City of Niagara Falls

Master Servicing Plan and Wet Weather Management Strategy
Volume 3: Water Master Servicing Plan

Niagara Falls, Ontario

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1. Introduction

1.1. Background and Study Area

The City of Niagara Falls (herein referred to as the "City") has completed the 2025 Master Servicing Plan and Wet Weather Management Strategy (MSP-WWMS). The 2025 MSP-WWMS aims to address existing system level of service for the water distribution, wastewater collection, and stormwater collection systems as well as develop a plan to support growth to 2051 and beyond.

The City encompasses a total area of 212 km^2 bounded by the Niagara River to the east, the Town of Niagara-on-the-Lake to the north, the Town of Fort Erie to the south, and the city of Thorold to the west. The City's urban service area encompasses approximately 82.3 km^2 or 39%, with the rest of the area defined as rural. The City is unique in that it experiences an annual influx of approximately 12 million tourists in the spring and summer seasons visiting the natural attraction of Niagara Falls, which puts significant seasonal load on the City's core infrastructure. Further, the City's aging infrastructure must continue to support a rapidly growing population as directed by the Provincial Planning Statement (2024) (superseding the *Places to Grow Growth Plan for the Greater Golden Horseshoe*), the City's Official Plan, and the Niagara Region's Official Plan.

The City is one of twelve municipally serviced lower-tier municipalities within the Niagara Region ("Region") where the water, wastewater, and stormwater systems operate under a two-tier municipal service delivery model. The Region is responsible for raw water supply, water and wastewater treatment, storage facilities, major water booster pumping stations, major sewage pumping stations, transmission mains, force mains, and trunk storm and wastewater conveyance. The City is responsible for the local water distribution network, and local wastewater and stormwater collection systems infrastructure.

The 2025 MSP-WWMS builds on the previous work undertaken as part of the 1998 Water Master Servicing Study, 2017 Pollution Prevention Control Plan, 2017 Master Drainage Plan Update, and 2021 Region Master Servicing Plan Update as well as previous long-term infrastructure planning studies.

1.2. Master Servicing Plan Objectives

Niagara Falls, like many municipalities, needs to balance addressing existing system level of service and state of good repair as part of a holistic and measurable management approach to infrastructure systems. The City has unique needs to balance existing servicing needs with level of service, development pressures, regulatory requirements, and protection of the environment. The MSP-WWMS aims to develop a long-term management plan with short- and long-term system upgrade needs and supporting maintenance and management activities. In the development of the MSP-WWMS, each upgrade (or program) trigger, financial implications, and functional objective is identified, thereby allowing the City to manage and adjust the plan moving forward based on changing growth trends and/or management priorities.

The objective of the MSP-WWMS is to develop a long-term servicing strategy for the drinking water, wastewater, and stormwater systems for the urban areas, current and future. More specifically, the key objectives are outlined as follows:

- Address the growth projections for the City as directed by the Provincial Planning Statement (2024)
- Develop a detailed system inventory, gap assessment, and capacity assessment to clearly identify the existing condition, State of Good Repair, risk and capacity of the City's existing water, wastewater, and stormwater infrastructure to meet level of service objectives and regulatory requirements.
- Review of existing and anticipated regulatory frameworks, existing system performance, and the City's existing financial constraints/tolerability to develop:
    - Appropriate system level of service criteria (in line with O.Reg 588/17)
    - Servicing policies and principles
    - Performance priorities
- Update the City's existing water, wastewater, and stormwater system models to enable the assessment of the existing and projected capacity and performance of the existing systems whilst addressing existing state of good repair and level of service deficits.
- Build off existing studies and recommendations while revisiting and updating past recommendations with the context of revised growth projection, updated performance criteria, and the latest infrastructure priorities.
- Review of system opportunities and constraints to identify potential servicing alternatives to address existing and long-term needs.
- Develop a comprehensive capital program, along with implementation triggers, to support the existing system needs and long-term growth.
- Develop a Wet Weather Flow Management Plan that outlines the City's strategy to monitor and address wet weather flows in the wastewater system including:
    - Prioritization of reduction programs including sewer separation, maintenance and rehabilitation recommendations, and public and private programs.
- Facilitate the necessary stakeholder to satisfy the Municipal Class Environmental Assessment Master Plan requirements, and to ensure stakeholder buy-in.
- Complete suitable documentation, outlining the methodology, results, and recommendations of the Master Servicing Plan.

