,738	563
161 & 180	4,058	4,464	4,624	4,828	5,114	5,442	1,383
164	48,489	51,866	53,804	56,963	60,114	64,447	15,958
168	2,499	3,025	3,226	3,512	3,785	4,196	1,697
200 & 220	5,327	5,616	5,799	6,078	6,379	6,876	1,548
227 & 257	10,583	11,198	11,585	12,088	12,650	13,354	2,770
Total	**80,412**	**86,653**	**89,821**	**94,544**	**99,471**	**106,205**	**25,790**

Note: Population numbers may not sum due to rounding.

B.2.2 Future Demand Projections

Table 3.B.9 and Table 3.B.10 summarize the projected average and maximum system demands by pressure zone.

Table 3.B.9 Projected Water System Average Day Demands (ADD) by Pressure Zone

Pressure Zone	2021 ADD (MLD)	2026 ADD (MLD)	2031 ADD (MLD)	2036 ADD (MLD)	2041 ADD (MLD)
127	3.8	4.0	4.2	4.3	4.4
144	5.0	5.4	5.7	5.8	6.0
154	3.0	3.3	3.4	3.8	4.0
161 & 180	1.5	1.6	1.7	2.1	2.5
164	35.0	37.1	40.1	43.5	46.7
168	3.8	4.0	4.3	4.5	4.8
200 & 220	3.4	3.7	4.1	4.4	4.7
227 & 257	8.6	8.9	9.4	10.4	11.0
Total	**64.1**	**68.0**	**72.9**	**78.8**	**84.1**

Table 3.B.10 Projected Water System Maximum Day Demands (MDD) by Pressure Zone

Pressure Zone	2021 MDD (MLD)	2026 MDD (MLD)	2031 MDD (MLD)	2036 MDD (MLD)	2041 MDD (MLD)
127	5.9	6.2	6.5	6.6	6.8
144	7.8	8.4	8.8	9.0	9.3
154	4.6	5.1	5.3	5.9	6.2
161 & 180	2.4	2.4	2.7	3.3	3.9
164	54.3	57.5	62.1	67.4	72.3
168	5.9	6.2	6.7	7.0	7.4
200 & 220	5.4	5.7	6.4	6.8	7.3
227 & 257	13.4	13.8	14.7	16.1	17.0
Total	**99.7**	**105.3**	**113.2**	**122.1**	**130.2**

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

B.3.1 Treatment Plant Capacity

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

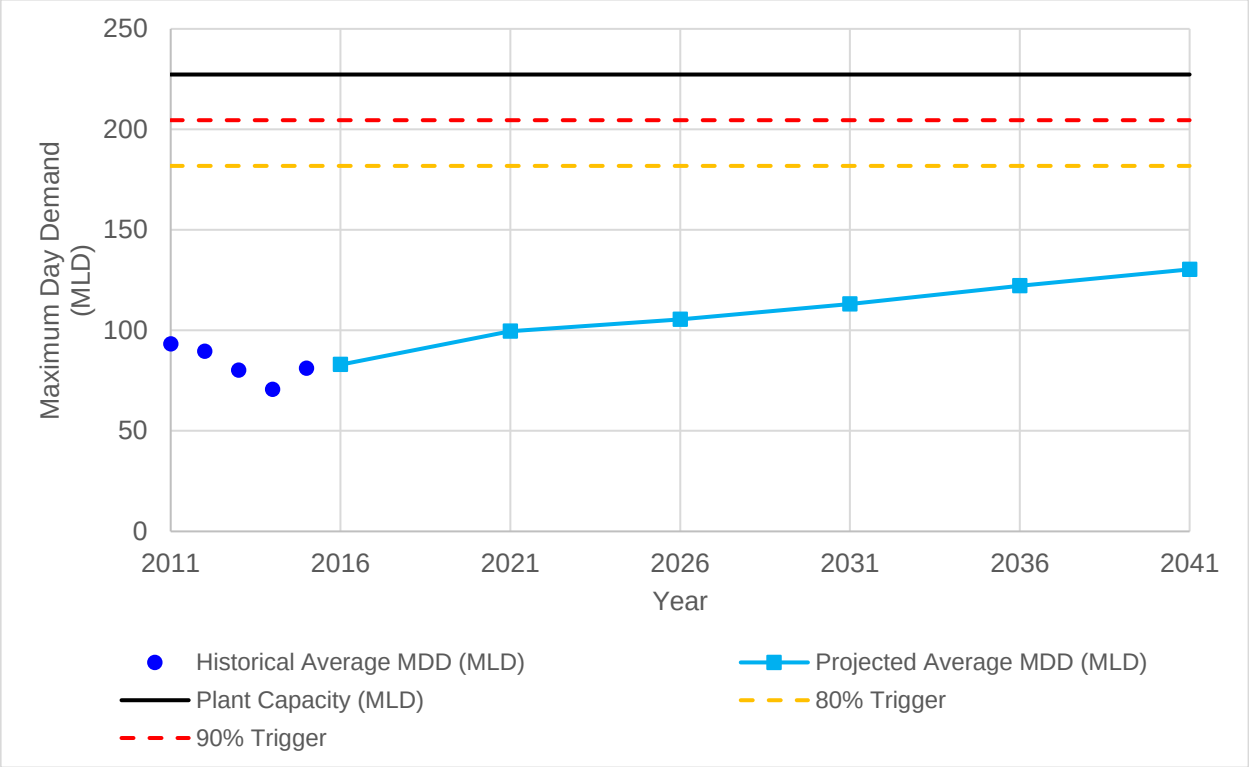


Figure 3.B.3 Projected Maximum Day Demand at Decew Water Treatment Plant

B.3.2 Pumping Capacity

Table 3.B.11 highlights the pumping station existing and projected capacity.

Table 3.B.11 System Pumping Station Performance

Pump Station	Pressure Zones Supplied	Total Effective Capacity (MLD)	Existing MDD (MLD)	2041 MDD (MLD)	2041 Surplus/ Deficit (MLD)
Decew Water Treatment Plant Gravity Feed*	127, 144, 154, 164, 200, 220	131.6	73.7	102.0	29.7
Decew Water Treatment Plant High Lift	161, 168, 180, 200, 220, 227, 257	106.0	25.0	35.7	70.3
Brock High Lift Booster Pumping Station					
Vineland Booster Pumping Station	154	13.3	4.2	6.2	7.1

*Capacity based on 2 m/s watermain velocity in the gravity feed.

The Decew system has surplus pumping capacity projected to 2041.

B.3.3 Storage Capacity

Table 3.B.12 highlights the storage existing and projected capacity.

Table 3.B.12 System Storage Capacities

Pressure Zones Supplied	Storage	Existing and 2041 Total Available Storage (ML)	Existing Required Storage (ML)	2041 Required Storage (ML)	2041 Surplus/ Deficit (ML)
164	Decew WTP Reservoir 1 Decew WTP Reservoir 2	56.6	26.3	32.8	23.8
200 & 220	Zone 2 Standpipe	4.4	6.0	8.0	-3.6
127, 144, & 168	St. David's Standpipe Virgil Elevated Tank	5.3	11.6	15.4	-10.1
154	Fifth Avenue Reservoir	8.5	4.0	5.7	2.8
161, 180, 227, & 257	Thorold South Elevated Tank	2.3	12.9	16.7	-14.4

When reviewed on individual zone-by-zone basis, portions of the Decew system to have storage deficiencies. However, when reviewed on a system basis, the system as whole has sufficient storage provided there is sufficient capacity to transfer surplus storage capacity to deficient zones.

Figure 3.B.4 through Figure 3.B.8 show the 5-day MDD storage performance of the existing infrastructure for existing and 2041 demands.

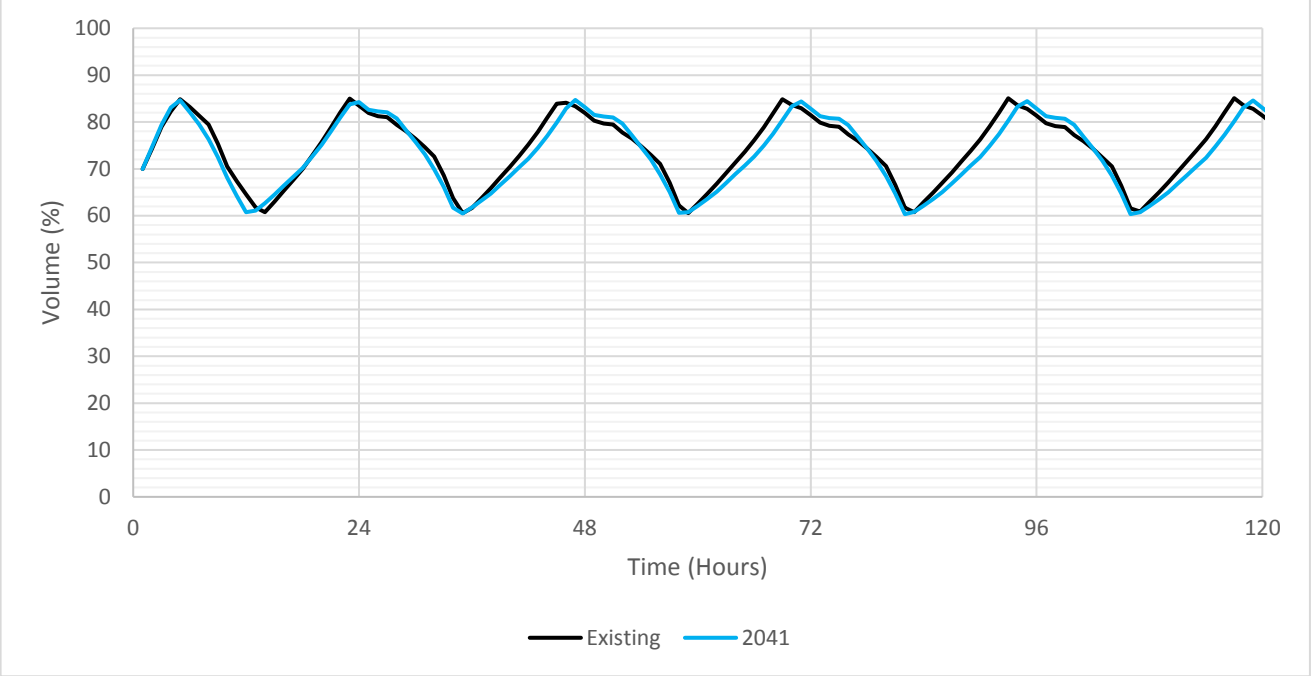


Figure 3.B.4 5-Day Maximum Day Demand Storage Performance – Fifth Avenue Reservoir

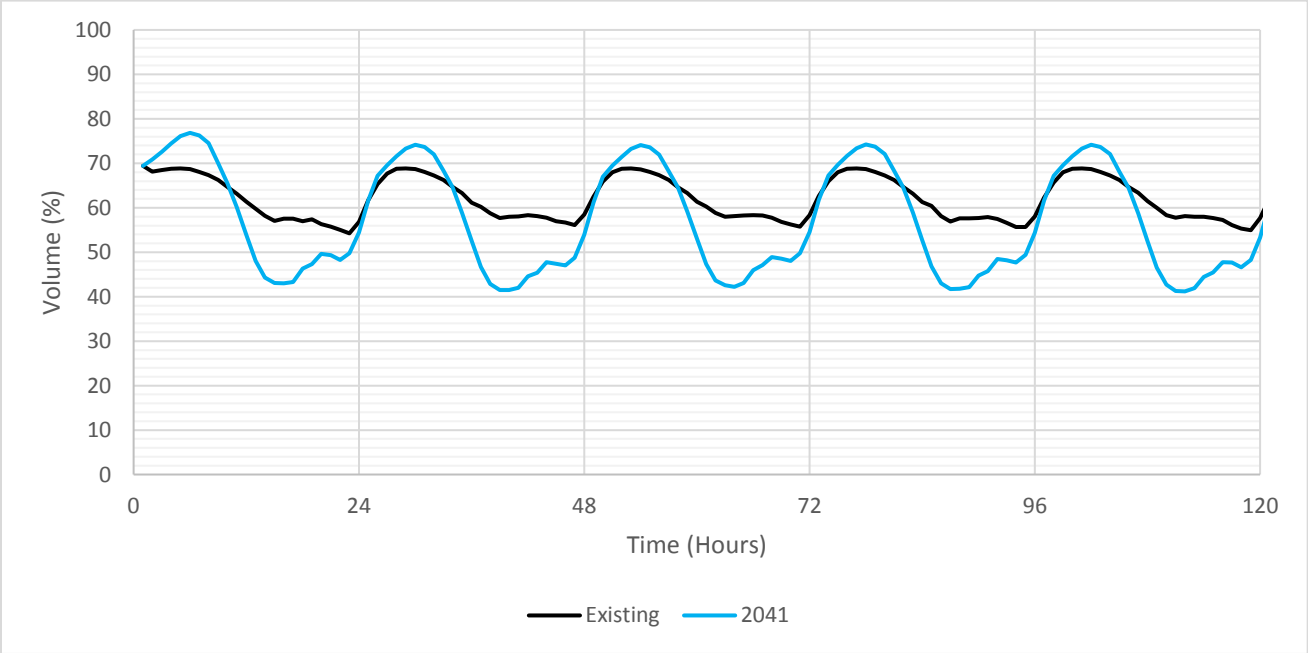


Figure 3.B.5 5-Day Maximum Day Demand Storage Performance – Virgil Elevated Tank

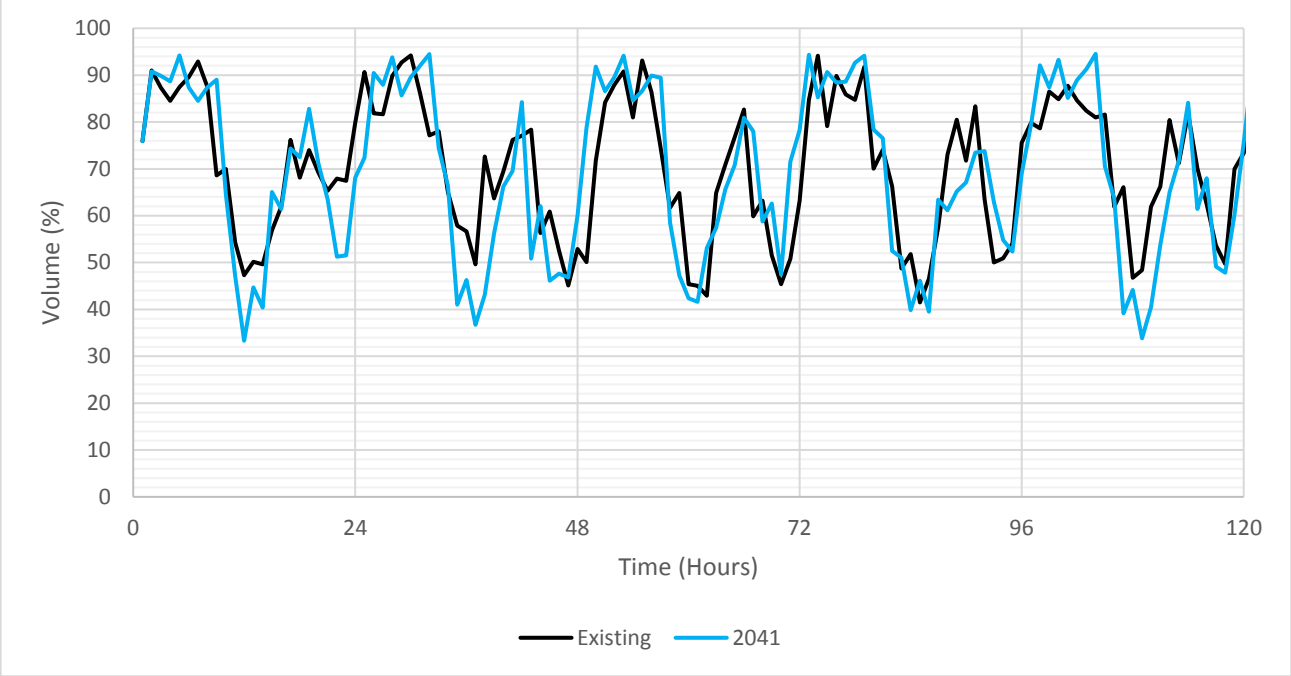


Figure 3.B.6 5-Day Maximum Day Demand Storage Performance – Thorold South Elevated Tank

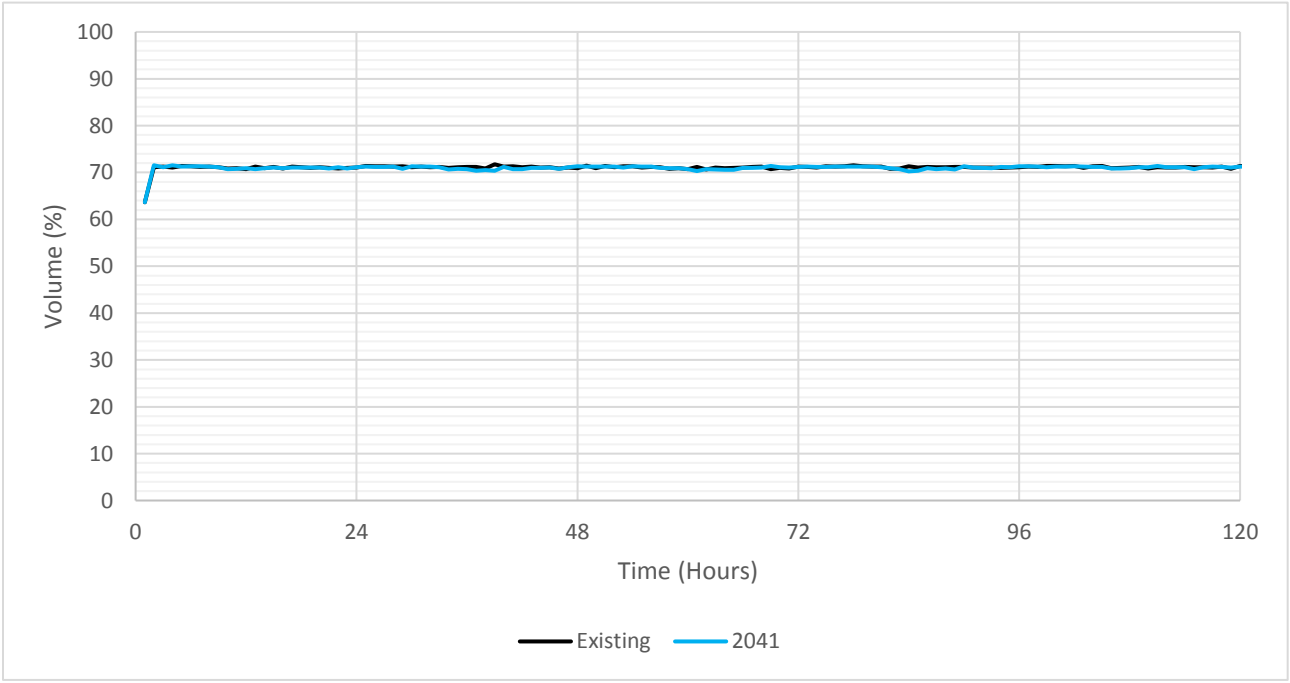


Figure 3.B.7 5-Day Maximum Day Demand Storage Performance – St. David's Standpipe

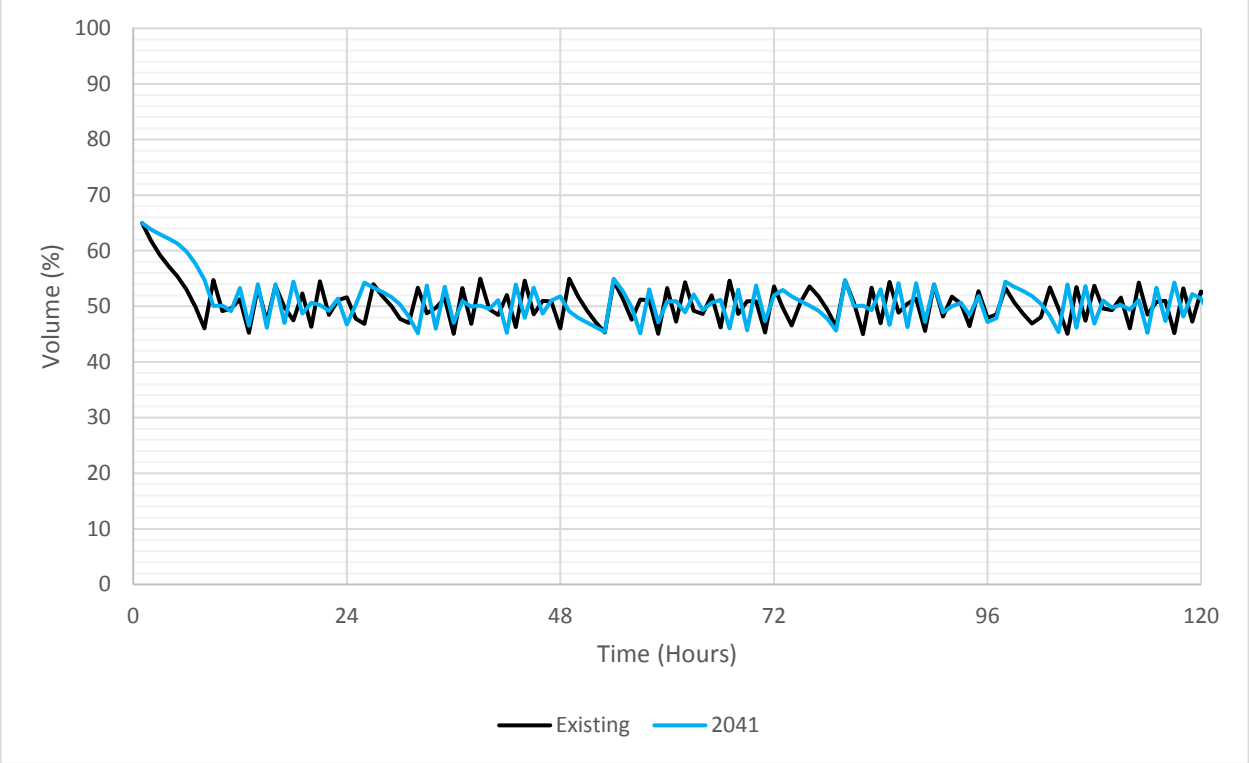


Figure 3.B.8 5-Day Maximum Day Demand Storage Performance – Zone 2 Elevated Tank

B.3.4 System Pressures and Fire Flows

Figure 3.B.9 to Figure 3.B.12 present the existing and projected 2041 system performance, based on existing system configuration and capacities.

Virgil Elevated Tank

Tremont Booster Pumping Station

Lake Ontario

United States of America

N

Vineland Booster Pumping Station

Brock Highlift Booster Pumping Station

Fifth Avenue Reservoir

DeCew Falls W.T.P.

DeCew Falls W.T.P. Pumping Station

DeCew Falls W.T.P. Reservoir 1 + 2

Town of Lincoln

Township of West Lincoln

Thorold South Elevated Tank

Allanburg Booster Pumping Station

Town of Pelham

City of Thorold

Township of West Lincoln

Town of Pelham

Pelham

Ridgeville

Fenwick

City of Thorold

City of Welland

Town of Niagara-on-the-Lake

City of Niagara Falls

Kent Avenue Booster Pumping Station

Kent Avenue Reservoir

Lundy's Lane Elevated Tank

Niagara Falls W.T.P.

Niagara Falls W.T.P. Pumping Station

Niagara Falls W.T.P. Reservoir

Niagara River

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127 161 180 227
144 164 200 250
154 168 220 257

Minimum Pressure (psi)

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

Figure 3.B.9

Existing Maximum Day Demand Pressure

Decew and Niagara Falls WTP

BluePlan Engineering

May 2017
715023-W-4-Existing Pressure (DCNF)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN

N

Virgil Elevated Tank

Tremont Booster Pumping Station

Lake Ontario

United States of America

Vineland Booster Pumping Station

Brock Highlift Booster Pumping Station

Fifth Avenue Reservoir

DeCew Falls W.T.P.

DeCew Falls W.T.P. Pumping Station

DeCew Falls W.T.P. Reservoir 1 + 2

Thorold South Elevated Tank

Allanburg Booster Pumping Station

Kent Avenue Booster Pumping Station

Kent Avenue Reservoir

Lundy's Lane Elevated Tank

Niagara Falls W.T.P.

Niagara Falls W.T.P. Pumping Station

Niagara Falls W.T.P. Reservoir

Niagara River

Town of Lincoln
Township of West Lincoln

Township of West Lincoln
Town of Pelham

Town of Pelham
City of Thorold

City of Thorold
City of Niagara Falls

City of Thorold
City of Welland

City of Welland
City of Niagara Falls

Town of Niagara-on-the-Lake
City of Niagara Falls

Pelham

Ridgeville

Fenwick

0 2 4 Kilometers

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

Figure 3.B.10

Existing System Fire Flow

Decew and Niagara Falls WTP

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

BluePlan Engineering

May 2017
715023-W-6-Existing Fire Flow (DCNF)
NAD 1983 UTM Zone 17N

Virgil Elevated Tank

Tremont Booster Pumping Station

Lake Ontario

United States of America

N

Vineland Booster Pumping Station

Brock Highlift Booster Pumping Station

Fifth Avenue Reservoir

DeCew Falls W.T.P.

DeCew Falls W.T.P. Pumping Station

DeCew Falls W.T.P. Reservoir 1 + 2

Town of Lincoln

Township of West Lincoln

Thorold South Elevated Tank

Allanburg Booster Pumping Station

Kent Avenue Booster Pumping Station

Kent Avenue Reservoir

Lundy's Lane Elevated Tank

Niagara Falls W.T.P.

Niagara Falls W.T.P. Pumping Station

Niagara Falls W.T.P. Reservoir

Niagara River

Town of Niagara-on-the-Lake

City of Niagara Falls

Town of Pelham

City of Thorold

Township of West Lincoln

Pelham

Ridgeville

Fenwick

City of Welland

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127 161 180 227
144 164 200 250
154 168 220 257

Minimum Pressure (psi)

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

Figure 3.B.11

2041 Maximum Day Demand Pressure

Decew and Niagara Falls WTP

BluePlan Engineering

May 2017
715023-W-5-2041 Pressure (DCNF)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN

N

Virgil Elevated Tank

Tremont Booster Pumping Station

Vineland Booster Pumping Station

Brock Highlift Booster Pumping Station

Fifth Avenue Reservoir

DeCew Falls W.T.P.

DeCew Falls W.T.P. Pumping Station

DeCew Falls W.T.P. Reservoir 1 + 2

Thorold South Elevated Tank

Allanburg Booster Pumping Station

Kent Avenue Booster Pumping Station

Kent Avenue Reservoir

Lundy's Lane Elevated Tank

Niagara Falls W.T.P.

Niagara Falls W.T.P. Pumping Station

Niagara Falls W.T.P. Reservoir

Lake Ontario

United States of America

Niagara River

Town of Lincoln

Township of West Lincoln

Town of Pelham

City of Thorold

City of Niagara Falls

Town of Niagara-on-the-Lake

City of Welland

Pelham

Ridgeville

Fenwick

0 2 4 Kilometers

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

Figure 3.B.12

2041 System Fire Flow

Decew and Niagara Falls WTP

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

BluePlan Engineering

May 2017
715023-W-7-2041 Fire Flow (DCNF)
NAD 1983 UTM Zone 17N

B.3.5 Water Age and Watermain Capacity

Figure 3.B.13 highlights the sampled chlorine residual (mg/L) versus the modelled water system age at each sample location.

The 90th percentile trend line represents the chlorine residual achieved by the bottom 10% of samples at a location, meaning that 90% of the samples taken at that location were above the 90th percentile trend line. Similarly, the 99th percentile trend line represents the chlorine residual achieved by the bottom 1% of samples at a location, meaning that 99% of the samples taken at that location were above the 99th percentile trend line. It is assumed that <10 days is required to maintain the 0.25 mg/L chlorine residual objective.

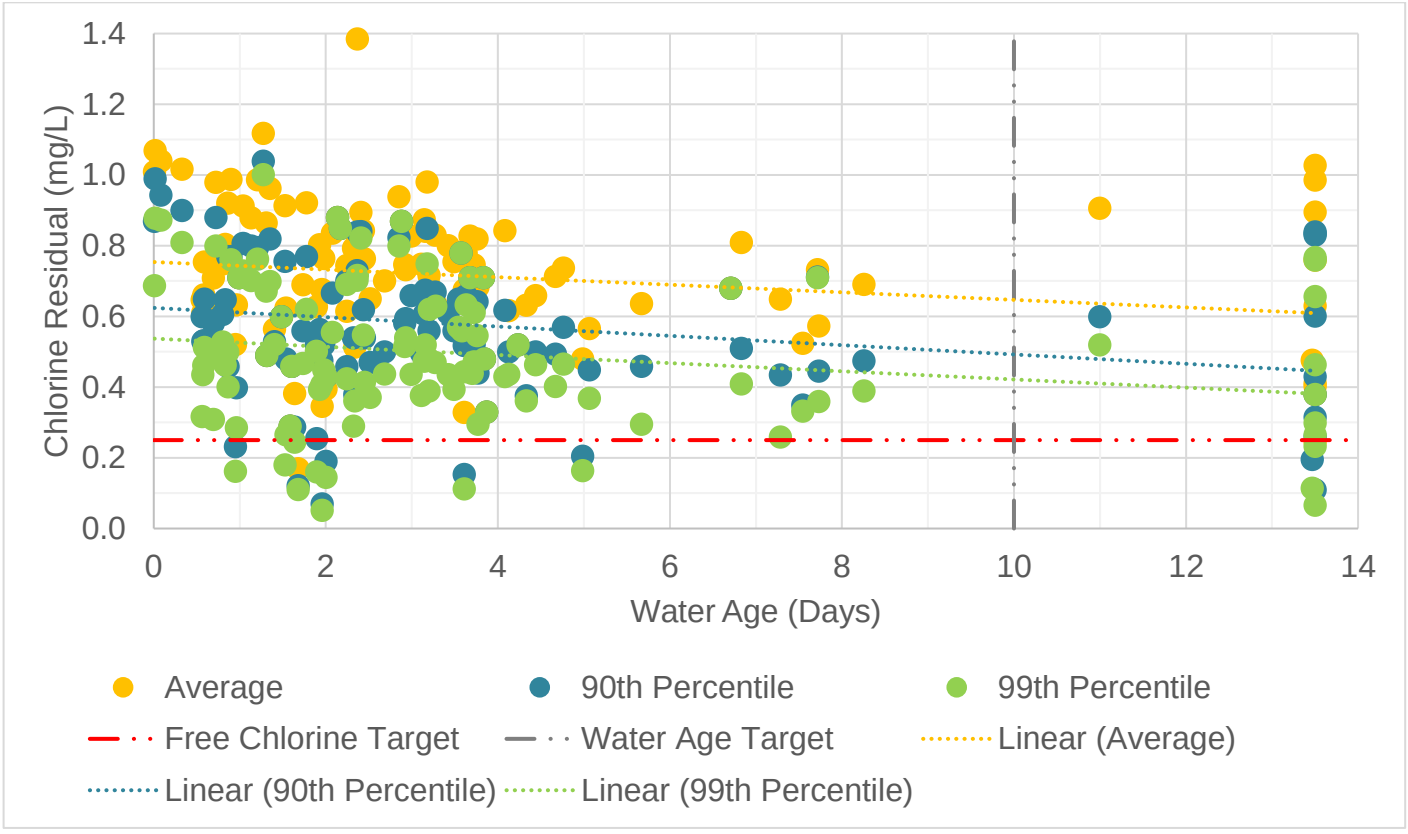
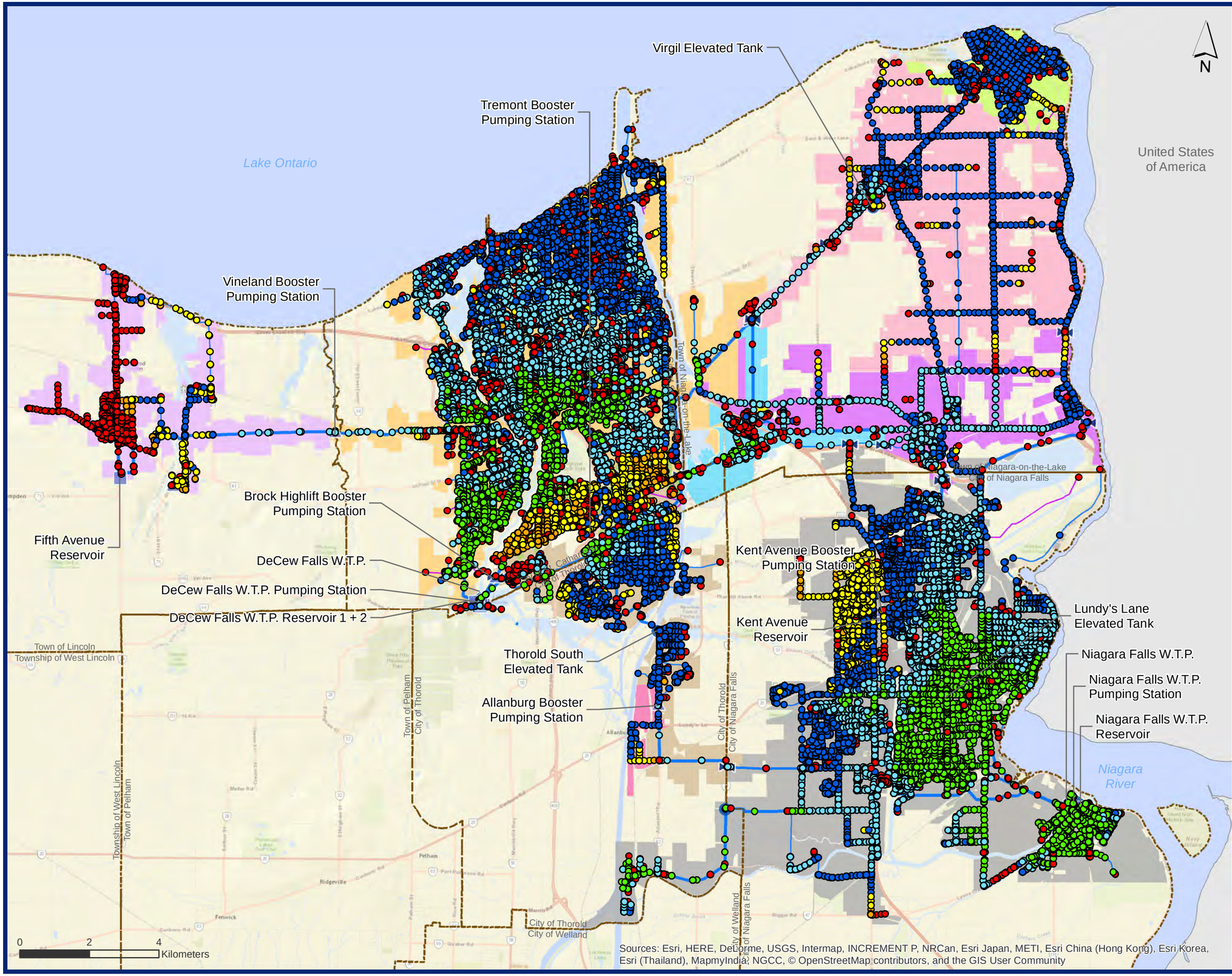


Figure 3.B.13 Existing Chlorine Residual vs Water System Age

Figure 3.B.14 shows the modelled water age throughout the system. Figure 3.B.15 shows the existing watermain capacity in the system as maximum head loss (m/km).

Niagara Region

2016 MASTER SERVICING PLAN



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Water Age (Days)

< 1	4 - 6
1 - 2	6 - 8
2 - 4	< 8

Figure 3.B.14

Water Age

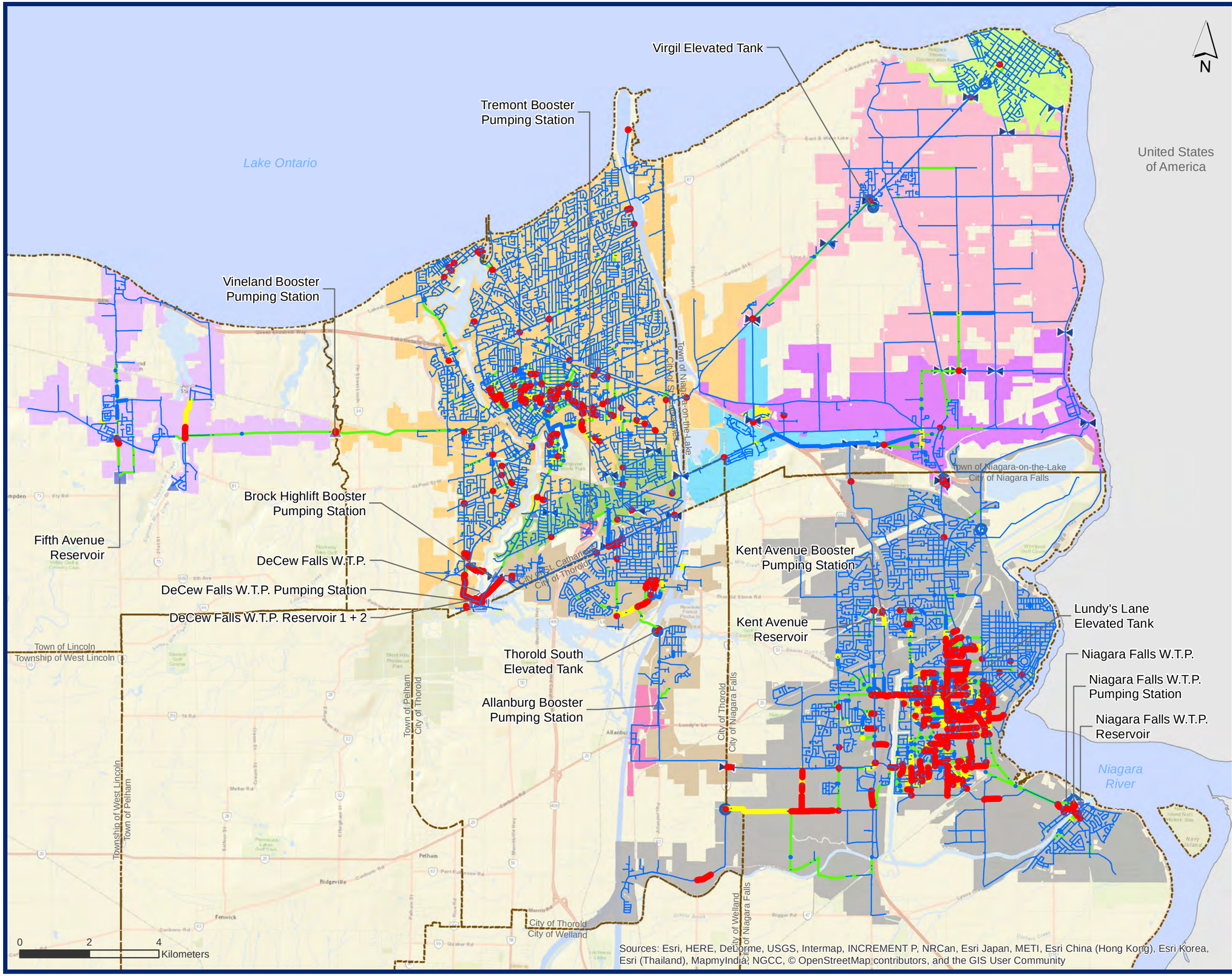
DeCew and Niagara Falls WTP

BluePlan Engineering

May 2017
715023-W-8-Water Age (DCNF)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Watermain Headloss (m/km)

- < 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4

Figure 3.B.15

Watermain Capacity

DeCew Falls WTP

BluePlan Engineering

May 2017
715023-W-9-Watermain Capacity (DCNF)
NAD 1983 UTM Zone 17N

B.4 System Opportunities and Constraints

Figure 3.B.16 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 93.6 MLD. The projected 2041 MDD is 130.2 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 2041.