All project deliverables are aligned with the City's concurrent Official Plan Review, Transportation Master Plan, Asset Management Plan for Core Assets, and Development Charges Bylaw Update. Additionally, the City's MSP-WWMS is developed under the context of the Niagara Region's Official Plan and 2021 Master Servicing Plan Update to ensure that all plans are based on the same foundational elements.

1.3. Master Servicing Plan Report Outline

The MSP-WWMS report, including all supporting volumes, is the document placed on public record for the prescribed review period. This document describes all required phases of the planning process and incorporates the procedure considered essential for the compliance with the Environmental Assessment Act. The MSP-WWMS report is organized into five volumes as described below:

Volume 1 – Executive Summary

Volume 1 provides an overview summary of the entire MSP-WWMS. It summarizes the information provided in Volumes 2 through 5 including problem statement, purpose of the study, significant planning, environmental and technical considerations, description of the analysis performed, and final capital program and recommendations.

Volume 2 – Planning and Consultation

Volume 2 details the master planning process; including the Master Plan Class EA process, related studies, legislative, and policy planning context, water, wastewater, and stormwater servicing principles and policies, population and employment growth forecasts, existing environmental conditions, costing methodology, and documentation related to all public consultation.

Volume 3 – Water Master Servicing Plan

Volume 3 consists of the principal document summarizing the study objectives, approach, methodologies, technical analyses, and selection of the preferred water servicing strategy. This volume details baseline and growth water system performance including detailed information regarding the capital program and additional implementation and ongoing maintenance solutions.

Volume 4 – Wastewater Master Servicing Plan and Wet Weather Management Strategy

Volume 4 consists of the principal document summarizing the study objectives, approach, methodologies, technical analyses, and selection of the preferred wastewater servicing strategy. This volume details baseline and growth wastewater system performance including detailed information regarding the capital program and additional implementation and ongoing maintenance solutions. This volume also details the sewer separation program and inflow and infiltration strategies as incorporated into the wet weather management strategy.

Volume 5 – Stormwater Master Servicing Plan

Volume 5 consists of the principal document summarizing the study objectives, approach, methodologies, technical analyses, and selection of the preferred stormwater servicing strategy. This volume details stormwater system performance including detailed information regarding the capital program and additional implementation and ongoing maintenance solutions.

2. Water System Policy and Criteria

Level of Service (LOS) objectives are critical elements in the evaluation of existing and future system performance and development of detailed servicing strategies, implementation of a system-wide capital program, and operations and maintenance practices. In addition to LOS objectives, policies were also laid out to provide guidelines and direction to the master planning process, in addition to ensuring that water demands are adequately representative to support the decision making for sizing and timing of future infrastructure.

This section summarizes the key Policy and LOS objectives as they relate to the water system. A detailed summary of the MSP Policies and LOS objectives review and recommendations is provided in **Appendix A** of **Volume 2**.

2.1. Water Servicing Principles and Policies

Based on the MSP-WWMS vision statement and the identified Policy statements, the following customer service statement for the City's water system was developed to guide the selection of Level of Service objectives and design criteria:

"*To provide an efficient, sustainable, and safe water system that meets regulatory requirements, minimizes service disruptions, and is capable of accommodating growth.*"

The detailed water servicing policies are summarized in **Appendix A** of **Volume 2**.