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 70.3 MLD for 2041.
- Increased intensification throughout St. Catharines increases transmission system; limiting available capacity to supplement peak flow transfers to the Niagara-on-the-Lake system.

B.4.3 Lincoln System

- There is sufficient conveyance, pumping, and storage capacity to support 2041 growth.

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.

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.

- New storage within Niagara-on-the-Lake and/or increase conveyance from St. Catharines and Thorold, and/or Niagara Falls is needed to address 2041 storage needs.

B.4.6 System Security of Supply & Interconnections

- There is a single trunk supply to the Vineland system.
- There is a single trunk connection crossing the Welland Canal supporting 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 trunk main 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

2016 MASTER SERVICING PLAN

Lake Ontario

United States of America

Tremont Booster Pumping Station

Intensification in St. Catharines limits trunk conveyance capacity to Niagara-on-the-Lake.

Trunk main has limited surplus capactiy conveyance to support storage deficits in Niagara-on-the-Lake.

Insufficient storage capacity in Niagara-on-the-Lake.

High headloss in local distribution system.

Virgil Elevated Tank

No Regional trunk main from Niagara Falls to Niagara-on-the-Lake.

Lincoln has sufficient pumping and storage capacity to support growth.

Vineland Booster Pumping Station

Single trunk main to Vineland.

Fifth Avenue Reservoir

Brock Highlift Booster Pumping Station

Storage deficits in Thorold and St. Catharines.

Kent Avenue Booster Pumping Station

Kent Avenue Reservoir

DeCew Falls W.T.P.

Surplus capacity at DeCew Water Treatment Plant.

DeCew Falls W.T.P. Pumping Station

DeCew Falls W.T.P. Reservoir 1 + 2

Thorold South Elevated Tank

Allanburg Booster Pumping Station

Surplus capacity at DeCew High Lift Pumps and Niagara Falls water system to support Thorold.

Niagara Falls W.T.P.

Niagara Falls W.T.P. Pumping Station

Niagara Falls W.T.P. Reservoir

Lundy's Lane Elevated Tank

Surplus capacity at Niagara Falls Water Treatment Plant to support increased transfer to DeCew System.

Niagara River

Town of Niagara-on-the-Lake

City of St. Catharines

City of Thorold

City of Niagara Falls

Town of Lincoln

Township of West Lincoln

Town of Pelham

City of Welland

Ridgeville

Fenwick

Pelham

N

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Figure 3.B.16

System Opportunities and Constraints

DeCew WTP

BluePlan Engineering

May 2017

715023-W-3-Opportunities and Constraints (DeCew)

NAD 1983 UTM Zone 17N

B.5 Assessment of Alternatives

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

- Baseline (No Changes)
- Increase Conveyance to Niagara-on-the-Lake
- New Elevated Tank in Niagara-on-the-Lake

The alternative of providing supplemental trunk mains to South Thorold (Zone 227 and Zone 257 east of the Welland Canal) was considered, but not carried forward due to:

- The high cost,
- The existing secondary trunk connection (Niagara Falls Interconnection), and
- Existing operating procedures already in place to address temporary outage of the Welland Canal crossing and/or Thorold Elevated Tank.

Both alternatives include:

- Upgrades to Decew inlet channel from the Welland Canal to the Decew Water Treatment Plant to provide capacity above the current 147 MLD. This project will be coordinated in partnership with OPG Corporation.
- Continued use of surplus pumping capacity at the Decew Water Treatment Plant High Lift and the Brock High Lift to support identified storage deficits within Thorold Zone 200 and Zone 220, and Zone 227 and Zone 257.

B.5.1 Alternative 1 – Increase Conveyance to Niagara-on-the-Lake

Alternative 1, highlighted in Figure 3.B.17, generally maintains the existing infrastructure, with an additional trunk main from Niagara Falls to Niagara-on-the-Lake. This alternative would provide additional capacity and security of supply to Niagara-on-the-Lake to support growth.

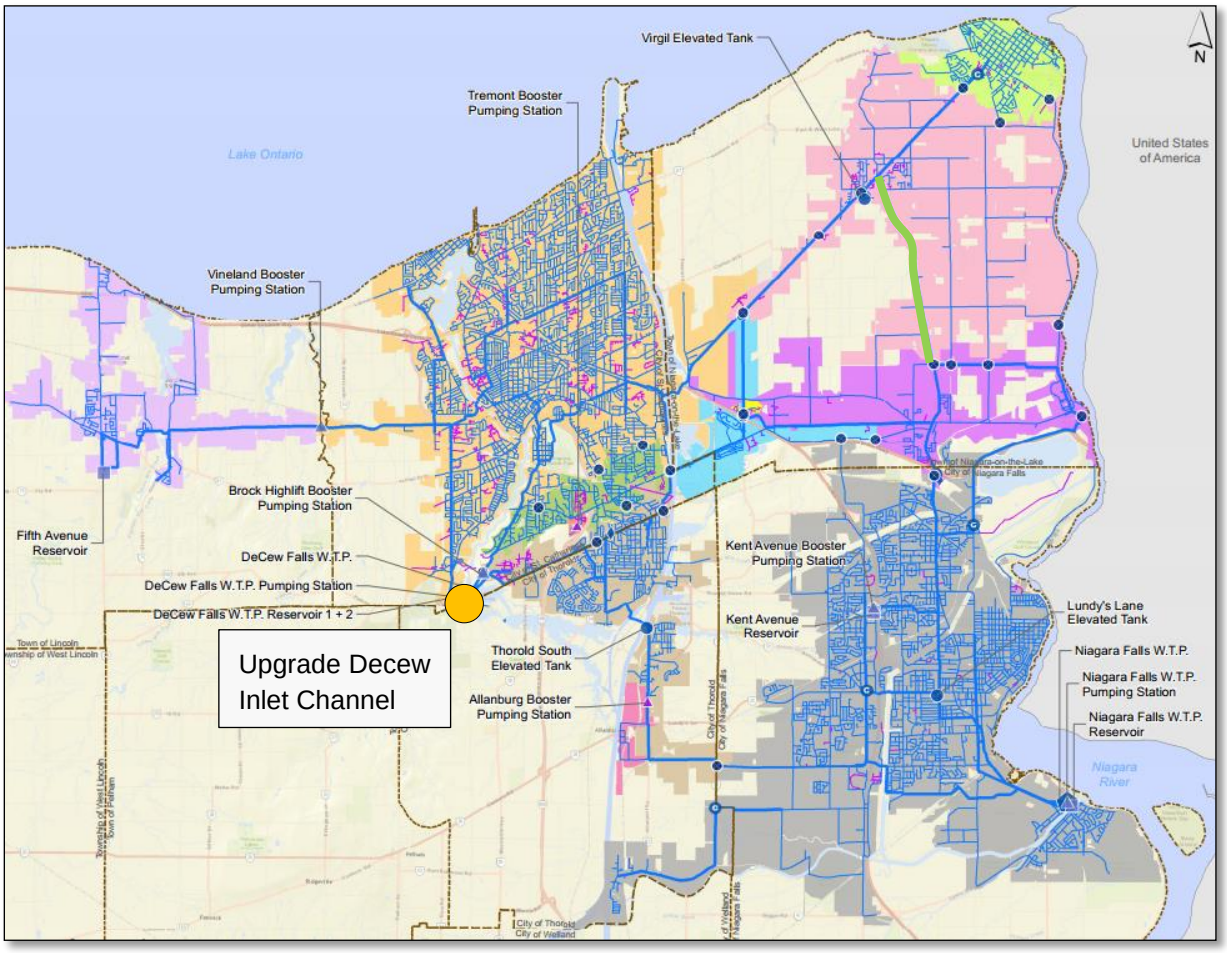


Figure 3.B.17 Alternative 1 – Increase Conveyance to Niagara-on-the-Lake

B.5.2 Alternative 2 – New Elevated Tank in Niagara-on-the-Lake

Alternative 2, highlighted in Figure 3.B.18, generally maintains the existing infrastructure, with the addition of a new elevated tank in Niagara-on-the-Lake. A new elevated tank would provide floating storage for Niagara-on-the-Lake to support growth. Under this configuration, the existing network would be maintained, with no new Regional trunk main between Niagara Falls and Niagara-on-the-Lake.

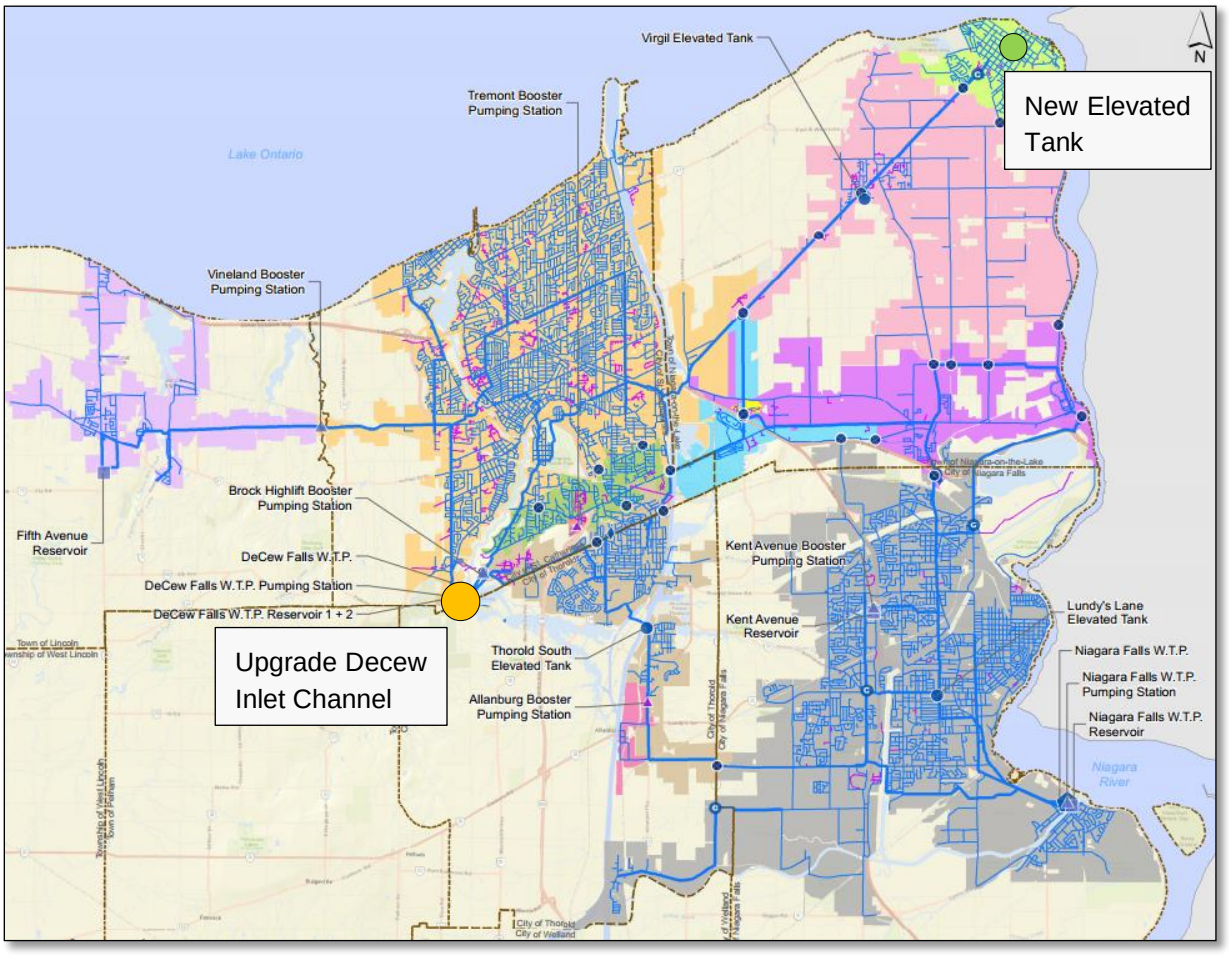


Figure 3.B.18 Alternative 2 – New Elevated Tank in Niagara-on-the-Lake

B.5.3 Alternatives Evaluation

Alternative 1 – Increase Conveyance to Niagara-on-the-Lake is the preferred servicing strategy as:

- Baseline strategy does not satisfy future servicing needs of the water system.
- Alternative 1 – Increase Conveyance to Niagara-on-the-Lake provides the following advantages in addressing the 2041 growth needs:
    - Provides additional security of supply to the Niagara-on-the-Lake system, and provides additional operational flexibility in the operation of the Decew Water Treatment Plant and Niagara Falls Water Treatment Plant.
    - Maximizes use of existing storage and supply surpluses within the Decew and Niagara Falls system.

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 2041.
- The inlet channel for the Decew Water Treatment Plant will have upgrades. This project is a shared project with Ontario Power Generation (OPG).
- Additional feedermain capacity is required in Niagara-on-the-Lake to support water supply to the growth areas.

Figure 3.B.19 and Figure 3.B.20 show the preferred servicing strategy, consisting of:

B.6.1 Treatment Plant

- Upgrades to Decew inlet channel from the Welland Canal to the Decew Water Treatment Plant to provide capacity above the current 147 MLD.

B.6.2 Trunk Watermain

- New 600 mm trunk main from Niagara Falls to Niagara-on-the-Lake.

B.6.3 Project Implementation and Considerations

Special project implementation and considerations for the preferred servicing strategy consist of:

- Upgrades to Decew inlet channel from the Welland Canal to the Decew Water Treatment Plant will be coordinated in partnership with OPG.
- New Niagara Falls to Niagara-on-the-Lake trunk main will triggered by growth needs.

B.7 Capital Program

Table 3.B.13 summarizes the recommended project costing, implementation schedule and Class EA requirements.

B.7.1 Schedule B Project Files

Project W-F-002 (Decew Inlet Channel) Environmental Assessment requirements to be satisfied by the Region.

Niagara Region

2016 MASTER SERVICING PLAN

MSP Water Projects

- Treatment Plant
- Reservoir
- Pumping Station
- Elevated Tank
- Watermain Projects

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station
- Regional
- Municipal

Water Network
- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Figure 3.B.19

Preferred Water Strategy

DeCew and Niagara Falls WTP

BluePlan Engineering Inc

May 2017
715023-W-Capital Projects (DCNF)
NAD 1983 UTM Zone 17N

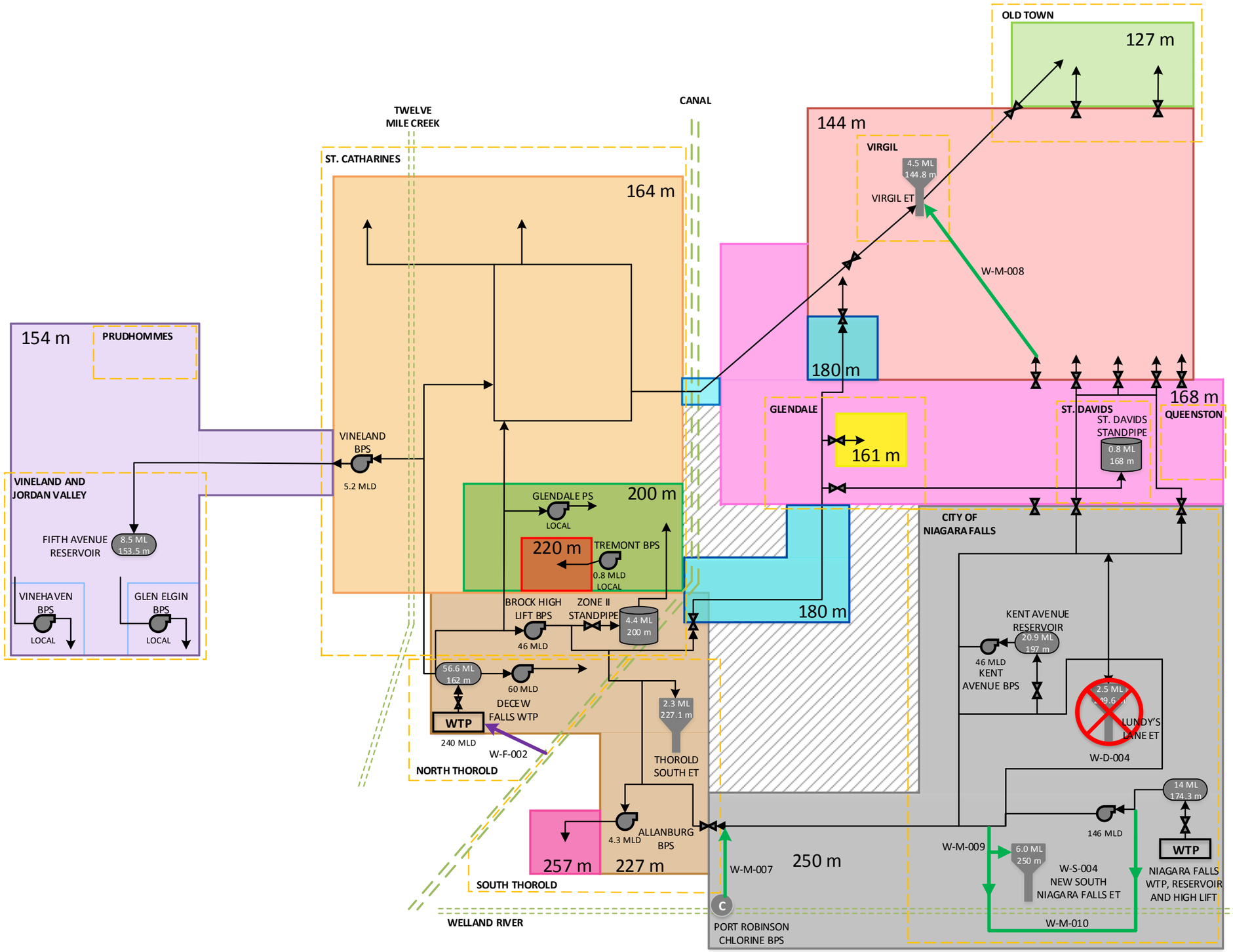
Virgil Elevated Tank
Tremont Booster Pumping Station
Lake Ontario
United States of America
Vineland Booster Pumping Station
W-M-008
Town of Niagara-on-the-Lake
City of St. Catharines
City of Niagara Falls
Brock Highlift Booster Pumping Station
Fifth Avenue Reservoir
DeCew Falls W.T.P.
DeCew Falls W.T.P. Pumping Station
DeCew Falls W.T.P. Reservoir 1 + 2
City of St. Catharines
City of Thorold
Kent Avenue Booster Pumping Station
Kent Avenue Reservoir
Niagara Falls W.T.P.
Lundy's Lane Elevated Tank
Niagara Falls W.T.P. Pumping Station
Niagara Falls W.T.P. Reservoir
W-D-004
W-F-002
Town of Lincoln
Township of West Lincoln
Thorold South Elevated Tank
Allanburg Booster Pumping Station
W-M-009
W-M-007
W-S-004
W-M-010
Niagara River
Township of West Lincoln
Town of Pelham
City of Thorold
City of Welland
0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

2016 Master Servicing Plan

Niagara Falls WTP and Decew WTP

2041 DISTRIBUTION SCHEMATIC



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

Facility Upgrade

Volume TWL — Standpipe

Trunk Watermain Network

Settlement Area Boundaries

Land and Water Features

New Watermain

Upgrade Watermain

Decommission Project

New Facility

Pressure Zone

127 m	180 m
144 m	200 m
154 m	220 m
161 m	227 m
164 m	250 m
168 m	257 m

May 2017
Figure 3.B.20
Not to Scale

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-F-002	Decew inlet channel	New intake channel from Welland Canal to the Decew Water Treatment Plant. This will provide capacity above the current 147 MLD. Recommended in 2011 MSP	256 MLD	2017 - 2021	St. Catharines	B	Region to Satisfy EA Requirements	Treatment	$ 22,969,000
W-M-008	Trunk main from South Niagara-on-the-Lake to Virgil Elevated Tank	Trunk main from South Niagara-on-the-Lake to Virgil Elevated Tank with PRV in Niagara-on-the-Lake to supply Decew system from Niagara Falls system	600 mm	2032 - 2041	Niagara-on-the-Lake	A+	Satisfied	Watermain	$ 13,535,000
Total									**$36,504,000**

PART C
NIAGARA FALLS WATER SYSTEM

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 City of Thorold, and Niagara-on-the-Lake. The system services an existing population of 86,274 and 43,604 employees within the Niagara Falls urban area boundary.[1]

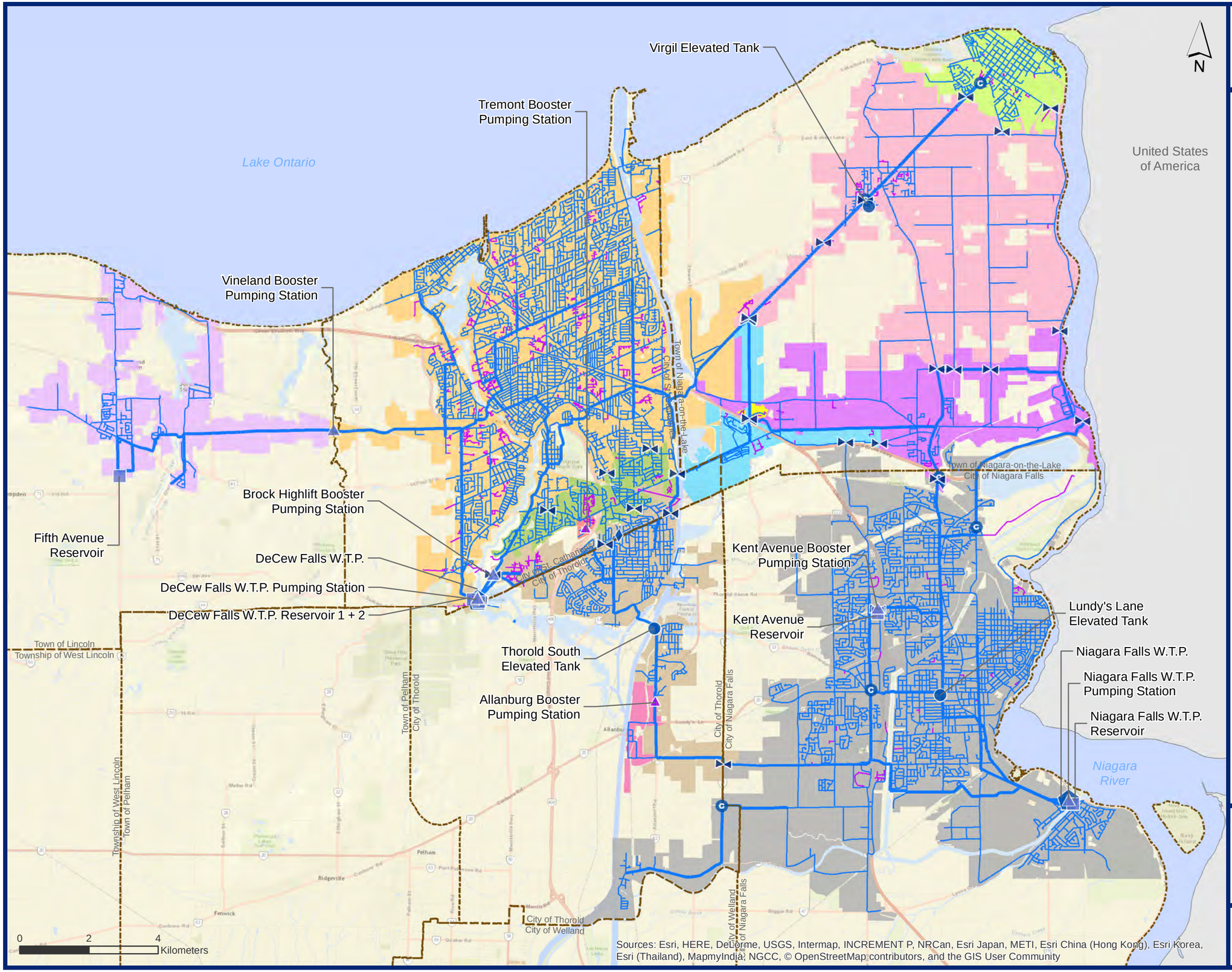
The system is supplied by the Niagara Falls Water Treatment Plant, located on 3599 Macklem Street, Niagara Falls. The plant is a conventional surface water treatment plant with zebra mussel control, traveling screens, coagulation, flocculation, sedimentation, filtration, and disinfection. The Niagara River serves as a source to the plant. The plant has a rated capacity of 145.5 MLD (1,684 L/s).[2]

The system supplies local area municipalities via a water main network, pumping stations, and service 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.

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

[2] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-202*



Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Figure 3.C.1

Existing Water System

DeCew Falls WTP

BluePlan Engineering

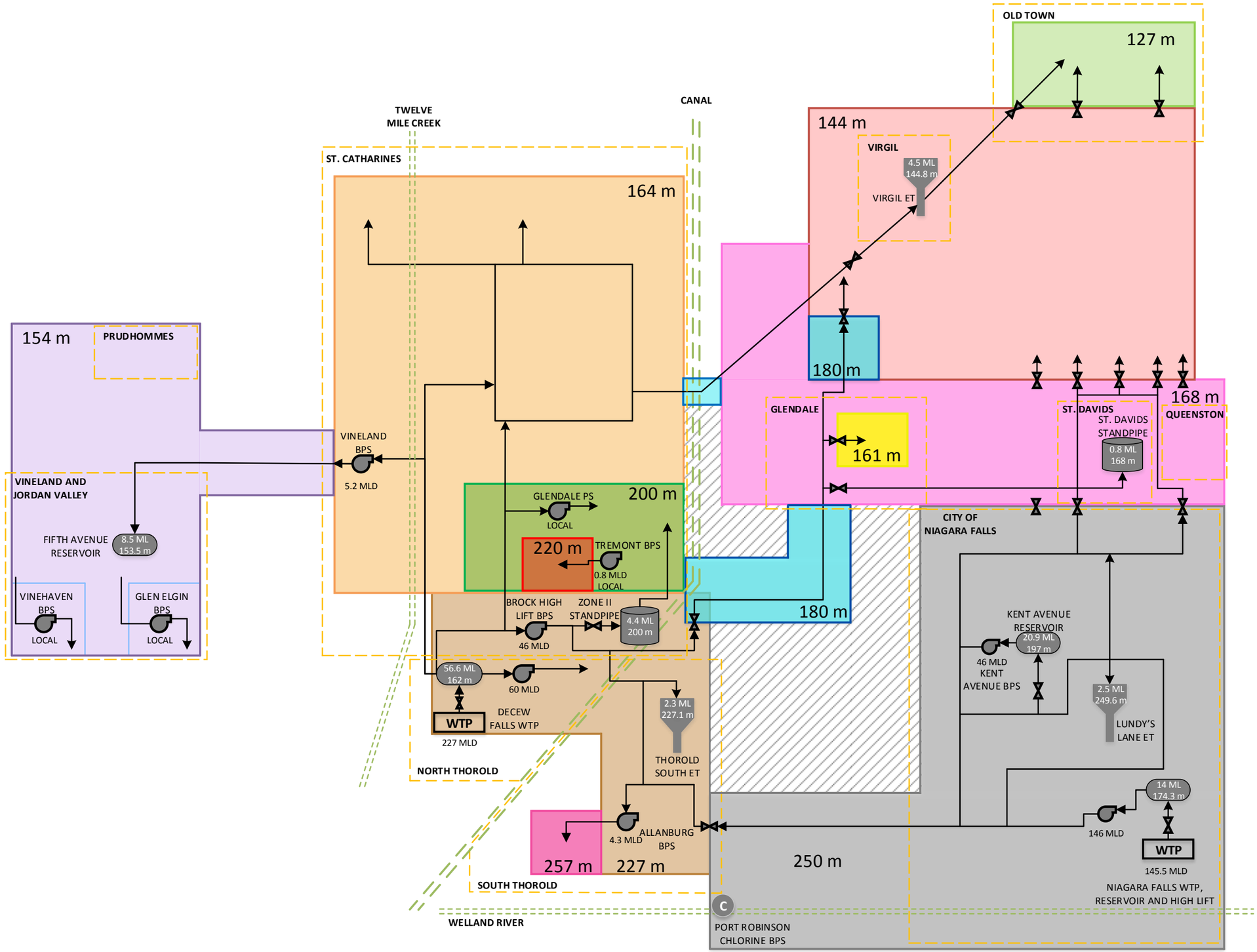
May 2017
715023-W-2-Existing Water System (DCNF)
NAD 1983 UTM Zone 17N

Niagara Region

2016 Master Servicing Plan

Niagara Falls WTP and Decew WTP

EXISTING DISTRIBUTION SCHEMATIC



- WTP (RATED CAPACITY) — Water Treatment Plant
- Pumping Station (FIRM CAPACITY)
- 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	180 m
144 m	200 m
154 m	220 m
161 m	227 m
164 m	250 m
168 m	257 m

May 2017
Figure 3.B.2
Not to Scale

BluePlan ENGINEERING

C.1.1 Facility Overview

Table 3.C.1 Water Treatment Plant Overview

Plant Name	Niagara Falls Water Treatment Plant[3]
Address	3599 Macklem Street, Niagara Falls
Source Water	Niagara River via Welland River
Rated Maximum Day Demand Capacity	145.5 MLD
Key Processes	• Zebra mussel control • Travelling Screens • Coagulation • Flocculation • Sedimentation • Filtration • Disinfection

Table 3.C.2 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone)	Discharge (Pressure Zone)	Pressure Zones Supplied	Number of Pumps (Total/ Firm)	Firm Capacity (MLD)	Total Dynamic Head (m)
Niagara Falls Water Treatment Plant (WTP) High Lift Pumps	3599 Macklem Street, Niagara Falls	WTP	250	168 (Niagara-on-the-Lake) 227 (Thorold), 250	5/4	146.0	83.2
Kent Avenue Booster Pumping Station	4281 Kent Avenue, Niagara Falls	250 (via Kent Avenue Reservoir)	250	168 (Niagara-on-the-Lake) 227 (Thorold), 250	3/2	46.0	57.9

[3] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-202*

Table 3.C.3 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	3599 Macklem Street, Niagara Falls	Pumped Reservoir	14.0	174.3	250	250
Kent Avenue Reservoir	4281 Kent Avenue, Niagara Falls	Pumped Reservoir	20.9	196.9	250	168, 227, & 250
Lundy's Lane Elevated Tank	6280 Lundy's Lane, Niagara Falls	Elevated Tank	2.5	249.6	250	168, 227, & 250

Refer to Figure 3.C.1 for pumping station and storage facility locations.

C.1.2 Demands Overview

Table 3.C.4 Historic Water System Demands

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***	***1.54***
5 Year Peak	***53.1***	***85.5***	***1.61***

Table 3.C.5 Water System Max Day Peaking Factor

Existing Service Population	86,274
Existing Service Employment	43,604
Total Service Equivalent Population	**129,878**
MOECC Peaking Factor[4]	1.65
Historic 5 Year Average Peaking Factor	1.54
Historic 5 Year Max Peaking Factor	1.61
2016 MSP Peaking Factor	**1.54**

The 2016 MSP peaking factor is the average of the peaking factors from 2011 to 2015.

Table 3.C.6 Water System Demands by Pressure Zone*

Pressure Zone	Total Service Equivalent Population[5]	2014 Average Day Demand (MLD)	2014 Maximum Day Demand (MLD)
250	129,878	41.7	64.2
Decew 168	4,772	3.5	5.5
Decew 227 & Decew 257	28,892	8.4	13.0
Total	**163,542**	**53.6**	**82.7**

Pressure zone existing equivalent population estimates were derived using the Niagara 2041 MCR traffic survey zone population allocations and are calculated to the end of 2014.[6]

[4] *Ministry of the Environment and Climate Change, 2008, Design Guidelines for Drinking-Water Systems, ISBN 978-1-4249-8517-3*
[5] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*
[6] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*

C.2 Growth Projections

C.2.1 Population Projections and Allocations

Table 3.C.7 and Table 3.C.8 outline the existing and projected serviced population and employment by pressure zone.

Table 3.C.7 Niagara Falls Water Treatment Plant Existing and Projected Serviced Population by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
250	86,274	91,772	98,397	106,511	114,902	121,624	35,350
Decew 168	2,273	2,553	3,156	3,793	4,341	4,817	2,543
Decew 227 & Decew 257	18,309	18,508	19,078	20,427	22,923	24,196	5,886
Total	**106,856**	**112,833**	**120,631**	**130,731**	**142,166**	**150,637**	**43,779**

Note: Population numbers may not sum due to rounding.

Table 3.C.8 Niagara Falls Water Treatment Plant Existing and Projected Serviced Employment by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
250	43,604	47,554	49,285	51,636	54,010	57,191	13,587
Decew 168	2,499	3,025	3,226	3,512	3,785	4,196	1,697
Decew 227 & Decew 257	10,583	11,198	11,585	12,088	12,650	13,354	2,770
Total	**56,686**	**61,777**	**64,096**	**67,236**	**70,445**	**74,741**	**18,054**

Note: Population numbers may not sum due to rounding.

C.2.2 Future Demand Projections

Table 3.C.9 and Table 3.C.10 summarize the projected average and maximum system demands by pressure zone.

Table 3.C.9 Projected Water System Average Demands by Pressure Zone

Pressure Zone	2021 ADD (MLD)	2026 ADD (MLD)	2031 ADD (MLD)	2036 ADD (MLD)	2041 ADD (MLD)
250	44.5	47.0	50.2	53.4	56.4
Decew 168	3.8	4.0	4.3	4.5	4.8
Decew 227 & Decew 257	8.6	8.9	9.5	10.4	11.0
Total	**56.9**	**59.9**	**64**	**68.3**	**72.2**

Table 3.C.10 Projected Water System Maximum Demands by Pressure Zone

Pressure Zone	2021 MDD (MLD)	2026 MDD (MLD)	2031 MDD (MLD)	2036 MDD (MLD)	2041 MDD (MLD)
250	68.6	72.4	77.3	82.3	86.8
Decew 168	5.9	6.2	6.7	7.0	7.4
Decew 227 & Decew 257	13.4	13.8	14.7	16.1	17.0
Total	**87.9**	**92.4**	**98.7**	**105.4**	**111.2**

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

C.3.1 Treatment Plant Capacity

Figure 3.C.3 shows the projected future demands at the Niagara Falls Water Treatment Plant. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.

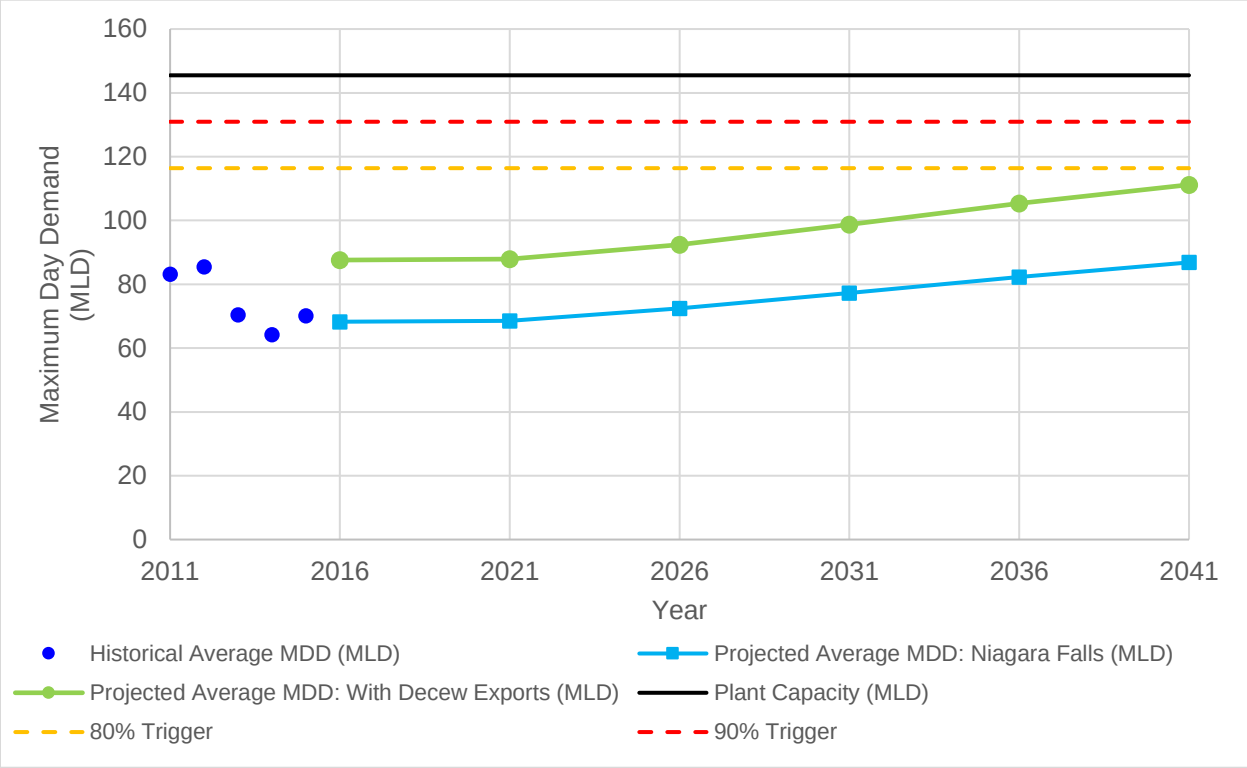


Figure 3.C.3 Projected Maximum Day Demand at Niagara Falls Water Treatment Plant

C.3.2 Pumping Capacity

Table 3.C.11 highlights the pumping station existing and projected capacity.

Table 3.C.11 System Pumping Station Performance

Pump Station	Pressure Zones Supplied	Total Effective Capacity (MLD)	Existing Maximum Day Demand (MLD)	2041 Maximum Day Demand (MLD)	2041 Surplus/ Deficit (MLD)
Niagara Falls Water Treatment Plant/ High Lift Pumping Station	168, 227, 257 & 250	146.0	82.7	111.3	34.7
Kent Avenue Booster Pumping Station					

The Kent Avenue Booster Pumping Station capacity is not included in the total effective capacity for the zone. The Booster Pumping Station capacity is considered for zone fire flow and peak hour capacities.

The Niagara Falls system has a surplus max day pumping capacity projected to 2041.

C.3.3 Storage Capacity

Table 3.C.12 highlight the storage existing and projected capacity.

Table 3.C.12 System Storage Capacities

Pressure Zones Supplied	Storage	Existing and 2041 Total Available Storage (ML)	Existing Required Storage (ML)	2041 Required Storage (ML)	2041 Surplus /Deficit (ML)
250	Niagara Falls Water Treatment Plant (WTP) Reservoir	37.4	30.3	37.3	0.1
	Kent Avenue Reservoir				
	Lundy's Lane Elevated Tank				
250 Decew 168	Niagara Falls WTP Reservoir	37.4	33.2	42.1	-4.7
	Kent Avenue Reservoir				
	Lundy's Lane Elevated Tank				

The Niagara Falls system has a storage surplus of 0.1 ML projected for 2041 when considering the Niagara Falls storage requirements alone. When considering the recommended strategy for the Decew system deficits includes transfers from the Niagara system (W-M-008), there is a projected storage deficit.

Figure 3.C.4 through Figure 3.C.5 show the 5-day MDD storage performance for each storage facility.

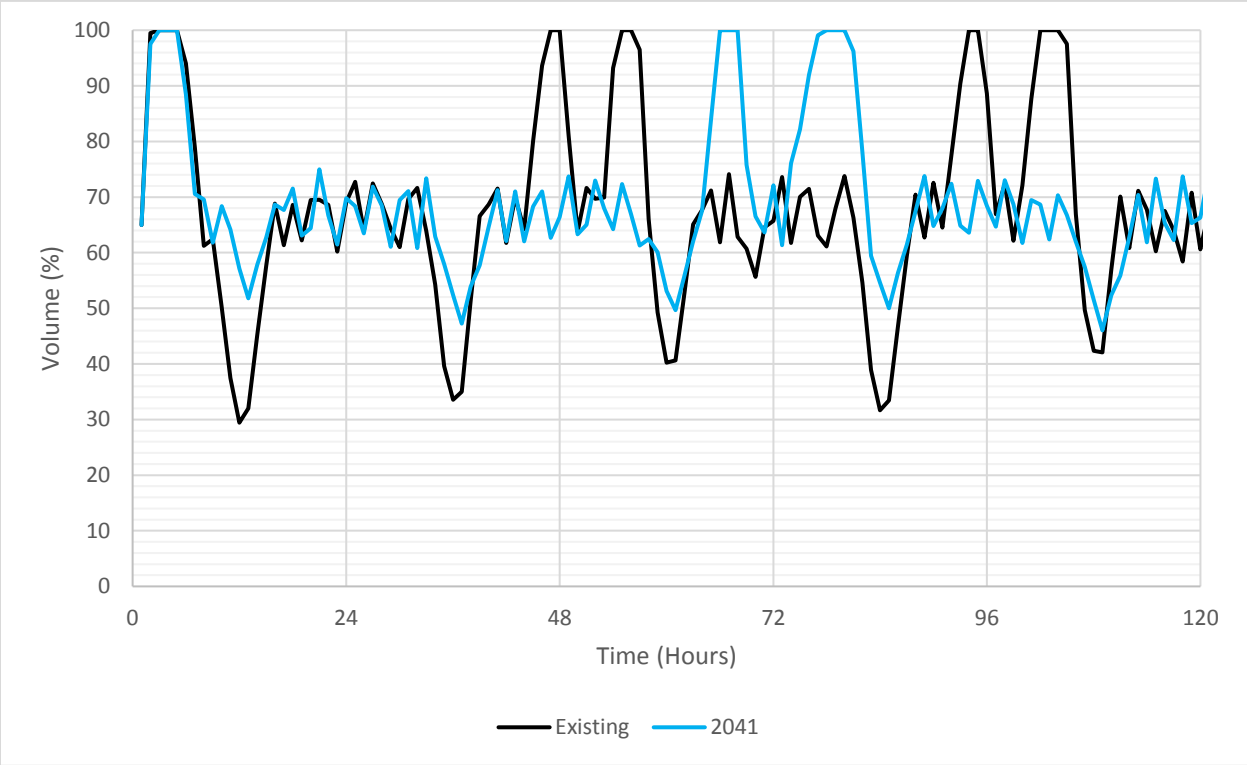


Figure 3.C.4 5-Day MDD Storage Performance – Lundy's Lane Elevated Tank

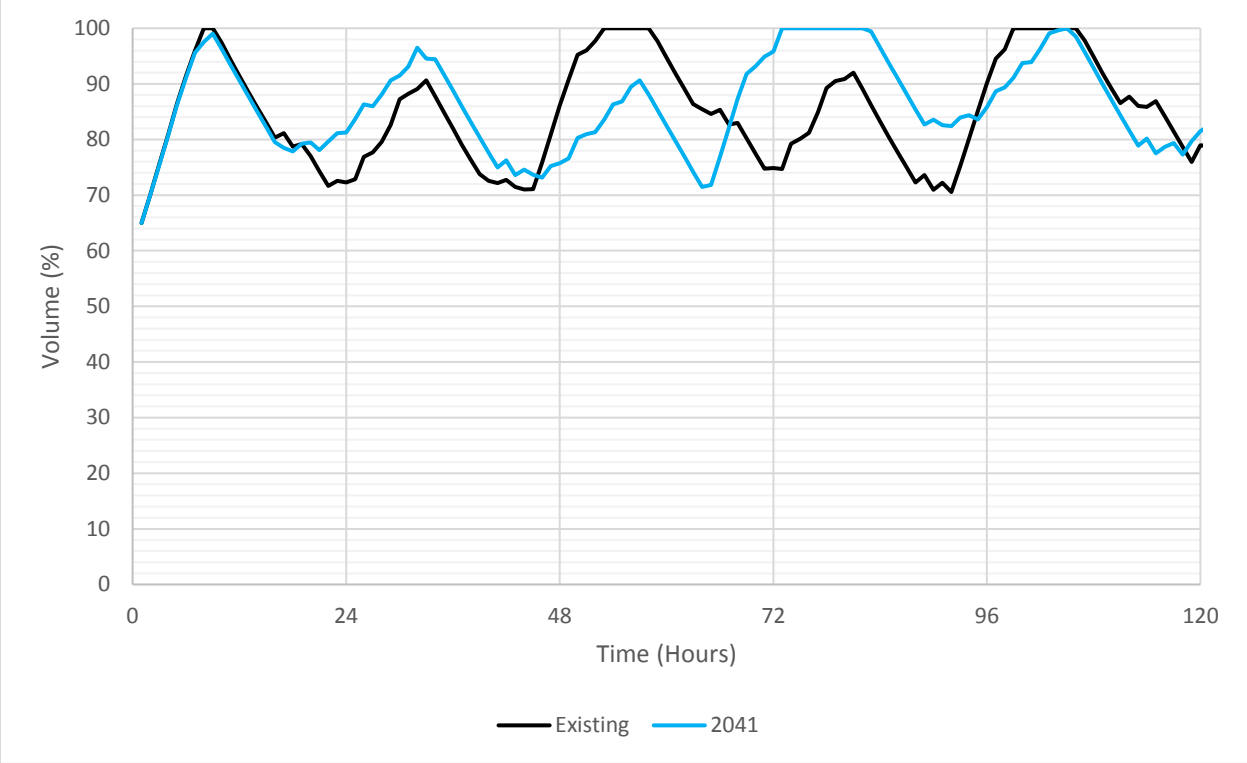


Figure 3.C.5 5-Day MDD Storage Performance – Kent Avenue Reservoir

C.3.4 System Pressures and Fire Flows

Figure 3.C.6 to Figure 3.C.9 present the existing and project 2041 system performance, based on existing system configuration and capacities.

Niagara Region

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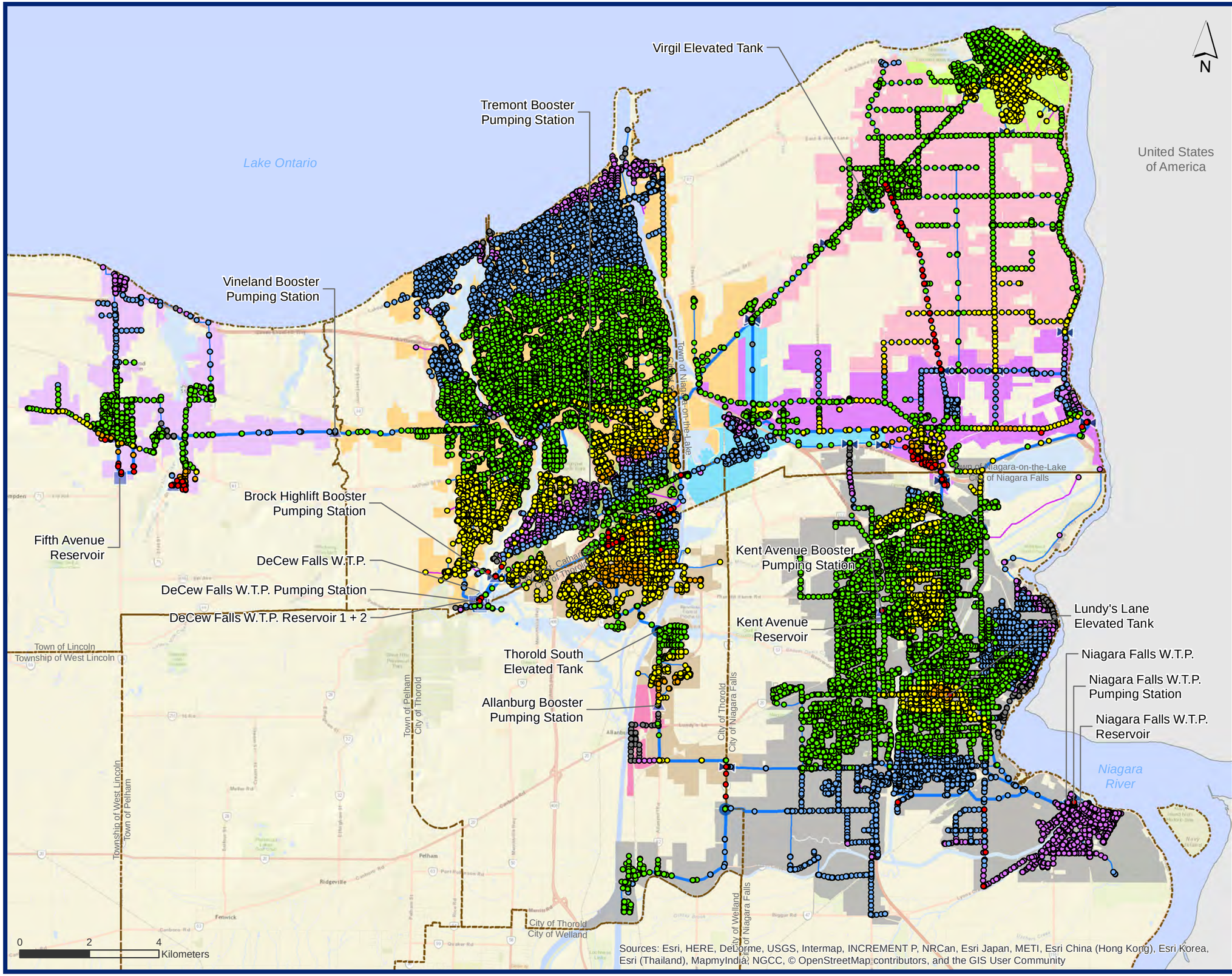

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Minimum Pressure (psi)

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

Figure 3.C.6

Existing Maximum Day Demand Pressure

Decew and Niagara Falls WTP

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

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May 2017
715023-W-4-Existing Pressure (DCNF)
NAD 1983 UTM Zone 17N

Niagara Region

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Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127 161 180 227
144 164 200 250
154 168 220 257

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

Virgil Elevated Tank
Tremont Booster Pumping Station
Vineland Booster Pumping Station
Brock Highlift Booster Pumping Station
Fifth Avenue Reservoir
DeCew Falls W.T.P.
DeCew Falls W.T.P. Pumping Station
DeCew Falls W.T.P. Reservoir 1 + 2
Thorold South Elevated Tank
Allanburg Booster Pumping Station
Kent Avenue Booster Pumping Station
Kent Avenue Reservoir
Lundy's Lane Elevated Tank
Niagara Falls W.T.P.
Niagara Falls W.T.P. Pumping Station
Niagara Falls W.T.P. Reservoir

Lake Ontario
United States of America
Niagara River
Town of Niagara-on-the-Lake
City of Niagara Falls
Town of Lincoln
Township of West Lincoln
Town of Pelham
City of Thorold
City of Welland
Pelham
Ridgeville
Fenwick

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 3.C.7

Existing System Fire Flow

Decew and Niagara Falls WTP

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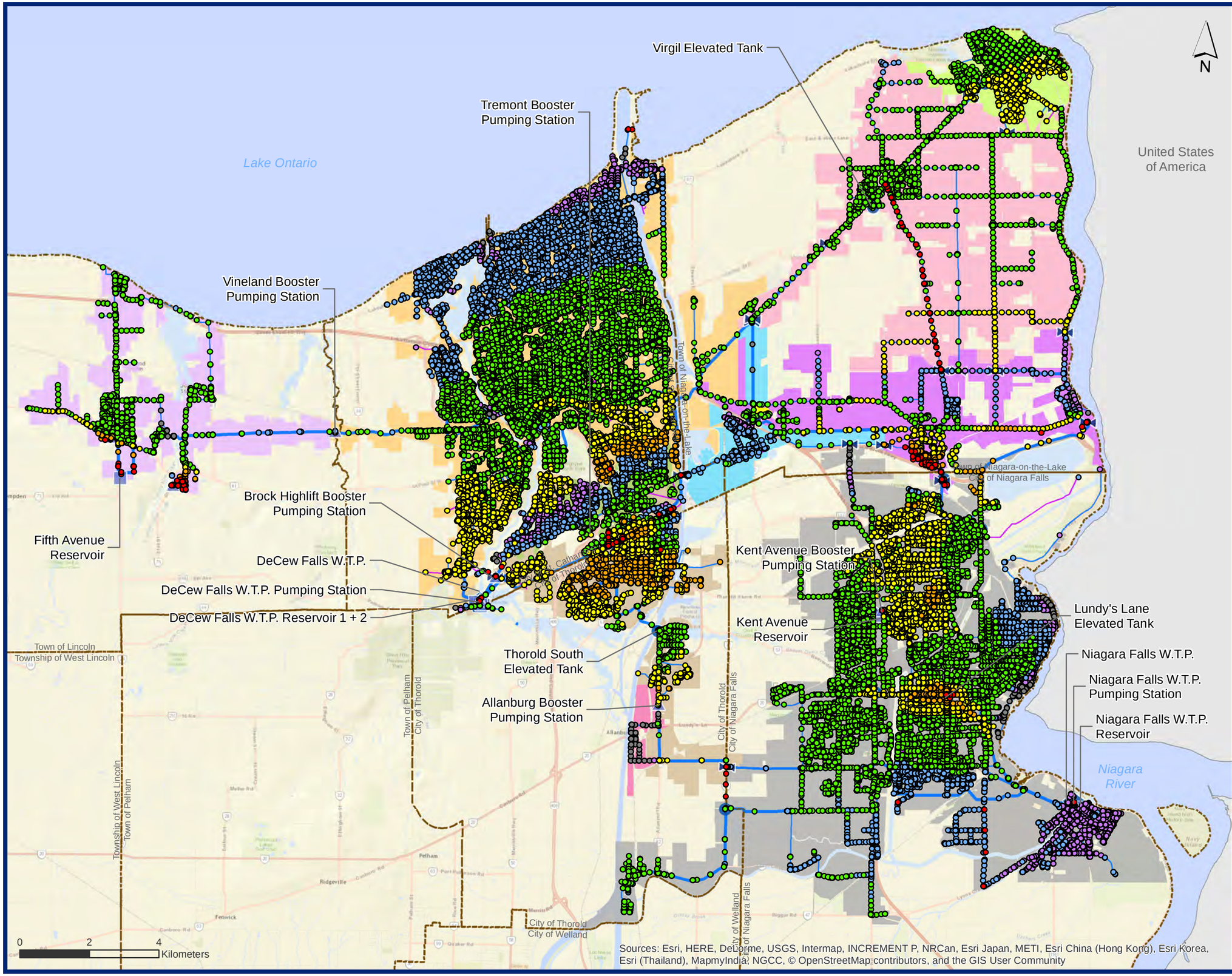
715023-W-6-Existing Fire Flow (DCNF)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Minimum Pressure (psi)

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

Figure 3.C.8

2041 Maximum Day Demand Pressure

Decew and Niagara Falls WTP

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715023-W-5-2041 Pressure (DCNF)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN

N

Virgil Elevated Tank

Tremont Booster Pumping Station

Vineland Booster Pumping Station

Brock Highlift Booster Pumping Station

Fifth Avenue Reservoir

DeCew Falls W.T.P.

DeCew Falls W.T.P. Pumping Station

DeCew Falls W.T.P. Reservoir 1 + 2

Thorold South Elevated Tank

Allanburg Booster Pumping Station

Kent Avenue Booster Pumping Station

Kent Avenue Reservoir

Lundy's Lane Elevated Tank

Niagara Falls W.T.P.

Niagara Falls W.T.P. Pumping Station

Niagara Falls W.T.P. Reservoir

Lake Ontario

United States of America

Niagara River

Town of Lincoln
Township of West Lincoln

Township of West Lincoln
Town of Pelham

Town of Pelham
City of Thorold

Town of Niagara-on-the-Lake
City of Thorold

City of Thorold
City of Niagara Falls

Town of Niagara-on-the-Lake
City of Niagara Falls

City of Thorold
City of Welland

City of Welland
City of Niagara Falls

Pelham

Ridgeville

Fenwick

0 2 4 Kilometers

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

Figure 3.C.9

2041 System Fire Flow

Decew and Niagara Falls WTP

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

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715023-W-7-2041 Fire Flow (DCNF)
NAD 1983 UTM Zone 17N

C.3.5 Water Age and Watermain Capacity

Figure 3.C.10 highlights the sampled chlorine residual (mg/L) versus the modelled water system age at each sample location.

The 90th percentile trend line represents the chlorine residual achieved by the bottom 10% of samples at a location, meaning that 90% of the samples taken at that location were above the 90th percentile trend line. Similarly, the 99th percentile trend line represents the chlorine residual achieved by the bottom 1% of samples at a location, meaning that 99% of the samples taken at that location were above the 99th percentile trend line. It is assumed that <10 days is required to maintain the 0.25 mg/L chlorine residual objective.

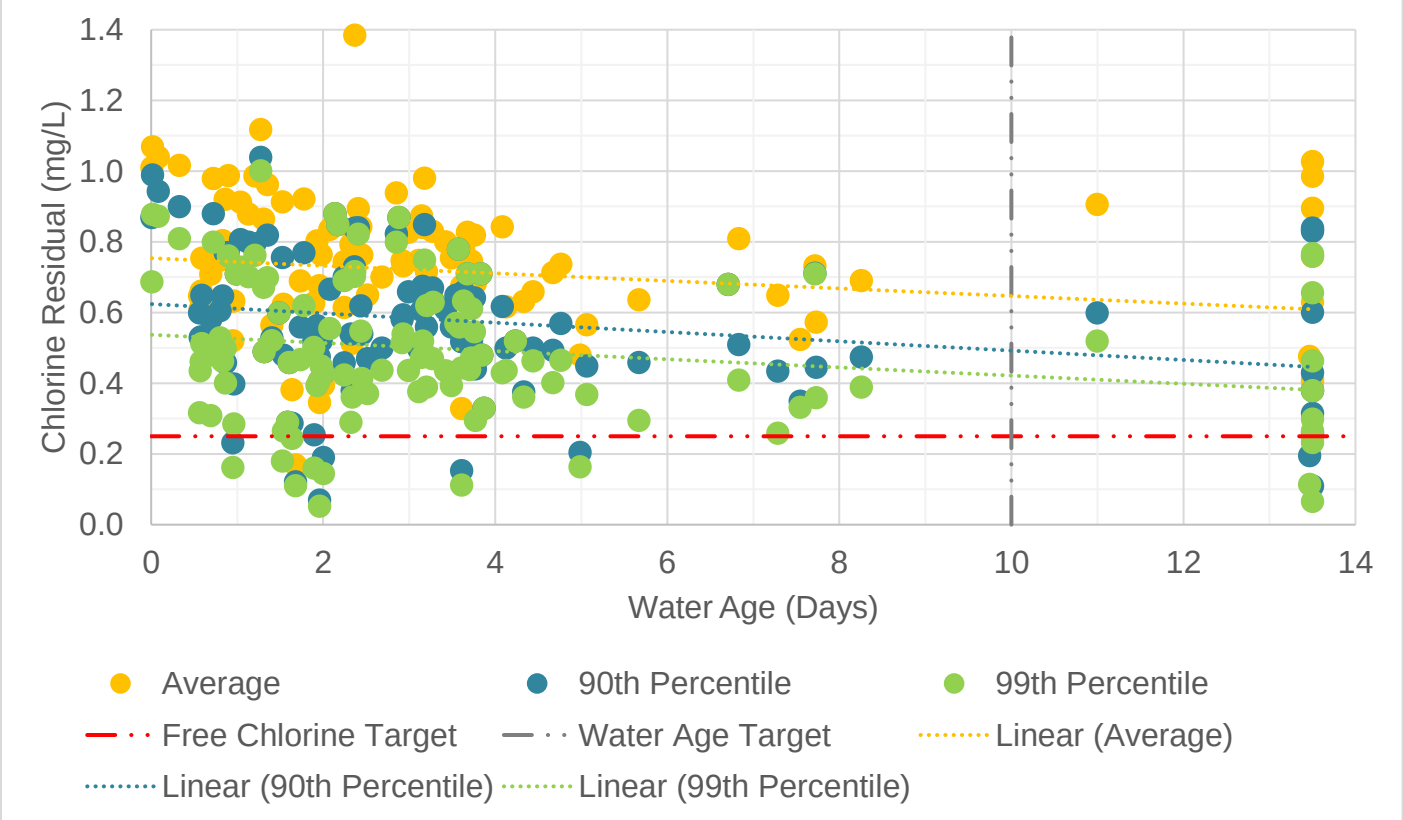


Figure 3.C.10 Existing Chlorine Residual vs. Water System Age

Figure 3.C.11 shows the modelled water age throughout the system. Figure 3.C.12 shows the existing watermain capacity in the system as maximum head loss (m/km).

Virgil Elevated Tank
Tremont Booster Pumping Station
Vineland Booster Pumping Station
Brock Highlift Booster Pumping Station
Fifth Avenue Reservoir
DeCew Falls W.T.P.
DeCew Falls W.T.P. Pumping Station
DeCew Falls W.T.P. Reservoir 1 + 2
Thorold South Elevated Tank
Allanburg Booster Pumping Station
Kent Avenue Booster Pumping Station
Kent Avenue Reservoir
Lundy's Lane Elevated Tank
Niagara Falls W.T.P.
Niagara Falls W.T.P. Pumping Station
Niagara Falls W.T.P. Reservoir

Lake Ontario
United States of America
Niagara River
Town of Lincoln
Township of West Lincoln
Town of Pelham
City of Thorold
City of Niagara Falls
City of Welland
Town of Niagara-on-the-Lake
Pelham
Ridgeville
Fenwick

N

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127 161 180 227
144 164 200 250
154 168 220 257

Water Age (Days)

- < 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- < 8

Figure 3.C.11

Water Age

DeCew and Niagara Falls WTP

BluePlan Engineering

May 2017
715023-W-8-Water Age (DCNF)
NAD 1983 UTM Zone 17N

Virgil Elevated Tank

Tremont Booster Pumping Station

Lake Ontario

United States of America

N

Vineland Booster Pumping Station

Brock Highlift Booster Pumping Station

Fifth Avenue Reservoir

DeCew Falls W.T.P.

DeCew Falls W.T.P. Pumping Station

DeCew Falls W.T.P. Reservoir 1 + 2

Town of Lincoln

Township of West Lincoln

Thorold South Elevated Tank

Allanburg Booster Pumping Station

Kent Avenue Booster Pumping Station

Kent Avenue Reservoir

Lundy's Lane Elevated Tank

Niagara Falls W.T.P.

Niagara Falls W.T.P. Pumping Station

Niagara Falls W.T.P. Reservoir

Niagara River

Town of Niagara-on-the-Lake

City of Niagara Falls

City of St. Catharines

City of Thorold

Town of Pelham

Township of West Lincoln

Pelham

Ridgeville

Fenwick

City of Welland

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127 161 180 227
144 164 200 250
154 168 220 257

Watermain Headloss (m/km)

- < 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4

Figure 3.C.12

Watermain Capacity

Decew and Niagara Falls WTP

BluePlan Engineering

May 2017
715023-W-9-Watermain Capacity (DCNF)
NAD 1983 UTM Zone 17N

C.4 System Opportunities and Constraints

Figure 3.C.13 highlights the existing opportunities and constraints.

C.4.1 Niagara Falls Water Treatment Plant

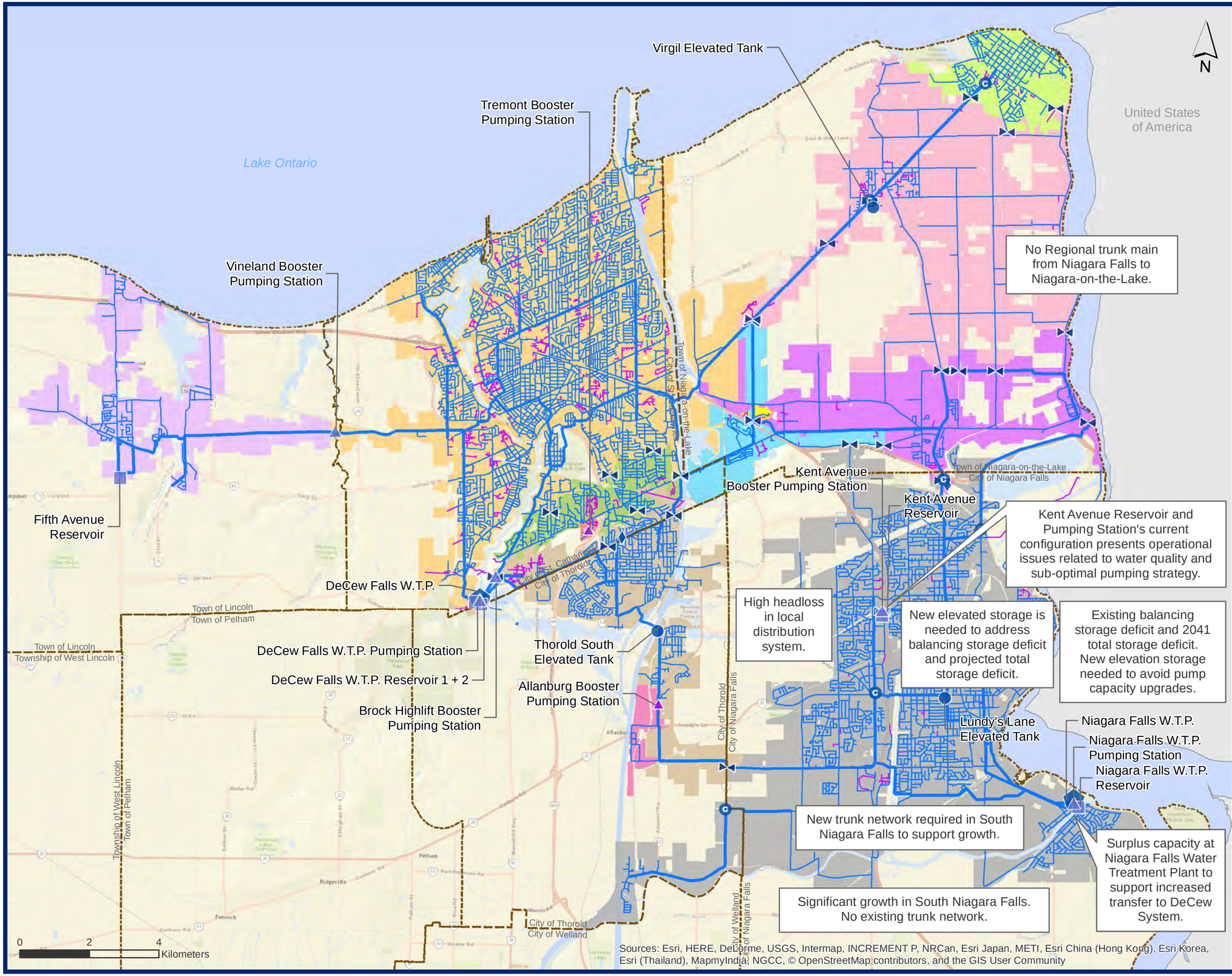
- The current rated MDD capacity is 145.5 MLD, with an existing demand of 74.7 MLD. The projected 2041 MDD is 111.2 MLD, which is below 80% of the water treatment plant rated capacity. As such, the Niagara Falls Water Treatment Plant has surplus capacity to accommodate growth beyond 2041.

C.4.2 Niagara Falls System

- The system has an existing storage surplus, and a marginal storage surplus is projected for 2041.
- Majority of the existing 37.3 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:
    - 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 trunk network has sufficient capacity to support intensification within the existing network. However; 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; new trunk network is needed to service new south growth areas

Niagara Region

2016 MASTER SERVICING PLAN



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127	161	180	227
144	164	200	250
154	168	220	257

Figure 3.C.13

System Opportunities and Constraints

Decew and Niagara Falls WTP

BluePlan Engineering

May 2017
715023-W-3-Opportunities and Constraints (NF)
NAD 1983 UTM Zone 17N

C.4.3 System Security of Supply & Interconnections

- There is no Regional trunk main 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
    - Provide alternative servicing strategies to support growth within Niagara-on-the-Lake and/or Thorold South.

C.5 Assessment of Alternatives

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

- Baseline (No Changes)
- Upgrade Existing Storage – Lundy's Lane
- New Storage – South Niagara Falls

All alternatives include:

- The required trunk network upgrades to support south growth areas.
- Trunk network upgrades in the southwest improving conveyance to the Port Robinson Chlorine Booster Station.

Further, options of increasing/new ground level reservoirs were not reviewed due to accompanying pump capacity upgrades required to support this servicing strategy.

C.5.1 Alternative 1 – Storage Capacity Upgrades & Additional Trunk Conveyance

Alternative 1, highlighted in Figure 3.C.14, generally maintains the existing system configuration, with increased storage upgrade to the Lundy's Lane Elevated Tank to support growth. Additionally, new trunk conveyance in South Niagara Falls would provide supply to new growth areas. However, space at the existing Lundy's Lane site is limited, presenting constrained constructability and limited upgrade feasibility.

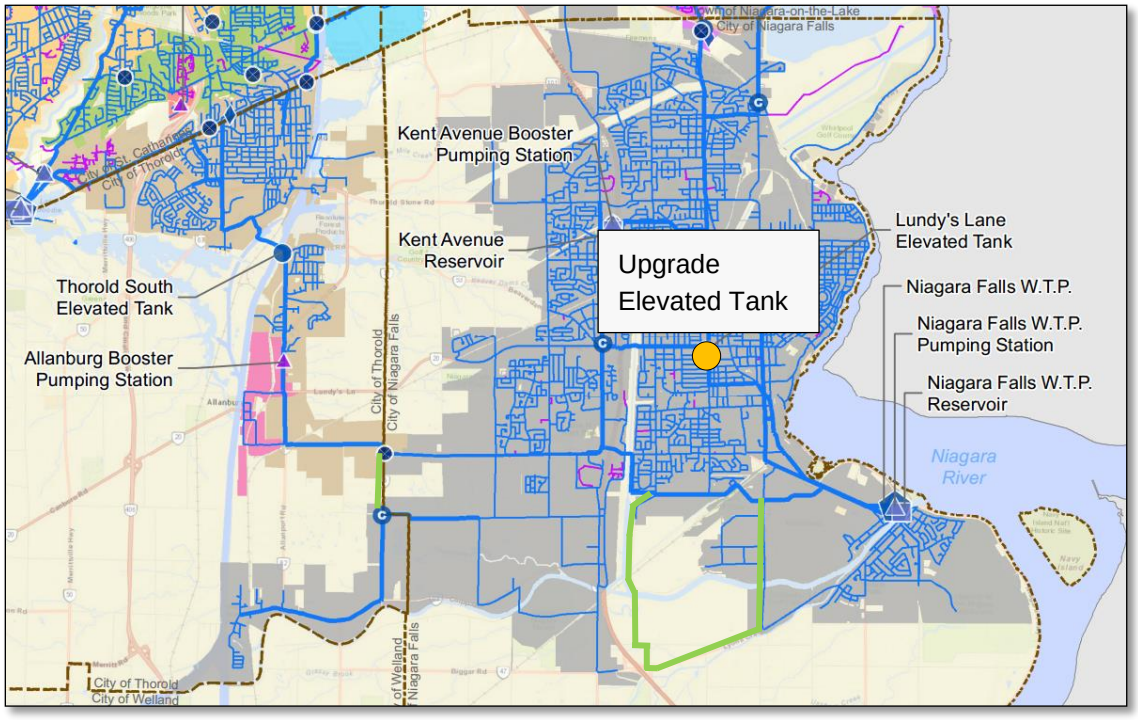


Figure 3.C.14 Alternative 1 – Storage Capacity Upgrades & Additional Trunk Conveyance

C.5.2 Alternative 2 – New Storage & Additional Trunk Conveyance

Alternative 2, highlighted in Figure 3.C.15, consists of decommissioning the existing Lundy's Lane Elevated Tank and the addition of a new elevated tank in South Niagara Falls growth area. Additionally, new trunk conveyance in South Niagara Falls would provide supply to new growth areas.

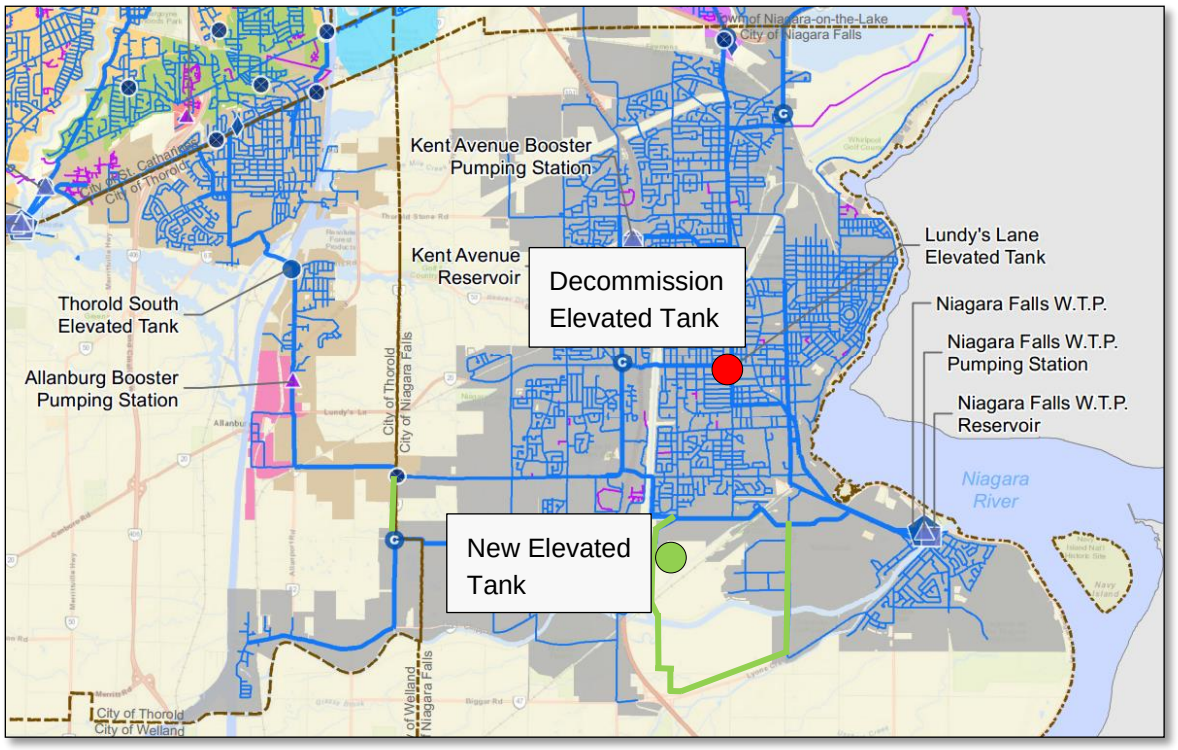


Figure 3.C.15 Alternative 2 – New Storage & Additional Trunk Conveyance

C.5.3 Alternatives Evaluation

Alternative 2 – New Storage and Additional Trunk Conveyance is the preferred servicing strategy as:

- Baseline strategy does not satisfy the future servicing needs of the water system.
- Alternative 2 – New Storage & Additional Trunk Conveyance provides the following advantages:
    - Places the new storage close to the large growth area allowing for improved capacity within the new growth area.
    - Further distributes storage within the network, with Kent Reservoir in the north and the new reservoir in the south, which improve security of supply within the system.
    - The existing Lundy's Lane Tank site is constrained; which may limit/complicate implementation of storage upgrades.

C.6 Preferred Servicing Strategy

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

- The Niagara Falls Water Treatment Plant has sufficient capacity to support growth to year 2041.
- The storage location in Niagara Falls will be optimized with additional storage capacity provided in a new tank located in closer proximity to the growth areas in South Niagara Falls. The existing Lundy's Lane tank will be decommissioned.
- Due to the amount of growth in South Niagara Falls, a new trunk water feedermain will be required to support the growth demands.
- Additional feedermain capacity is required in the Port Robinson area due to growth and for trunk system connectivity

Figure 3.C.16 and Figure 3.C.17 show the preferred servicing strategy and schematic, consisting of:

C.6.1 Storage

A new 6.0 ML elevated tank (W-S-004) is to be built in South Niagara Falls growth area to support growth. The 6.0 ML includes the existing 2.5 ML of at Lundy's Lane and the 3.5 ML of additional storage to support 2041 growth.

Note: the new storage does not support the full 2041 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.

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 Trunk Watermain

- New 750 mm trunk main to New South Niagara Falls Elevated Tank (W-M-009).
- New 450 mm trunk main from PRV to Port Robinson Chlorine Booster Pumping Station (W-M-007).
- New 400 mm trunk main in South Niagara Falls (W-M-010).

C.6.4 Project Implementation and Considerations

Special project implementation and considerations for the preferred servicing strategy consist of:

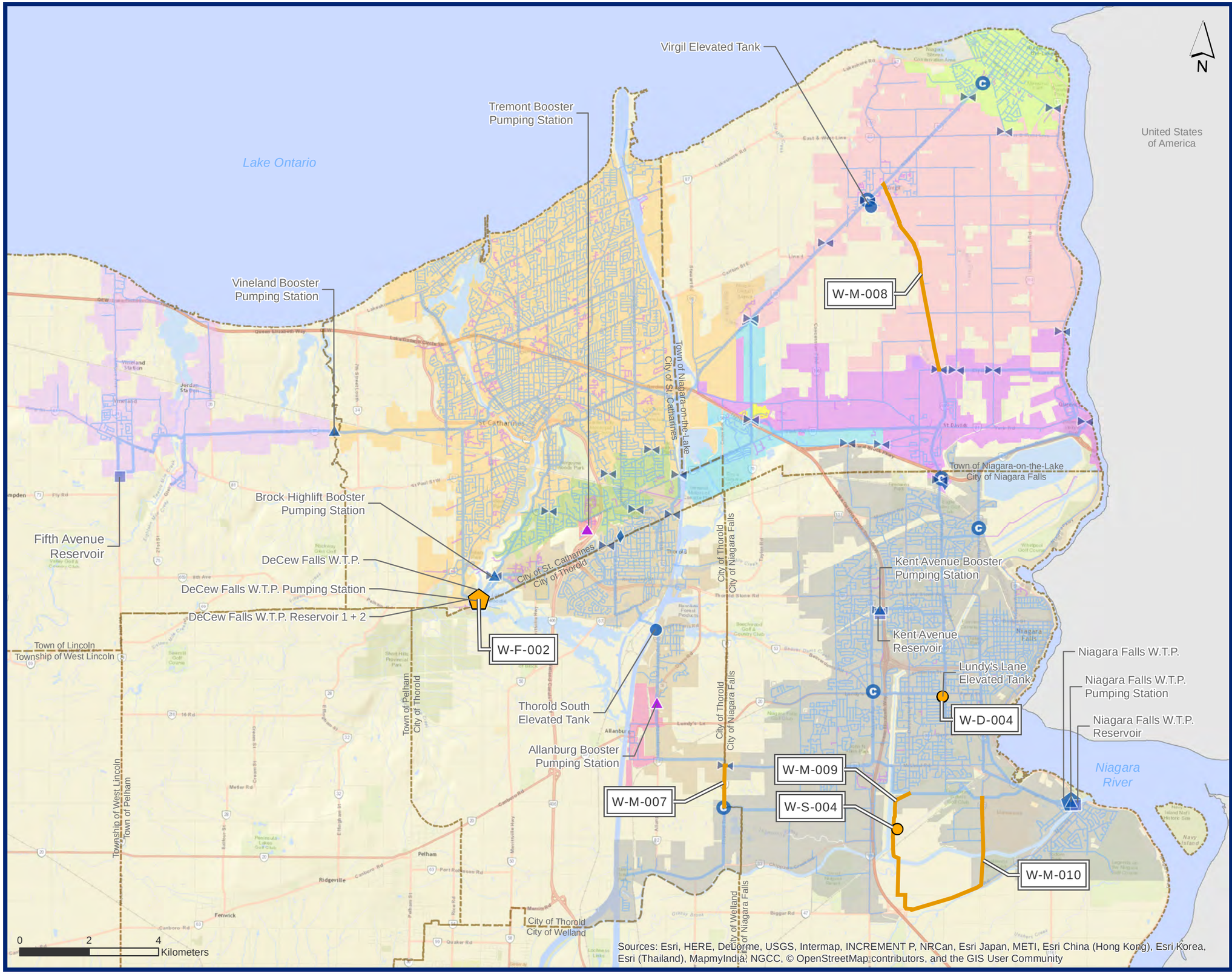
- New South Niagara Falls trunk main will be triggered by growth and local distribution system needs. The new trunk main loop could be completed in phases depending on location and timing of growth
- Completion of the new South Niagara Falls Tank is needed before the Region can decommission the Lundy's Lane Tank.

C.7 Capital Program

Table 3.C.13 summarizes the recommended project costing, implementation schedule and Class EA requirements.

C.7.1 Schedule B Project Files

Project W-M-010 (New Niagara Falls South Trunk Watermain), project W-S-004 (New South Niagara Falls Elevated Tank), and project W-M-009 (New Niagara Falls South Trunk Main to New Elevated Tank) – new infrastructure constructed to support growth in South Niagara Falls. Infrastructure alignments and tank location will be subject to future land use plan. Municipal Class Schedule B Environmental Assessment requirements to be satisfied through the secondary plan for the South Niagara Falls area.



Niagara Region

2016 MASTER SERVICING PLAN

MSP Water Projects

- Treatment Plant
- Reservoir
- Pumping Station
- Elevated Tank
- Watermain Projects

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station
- Regional
- Municipal

Water Network
- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

127 161 180 227
144 164 200 250
154 168 220 257

Figure 3.C.16

Preferred Water Strategy

Decew and Niagara Falls WTP

BluePlan Engineering Inc

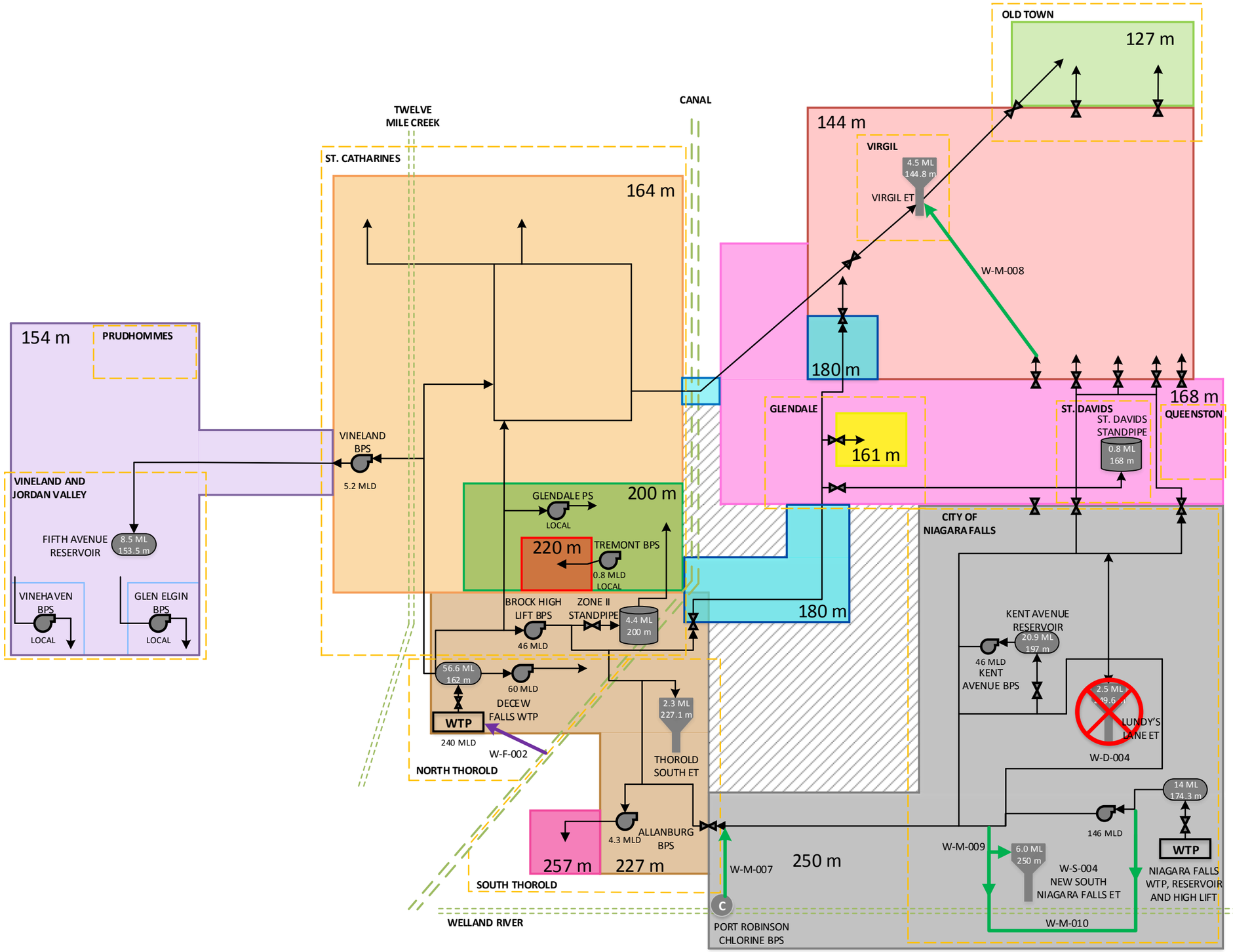
May 2017
715023-W-Capital Projects (DCNF)
NAD 1983 UTM Zone 17N

Niagara Region

2016 Master Servicing Plan

Niagara Falls WTP and Decew WTP

2041 DISTRIBUTION SCHEMATIC



WTP — RATED CAPACITY — Water Treatment Plant

Pumping Station — FIRM CAPACITY

Volume TWL — Reservoir

Volume TWL — Elevated Tanks

Control Valve (Only normally operated valves shown)

C — Chlorine Facility

Facility Upgrade

Volume TWL — Standpipe

Trunk Watermain Network

Settlement Area Boundaries

Land and Water Features

New Watermain

Upgrade Watermain

Decommission Project

New Facility

Pressure Zone

127 m	180 m
144 m	200 m
154 m	220 m
161 m	227 m
164 m	250 m
168 m	257 m

May 2017
Figure 3.C.17
Not to Scale

BluePlan ENGINEERING

Table 3.C.13 Summary of Niagara Falls 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 Elevated Tank	Lundy's Lane Elevated Tank to be decommissioned and replaced by new South Niagara Falls Elevated Tank	N/A	2032 - 2041	Niagara Falls	A+	Satisfied	Storage	$ 1,979,000
W-M-007	New trunk main from Pressure Reducing Valve (PRV) to Port Robinson Chlorine Booster Pumping Station in Niagara Falls	New trunk main from PRV to Port Robinson Chlorine Booster Pumping Station in Niagara Falls	450 mm	2017 - 2021	Niagara Falls	A+	Satisfied	Watermain	$ 2,543,000
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 and to serves as connection between existing transmission network and new South Niagara Falls Elevated Tank	750 mm	2032 - 2041	Niagara Falls	A+	To Be Satisfied Through Secondary Plan	Watermain	$ 4,858,000
W-M-010	New Niagara Falls South trunk main	New Niagara Falls South trunk main to provide additional supply to new growth areas	400 mm	2032 - 2041	Niagara Falls	B	To Be Satisfied Through Secondary Plan	Watermain	$ 18,316,000
W-S-004	New South Niagara Falls Elevated Tank	New South Niagara Falls Elevated Tank to replace the Lundy's Lane Elevated Tank and provide additional storage	6 ML	2032 - 2041	Niagara Falls	B	To Be Satisfied Through Secondary Plan	Storage	$ 9,629,000
Total									**$37,325,000**

PART D
FORT ERIE WATER SYSTEM

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 30,419 and 10,839 employees.[1]

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).[2]

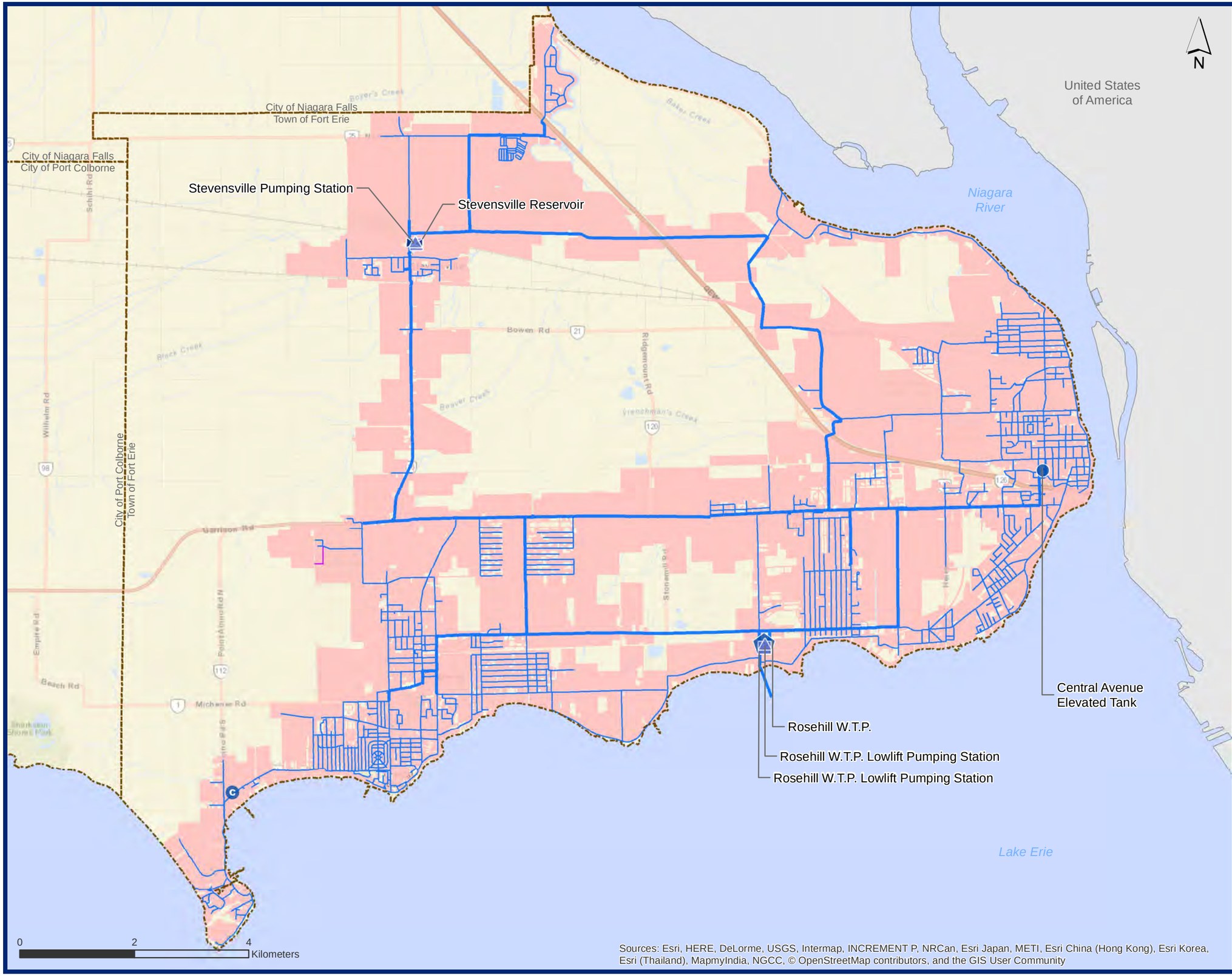
The system supplies local area municipalities via a water main network, pumping stations, and service reservoirs. The supply area has a single pressure zone. Figure 3.D.1 and Figure 3.D.2 present an overview of the water system and a water system schematic diagram, respectively.

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

[2] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-203*

Niagara Region

2016 MASTER SERVICING PLAN



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

- 241

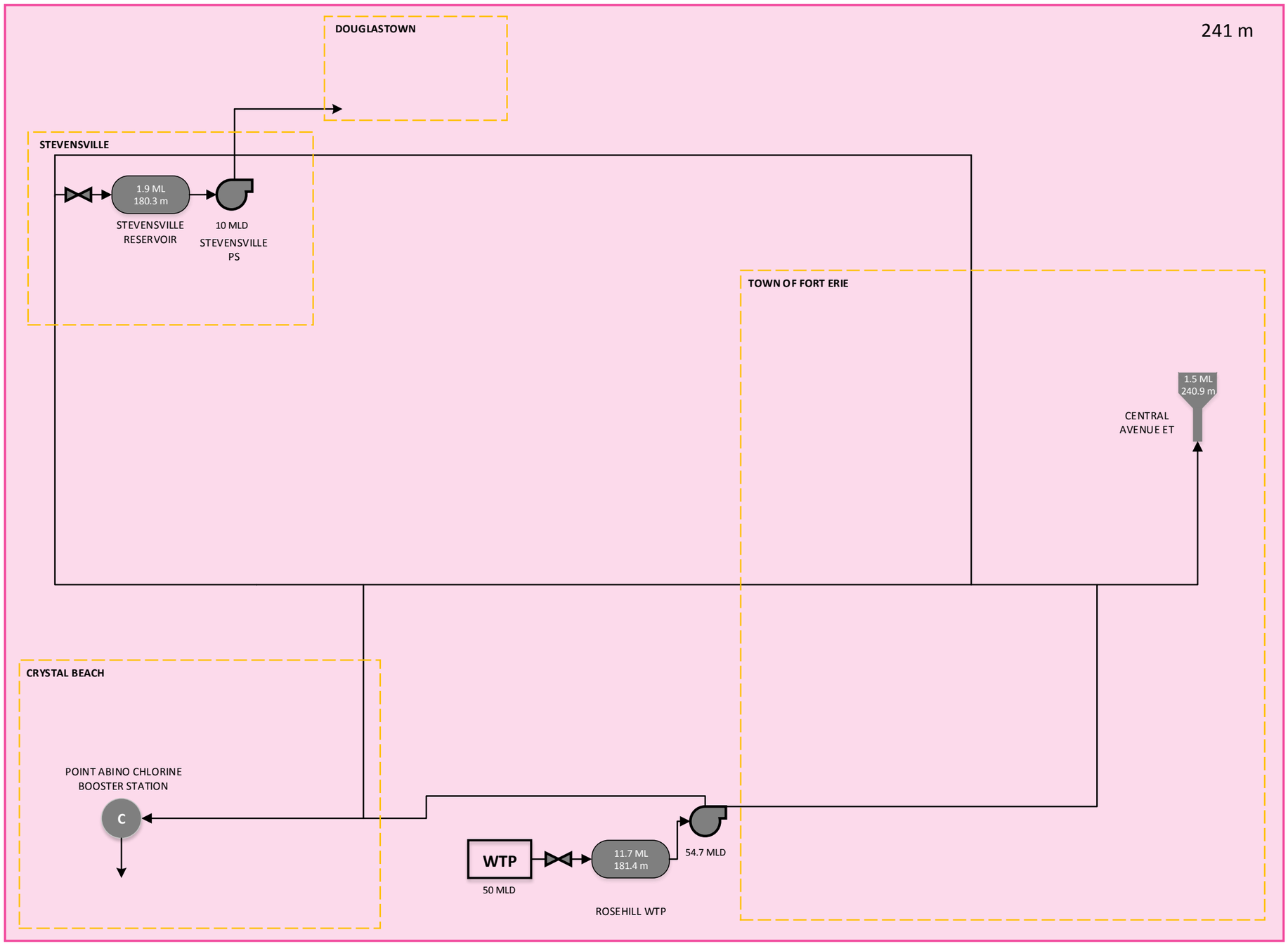
Figure 3.D.1

Existing Water System

Rosehill WTP

BluePlan Engineering Inc

May 2017
715023-W-2-Existing Water System (FE)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Rosehill WTP (Fort Erie)

EXISTING DISTRIBUTION SCHEMATIC

- WTP (RATED CAPACITY) — Water Treatment Plant
- Volume TWL — Standpipe
- Pumping Station (FIRM CAPACITY)
- 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

241 m

May 2017
Figure 3.D.2
Not to Scale

BluePlan ENGINEERING

D.1.1 Facility Overview

Table 3.D.1 Water Treatment Plant Overview

Plant Name	Rosehill Water Treatment Plant[3]
Address	300 Rosehill Road, Fort Erie
Source Water	Lake Erie
Rated Maximum Day Demand Capacity	50.0 MLD
Key Processes	• Zebra mussel control • Raw water screening • Coagulation • Flocculation • Sedimentation • Filtration • Disinfection • pH correction

Table 3.D.2 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone)	Discharge (Pressure Zone)	Pressure Zones Supplied	Number of Pumps (Total/ Firm)	Firm Capacity (MLD)	Total Dynamic Head (m)
Rosehill Water Treatment Plant (WTP) High Lift Pumps	300 Rosehill Road, Fort Erie	WTP	241	241	4/3	54.7	70.4
Stevensville Pumping Station	2650 Stevensville Road, Fort Erie	241	241	241	4/3	10.0	43.0

[3] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-203*

Table 3.D.3 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	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

Refer to Figure 3.D.1 for pumping station and storage facility locations.

D.1.2 Demands Overview

Table 3.D.4 Historic Water System Demands

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***	***1.54***
5 Year Peak	***12.8***	***22.3***	***1.75***

Table 3.D.5 Water System Maximum Day Peaking Factor

Existing Service Population	30,419
Existing Service Employment	10,839
Total Service Equivalent Population	**41,258**
MOECC Peaking Factor[4]	1.80
Historic 5 Year Average Peaking Factor	1.54
Historic 5 Year Max Peaking Factor	1.75
2016 MSP Peaking Factor	**1.54**

The 2016 MSP peaking factor is the average of the peaking factors from 2011 to 2015.

Table 3.D.6 Water System Demands by Pressure Zone*

Pressure Zone	Total Service Equivalent Population[5]	2014 Average Day Demand (MLD)	2014 Maximum Day Demand (MLD)
241	41,258	12.4	19.1
Total	**41,258**	**12.4**	**19.1**

Pressure zone existing equivalent population estimates were derived using the Niagara 2041 MCR traffic survey zone population allocations and are calculated to the end of 2014. [6]

[4] *Ministry of the Environment and Climate Change, 2008, Design Guidelines for Drinking-Water Systems, ISBN 978-1-4249-8517-3*
[5] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*
[6] *Hemson Consulting Ltd, 2016. Niagara Region TAZ Forecasts to 2041*

D.2. Growth Projections

D.2.1 Population Projections and Allocations

Table 3.D.7 and Table 3.D.8 outline the existing and projected serviced population and employment by pressure zone.

Table 3.D.7 Rosehill Water Treatment Plant Serviced Population by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
241	30,419	31,881	34,109	37,096	40,611	43,134	12,715
Total	**30,419**	**31,881**	**34,109**	**37,096**	**40,611**	**43,134**	**12,715**

Note: Population numbers may not sum due to rounding.

Table 3.D.8 Rosehill Water Treatment Plant Serviced Employment by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
241	10,839	11,729	12,231	12,944	13,699	14,698	3,859
Total	**10,839**	**11,729**	**12,231**	**12,944**	**13,699**	**14,698**	**3,859**

Note: Population numbers may not sum due to rounding.

D.2.2 Future Demand Projections

Table 3.D.9 and Table 3.D.10 summarize the projected average and maximum system demands by pressure zone.

Table 3.D.9 Projected Water System Average Day Demands (ADD) by Pressure Zone

Pressure Zone	2021 ADD (MLD)	2026 ADD (MLD)	2031 ADD (MLD)	2036 ADD (MLD)	2041 ADD (MLD)
241	13.1	13.9	15.0	16.3	17.4
Total	**13.1**	**13.9**	**15.0**	**16.3**	**17.4**

Table 3.D.10 Projected Water System Maximum Day Demands (MDD) by Pressure Zone

Pressure Zone	2021 MDD (MLD)	2026 MDD (MLD)	2031 MDD (MLD)	2036 MDD (MLD)	2041 MDD (MLD)
241	20.2	21.4	23.2	25.1	26.8
Total	**20.2**	**21.4**	**23.2**	**25.1**	**26.8**

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

D.3.1 Treatment Plant Capacity

Figure 3.D.3 shows the projected future demands at the Rosehill Water Treatment Plant. The plant has surplus pumping capacity out to 2041.

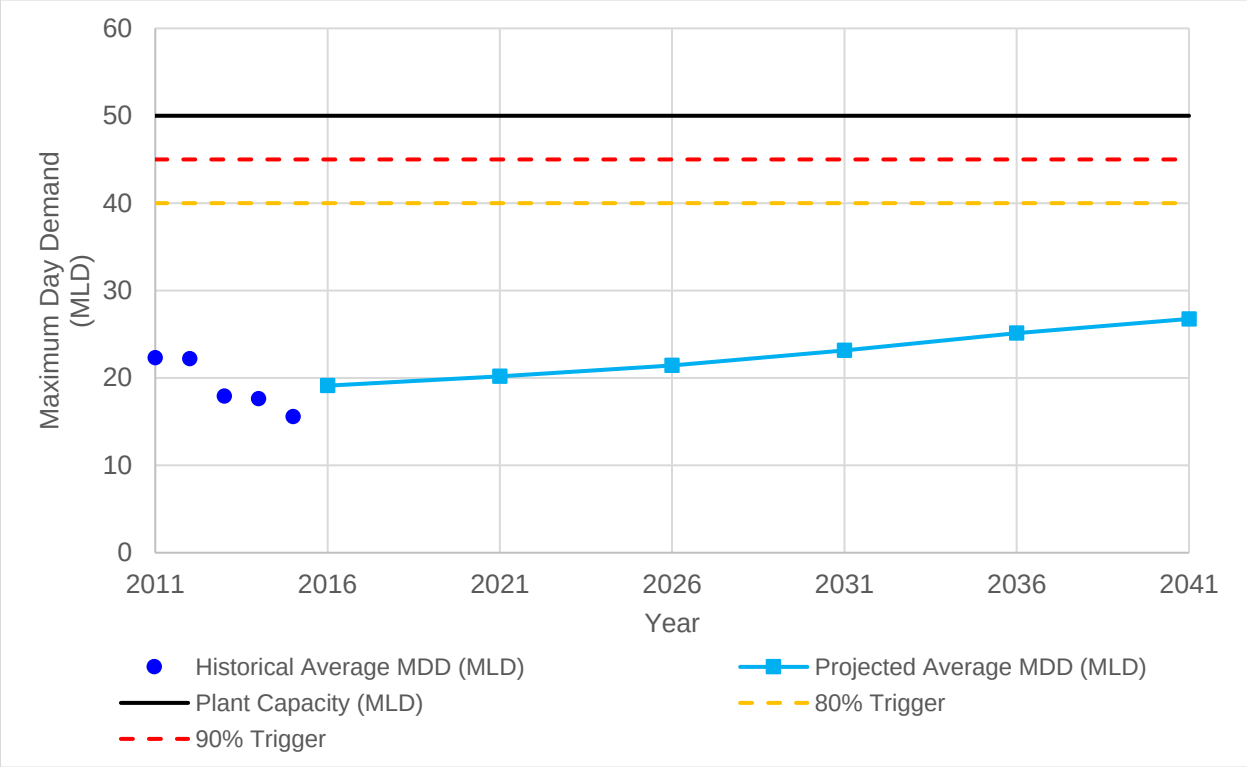


Figure 3.D.3 Projected Maximum Day Demand at Rosehill Water Treatment Plant

D.3.2 Pumping Capacity

Table 3.D.11 highlights the pumping station existing and projected capacity.

Table 3.D.11 System Pumping Station Performance

Pump Station	Pressure Zones Supplied	Total Effective Capacity (MLD)	Existing Maximum Day Demand (MLD)	2041 Maximum Day Demand (MLD)	2041 Surplus/ Deficit (MLD)
Rosehill Water Treatment Plant/ High Lift Pumping Station	241	54.7	19.1	26.8	27.9
Stevensville Pumping Station	241				

The Stevensville Pumping Station capacity is not included in the total effective capacity for the zone. The Pumping Station capacity is considered for zone fire flow and peak hour capacities.

The Fort Erie water system has existing and future surplus max day pumping capacity.

D.3.3 Storage Capacity

Table 3.D.12 highlights the existing and projected storage capacity.

Table 3.D.12 System Storage Capacities

Pressure Zones Supplied	Storage	Existing and 2041 Total Available Storage (ML)	Existing Required Storage (ML)	2041 Required Storage (ML)	2041 Surplus/ Deficit (ML)
241	Rosehill Water Treatment Plant Reservoir Central Avenue Elevated Tank Stevensville Reservoir	15.1	16.2	18.6	-3.5

The Fort Erie system has existing storage deficit, which is projected to grow to 3.5 ML by 2041.

Figure 3.D.4 through Figure 3.D.5 show the 5-day MDD storage performance for each storage facility.

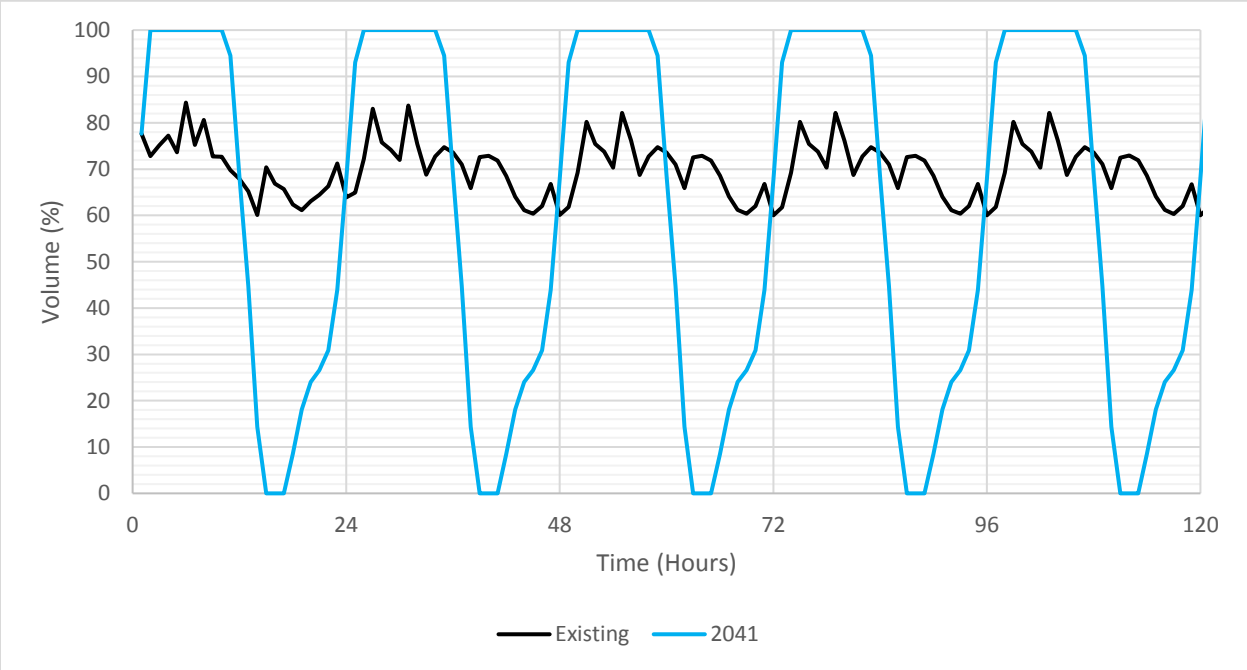


Figure 3.D.4 5-Day Maximum Day Demand Storage Performance – Central Avenue Elevated Tank

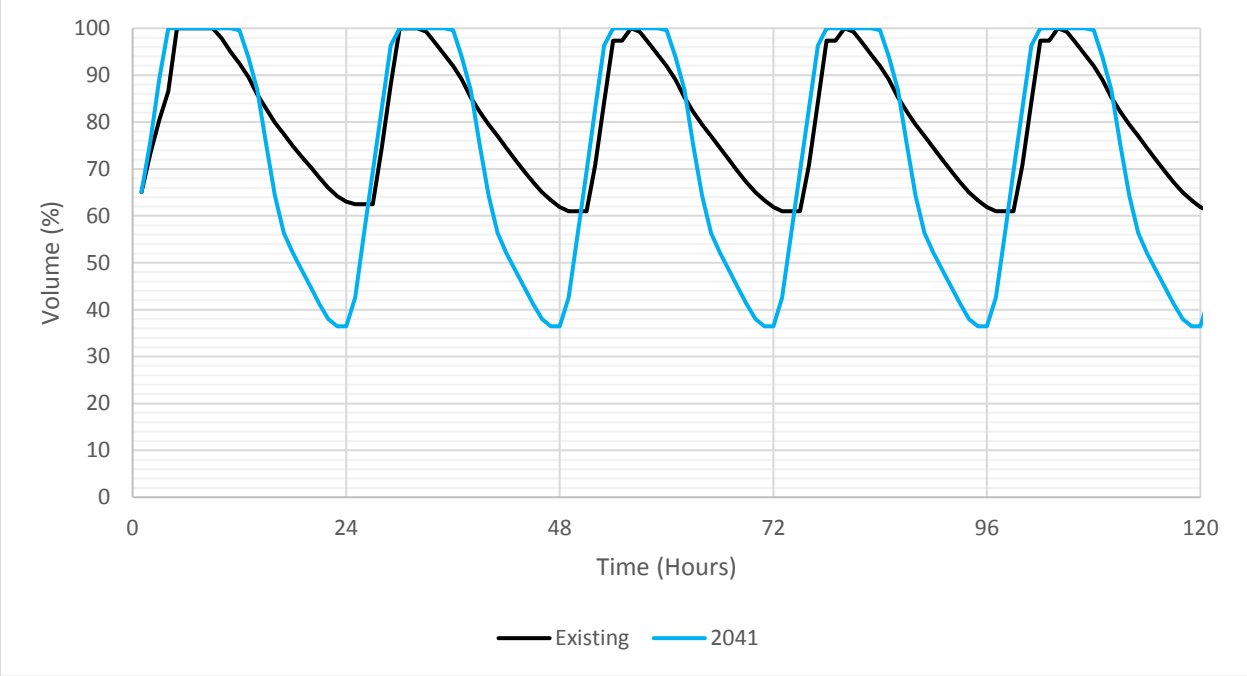


Figure 3.D.5 5-Day Maximum Day Demand Storage Performance – Stevensville Reservoir

D.3.4 System Pressures and Fire Flows

Figure 3.D.6 to Figure 3.D.9 present the existing and project 2041 system performance, based on existing system configuration and capacities.

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

241

Minimum Pressure (psi)

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

Stevensville Pumping Station

Stevensville Reservoir

Central Avenue Elevated Tank

Rosehill W.T.P.

Rosehill W.T.P. Lowlift Pumping Station

Rosehill W.T.P. Lowlift Pumping Station

City of Niagara Falls
Town of Fort Erie

City of Niagara Falls
City of Port Colborne

City of Port Colborne
Town of Fort Erie

United States of America

Niagara River

Lake Erie

Bowen Rd

Garrison Rd

Beach Rd

Michener Rd

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 3.D.6

Existing Maximum Day Demand Pressure

Rosehill WTP

BluePlan Engineering

May 2017
715023-W-4-Existing Pressure (FE)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN

N

United States of America

Niagara River

Lake Erie

City of Niagara Falls
Town of Fort Erie

City of Niagara Falls
City of Port Colborne

City of Port Colborne
Town of Fort Erie

Stevensville Pumping Station

Stevensville Reservoir

Central Avenue Elevated Tank

Rosehill W.T.P.

Rosehill W.T.P. Lowlift Pumping Station

Rosehill W.T.P. Lowlift Pumping Station

Bowen Rd

Garrison Rd

Michener Rd

Beach Rd

Empire Rd

Schisler Rd

Wilhelm Rd

Black Creek

Beaver Creek

Frenchman's Creek

Baker Creek

Roger's Creek

Ridgemount Rd

Stonemill Rd

Point Abino Rd

Niagara Pkwy

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

241

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 3.D.7

Existing System Fire Flow

Rosehill WTP

BluePlan Engineering

May 2017
715023-W-6-Existing Fire Flow (FE)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

241

Minimum Pressure (psi)

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

Stevensville Pumping Station

Stevensville Reservoir

Central Avenue Elevated Tank

Rosehill W.T.P.

Rosehill W.T.P. Lowlift Pumping Station

Rosehill W.T.P. Lowlift Pumping Station

City of Niagara Falls
Town of Fort Erie

City of Niagara Falls
City of Port Colborne

City of Port Colborne
Town of Fort Erie

United States of America

Niagara River

Lake Erie

Bowen Rd

Garrison Rd

Beach Rd

Michener Rd

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

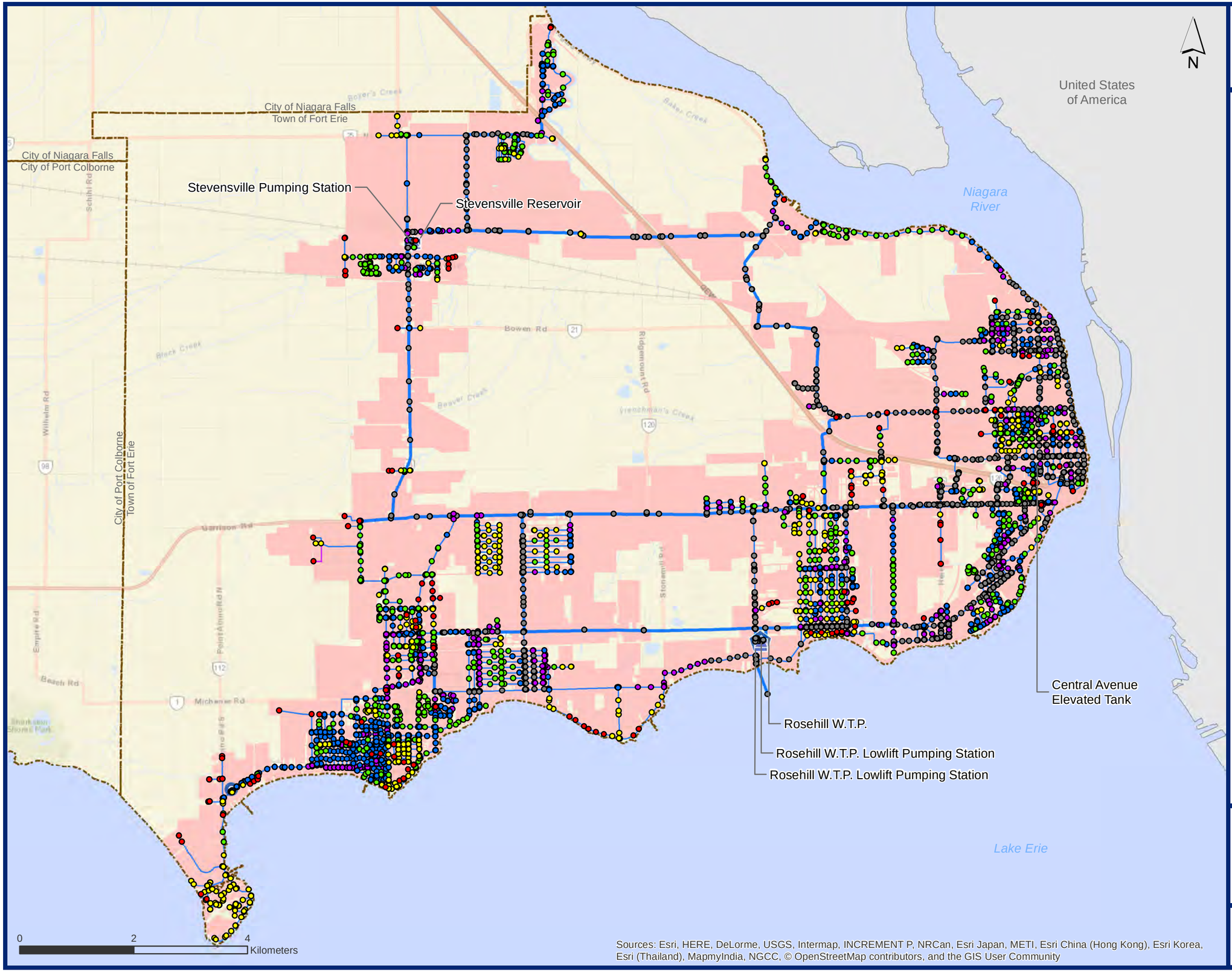
Figure 3.D.8

2041 Maximum Day Demand Pressure

Rosehill WTP

BluePlan Engineering

May 2017
715023-W-5-2041 Pressure (FE)
NAD 1983 UTM Zone 17N



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

241

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

Figure 3.D.9

2041 System Fire Flow

Rosehill WTP

BluePlan Engineering

May 2017
715023-W-7-2041 Fire Flow (FE)
NAD 1983 UTM Zone 17N

D.3.5 Water Age and Watermain Capacity

Figure 3.D.10 highlights the sampled chlorine residual (mg/L) versus the modelled water system age at each sample location.

The 90th percentile trend line represents the chlorine residual achieved by the bottom 10% of samples at a location, meaning that 90% of the samples taken at that location were above the 90th percentile trend line. Similarly, the 99th percentile trend line represents the chlorine residual achieved by the bottom 1% of samples at a location, meaning that 99% of the samples taken at that location were above the 99th percentile trend line. It is assumed that <10 days is required to maintain the 0.25 mg/L chlorine residual objective.

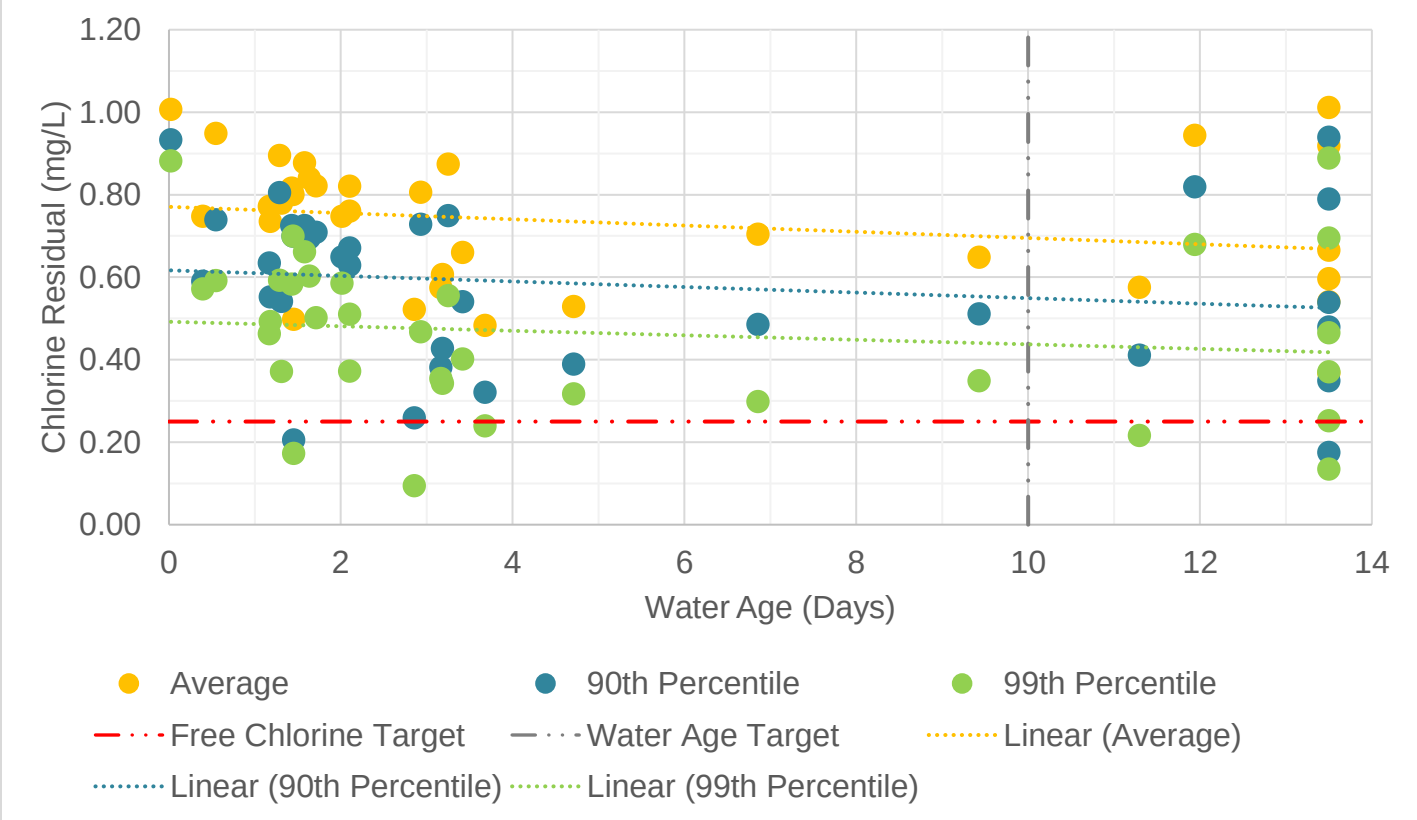


Figure 3.D.10 Existing Chlorine Residual vs Water System Age

Figure 3.D.11 shows the modelled water age throughout the system. Figure 3.D.12 shows the existing watermain capacity in the system as maximum head loss (m/km).

Niagara Region

2016 MASTER SERVICING PLAN

N

United States of America

Niagara River

City of Niagara Falls
Town of Fort Erie

City of Niagara Falls
City of Port Colborne

City of Port Colborne
Town of Fort Erie

Stevensville Pumping Station

Stevensville Reservoir

Central Avenue Elevated Tank

Rosehill W.T.P.

Rosehill W.T.P. Lowlift Pumping Station

Rosehill W.T.P. Lowlift Pumping Station

Lake Erie

Bowen Rd

Garrison Rd

Beach Rd

Michener Rd

Empire Rd

Schisler Rd

Wilhelm Rd

Point Abino Rd

Ridgemount Rd

Stonemill Rd

Black Creek

Beaver Creek

Frenchman's Creek

Roger's Creek

Baker Creek

0 2 4 Kilometers

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

241

Water Age (Days)

- < 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- < 8

Figure 3.D.11

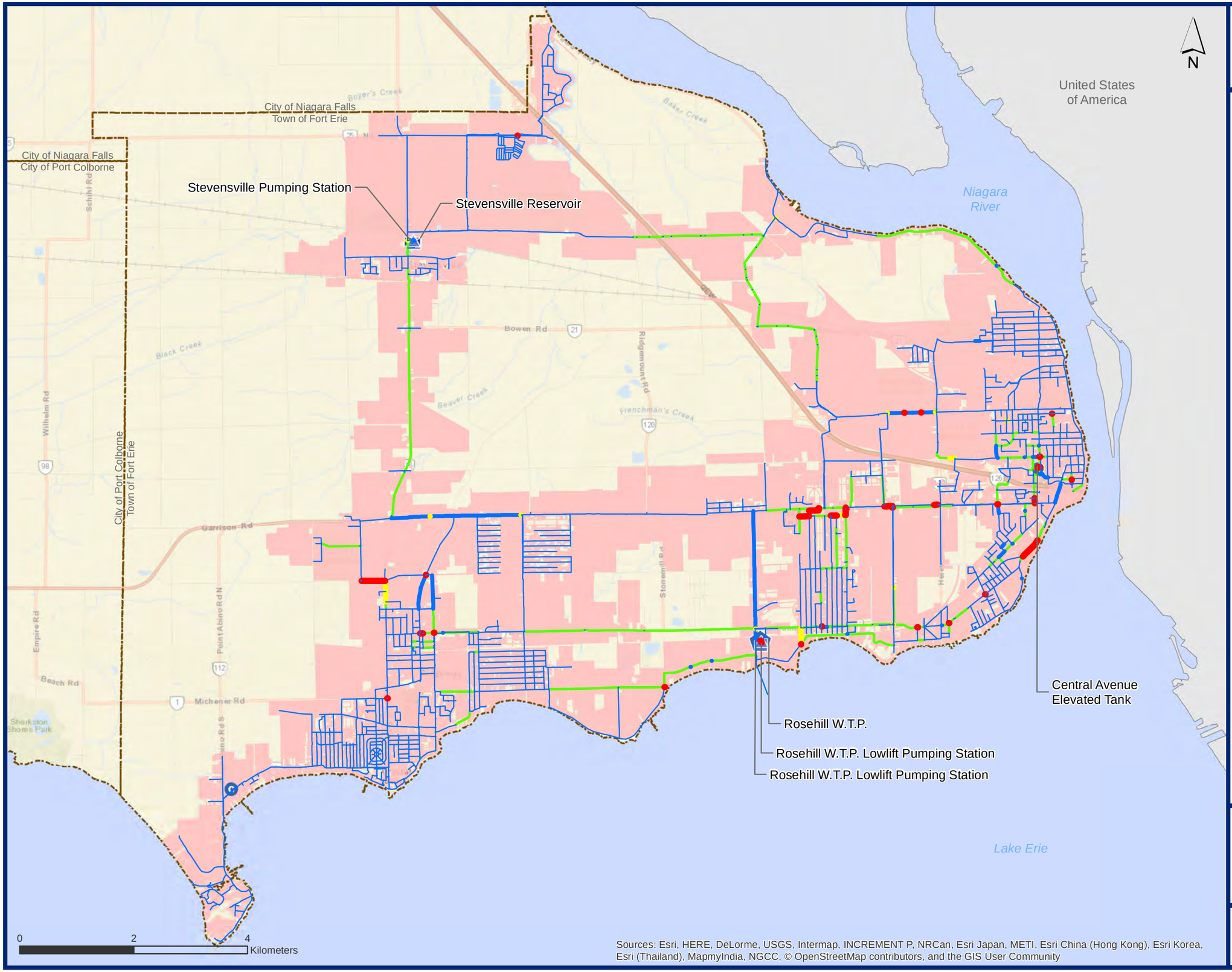
Water Age

Rosehill WTP

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

BluePlan Engineering

May 2017
715023-W-8-Water Age (FE)
NAD 1983 UTM Zone 17N



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

241

Watermain Headloss (m/km)

- < 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4

Figure 3.D.12

Watermain Capacity

Rosehill WTP

BluePlan Engineering

May 2017
715023-W-9-Watermain Capacity (FE)
NAD 1983 UTM Zone 17N

D.4. System Opportunities and Constraints

Figure 3.D.13 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 19.1 MLD. The projected 2041 MDD is 26.8 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 2041.

D.4.2 Fort Erie System

- The system has an existing and future pumping surplus.
- There is an existing storage deficit of 1.1 ML, which is increased to 3.5 ML in 2041.
- Majority of the existing 15.1 ML of system storage is ground level pumped storage, with only 1.5 ML of elevated storage is available for conventional balancing storage. This leads to:
    - Deficit of balancing storage within the system
    - Deficit of 2041 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 projected total storage deficit. The new balancing storage will also address the potential 2041 peak pumping deficits
- 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.

D.4.3 System Security of Supply & Interconnections

- Central Fort Erie, Crystal Beach, and Stevensville/Douglastown are connected by a Regional trunk loop.
- There is only one Regional trunk main from the water treatment plant to central Fort Erie from the main trunk loop. Single trunk main is supplemented with existing elevated storage (Central Avenue Elevated Tank).

Niagara Region

2016 MASTER SERVICING PLAN

N

United States of America

Niagara River

City of Niagara Falls
Town of Fort Erie

City of Niagara Falls
City of Port Colborne

Stevensville Pumping Station

Stevensville Reservoir

Stevensville Reservoir and Pumping Station's current configuration presents existing operational issues related to water quality and sub-optimal pumping strategy.

Majority of system storage is ground level pumped storage.

New elevated storage is required to address existing balancing storage deficit and 2041 total storage deficit.

Single Regional trunk main from the Water Treatment Plant to Central Fort Erie.

Central Avenue Elevated Tank

Rosehill W.T.P.

Rosehill W.T.P. Lowlift Pumping Station

Rosehill W.T.P. Lowlift Pumping Station

The Water Treatment Plant has surplus capacity to accomodate growth beyond 2041.

Lake Erie

Garrison Rd

Beach Rd

Michener Rd

Point Abino Rd

Stonemill Rd

Empire Rd

Wilhelm Rd

Schisler Rd

Black Creek

Boyer's Creek

Baker Creek

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

- 241

Figure 3.D.13

System Opportunities and Constraints

Rosehill WTP

BluePlan Engineering Inc

May 2017
715023-W-3-Opportunities and Constraints (FE)
NAD 1983 UTM Zone 17N

D.5. Assessment of Alternatives

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

- Baseline (No Changes)
- Additional Storage at Water Treatment Plant
- Additional Storage and Pumping at Stevensville Reservoir
- New Consolidated Elevated Storage

D.5.1 Alternative 1 – Additional Storage at Water Treatment Plant

Alternative 1, highlighted in Figure 3.D.14, includes increased storage capacity at the water treatment plant to overcome existing and future storage deficits. To support this strategy, additional high lift pumping capacity at the water treatment plant would be required to address peak pumping needs caused by elevated balancing storage deficit.

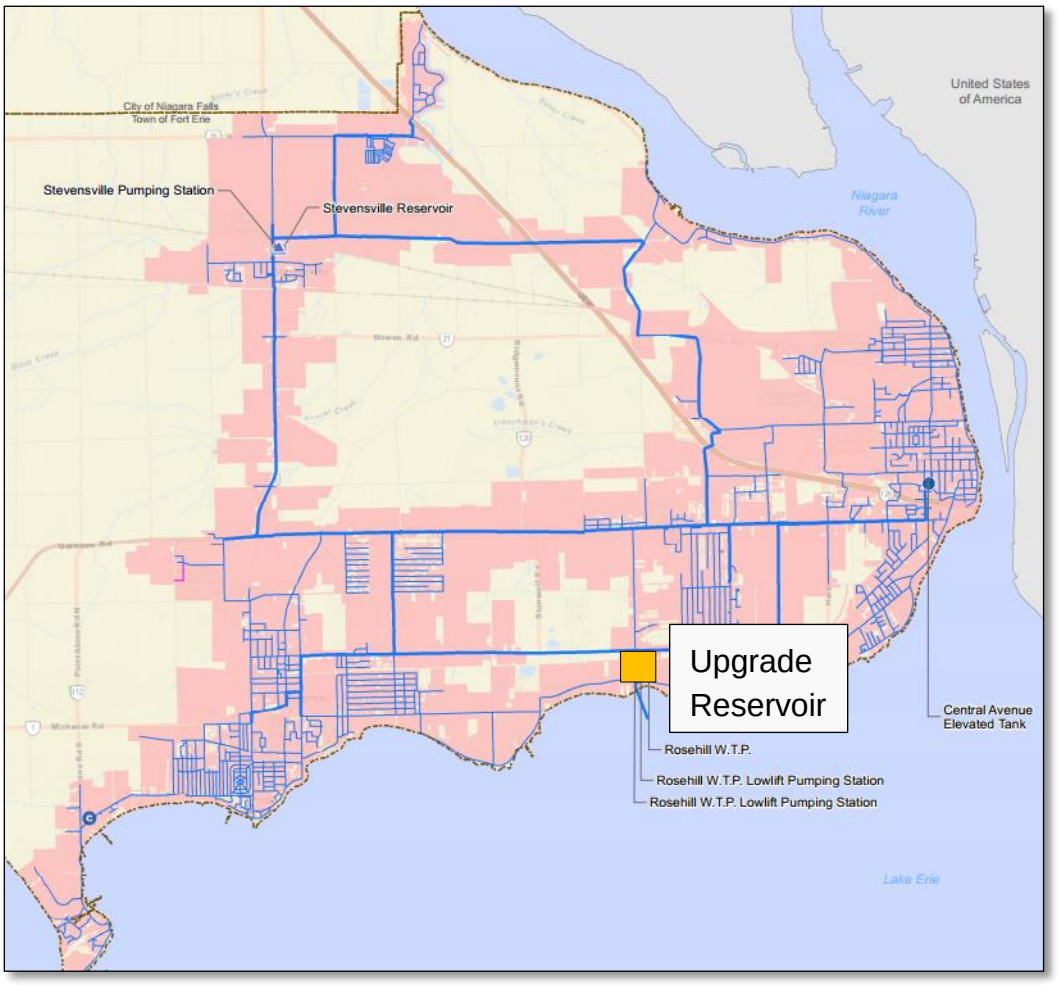


Figure 3.D.14 Alternative 1 – Additional Storage at Water Treatment Plant

D.5.2 Alternative 2 – Additional Storage and Pumping at Stevensville Reservoir and Pumping Station

Alternative 2, highlighted in Figure 3.D.15, includes increased storage and pumping capacity at the Stevensville Reservoir and Pumping Station to overcome existing and future storage deficits and to address the peak pumping needs resulting from the elevated balancing storage deficit.

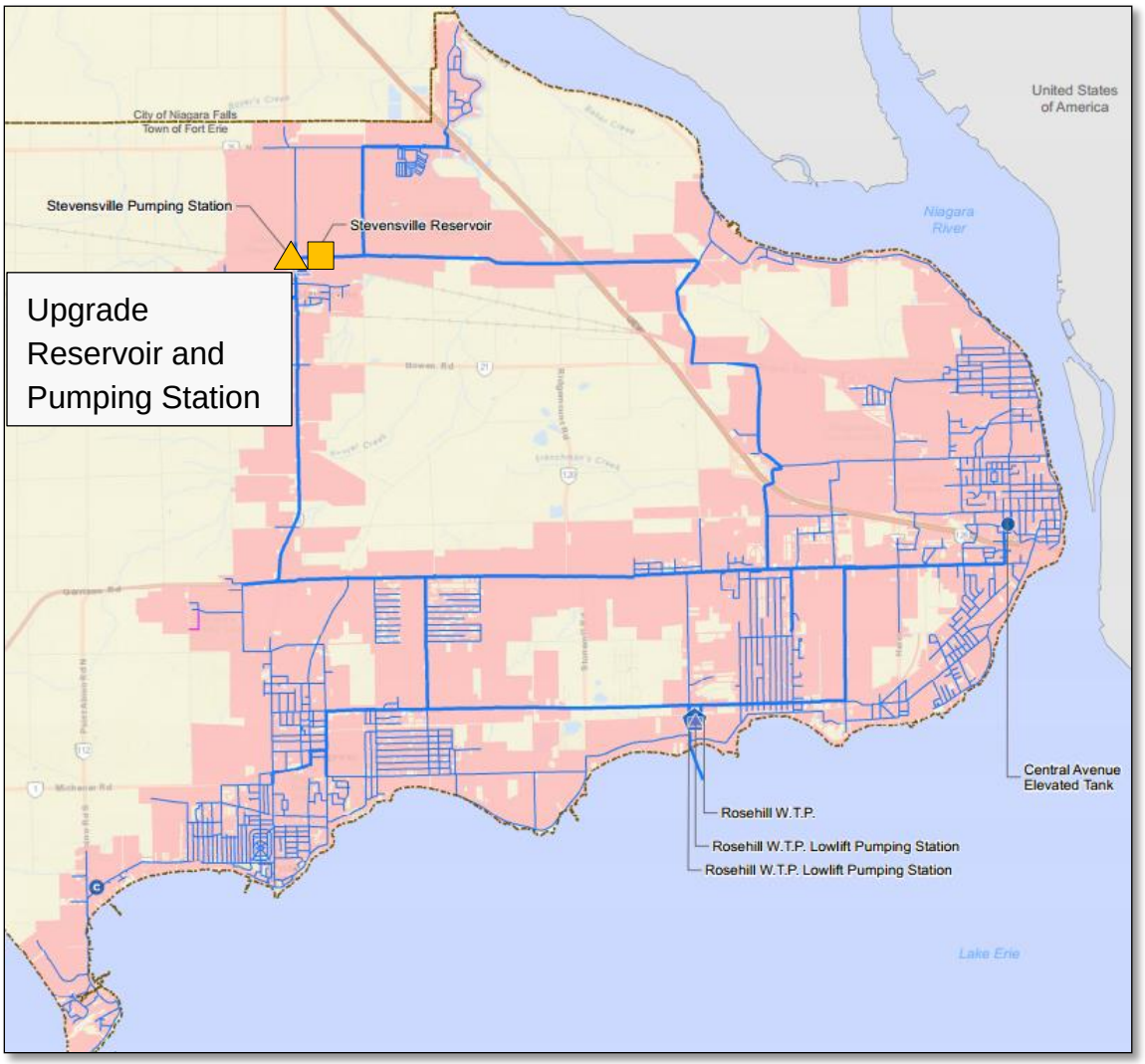


Figure 3.D.15 Alternative 2 – Additional Storage and Pumping at Stevensville Reservoir and Pumping Station

D.5.3 Alternative 3 – New Consolidated Elevated Storage

Alternative 3, highlighted in Figure 3.D.16, consists of decommissioning the Central Avenue Elevated Tank, the decommissioning of Stevensville Reservoir and Pumping Station, and the addition of a new elevated tank in Fort Erie to increase floating storage and total storage capacity. Additionally, there is new trunk conveyance in central Fort Erie to re-establish similar security of supply resulting from the decommissioning of the Central Avenue Elevated Tank.

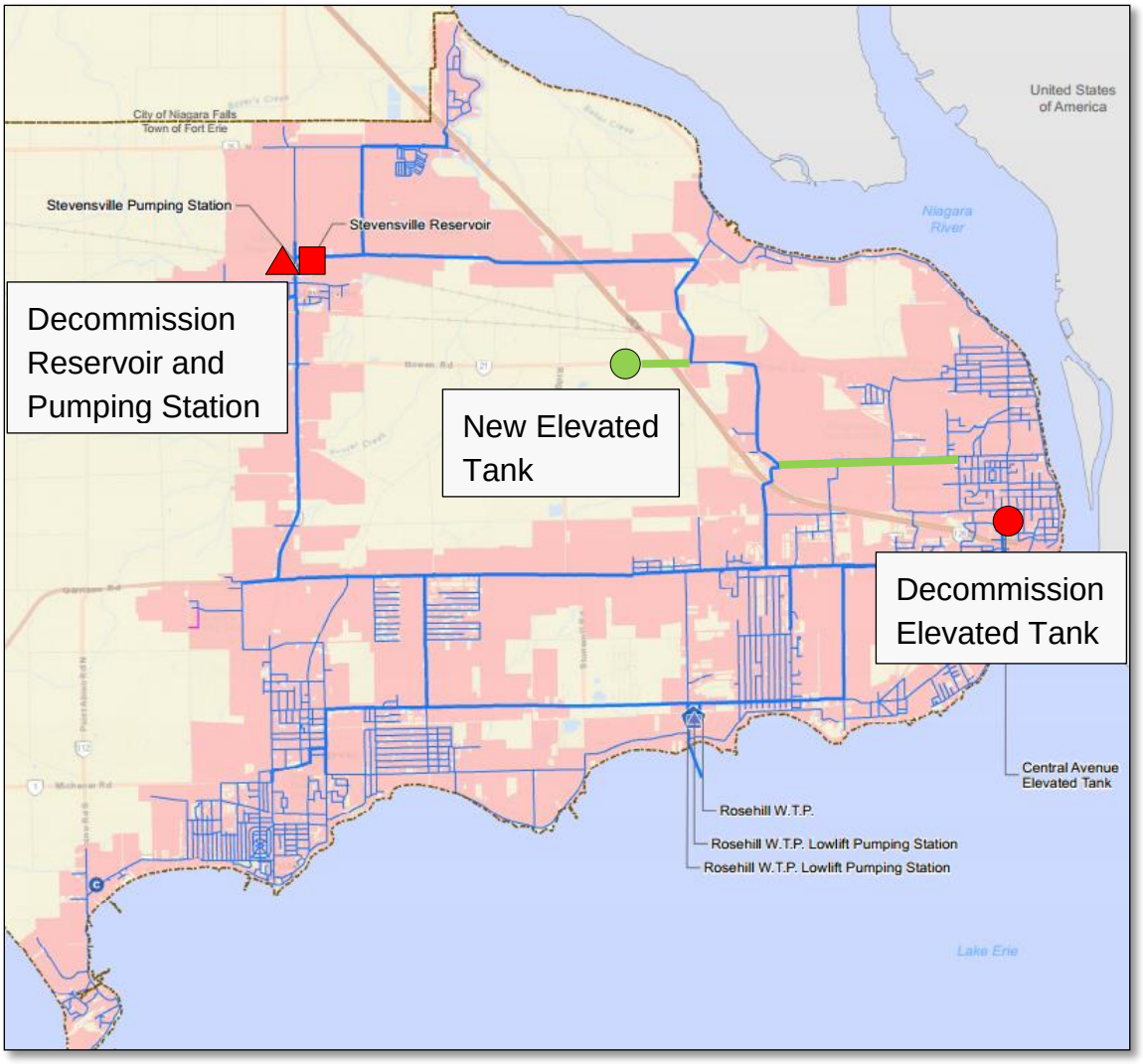


Figure 3.D.16 Alternative 3 – New Consolidated Elevated Storage

D.5.4 Alternatives Evaluation

Alternative 3 – New Consolidated Elevated Storage is the preferred servicing strategy as:

- Baseline strategy does not satisfy the future servicing needs of the water system.
- Alternative 1 and Alternative 2 also require additional pumping capacity upgrades to address the floating storage deficits.
- Alternative 3 – New Consolidated Elevated Storage provides the following advantages:
    - Simplifies and optimizes system operations through the consolidation of multiple facilities.
    - Allows for more efficient pumping strategy.
    - Increasing balancing storage supply eliminated need for additional pumping capacity upgrades
    - Places the new storage close to the large growth area allowing for improved capacity within the new growth area.
    - The new trunk watermain maintains security of supply to Central Fort Erie.

D.6. Preferred Servicing Strategy

The following is a summary of the Fort Erie water servicing strategy:

- The Rosehill Water Treatment Plant has sufficient capacity to support growth to year 2041.
- 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 water 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.
- Additional trunk feedermain capacity is required to support the new tank and for distribution in central Fort Erie.

Figure 3.D.17 and Figure 3.D.18 present the preferred servicing strategy, consisting of:

D.6.1 Storage

A new 8.0 ML elevated tank is to be built in central Fort Erie to improve existing conditions, support growth, and increase floating storage in the zone.

D.6.2 Trunk Main

- New 450 mm trunk main to the New Elevated Tank
- New 450 mm trunk main 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 Project Implementation and Considerations

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.
- The new trunk main to central Fort Erie may be completed at any time.

D.7. Capital Program

Table 3.D.13 summarizes the recommended project costing, implementation schedule and Class EA requirements.

D.7.1 Schedule B Project Files

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

Niagara Region

2016 MASTER SERVICING PLAN

MSP Water Projects

- Treatment Plant
- Reservoir
- Pumping Station
- Elevated Tank
- Watermain Projects

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station
- Regional
- Municipal

Water Network
- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

241

Stevensville Reservoir
W-D-002
Stevensville Pumping Station
W-M-011
W-S-001
W-M-001
W-D-001
Central Avenue Elevated Tank
Rosehill W.T.P.
Rosehill W.T.P. Highlift Pumping Station
Rosehill W.T.P. Reservoir

United States of America
Niagara River
Lake Erie
City of Niagara Falls
Town of Fort Erie
City of Niagara Falls
City of Port Colborne
City of Port Colborne
Town of Fort Erie
Stevensville
Ridgeway
Crystal Beach
Fort Erie
Bowen Rd
Garrison Rd
Nelles Rd
Michener Rd
Beach Rd
Black Creek
Beaver Creek
Frenchman's Creek
Boyer's Creek
Baker Creek
Schisler Rd
Wilhelm Rd
Empire Rd
Point Abino Rd N
Point Abino Rd S
Ridge Rd
Stonemill Rd
Sherkston Shores Park
Bridgewater Country Club
Fort Erie Racetrack
Rio Vista Golf Course
Clarence Hill Golf & Country Club
International Country Club Niagara
Safari Niagara

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

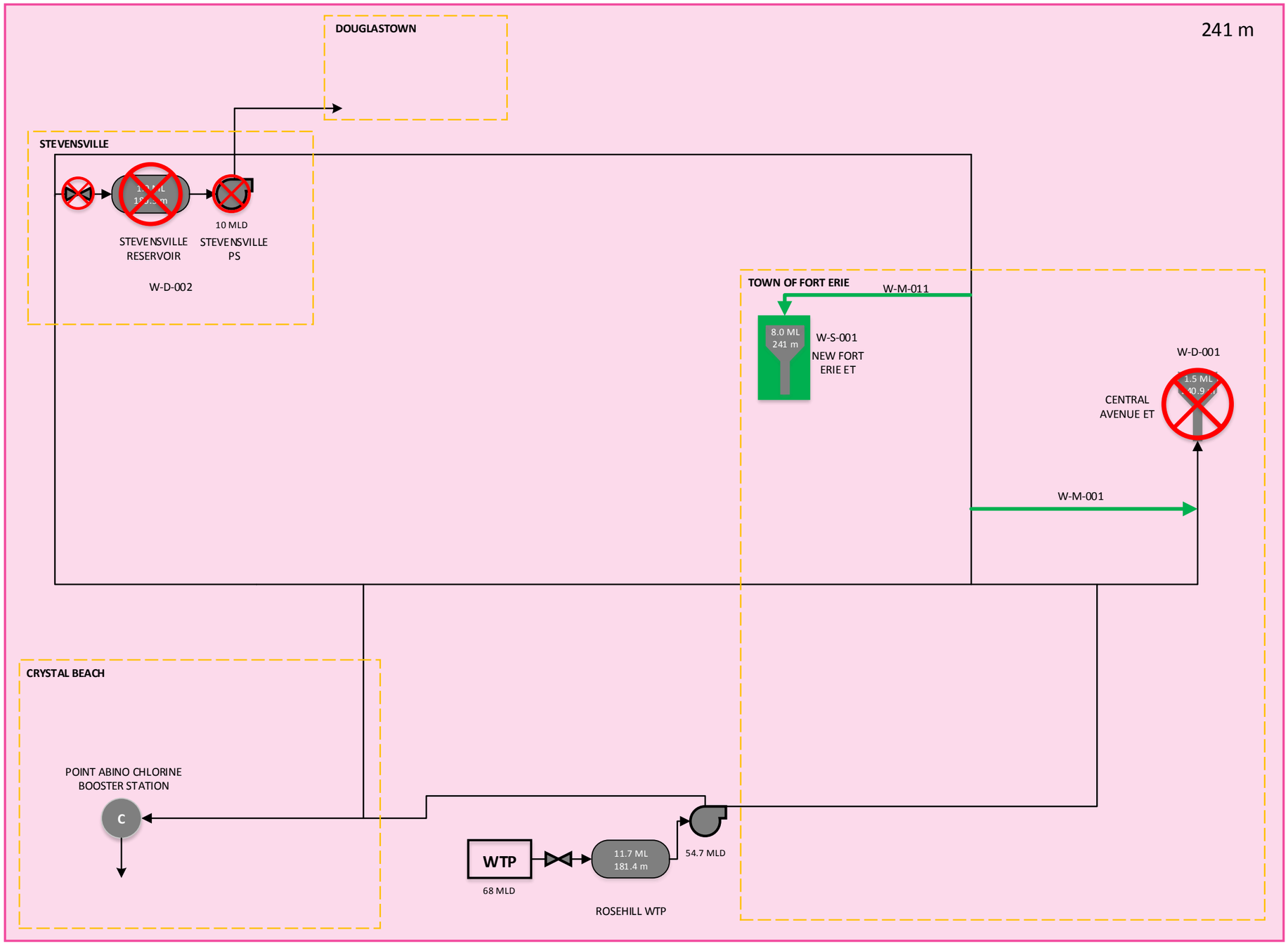
Figure 3.D.17

Preferred Water Strategy

Rosehill WTP

BluePlan Engineering

May 2017
715023-W-6-Capital Projects (FE)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Rosehill WTP (Fort Erie)

2041 DISTRIBUTION SCHEMATIC

- WTP (RATED CAPACITY) — Water Treatment Plant
- Pumping Station (FIRM CAPACITY)
- Volume TWL — Reservoir
- Volume TWL — Elevated Tanks
- Control Valve (Only normally operated valves shown)
- C — Chlorine Facility
- Facility Upgrade
- Volume TWL — Standpipe
- Trunk Watermain Network
- Settlement Area Boundaries
- Land and Water Features
- New Watermain
- Upgrade Watermain
- Decommission Project
- New Facility

Pressure Zone

241 m

May 2017
Figure 3.D.18
Not to Scale

BluePlan ENGINEERING

Table 3.D.13 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 Avenue (Fort Erie South) Elevated Tank	New Fort Erie Elevated Tank to replace the Central Avenue Elevated Tank and Stevensville Reservoir; Central Avenue Elevated Tank to be decommissioned	N/A	2022 - 2031	Fort Erie	A+	Satisfied	Storage	$ 1,979,000
W-D-002	Decommissioning of Stevensville Reservoir + Pumping Station	New Fort Erie Elevated Tank to replace the Central Avenue Elevated Tank and Stevensville Reservoir; Stevensville Reservoir and Pumping Station to be decommissioned	N/A	2022 - 2031	Fort Erie	A+	Satisfied	Storage	$ 2,913,000
W-M-001	New trunk main in Central Fort Erie	New trunk main in Central Fort Erie	450 mm	2022 - 2031	Fort Erie	A+	Satisfied	Watermain	$ 9,479,000
W-M-011	New trunk main to Fort Erie Elevated Tank	New trunk main to Fort Erie Elevated Tank	450 mm	2017 - 2021	Fort Erie	A+	EA Previously Completed	Watermain	$ 4,107,000
W-S-001	New Fort Erie Elevated Tank	New Fort Erie Elevated Tank to replace the Central Avenue Elevated Tank and Stevensville Reservoir	8 ML	2017 - 2021	Fort Erie	B	Satisfied (Project File Included)	Storage	$ 12,838,000
Total									**$31,316,000**

PART E
PORT COLBORNE WATER SYSTEM

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 16,417 and 5,655 employees.[1]

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).[2]

The system supplies local area municipalities via a water main network, pumping stations, and service 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.

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

[2] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-201*

Niagara Region

2016 MASTER SERVICING PLAN

Fielden Avenue Pumping Station

Fielden Avenue Reservoir

Port Colborne W.T.P.

Port Colborne W.T.P. Pumping Station

Port Colborne W.T.P. Reservoir

King Street Elevated Tank

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

223

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

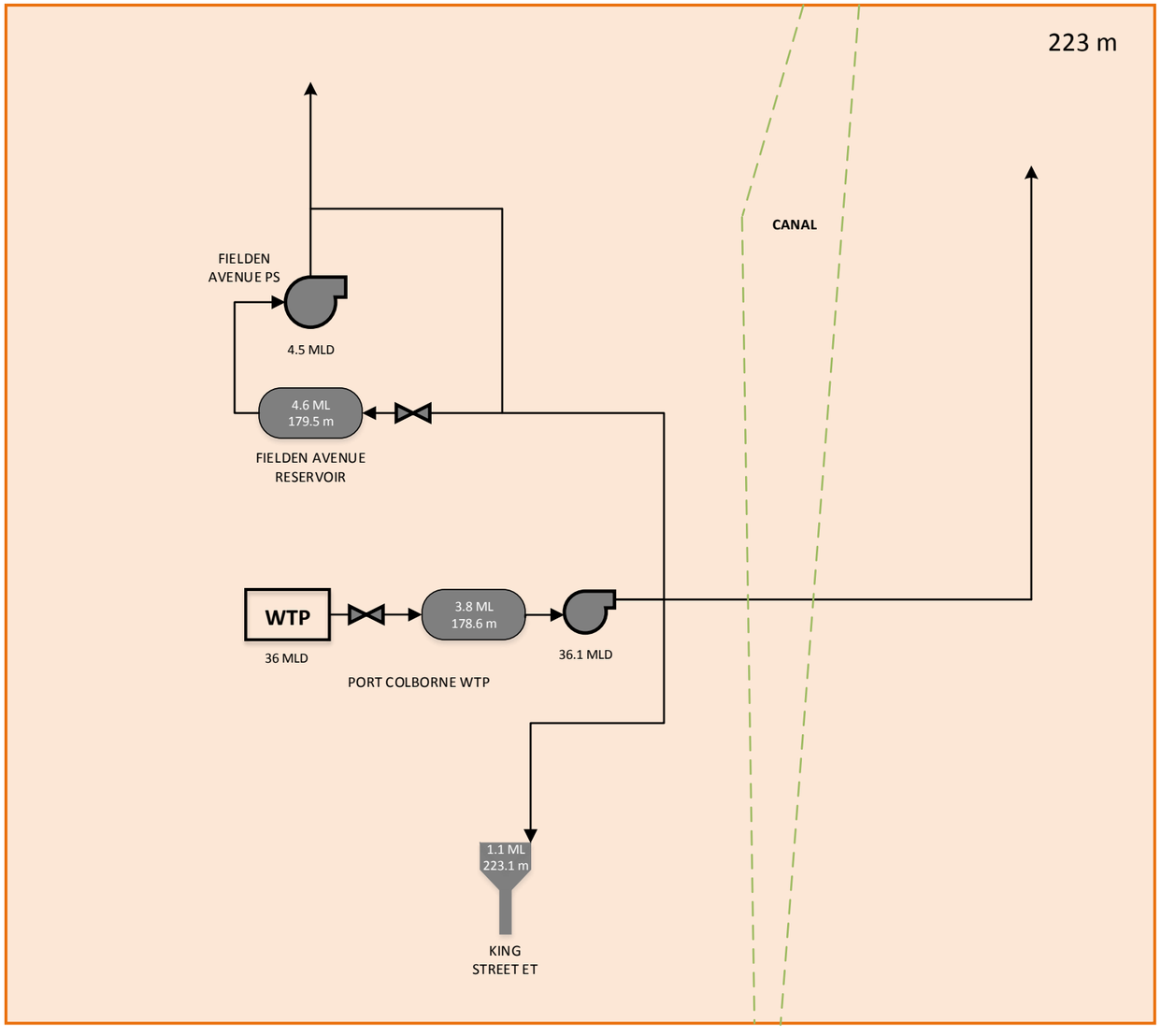
Figure 3.E.1

Existing Water System

Port Colborne WTP

BluePlan Engineering

May 2017
715023-W-2-Existing Water System (PC)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Port Colborne WTP

EXISTING DISTRIBUTION SCHEMATIC

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

223 m

May 2017
Figure 3.E.2
Not to Scale

BluePlan ENGINEERING

E.1.1 Facility Overview

Table 3.E.1 Water Treatment Plant Overview

Plant Name	Port Colborne Water Treatment Plant[3]
Address	323 King Street, Port Colborne
Source Water	Lake Erie via Welland Canal
Rated MDD Capacity	36.0 MLD
Key Processes	• Zebra mussel control • Travelling screens • Coagulation • Flocculation • Sedimentation • Filtration • Disinfection

Table 3.E.2 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone)	Discharge (Pressure Zone)	Zones Supplied	Number of Pumps (Total / Firm)	Firm Capacity (MLD)	Total Dynamic Head (m)
Port Colborne Water Treatment Plant (WTP) High Lift Pumps	323 King Street, Port Colborne	WTP	223	223	5/4	36.1	48.8
Fielden Avenue Booster Pumping Station	805 Fielden Avenue, Port Colborne	223	223	223	2/1	4.5	61.0

[3] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-201*

Table 3.E.3 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	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
King Street Elevated Tank	35 King Street, Port Colborne	Elevated Tank	1.1	223.1	223	223
Barrick Road Elevated Tank[1]	Barrick Road and Elm Street, Port Colborne	Elevated Tank	6.0 ML	223	223	223

[1] Barrick Road Elevated Tank will be in service prior to the end of 2017.

Refer to Figure 3.E.1 for pumping station and storage facility locations.

E.1.2 Demands Overview

Table 3.E.4 Historic Water System Demands

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***	***12.9***	***1.56***
5 Year Peak	***9.0***	***14.9***	***1.65***

Table 3.E.5 Water System Max Day Peaking Factor

Existing Service Population	16,417
Existing Service Employment	5,655
Total Service Equivalent Population	**22,072**
MOECC Peaking Factor[4]	1.90
Historic 5 Year Average Peaking Factor	1.56
Historic 5 Year Max Peaking Factor	1.65
2016 MSP Peaking Factor	**1.56**

The 2016 MSP peaking factor is the average of the peaking factors from 2011 to 2015.

[4] *Ministry of the Environment and Climate Change, 2008, Design Guidelines for Drinking-Water Systems, ISBN 978-1-4249-8517-3*

Table 3.E.6 Water System Demands by Pressure Zone

Pressure Zone	Total Service Equivalent Population[5]	2014 Average Day Demand (MLD)	2014 Maximum Day Demand (MLD)
223	22,072	8.3	12.9
Total	**22,072**	**8.3**	**12.9**

Pressure zone existing equivalent population estimates were derived using the Niagara 2041 MCR traffic survey zone population allocations and are calculated to the end of 2014. [6]

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

E.2 Growth Projections

E.2.1 Population Projections and Allocations

Table 3.E.7 and Table 3.E.8 outline the existing and projected serviced population and employment by pressure zone.

Table 3.E.7 Port Colborne Water Treatment Plant Serviced Population by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
223	16,417	16,320	16,906	17,728	18,696	19,428	3,011
Total	**16,417**	**16,320**	**16,906**	**17,728**	**18,696**	**19,428**	**3,011**

Note: Population numbers may not sum due to rounding.

Table 3.E.8 Port Colborne Water Treatment Plant Serviced Employment by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
223	5,655	5,733	5,876	6,116	6,358	6,679	1,024
Total	**5,655**	**5,733**	**5,876**	**6,116**	**6,358**	**6,679**	**1,024**

Note: Population numbers may not sum due to rounding.

E.2.2 Future Demand Projections

Table 3.E.9 and Table 3.E.10 summarize the projected average and maximum system demands by pressure zone.

Table 3.E.9 Projected Water System Average Day Demands (ADD) by Pressure Zone

Pressure Zone	2021 ADD (MLD)	2026 ADD (MLD)	2031 ADD (MLD)	2036 ADD (MLD)	2041 ADD (MLD)
223	8.3	8.5	8.8	9.2	9.5
Total	**8.3**	**8.5**	**8.8**	**9.2**	**9.5**

Table 3.E.10 Projected Water System Maximum Day Demands (MDD) by Pressure Zone

Pressure Zone	2021 MDD (MLD)	2026 MDD (MLD)	2031 MDD (MLD)	2036 MDD (MLD)	2041 MDD (MLD)
223	12.9	13.3	13.8	14.3	14.8
Total	**12.9**	**13.3**	**13.8**	**14.3**	**14.8**

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

E.3.1 Treatment Plant Capacity

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

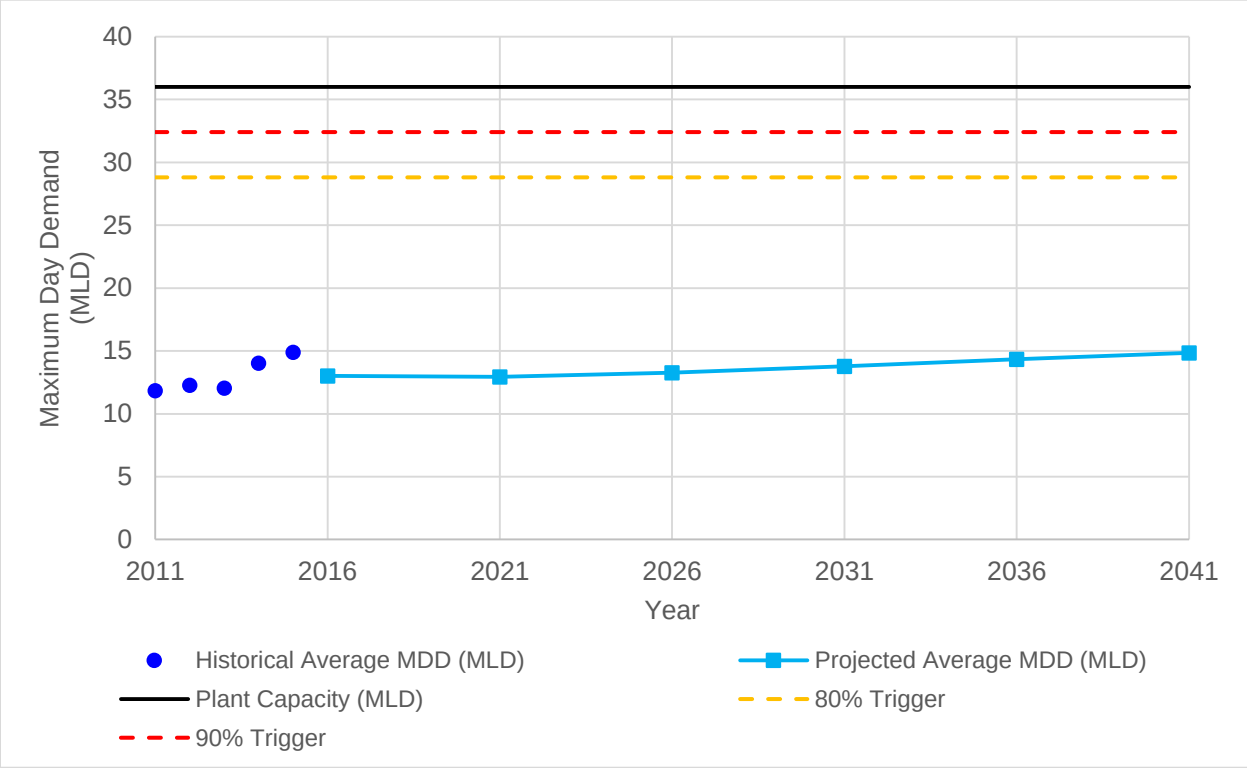


Figure 3.E.3 Projected Maximum Day Demand at Port Colborne Water Treatment Plant

E.3.2 Pumping Capacity

Table 3.E.11 highlights the pumping station existing and projected capacity.

Table 3.E.11 System Pumping Station Performance

Pump Station	Pressure Zones Supplied	Total Effective Capacity (MLD)	Existing Maximum Day Demand (MLD)	2041 Maximum Day Demand (MLD)	2041 Surplus/ Deficit (MLD
Port Colborne Water Treatment Plant/ High Lift Pumping Station	223	36.1	12.9	14.8	21.3
Fielden Avenue Booster Pumping Station					

The Fielden Avenue Booster Pumping Station capacity is not included in the total effective capacity for the zone. The Booster Pumping Station capacity is considered for zone fire flow and peak hour capacities.

The Port Colborne system has a surplus max day pumping capacity projected to 2041.

E.3.3 Storage Capacity

Table 3.E.12 highlights the existing and projected storage capacity.

Table 3.E.12 System Storage Capacities

Pressure Zones Supplied	Storage	Existing Total Available Storage (ML)	2041 Total Available Storage (ML)	Existing Required Storage (ML)	2041 Required Storage (ML)	2041 Surplus / Deficit (ML)
223	Port Colborne Water Treatment Plant Reservoir	9.5	14.4	8.3	9.7	4.7
	Fielden Avenue Reservoir					
	King Street Elevated Tank[1]					
	Barrick Road Elevated Tank[2]					

[1] To be decommissioned pre-2041; volume is not included in 2041 Total Available Storage.

[2] Planned works to be online pre-2041; volume is not included in Existing Total Available Storage.

The Port Colborne system has surplus storage capacity projected for 2041, with the Barrick Road Elevated Tank online prior to the end of 2017. Due to surplus pumping capacity and low projected growth to 2041, a 15% balancing storage requirement was used.

Figure 3.E.4 through Figure 3.E.5 show the 5-day MDD storage performance for each storage facility.

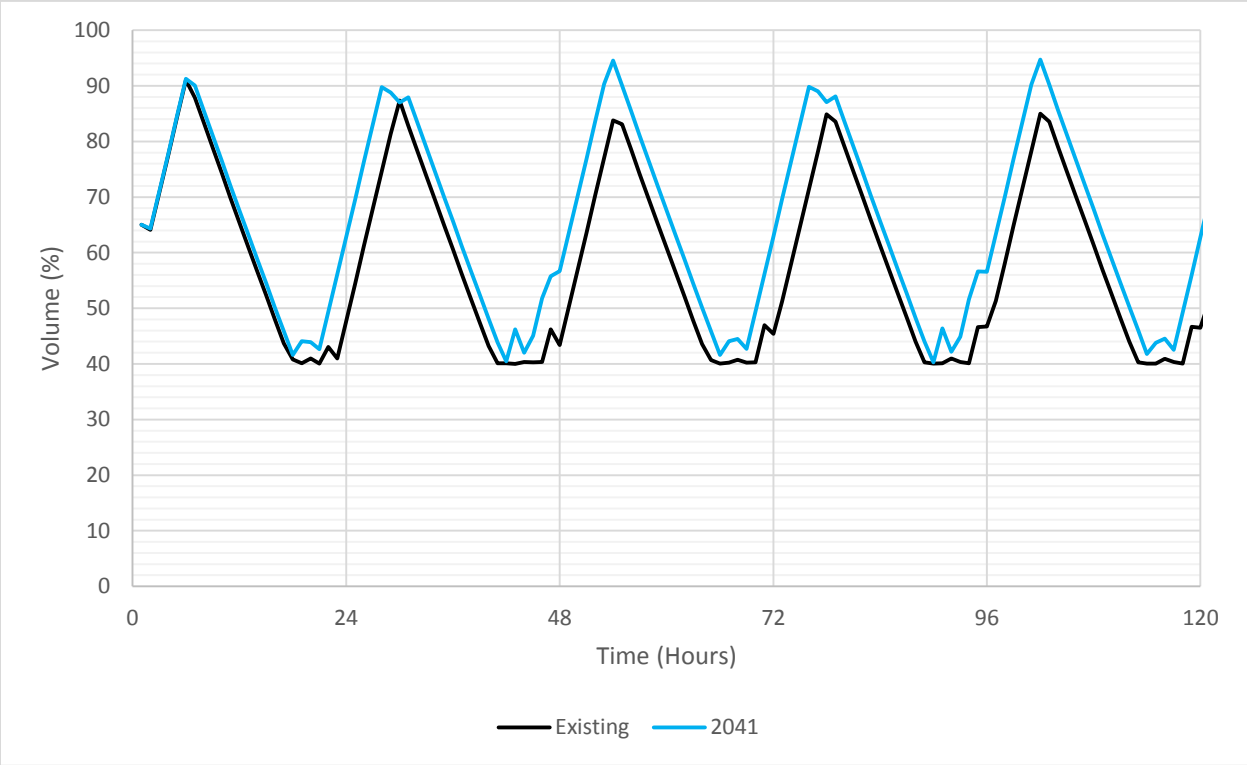


Figure 3.E.4 5-Day MDD Storage Performance – Fielden Avenue Reservoir

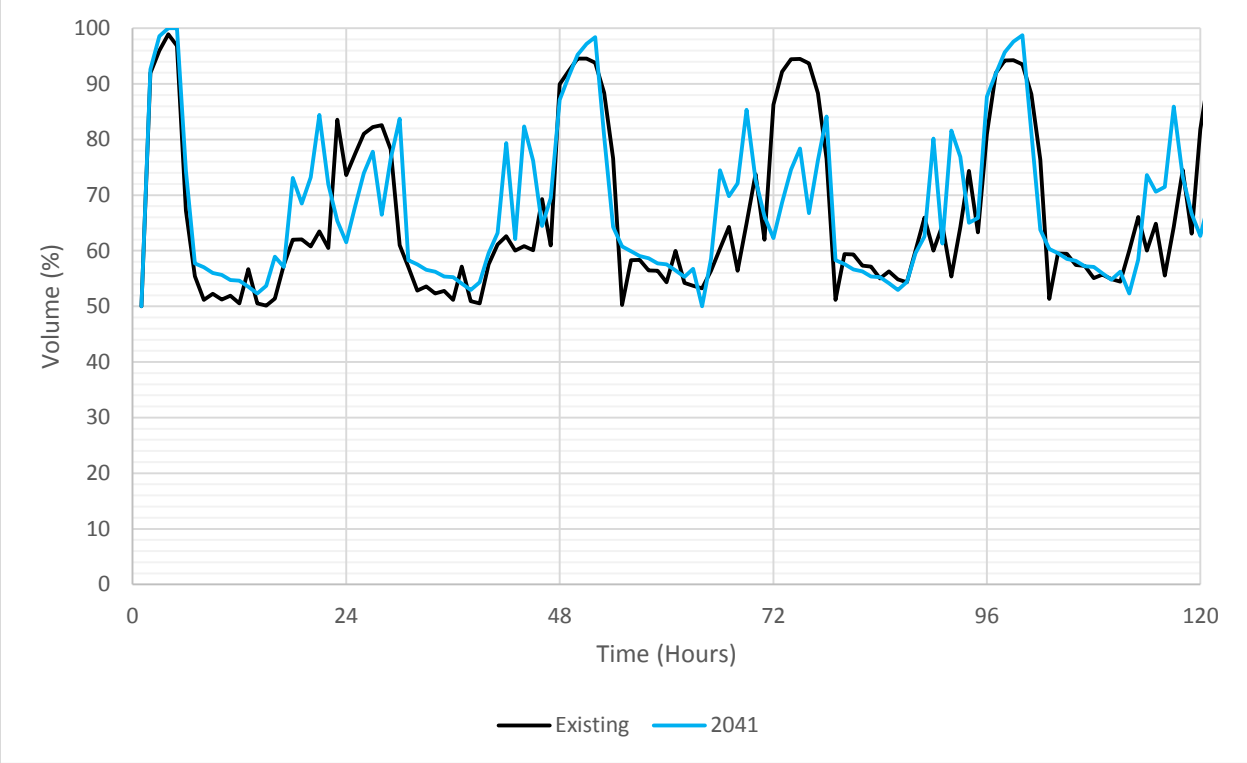


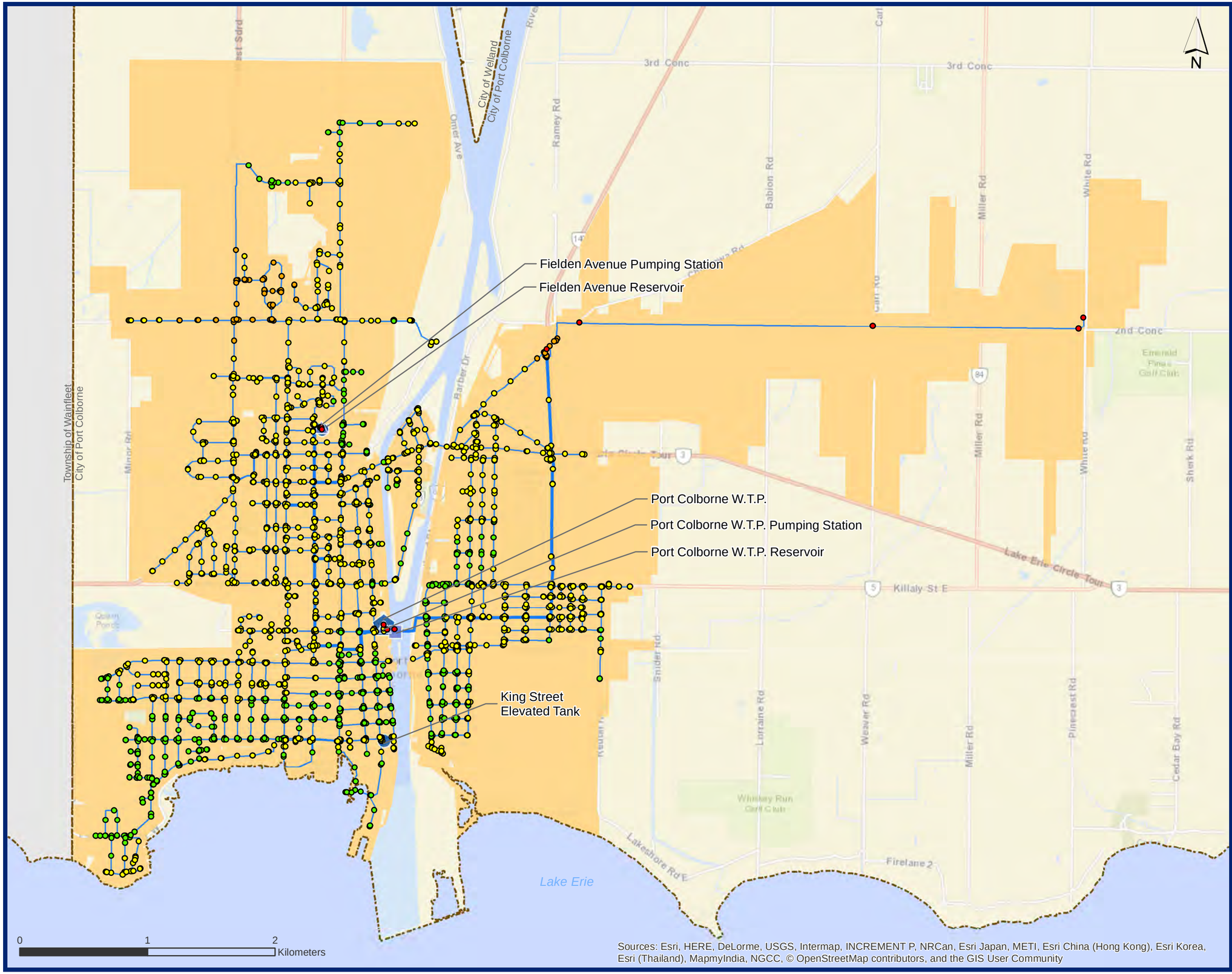
Figure 3.E.5 5-Day MDD Storage Performance – King Street Elevated Tank

E.3.4 System Pressures and Fire Flow

Figure 3.E.6 to Figure 3.E.9 present the existing and project 2041 system performance, based on existing system configuration and capacities.

Niagara Region

2016 MASTER SERVICING PLAN



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

223

Minimum Pressure (psi)

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

Figure 3.E.6

Existing Maximum Day Demand Pressure

Port Colborne WTP

BluePlan Engineering

May 2017
715023-W-4-Existing Pressure (PC)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN

Fielden Avenue Pumping Station

Fielden Avenue Reservoir

Port Colborne W.T.P.

Port Colborne W.T.P. Pumping Station

Port Colborne W.T.P. Reservoir

King Street Elevated Tank

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

223

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 3.E.7

Existing System Fire Flow

Port Colborne WTP

BluePlan Engineering

May 2017
715023-W-6-Existing Fire Flow (PC)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN

Fielden Avenue Pumping Station

Fielden Avenue Reservoir

Port Colborne W.T.P.

Port Colborne W.T.P. Pumping Station

Port Colborne W.T.P. Reservoir

King Street Elevated Tank

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

223

Minimum Pressure (psi)

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

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 3.E.8

2041 Maximum Day Demand Pressure

Port Colborne WTP

BluePlan Engineering

May 2017
715023-W-5-2041 Pressure (PC)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN

Fielden Avenue Pumping Station

Fielden Avenue Reservoir

Port Colborne W.T.P.

Port Colborne W.T.P. Pumping Station

Port Colborne W.T.P. Reservoir

King Street Elevated Tank

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

223

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 3.E.9

2041 System Fire Flow

Port Colborne WTP

BluePlan Engineering

May 2017
715023-W-7-2041 Fire Flow (PC)
NAD 1983 UTM Zone 17N

E.3.5 Water Age and Watermain Capacity

Figure 3.E.10 highlights the sampled chlorine residual (mg/L) versus the modelled water system age at each sample location.

The 90th percentile trend line represents the chlorine residual achieved by the bottom 10% of samples at a location, meaning that 90% of the samples taken at that location were above the 90th percentile trend line. Similarly, the 99th percentile trend line represents the chlorine residual achieved by the bottom 1% of samples at a location, meaning that 99% of the samples taken at that location were above the 99th percentile trend line. It is assumed that <10 days is required to maintain the 0.25 mg/L chlorine residual objective.

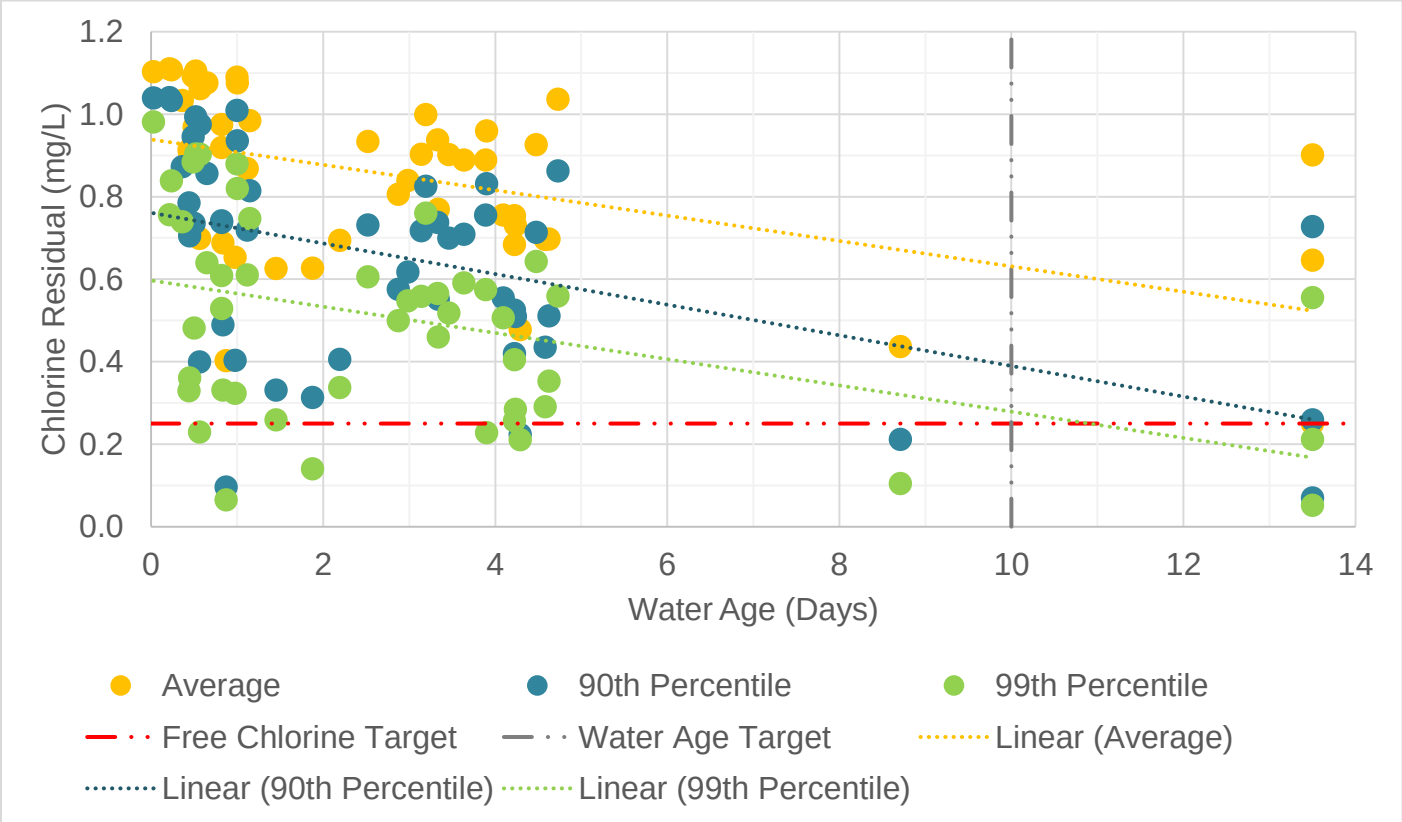


Figure 3.E.10 Existing Chlorine Residual vs Water System Age

Figure 3.E.11 shows the modelled water age throughout the system. Figure 3.E.12 shows the existing watermain capacity in the system as maximum head loss (m/km).

Niagara Region

2016 MASTER SERVICING PLAN

Fielden Avenue Pumping Station

Fielden Avenue Reservoir

Port Colborne W.T.P.

Port Colborne W.T.P. Pumping Station

Port Colborne W.T.P. Reservoir

King Street Elevated Tank

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

223

Water Age (Days)

- < 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- < 8

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 3.E.11

Water Age

Port Colborne WTP

BluePlan Engineering

May 2017
715023-W-8-Water Age (PC)
NAD 1983 UTM Zone 17N

Fielden Avenue Pumping Station
Fielden Avenue Reservoir
Port Colborne W.T.P.
Port Colborne W.T.P. Pumping Station
Port Colborne W.T.P. Reservoir
King Street
Elevated Tank

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station
- Regional
- Municipal

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

223

Watermain Headloss (m/km)

- < 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4

Figure 3.E.12

Watermain Capacity

Port Colborne WTP

BluePlan Engineering

May 2017
715023-W-9-Watermain Capacity (PC)
NAD 1983 UTM Zone 17N

E.4 System Opportunities and Constraints

Figure 3.E.13 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 12.9 MLD. The projected 2041 MDD is 14.8 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 2041.
- 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 2041, there are opportunities to reduce the amount of balancing storage that needs to be maintained within the Port Colborne water system.

E.4.2 Port Colborne System

- The system has the following storage characteristics; when not considering potential reductions in balancing storage needs due to the surplus capacity at the water treatment plant.
    - Existing configuration has a storage surplus of 1.5 ML.
    - Construction of the new Barrick Road Elevated Tank and decommissioning of existing King Street Elevated Tank will increase total system storage, resulting in a projected 2041 storage surplus of 4.7 ML.
- The system generally has adequate minimum peak hour pressures and fire flow.
- Fielden Avenue Reservoir
    - Current configuration presents existing operational issues related to water quality and sub-optimal pumping strategy.
    - When considering reduced balancing storage requirements of 15% by leveraging the large long-term surplus of treatment and pumping capacity projected at the water treatment plant, decommissioning of the Fielden Reservoir would also be required.

E.4.3 System Security of Supply and Interconnections

- There is only one Regional feed to east side of canal.
- There is no floating storage east of canal.

Niagara Region

2016 MASTER SERVICING PLAN

Fielden Avenue Reservoir and Pumping Station's current configuration presents existing operational issues related to water quality and sub-optimal pumping strategy.

Fielden Avenue Pumping Station

Fielden Avenue Reservoir

Single Regional trunk main to east side of canal.

No floating storage on east side of canal.

Existing storage deficit with current configuration.

Port Colborne W.T.P.

Port Colborne W.T.P. Pumping Station

Port Colborne W.T.P. Reservoir

The Water Treatment Plant has surplus capacity to accomodate growth beyond 2041.

2041 MDD less than 50% of rated capacity. Opportunity to reduce balancing storage requirements.

King Street Elevated Tank

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

223

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 3.E.13

System Opportunities and Constraints

Port Colborne WTP

BluePlan Engineering

May 2017

715023-W-3-Opportunities and Constraints (PC)

NAD 1983 UTM Zone 17N

E.5 Assessment of Alternatives

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

- Baseline (No Changes)
- New Floating Storage
- New East & West Storage
- New Floating Storage & Reduced Balancing Storage Requirements

All alternatives include:

- A new 6.0 ML Barrick Street Elevated Tank – under construction and to be in service prior to the end of 2017.
- Decommissioning of the King Street Elevated tank following construction of the Barrick Street Elevated Tank.

E.5.1 Alternative 1 – New Floating Storage

Alternative 1, highlighted in Figure 3.E.14, includes the above mentioned upgrades, while maintaining long-term operation of the Fielden Avenue Pumping Station and Reservoir.

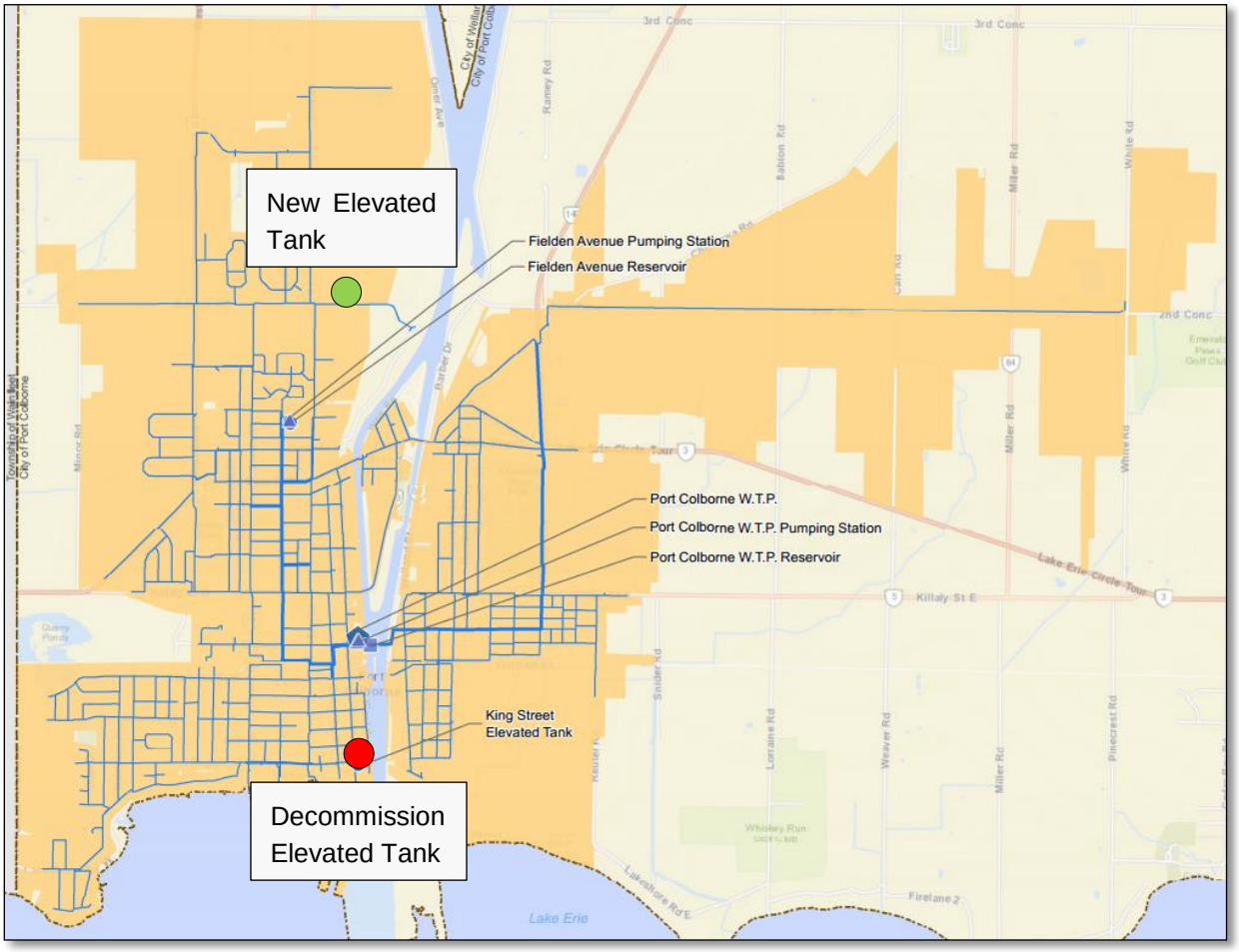


Figure 3.E.14 Alternative 1 – New Floating Storage

E.5.2 Alternative 2 – New East & West Storage

Alternative 2, highlighted in Figure 3.E.15 includes the addition of a new elevated tank on the east side of the canal to provide security of supply, to support growth, and to allow for the decommissioning of the Fielden Avenue Pumping Station and Reservoir. The configuration would allow for an optimized pumping strategy and improved flexibility of operation and maintenance activities.

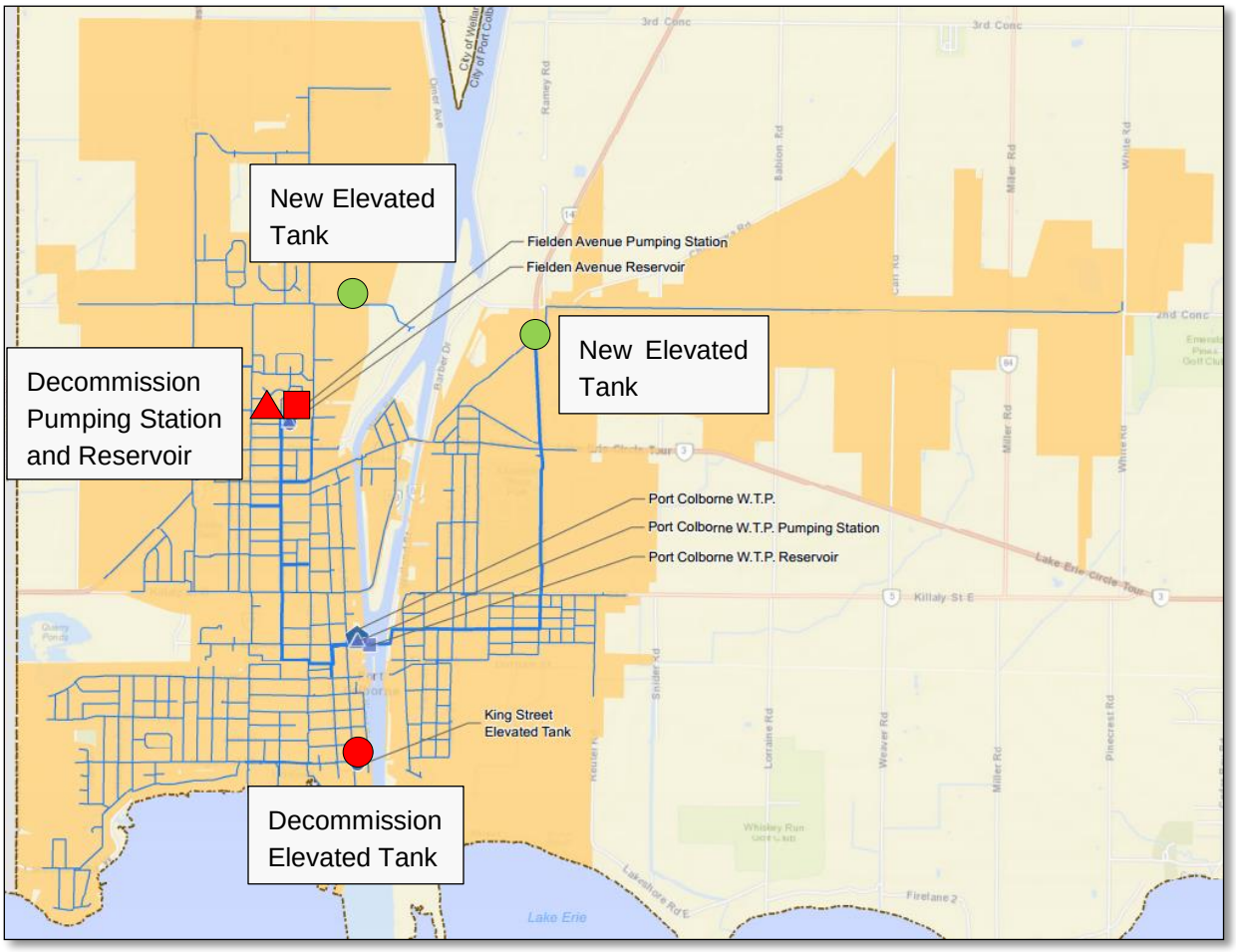


Figure 3.E.15 Alternative 2 – New East & West Storage

E.5.3 Alternative 3 – New Floating Storage & Reduced Balancing Storage Requirements

Alternative 3, highlighted in Figure 3.E.16, includes the above mentioned upgrades with the decommissioning of the Fielden Avenue Pumping Station and Reservoir, through the reduction in system balancing storage requirements by leveraging the large long-term surplus of treatment and pumping capacity projected at the water treatment plant.

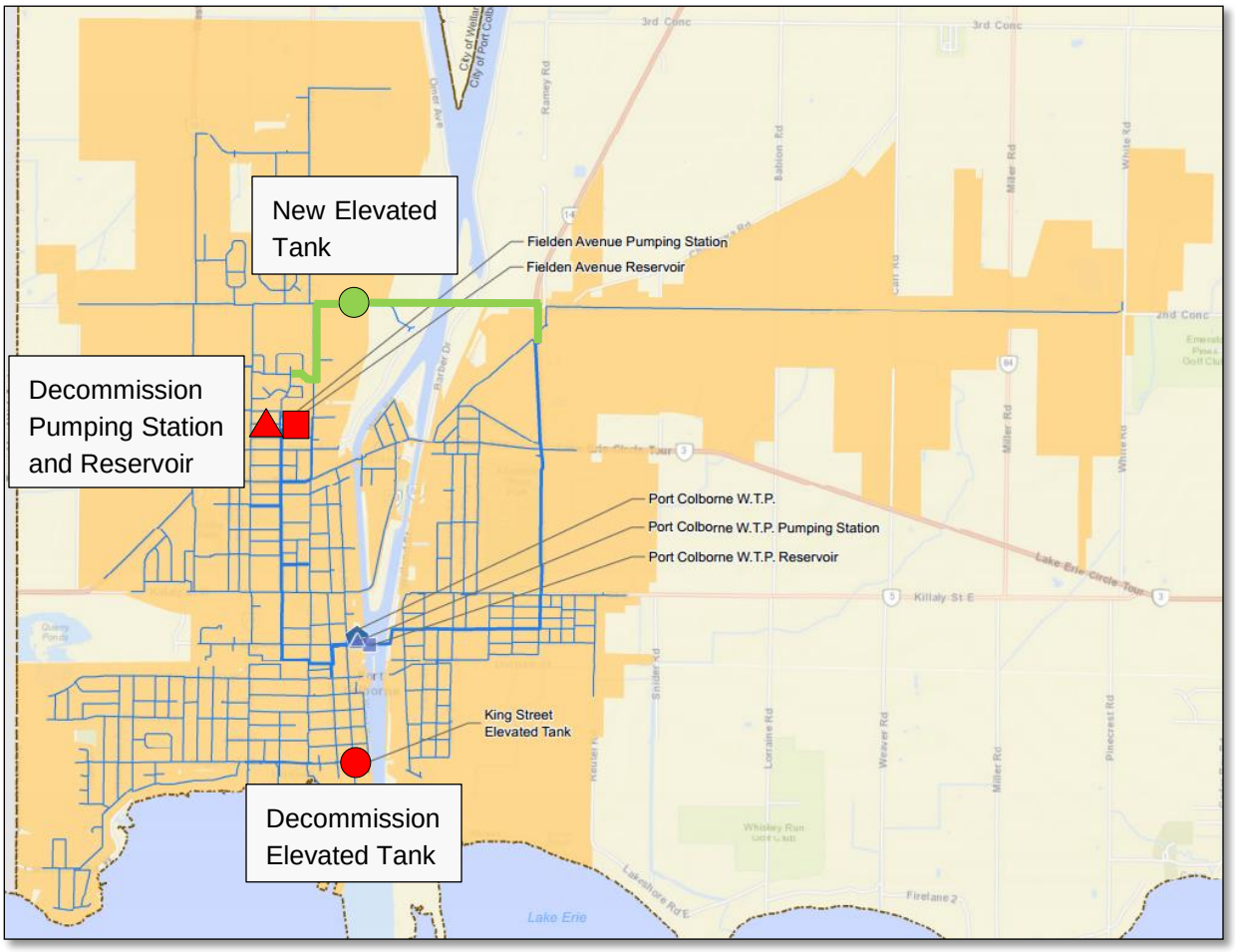


Figure 3.E.16 Alternative 3 – New Floating Storage & Reduced Balancing Storage Requirements

E.5.4 Alternatives Evaluation

Alternative 3 – New Floating Storage & Reduced Balancing Storage Requirements as:

- Baseline strategy does not satisfy the existing or future servicing needs of the water system.
- The new canal crossing provides the required security of supply to the eastern half of the City.
- Alternative 3 provides the following advantages
    - Maximizes the use of existing supply and pumping capacity at the Port Colborne Water Treatment Plant.
    - Allows for the decommissioning of the Fielden Reservoir and Pumping Station.

Alternative 2 does provide additional operation efficiency and flexibility relative to the other alternatives; however, presents a substantially higher capital cost. Further, the presence of 2 separate elevated storages within a single zone may present future operational challenges and issues.

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 to year 2041.
- 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.
- New Barrick Road Elevated Tank will be provided in northern Port Colborne to support the system growth and optimize water levels for the system.
- The new tank will allow for decommissioning of the Fielden reservoir and pumping station as well as the King Street Elevated Tank.
- Additional trunk water feedermain will be provided crossing the Canal to support growth on the east and west side of Port Colborne.

Figure 3.E.17 and Figure 3.E.18 show the preferred servicing strategy and schematic, consisting of:

E.6.1.1 Storage

New 6.0 ML Barrick Road Elevated Tank is to be built in the North side of Port Colborne to support growth (W-S-002). The 6.0 ML includes the existing 1.1 ML at the King Street Elevated Tank and 4.9 ML of additional storage to support existing system operations and 2041 growth.

Leverage the long-term surplus treatment capacity at the Port Colborne Water Treatment Plant, to reduce the zone balancing storage requirements to 15% of MDD, allowing for the decommissioning of the Fielden Avenue Reservoir.

E.6.1.2 Decommissioning of Existing Facilities

The King Street Elevated Tank will be decommissioned (W-D-006) with the addition of the new Barrick Road Elevated Tank. The Fielden Avenue Reservoir and Pumping Station will be decommissioned to optimize system operations and energy use (W-D-007).

E.6.1.3 Trunk Watermain

- New 450 mm watermain to Barrick Street Elevated Tank (W-M-012).
- New 450 mm watermain across the canal to improve security of supply to the east side (W-M-002).

E.6.2 Project Implementation and Considerations

Special project implementation and considerations for the preferred servicing strategy consist of:

- Completion of the new Barrick Road Elevated Tank is required prior to the decommissioning of the King Street Elevated Tank.
- Construction the new canal crossing can occur at any time.
- Decommissioning of the Fielden Avenue Reservoir and Pumping Station can only be decommissioned following further review of current water consumption and max day peaking factors trends. This is to confirm viability of the reduced balancing storage requirement and operational strategy of leveraging the large long-term surplus of treatment and pumping capacity projected at the water treatment plant.

E.7 Capital Program

Table 3.E.13 summarizes the recommended project costing, implementation schedule and Class EA requirements.

E.7.1 Schedule B Project Files

Municipal Class Schedule B Environmental Assessment requirements have already been satisfied for project W-S-002 (New Barrick Road Elevated Tank), which will be in operation prior to the end of 2017.

Niagara Region

2016 MASTER SERVICING PLAN

MSP Water Projects

- Treatment Plant
- Reservoir
- Pumping Station
- Elevated Tank
- Watermain Projects

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station
- Regional
- Municipal

Water Network
- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

223

W-S-002
W-M-002
W-M-012
W-D-007
Fielden Avenue Reservoir
Fielden Avenue Pumping Station
Port Colborne W.T.P.
Port Colborne W.T.P. Pumping Station
Port Colborne W.T.P. Reservoir
W-D-006
King Street Elevated Tank

N

0 1 2 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

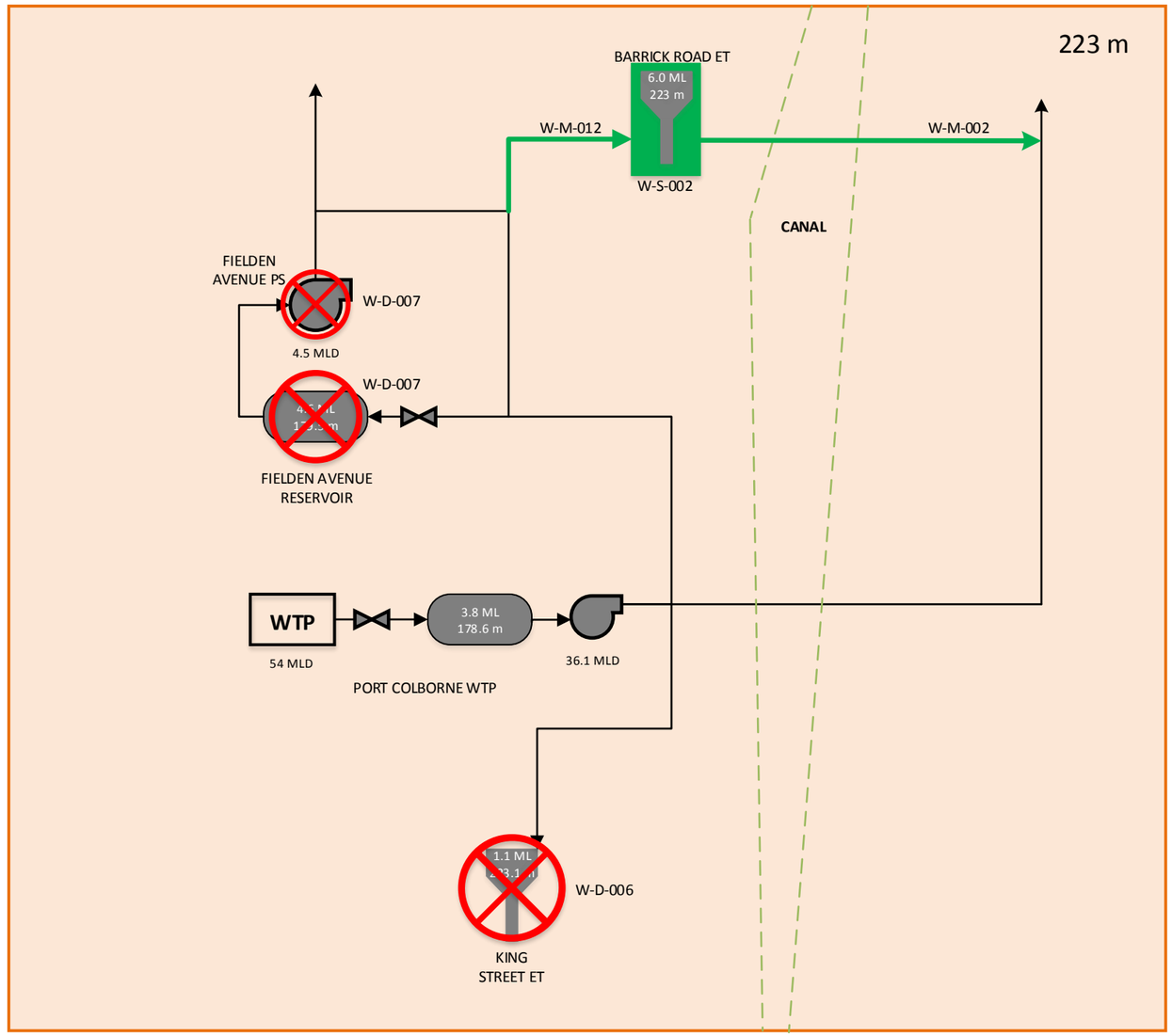
Figure 3.E.17

Preferred Water Strategy

Port Colborne WTP

BluePlan Engineering

May 2017
715023-W-Capital Projects (PC)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Port Colborne WTP

2041 DISTRIBUTION SCHEMATIC

- WTP (RATED CAPACITY) — Water Treatment Plant
- Pumping Station (FIRM CAPACITY)
- Volume TWL — Reservoir
- Volume TWL — Elevated Tanks
- Control Valve (Only normally operated valves shown)
- C — Chlorine Facility
- Facility Upgrade
- Volume TWL — Standpipe
- Trunk Watermain Network
- Settlement Area Boundaries
- Land and Water Features
- New Watermain
- Upgrade Watermain
- Decommission Project
- New Facility

Pressure Zone

223 m

May 2017
Figure 3.E.18
Not to Scale

BluePlan ENGINEERING

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-006	Decommissioning of King Street Elevated Tank	Decommissioning of King Street Elevated Tank, to be replaced by storage at new Barrick Road Elevated Tank	N/A	2017 - 2021	Port Colborne	A+	Satisfied	Storage	$ 1,979,000
W-D-007	Decommissioning of Fielden Avenue Reservoir + Pumping Station	Decommissioning of Fielden Avenue Reservoir and Pumping Station	N/A	2032 - 2041	Port Colborne	A+	Satisfied	Storage	$ 2,913,000
W-M-002	New Conveyance to Port Colborne East side	New Conveyance to East side of Port Colborne across canal	450 mm	2017 - 2021	Port Colborne	A+	Satisfied	Watermain	$ 11,548,000
W-M-012	Upgrade watermain in Port Colborne to new Barrick Road Elevated Tank	Upgrade watermain in Port Colborne to new Barrick Road Elevated Tank	450 mm	2017 - 2021	Port Colborne	A+	Satisfied	Watermain	$ 2,185,000
W-S-002	New Barrick Road Elevated Tank in Port Colborne	New Barrick Road Elevated Tank in Port Colborne to replace the King Street Elevated Tank	6 ML	2017 - 2021	Port Colborne	B	EA Previously Completed	Storage	$ 8,022,000
Total									**$ 26,647,000**

PART F
WELLAND WATER SYSTEM

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 68,288 and 27,304 employees.[1]

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 has a rated capacity of 102.3 MLD (1,184 L/s).[2]

The system supplies local area municipalities via a water main network, pumping stations, and service reservoirs. The supply area is divided into five 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.

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

[2] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-204*

Pelham Elevated Tank

Shoalts Drive Reservoir

Shoalts Drive
Pumping Station 1 + 2

Welland W.T.P.

Welland W.T.P. Reservoir

Welland W.T.P. Pumping Station

Bemis Park Elevated Tank

Township of West Lincoln
Town of Pelham

Town of Pelham
City of Thorold

City of Thorold
City of Welland

City of Thorold
City of Niagara Falls

Town of Pelham
City of Welland

City of Welland
City of Niagara Falls

Township of Wainfleet
City of Welland

Township of Wainfleet
City of Port Colborne

City of Welland
City of Port Colborne

Canboro

Webber Rd

Forks Rd W

Netherby

Biggar Rd

Schisler

Peninsula Lakes Golf Club

Pelham Hills Golf & Country Club

Sparrow Lakes Golf Club

Welland-Port Colborne Airport

River Road Park

Meyer Rd

Merritt Rd

Balfour St

Effingham St

Merritville Hwy

Allanport Rd

Thorold Townline

Chippawa C

Green Brook

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China

N

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

220 248 272
247 268

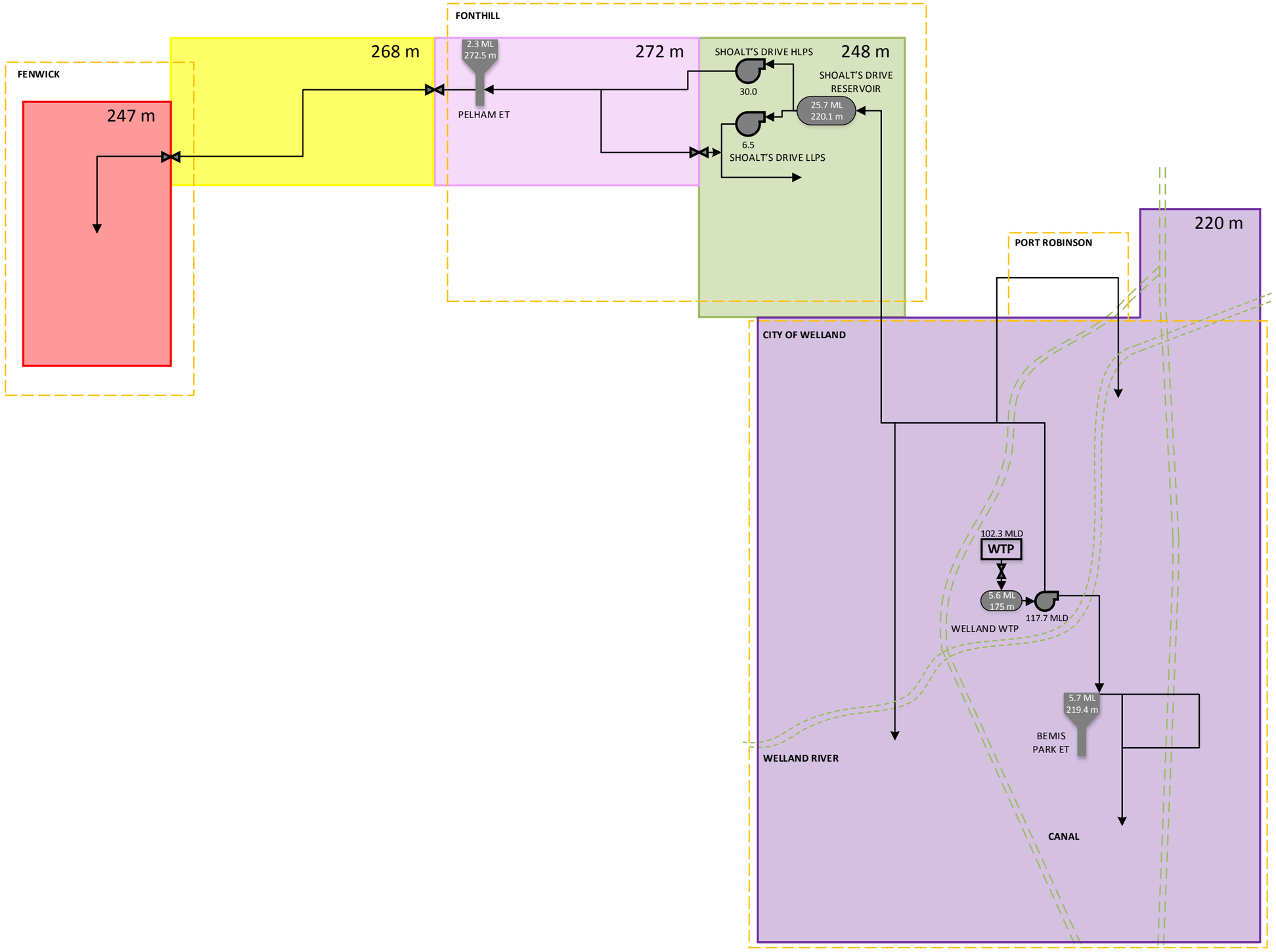
Figure 3.F.1

Existing Water System

Welland WTP

BluePlan Engineering Inc

May 2017
715023-W-2-Existing Water System (Welland)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Welland WTP

EXISTING DISTRIBUTION SCHEMATIC

- 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

220 m	268 m
247 m	272 m
248 m	

May 2017
Figure 3.F.2
Not to Scale

BluePlan ENGINEERING

F.1.1 Facility Overview

Table 3.F.1 Water Treatment Plant Overview

Plant Name	Welland Water Treatment Plant[3]
Address	4 Cross Street North, Welland
Source Water	Lake Erie via Welland Canal
Rated MDD Capacity	102.3 MLD
Key Processes	• Zebra mussel control • Traveling screens • Coagulation • Flocculation • Sedimentation • Filtration • Disinfection

Table 3.F.2 Pump Stations Overview

Pump Station	Location	Inlet Source (Pressure Zone)	Discharge (Pressure Zone)	Zones Supplied	Number of Pumps (Total/ Firm)	Firm Capacity (MLD)	Total Dynamic Head (m)
Welland Water Treatment Plant (WTP) High Lift Pumps	4 Cross Street North, Welland	WTP	220	All	6/5	117.7	53.3
Shoalt's Drive High Lift Pumping Station	5 Shoalt's Drive, Fonthill	220	272	247, 268, 272	4/3	16.4	65.0
Shoalt's Drive Low Lift Pumping Station		220	248	248	2/1*	3.0	40.0

*Closed pressure zone with additional supply via a PRV flows from 272 m Zone. Station Firm Capacity calculated with largest pump out of service.

[3] *Ministry of Environment Ontario, 15 August 2014. Drinking Water Works Permit. Number 007-204*

Table 3.F.3 Storage Facilities Overview

Storage Facility	Location	Storage Type	Volume (ML)	Top Water Level (m)	Fire Supply Zones	Maximum Day Demand Supply Zones
Welland Water Treatment Plant Reservoir	4 Cross Street North, Welland	Pumped Reservoir	5.6	175.0	220	220
Shoalt's Drive Reservoir	5 Shoalt's Drive, Fonthill	Pumped/ Floating Reservoir	25.7	220.1	220 Floating, 248 Pumped	220 Floating, 248 Pumped
Pelham Elevated Tank	177 Highway #20 West, Fonthill	Elevated Tank	2.3	272.5	247, 268, 272	247, 268, 272
Bemis Elevated Tank	Coventry Road-East Side, Welland	Elevated Tank	5.7	219.4	220	220

Refer to Figure 3.F.1 for pumping station and storage facility locations.

F.1.2 Demands Overview

Table 3.F.4 Historic Water System Demands

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***	***33.2***	***1.53***
5 Year Peak	***24.4***	***41.0***	***1.68***

Table 3.F.5 Water System Max Day Peaking Factor

Existing Service Population	68,288
Existing Service Employment	27,304
Total Service Equivalent Population	**95,592**
MOECC Peaking Factor[4]	1.65
Historic 5 Year Average Peaking Factor	1.53
Historic 5 Year Max Peaking Factor	1.68
2016 MSP Peaking Factor	**1.53**

The 2016 MSP peaking factor is the average of the peaking factors from 2011 to 2015.

[4] *Ministry of the Environment and Climate Change, 2008, Design Guidelines for Drinking-Water Systems, ISBN 978-1-4249-8517-3*

Table 3.F.6 Water System Demands by Pressure Zone*

Pressure Zone	Total Service Equivalent Population	2014 Average Day Demand (MLD)	2014 Maximum Day Demand (MLD)
220	76,412	17.3	26.5
247	2,284	0.7	1.0
248	10,239	2.2	3.4
268	2,459	0.3	0.4
272	4,198	1.2	1.9
Total	**95,592**	**21.7**	**33.2**

Pressure zone existing equivalent population estimates were derived using the Niagara 2041 MCR traffic survey zone population allocations and are calculated to the end of 2014. [5]

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

F.2 Growth Projections

F.2.1 Population Projections and Allocations

Table 3.F.7 and Table 3.F.8 outline the existing and projected serviced population and employment by pressure zone.

Table 3.F.7 Welland Water Treatment Plant Serviced Population by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
220	53,149	55,286	58,223	61,696	65,209	68,490	15,341
247	1,664	1,710	1,853	2,042	2,268	2,550	886
248	7,968	8,630	9,824	11,503	12,833	13,685	5,717
268	2,229	2,297	2,458	2,675	2,914	3,212	983
272	3,278	3,321	3,337	3,378	3,753	3,835	557
Total	**68,288**	**71,244**	**75,695**	**81,294**	**86,977**	**91,772**	**23,485**

Note: Population numbers may not sum due to rounding.

Table 3.F.8 Welland Water Treatment Plant Serviced Employment by Pressure Zone

Pressure Zone	2014	2021	2026	2031	2036	2041	Growth: 2014 - 41
220	23,263	24,818	25,543	26,662	27,801	29,415	6,152
247	620	709	764	855	945	1,061	441
248	2,271	2,522	2,693	2,964	3,233	3,572	1,301
268	230	257	273	293	315	340	110
272	920	1,009	1,072	1,170	1,268	1,389	469
Total	**27,304**	**29,315**	**30,345**	**31,944**	**33,562**	**35,777**	**8,473**

Note: Population numbers may not sum due to rounding.

F.2.2 Future Demand Projections

Table 3.F.9 and Table 3.F.10 summarize the projected average and maximum system demands by pressure zone.

Table 3.F.9 Projected Water System Average Day Demands (ADD) by Pressure Zone

Pressure Zone	2021 ADD (MLD)	2026 ADD (MLD)	2031 ADD (MLD)	2036 ADD (MLD)	2041 ADD (MLD)
220	18.4	19.5	20.9	22.3	23.8
247	0.7	0.8	0.9	0.9	1.1
248	2.5	2.9	3.5	4.0	4.3
268	0.3	0.3	0.4	0.5	0.6
272	1.3	1.3	1.3	1.5	1.5
Total	**23.2**	**24.8**	**27.0**	**29.2**	**31.3**

Table 3.F.10 Projected Water System Maximum Day Demands (MDD) by Pressure Zone

Pressure Zone	2021 MDD (MLD)	2026 MDD (MLD)	2031 MDD (MLD)	2036 MDD (MLD)	2041 MDD (MLD)
220	28.2	29.9	32.0	34.1	36.5
247	1.1	1.2	1.3	1.4	1.6
248	3.8	4.5	5.3	6.1	6.6
268	0.4	0.5	0.6	0.8	0.9
272	1.9	2.0	2.0	2.2	2.3
Total	**35.4**	**38.1**	**41.2**	**44.6**	**47.9**

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

F.3.1 Treatment Plant Capacity

Table 3.F.3 shows the projected future demands at the Welland Water Treatment Plant. The plant has surplus capacity and will not reach 80% capacity within the 2041 time horizon.

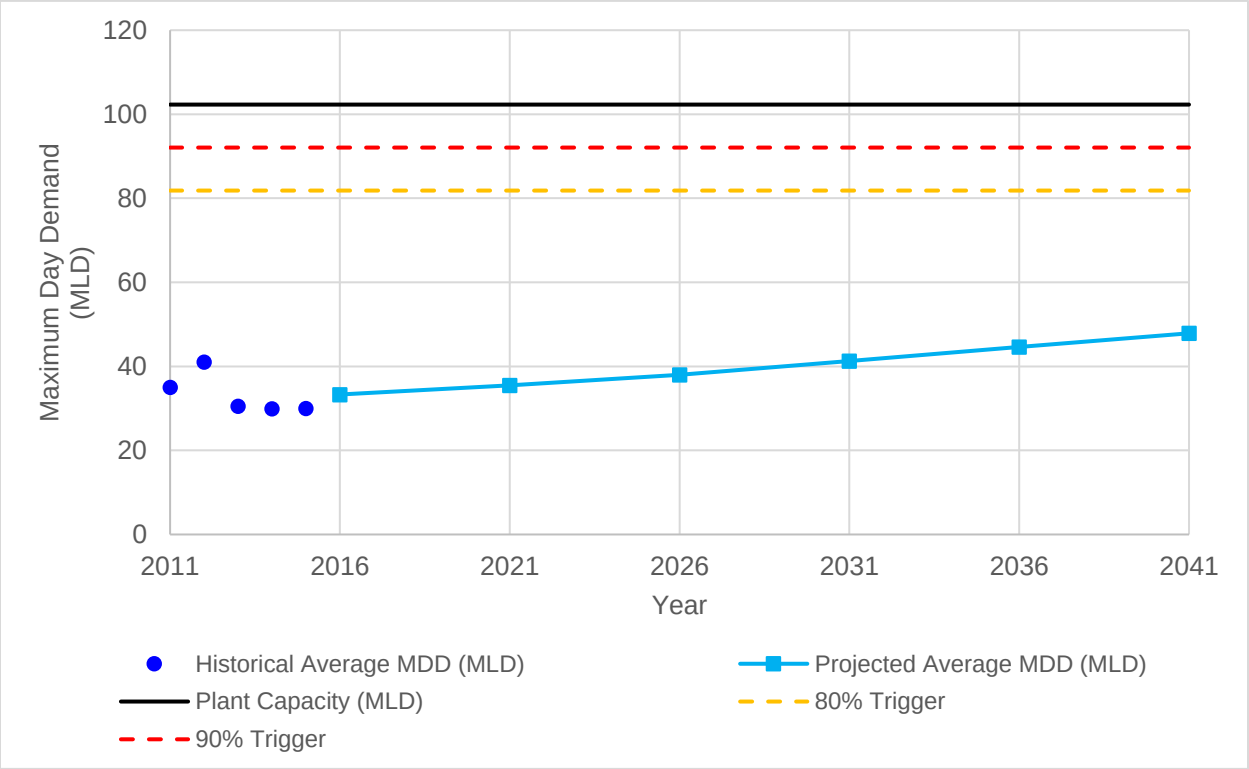


Figure 3.F.3 Projected Maximum Day Demand at Welland Water Treatment Plant

F.3.2 Pumping Capacity

Table 3.F.11 highlights the pumping station existing and projected capacity.

Table 3.F.11 System Pumping Station Performance

Pump Station	Pressure Zones Supplied	Total Effective Capacity (MLD)	Existing Maximum Day Demand (MLD)	2041 Maximum Day Demand (MLD)	2041 Surplus/ Deficit (MLD)
Welland Water Treatment Plant/High Lift Pumping Station	All	117.7	33.2	47.9	69.8
Shoalt's Drive High Lift Pumping Station	247, 268, 272	16.4	3.3	4.9	11.5
Shoalt's Drive Low Lift Pumping Station	248	3.0	3.4	6.6	-3.6

The Shoalt's Drive Low Lift Pumping Station has an existing pumping deficit of 0.4 MLD and a 3.6 MLD deficit projected for 2041.

F.3.3 Storage Capacity

Table 3.F.12 highlight the storage existing and projected capacity.

Table 3.F.12 System Storage Capacities

Pressure Zones Supplied	Storage	Existing and 2041 Total Available Storage (ML)	Existing Required Storage (ML)	2041 Required Storage (ML)	2041 Surplus/ Deficit (ML)
220	Welland WTP Reservoir	37.0	18.5	21.6	15.4
	Bemis Elevated Tank				
	Shoalt's Drive Reservoir				
247, 248, 268, & 272	Pelham Elevated Tank	2.3	7.2	11.0	-8.7

The upper pressure zones (247, 248, 268, and 272) have an existing storage deficit and an 8.7 MLD deficit projected for 2041.

Figure 3.F.4 through Figure 3.F.6 show the 5-day MDD storage performance for each storage facility.

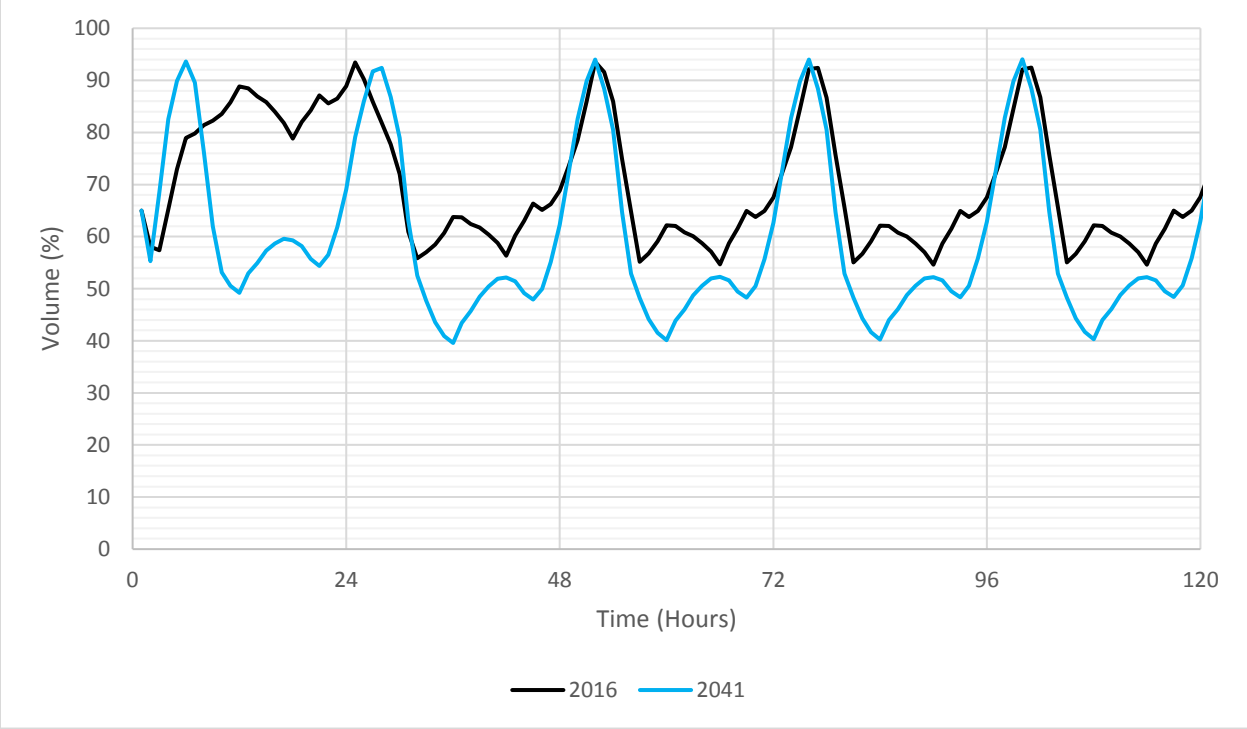


Figure 3.F.4 5-Day MDD Storage Performance – Pelham Elevated Tank

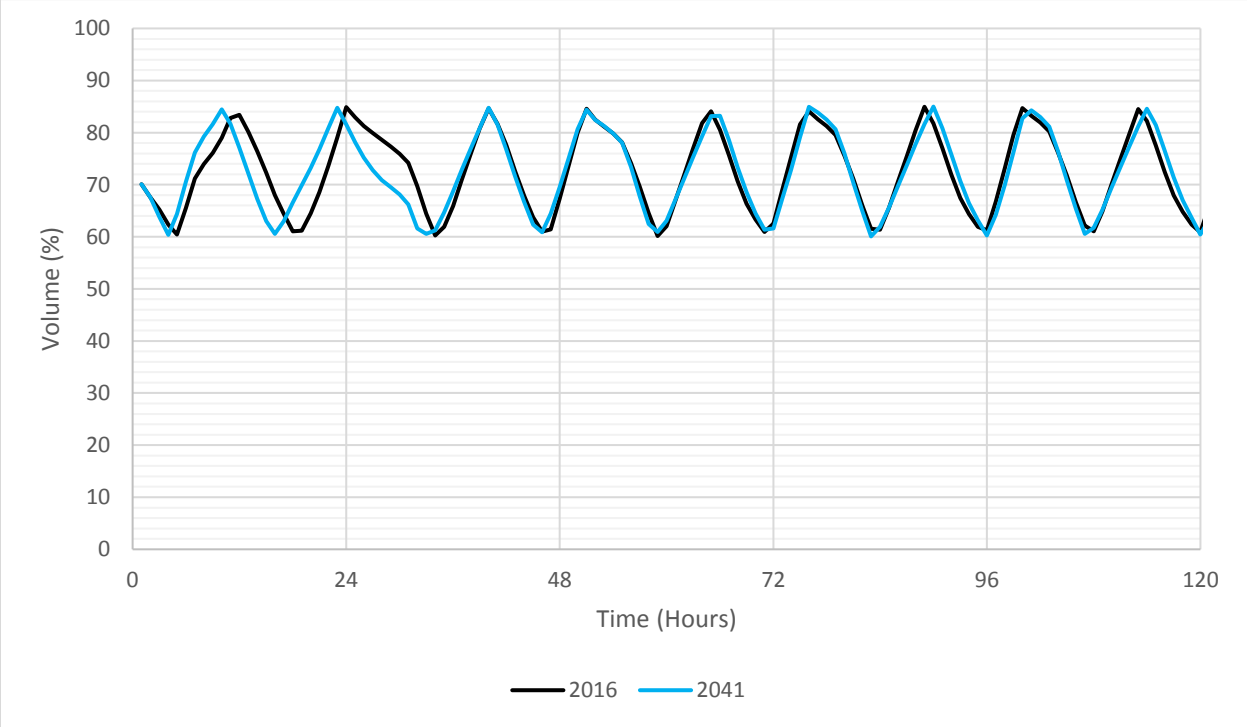


Figure 3.F.5 5-Day MDD Storage Performance – Shoalt's Reservoir

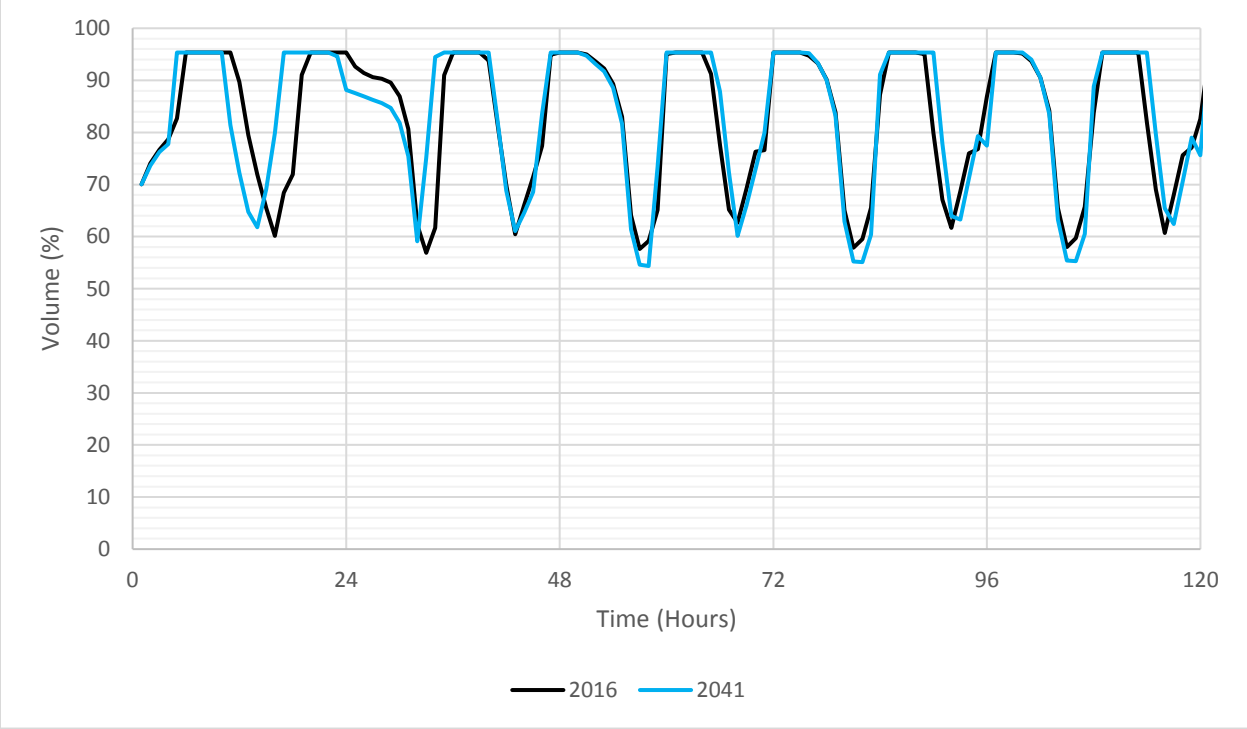


Figure 3.F.6 5-Day MDD Storage Performance – Bemis Elevated Tank

F.3.4 System Pressures and Fire Flows

Figure 3.F.7 to Figure 3.F.10 present the existing and project 2041 system performance, based on existing system configuration and capacities.

Pelham Elevated Tank

Shoalts Drive Reservoir

Shoalts Drive Pumping Station 1 + 2

Welland W.T.P.

Welland W.T.P. Reservoir

Welland W.T.P. Pumping Station

Bemis Park Elevated Tank

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

220 248 272

247 268

Peak Hour Pressure

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

Figure 3.F.7

Existing Maximum Day Demand Pressure

Welland WTP

BluePlan Engineering

May 2017

715023-W-4-Existing Pressure (Welland)

NAD 1983 UTM Zone 17N

Pelham Elevated Tank

Shoalts Drive Reservoir

Shoalts Drive
Pumping Station 1 + 2

Welland W.T.P.

Welland W.T.P. Reservoir

Welland W.T.P. Pumping Station

Bemis Park Elevated Tank

Township of West Lincoln
Town of Pelham
Town of Pelham
City of Thorold
City of Thorold
City of Welland
City of Thorold
City of Niagara Falls
City of Welland
City of Niagara Falls
Town of Pelham
City of Welland
Township of Wainfleet
City of Welland
Township of Wainfleet
City of Port Colborne
City of Welland
City of Port Colborne

Canboro
Webber Rd
Forks Rd W
Biggar Rd
Moyer Rd
Netherby
Schisler
Peninsula Lakes Golf Club
Pelham Hills Golf & Country Club
Welland-Port Colborne Airport
Sparrow Lakes Golf Club
River Road Park

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

220 248 272
247 268

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

Figure 3.F.8

Existing System Fire Flow

Welland WTP

BluePlan Engineering

May 2017
715023-W-6-Existing Fire Flow (Welland)
NAD 1983 UTM Zone 17N

Niagara Region

2016 MASTER SERVICING PLAN

Pelham Elevated Tank

Shoalts Drive Reservoir

Shoalts Drive Pumping Station 1 + 2

Welland W.T.P.

Welland W.T.P. Reservoir

Welland W.T.P. Pumping Station

Bemis Park Elevated Tank

N

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

220 248 272

247 268

Minimum Pressure (psi)

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

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China

Figure 3.F.9

2041 Maximum Day Demand Pressure

Welland WTP

BluePlan Engineering

May 2017
715023-W-5-2041 Pressure (Welland)
NAD 1983 UTM Zone 17N

Pelham Elevated Tank

Shoalts Drive Reservoir

Shoalts Drive
Pumping Station 1 + 2

Welland W.T.P.

Welland W.T.P. Reservoir

Welland W.T.P. Pumping Station

Bemis Park Elevated Tank

Township of West Lincoln
Town of Pelham

Town of Pelham
City of Thorold

City of Thorold
City of Welland

City of Thorold
City of Niagara Falls

Town of Pelham
City of Welland

City of Welland
City of Niagara Falls

Township of Wainfleet
City of Welland

Township of Wainfleet
City of Port Colborne

City of Welland
City of Port Colborne

Canboro

Webber Rd

Forks Rd W

Netherby

Biggar Rd

Meyer Rd

Peninsula Lakes Golf Club

Pelham Hills Golf & Country Club

Welland-Port Colborne Airport

Sparrow Lakes Golf Club

River Road Park

Balfour St

Effingham St

Merritt Rd

Allanport Rd

Thorold Townline

Chippawa C

Schisler

West St Rd

Elm St

Miller Rd

0 2 4 Kilometers

N

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

220 248 272
247 268

Available Fire Flow (L/s)

- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- > 250

Figure 3.F.10

2041 System Fire Flow

Welland WTP

BluePlan Engineering

May 2017
715023-W-7-2041 Fire Flow (Welland)
NAD 1983 UTM Zone 17N

F.3.5 Welland Water Treatment Plant

Figure 3.F.11 highlights the sampled chlorine residual (mg/L) versus the modelled water system age at each sample location.

The 90th percentile trend line represents the chlorine residual achieved by the bottom 10% of samples at a location, meaning that 90% of the samples taken at that location were above the 90th percentile trend line. Similarly, the 99th percentile trend line represents the chlorine residual achieved by the bottom 1% of samples at a location, meaning that 99% of the samples taken at that location were above the 99th percentile trend line. It is assumed that <10 days is required to maintain the 0.25 mg/L chlorine residual objective.

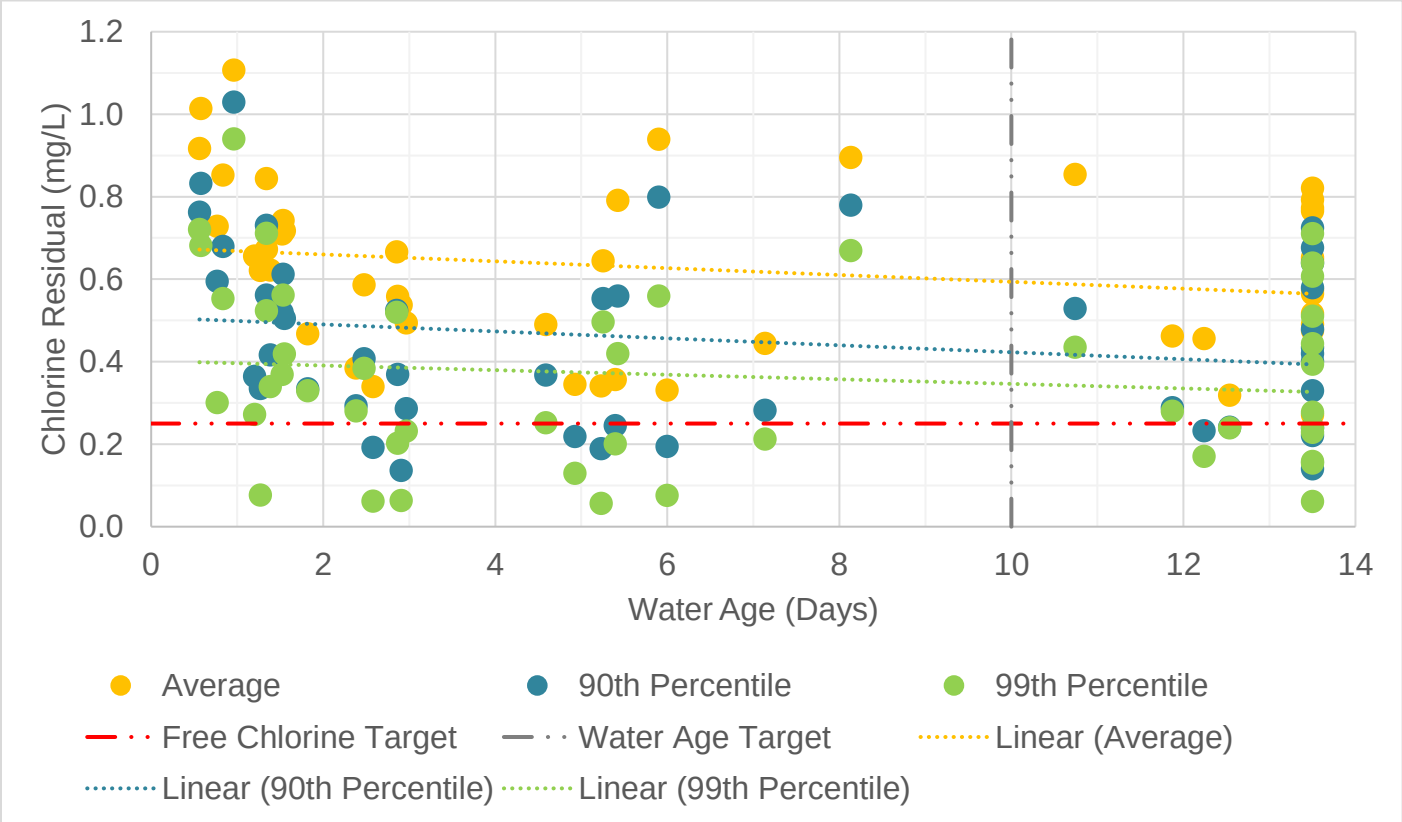


Figure 3.F.11 Existing Chlorine Residual vs Water System Age

Figure 3.F.12 shows the modelled water age throughout the system. Figure 3.F.13 shows the existing watermain capacity in the system as maximum head loss (m/km).

Pelham Elevated Tank

Shoalts Drive Reservoir

Shoalts Drive
Pumping Station 1 + 2

Welland W.T.P.

Welland W.T.P. Reservoir

Welland W.T.P. Pumping Station

Bemis Park Elevated Tank

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

220 248 272
247 268

Water Age (Days)

< 1
1 - 2
2 - 4
4 - 6
6 - 8
< 8

Figure 3.F.12
Water Age
Welland WTP

BluePlan Engineering

May 2017
715023-W-8-Water Age (Welland)
NAD 1983 UTM Zone 17N

Pelham Elevated Tank

Shoalts Drive Reservoir

Shoalts Drive Pumping Station 1 + 2

Welland W.T.P.

Welland W.T.P. Reservoir

Welland W.T.P. Pumping Station

Bemis Park Elevated Tank

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

220 248 272

247 268

Watermain Headloss (m/km)

- < 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4

Figure 3.F.13

Watermain Capacity

Welland WTP

BluePlan Engineering

May 2017

715023-W-9-Watermain Capacity (Welland)

NAD 1983 UTM Zone 17N

F.4 System Opportunities and Constraints

Figure 3.F.14 highlights the existing opportunities and constraints.

F.4.1 Welland Water Treatment Plant

- The current rated MDD capacity is 102.3 MLD, with an existing demand of 33.2 MLD. The projected 2041 MDD is 47.9 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 2041.

F.4.2 Welland System

- Welland has surplus existing and future pumping and storage capacity.
- There are localized low pressure area in northwest Welland under Peak Hour conditions.
- Under peak demand conditions there is operational difficulty filling the Shoalt's Drive Reservoir, due to 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.

F.4.3 Pelham System

- The Shoalt's Drive Low Lift Pumping Station has an existing and future pumping deficit. Currently, a PRV from the upper zone is utilized to support the existing pumping deficit. Growth in Pelham will minimize the total available capacity that can be transferred thought the PRVs.
- The Pelham Elevated Tank has an existing and future storage deficit. Currently, the storage deficit is supported through pumped transfers from the Shoalt's Drive Reservoir and High Lift Pumps. Growth in Pelham will minimize the surplus capacity, triggering a pumping and/or storage upgrade need.
- There is limited floating storage Pelham as the Pelham Elevated Tank is 2.3 ML.
- 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.
- High water age within Pelham system, leading to existing operational challenges in maintaining water quality objectives.

F.4.4 Thorold – Port Robinson Area System

- New trunk watermain is required to support large growth area.

F.4.5 System Security of Supply & Interconnections

- There is a single trunk main to North Welland and the Shoalt's Drive Reservoir.
- There is a single trunk main to Fenwick.

Pelham Elevated Tank

Pelham Elevated Tank has an existing and future storage deficit.

Shoalts Drive Reservoir

Shoalts Drive Pumping Station 1 + 2

Shoalt's Drive Low Lift Pumping Station has an existing and future pumping deficit.

Zone peak flows supported by pressure reducting valve for upper zone.

Single Regional trunk main to Fenwick.

Surplus storage available at Shoalts Drive Reservoir.

Large growth area in Port Robinson west.

Peak hour transmission capacity limits to Shoalts Drive Reservoir. Requires operational intervention at Bemis Tank to convey more water north.

Low pressures in North Welland under peak demands.

Water quality issue in Fenwick.

Welland has surplus existing and future pumping and storage capacity.

The Water Treatment Plant has surplus capacity to accommodate growth beyond 2041.

Welland W.T.P.

Welland W.T.P. Reservoir

Welland W.T.P. Pumping Station

Bemis Park Elevated Tank

Township of West Lincoln
Town of Pelham
Town of Pelham
City of Thorold
City of Thorold
City of Welland
Town of Pelham
City of Welland
City of Thorold
City of Niagara Falls
City of Welland
City of Niagara Falls
Township of Wainfleet
City of Welland
Township of Wainfleet
City of Port Colborne
City of Welland
City of Port Colborne

Canboro
Golf Club
Webber Rd
Welland-Port Colborne Airport
Sparrow Lake Golf Club
Forks Rd W
Netherby
Merritt Rd
Biggar Rd
Schisler
Chippawa C

0 2 4 Kilometers

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China

N

Niagara Region

2016 MASTER SERVICING PLAN

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station

- Regional
- Municipal

Water Network

- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

220 248 272
247 268

Figure 3.F.14
System Opportunities and Constraints
Welland WTP

BluePlan Engineering

May 2017
715023-W-3-Opportunities and Constraints (Welland)
NAD 1983 UTM Zone 17N

F.5 Assessment of Alternatives

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

- Baseline (No Changes)
- New Storage in Pelham
- Upgrades at Shoalt's Drive High Lift and Low Lift Pumping Stations
- Optimize Pumping and Storage Upgrades in Pelham

All alternatives include:

- New trunk watermain along River Road and Woodlawn Road to support increased conveyance from the Welland Water Treatment Plant to North Welland to support growth and address existing operational issues at the Shoalt's Drive Reservoir.
- New trunk watermain under Highway 406 to support growth in the Port Robinson Area.[6]

F.5.1.1 Fenwick Security of Supply

To address the identified security of supply concerns to Fenwick area the following concepts were considered:

- New secondary trunk connections from the 248 Pressure Zone.
- New elevated storage in Fenwick.

However, the supplemental analysis indicated that:

- New secondary trunk connection or new elevated storage are not needed to support growth.
- New secondary trunk connection or new elevated storage would increase the existing water quality issues within Fenwick, increasing operational cost.

[6] New trunk watermain to service the Port Robinson area is currently under construction. This project has been included as part of the overall recommended servicing strategy, but due to its current status has not been included in the final capital project list.

- The current supply main to Fenwick is in good condition with no break history. Further, operations staff do not anticipate repair issues in the event of a watermain break.

Based on the notes above, the relative high cost of the new secondary trunk connection or new elevated storage combined with the resulting operational issues related to water quality, these concepts were not carried forward for further evaluation.

F.5.1.2 Pelham Local Capacity Issues

The identified fire flow and capacity issues in Pelham (Fonthill) can be addressed through changes within the local distribution system through either the local upsizing and or system looping[7].

[7] Pelham Elevated Tank and Fonthill Analysis – 2013 (BluePlan Engineering Consultants Ltd.)

F.5.2 Alternative 1 – New Storage in Pelham

Alternative 1, highlighted in Figure 3.F.15, includes a new storage facility size to support the full storage needs within the Pelham system. This will address existing and future storage deficit, and reduces total pumping needs from the Shoalt's Drive Reservoir. Under this configuration, the pumping deficits at the Shoalt's Drive Low Lift Pumps will continue to be addressed through the existing PRVs.

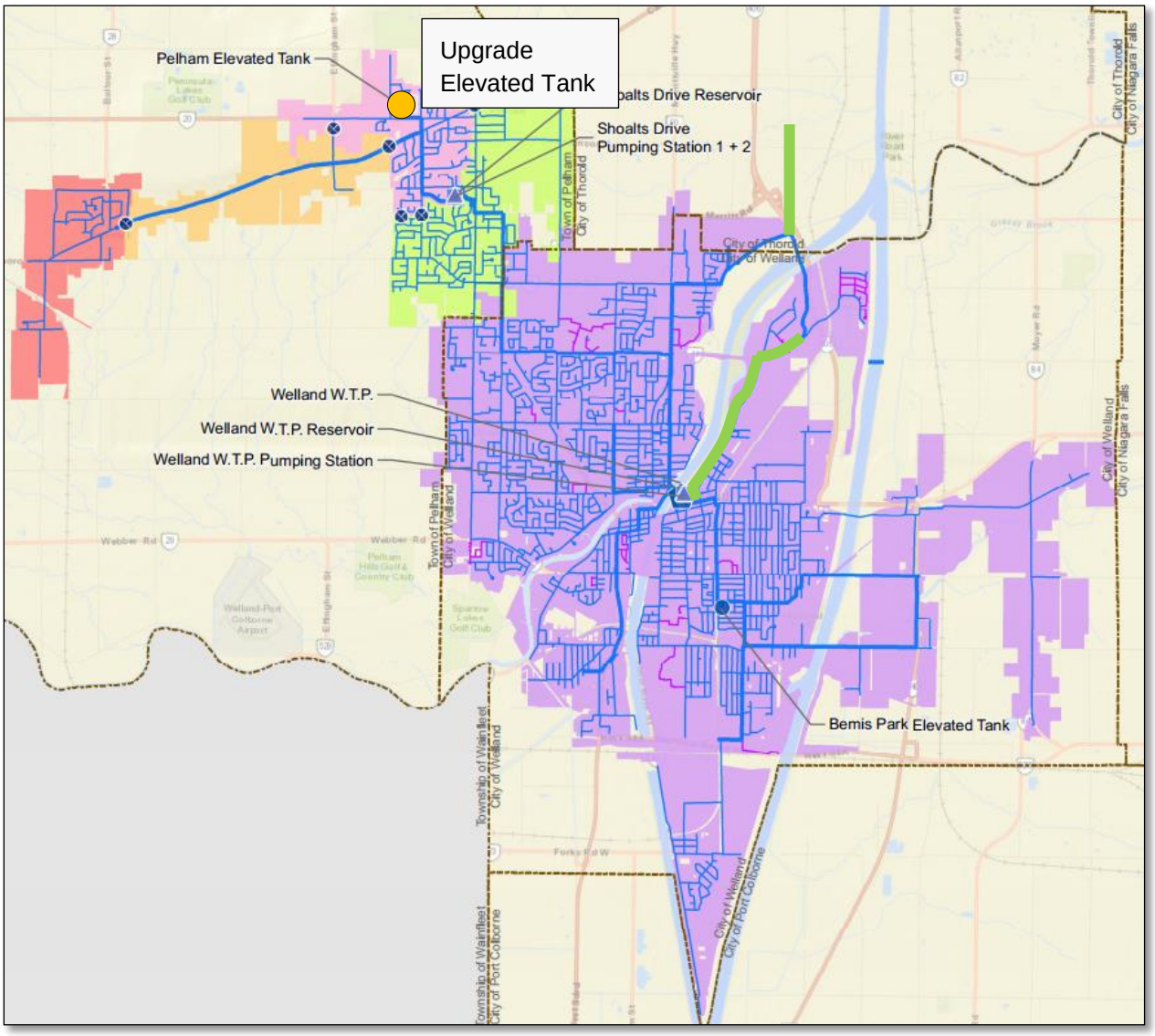


Figure 3.F.15 Alternative 1 – New Storage in Pelham

F.5.3 Alternative 2 – Upgrades at Shoalt's Drive High Lift and Low Lift Pumping Stations

Alternative 2, highlighted in Figure 3.F.16, includes upgrades to the Shoalt's Drive High Lift and Low Lift Pumping Stations to improve existing conditions and support growth. Under this configuration the surplus storage capacity at the Shoalt's Drive Reservoir will be utilized to support pumped transfers to the Pelham system. However this will increase total pumping capacity needed to overcome the floating storage deficit, and requiring upgrades to both the Shoalt's Drive High Lift and Low Lift Pumps.

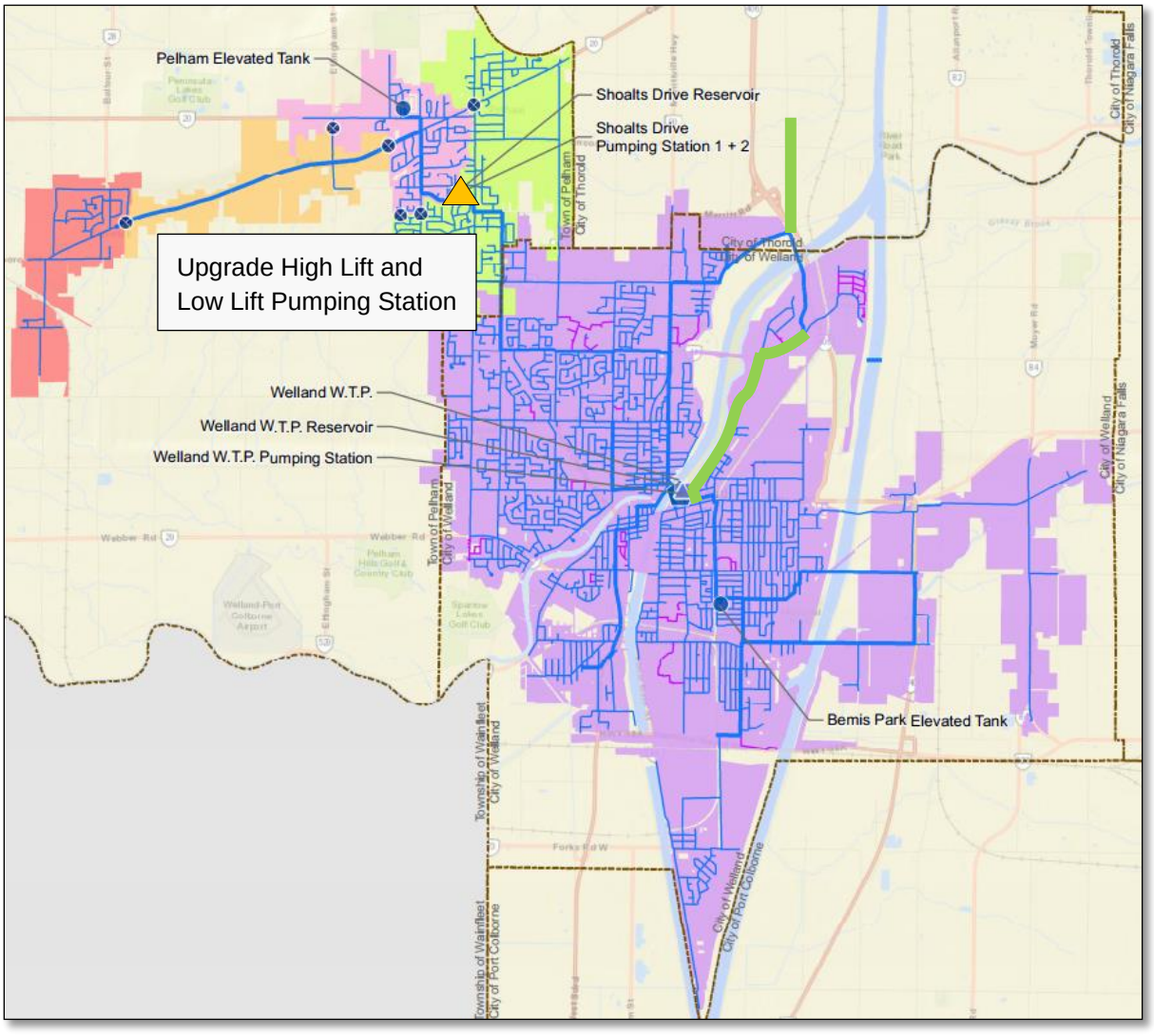


Figure 3.F.16 Alternative 2 – Upgrades at Shoalt's Drive High Lift and Low Lift Pumping Stations

F.5.4 Alternative 3 – Optimize Pumping and Storage Upgrades in Pelham

Alternative 3, highlighted in Figure 3.F.17, includes upgrades replacing the existing Pelham Elevated Tank with a new elevated tank to provide additional capacity to improve existing conditions and support growth. The elevated tank will be size to provide balancing storage requirements. This options includes upgrade to both the Shoalt's Drive High Lift and Low Lift Pumping Stations. The Low Lift Pumping Station will be sized to provide MDD to the lower zone and the High Lift Pumping Station will be sized to support pumped storage transfer needs from the Shoalt's Reservoir to Pelham.

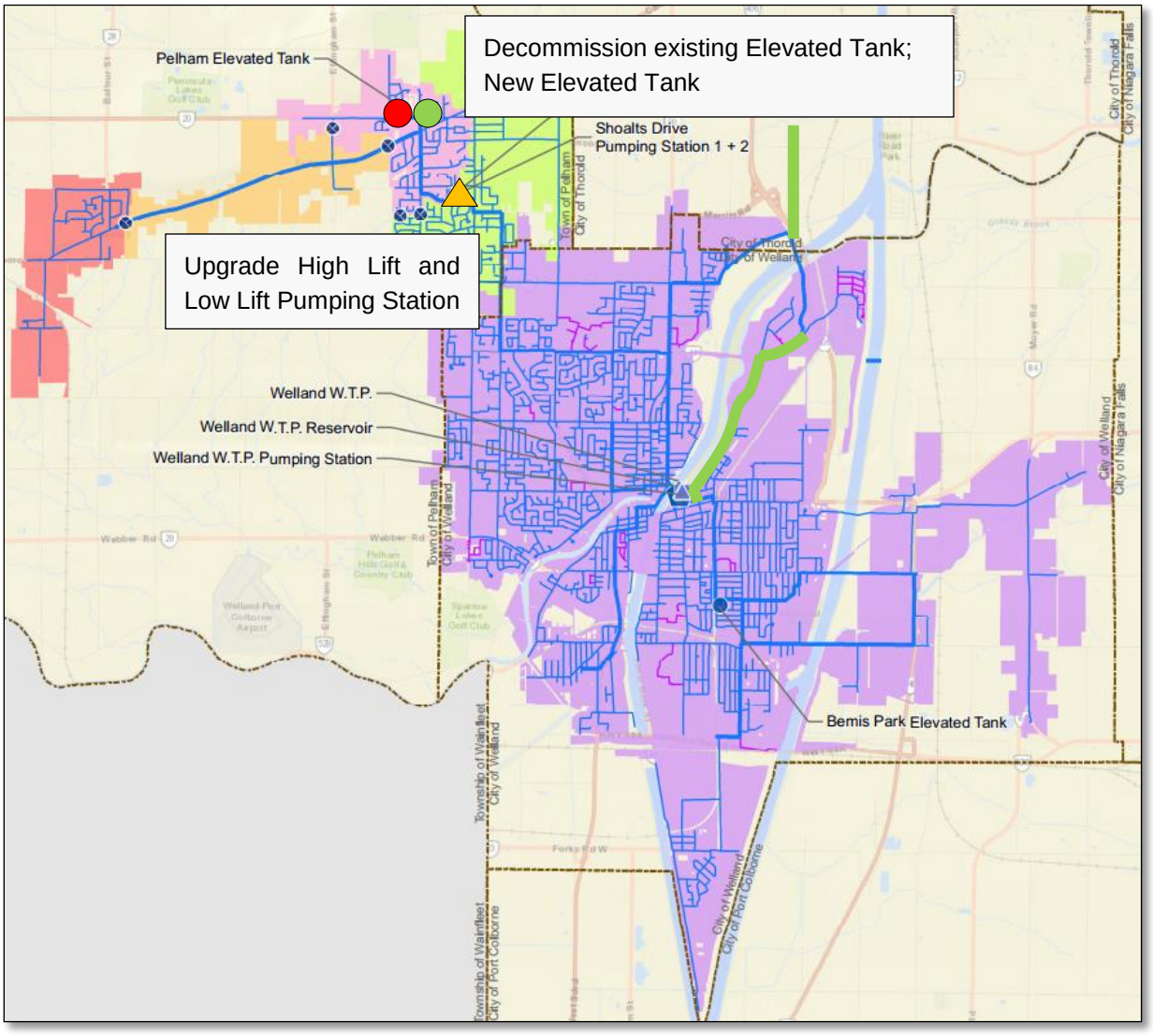


Figure 3.F.17 Alternative 3 – Optimize Pumping and Storage Upgrades in Pelham

F.5.5 Alternatives Evaluation

Alternative 3 – Optimize Pumping and Storage Upgrades in Pelham is the preferred servicing strategy as:

- Baseline strategy does not satisfy the existing and future servicing needs of the water system.
- Alternative 3 allows for:
    - Increased security of transmission 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.
    - Maximizes the existing capacity at the Shoalt's Drive Reservoir.
    - The combination of increased pumping and storage capacity:
    - Allows for a more efficient operation of the overall system.
    - Increases the operational flexibility within the Pelham system.
- Alternative 1 requires significant elevated storage volume resulting in:
    - A significant cost impact relative to the other alternatives.
    - Pump upgrades may still be required to support maintenance of the tank.
    - Potential construction and implementation challenges due to tank size, including the sighting of a new tank location and potential transmission upgrades.
- Alternative 2 increases the system reliance on pumping resulting in:
    - Increased pump sizing requirements to overcome balancing storage deficits.
    - Sub-optimal system operations and energy usage.

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 2041.
- 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.
- 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 water tank replacing the existing water tank, at the same location, will be provided to support growth and optimize system pressures and performance in the area.
- Based on growth in the north and east limits of the system, additional water feedermain capacity is required.

Figure 3.F.18 and Figure 3.F.19 show the preferred servicing strategy and schematic, consisting of:

F.6.1 Storage

A new 6.0 ML elevated tank is to be built in Pelham to replace the existing Pelham Elevated Tank at the same location. It will be installed following the upgrades at the Shoalt's Drive High Lift and Low Lift Pumping Stations and the decommissioning of the existing Pelham Elevated Tank.

F.6.2 Pumping

- All four (4) existing 5.4 MLD pumps will be replaced with 10.0 MLD pumps at the Shoalt's Drive High Lift Pumping Station.
- Both (2) existing 3.0 MLD pumps will be replaced with 6.5 MLD pumps at the Shoalt's Drive Low Lift Pumping Station.

F.6.3 Decommissioning of Existing Facilities

The Pelham Elevated Tank will be decommissioned and replaced with a new elevated tank following the upgrades at Shoalt's Drive High Lift and Low Lift Pumping Stations.

F.6.4 Trunk Watermain

- New 450 mm trunk main from Welland Water Treatment Plant to north service area.
- New trunk watermain crossing the Highway 406 to support growth in the Port Robinson Area.[8]

F.6.5 Project Implementation and Considerations

Special project implementation and considerations for the preferred servicing strategy consist of:

- The Region must upgrade the Shoalt's Drive High Lift and Low Lift Pumping Stations prior to decommissioning the Pelham Elevated Tank.
- The new elevated tank must be built following the decommissioning of the existing Pelham Elevated Tank.

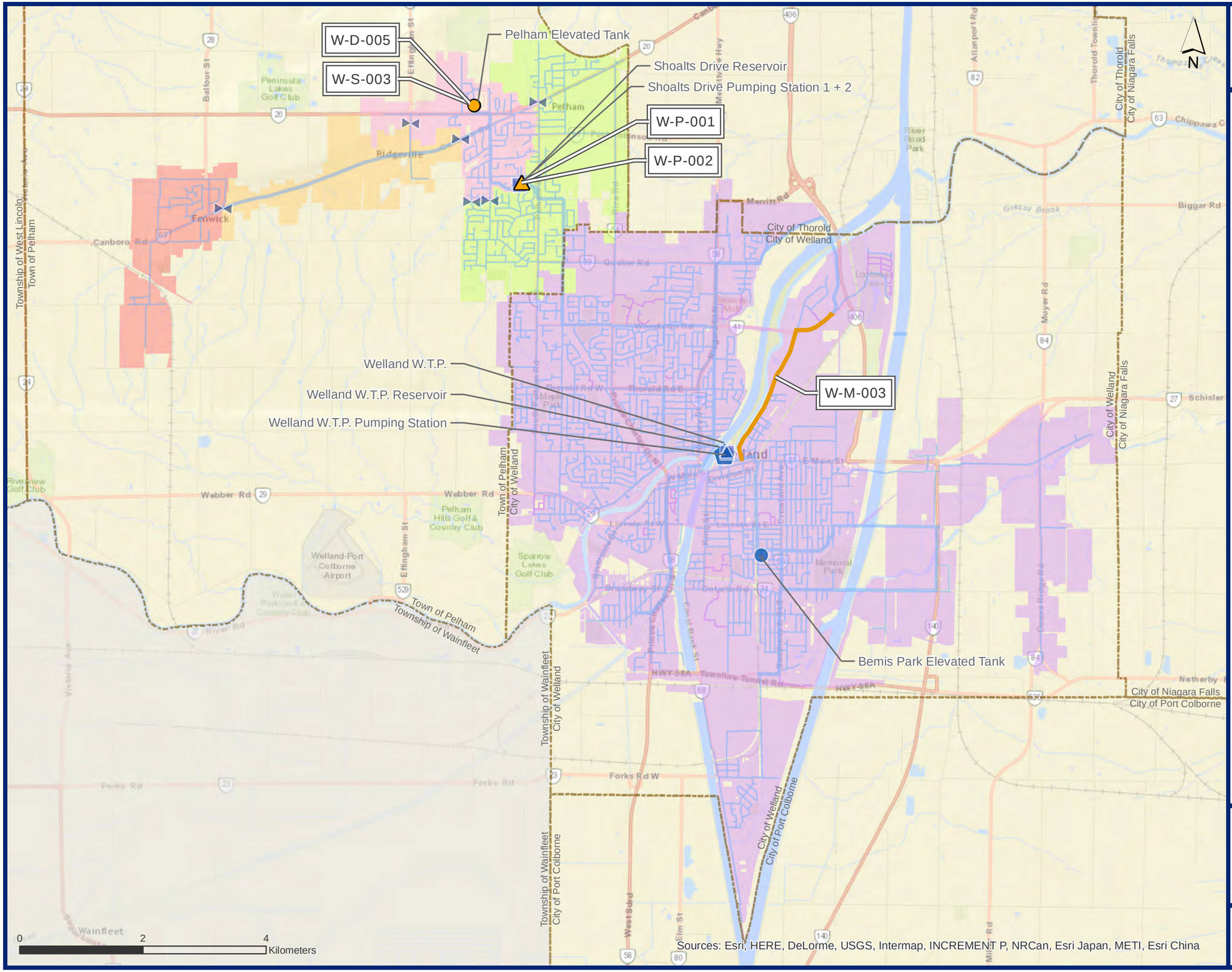
[8] New trunk watermain to service the Port Robinson area is currently under construction. This project has been included as part of the overall recommended servicing strategy, but due to its current status has not been included in the final capital project list.

F.7 Capital Program

Table 3.F.13 summarizes the recommended project costing, implementation schedule and Class EA requirements.

F.7.1 Schedule B Project Files

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



Niagara Region

2016 MASTER SERVICING PLAN

MSP Water Projects

- Treatment Plant
- Reservoir
- Pumping Station
- Elevated Tank
- Watermain Projects

Water Facilities

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve

Pumping Station
- Regional
- Municipal

Water Network
- Regional
- Local
- Private

Pressure Zone System*

*Pressure zone limits are shown based on property boundaries.

220 248 272
247 268

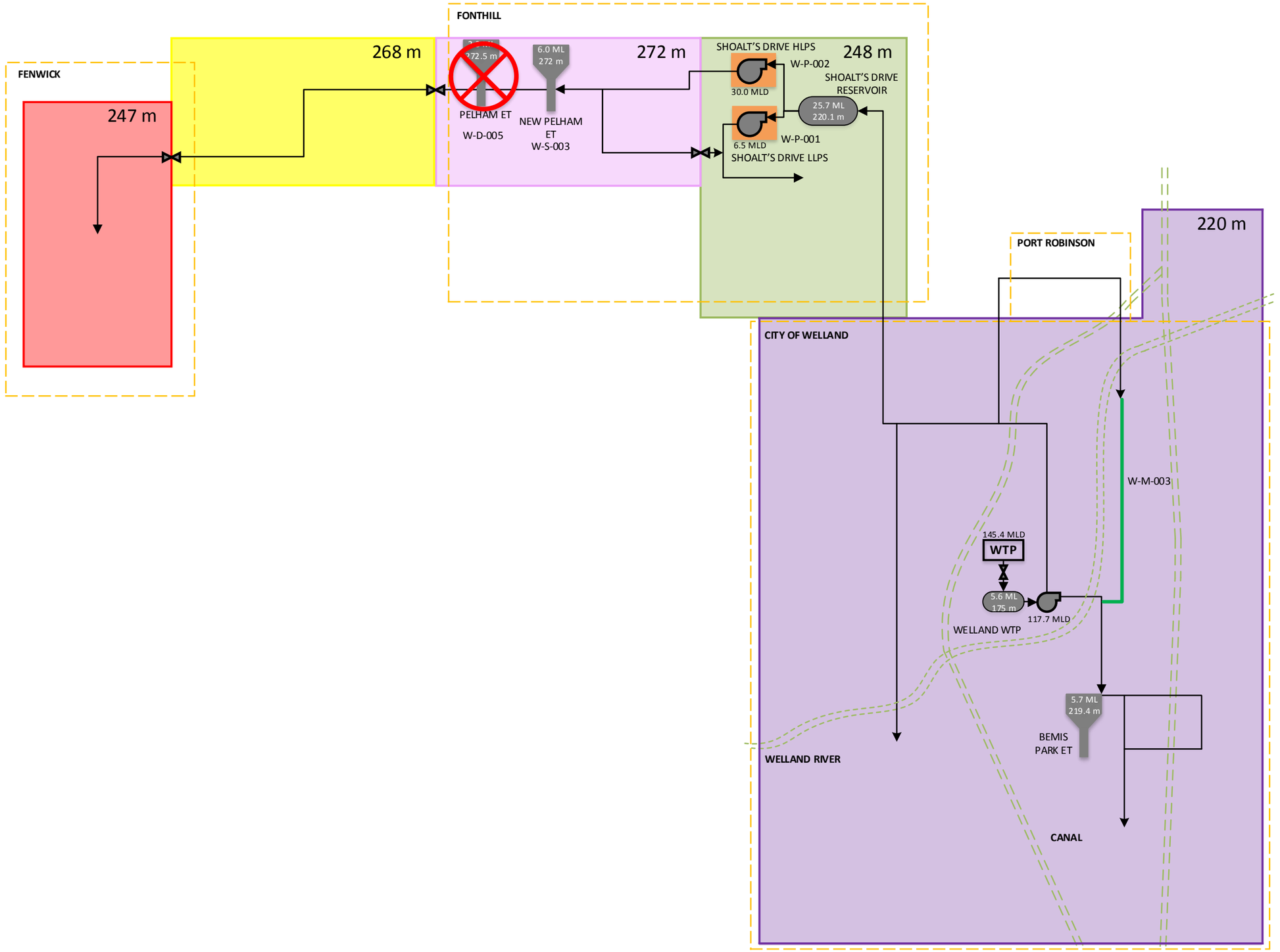
Figure 3.F.18

Preferred Water Strategy

Welland WTP

BluePlan Engineering

May 2017
715023-W-6-Capital Projects (Welland)
NAD 1983 UTM Zone 17N



Niagara Region

2016 Master Servicing Plan

Welland WTP

2041 DISTRIBUTION SCHEMATIC

- WTP — RATED CAPACITY — Water Treatment Plant
- Pumping Station — FIRM CAPACITY
- Volume TWL — Reservoir
- Volume TWL — Elevated Tanks
- Control Valve (Only normally operated valves shown)
- C — Chlorine Facility
- Facility Upgrade
- Volume TWL — Standpipe
- Trunk Watermain Network
- Settlement Area Boundaries
- Land and Water Features
- New Watermain
- Upgrade Watermain
- Decommission Project
- New Facility

Pressure Zone

- 220 m
- 268 m
- 247 m
- 272 m
- 248 m

May 2017
Figure 3.F.19
Not to Scale

BluePlan ENGINEERING

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 Elevated Tank	Decommissioning of existing Pelham Elevated Tank, to be replaced by a new Elevated Tank	N/A	2022 - 2031	Pelham	A+	Satisfied	Storage	$ 1,028,000
W-M-003	New trunk main from Welland Water Treatment Plant to North	New trunk main from Welland Water Treatment Plant to North service area	450 mm	2032 - 2041	Welland	A+	Satisfied	Watermain	$ 7,556,000
W-P-001	Upgrade Shoalt's Drive Low Lift Pumping Station	Replace both 3 MLD low lift pumps with 6.5 MLD pumps each	75 L/s	2017 - 2021	Pelham	A+	Satisfied	Pumping	$ 3,062,000
W-P-002	Upgrade Shoalt's Drive High Lift Pumping Station	Replace all four 5.4 MLD high lift pumps with 10 MLD pumps each	347 L/s	2017 - 2021	Pelham	A+	Satisfied	Pumping	$ 7,882,000
W-S-003	New Pelham Elevated Tank	New Pelham Elevated Tank to replace existing Elevated Tank	6 ML	2022 - 2031	Pelham	B	Satisfied (Project File Included)	Storage	$ 9,307,000
Total									**$ 28,835,000**