2.2. Regional Water Level of Service Design Criteria

Given the inter-dependency between the Region and City infrastructure performance, it is critical that the City's LOS include consideration for the Region's criteria in order to harmonize servicing strategies and to avoid competing priorities and/or servicing philosophies.

For the MSP-WWMS, only demand and system performance criteria were reviewed as they have impact on the City's distribution system. Detailed historic data analysis for non-revenue water (NRW), per capita rate, peaking factor, and the diurnal curve as well as the summarized water system LOS design criteria used in the Region's 2021 MSPU are provided in **Appendix A** of **Volume 2**.

2.3. System Hydraulic Performance Criteria

Following the detailed review of all hydraulic performance data, including pressures, fire flows, water quality, and velocities, the water system technical level of service criteria used in the Niagara Falls MSP-WWMS is summarized in **Table 2-1**. The majority of these criteria are inline with the Region's design criteria with adjustment to additional tourist area peaking factor and more defined fire flow targets.

Table 2-1. Summary of Water Technical Criteria

Criteria			Performance Target
Water Use	Per Capital Rate	Residential	240 L/c/d
		Employment	270 L/c/d
	Peaking Factor	Tourist Area	2.0
		Remainder of City	1.6
System Performance	Peak Velocity		Flag >1.5 m/s Trigger upgrades > 2 m/s
	Water Age		Flag >7 days
	Pressure	Pressure under daily demand	40 – 100 psi
		Pressure under fire flow	20 psi
	Fire Flow	Single Family Dead End	50 L/s
		Single Family Residential	75 L/s
		Semi Family Residential and Row Houses	150 L/s
		Residential Multi (Apartments and Stacked Townhouses)	200 L/s
		Commercial	175 L/s
		Institutional	175 L/s
		Industrial	250 L/s
		Tourist Area	300 L/s

2.4. Costing Framework

A capital costing framework is provided for all projects proposed as part of this MSP-WWMS. For the majority of the water system projects, a base construction cost was first obtained using either a unit rate construction cost, based on pipe diameter or unique project analysis. The base construction cost considered several complexity factors specific to each project such as creek crossings, railway and highway crossings, tunneling requirements, and area condition (rural, urban, suburban). Additional construction, design, administration, project contingency, provisional allowance, and non-recoverable HST costs were included as fixed percentages to produce a final project cost. For a further detailed breakdown, please refer to **Section 7** of **Volume 2**.

Further to costed project breakdown, considerations for development charge splits were incorporated into the final costing to include development charges costs, out-of-bylaw costs (OBL) for post period projects, and City or benefit to existing (BTE) costs. The categories and their definitions are outlined in **Table 2-2**.

Table 2-2. Development Charges Shares by Category

Category	**Low/Limited Growth** Local flow increase <50% and no change in Fire Flow requirement	**Moderate Growth** Local flow increase >50% or change in Fire Flow requirement	**Substantial Growth** Local flow increase >100% with/without change in Fire Flow requirement
Addresses Existing Needs	10% - Existing deficiencies with limited growth. Provides capacity for secondary units and infill development	N/A	
Addresses Existing Needs and Supports Growth Needs	N/A	50% - Needed to support growth but also services existing users	75% - Predominately needed to support growth but also serves existing users
Triggered by Growth	75% - Needed to support growth but also serves existing users	N/A	
Supports New Growth Areas	N/A		100% - Servicing greenfield growth area (10% OB)
Supports Growth Needs and Operational Resiliency	50% - Support operational improvement. Provides additional system capacity for future growth (40% OB)	75% - Support operational improvement. Provides additional system capacity for future growth (50% OB)	
Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	N/A	75% - Support operational improvement. Provides additional system capacity for future growth (75% OB)	

Note: OB – Out of Bylaw supports post period growth

3. Existing Water System

3.1. Existing Water Infrastructure

The City of Niagara Falls' existing water system is part of a two-tier water system within Niagara Region. The Region owns and operates all supply and transmission infrastructure including the Water Treatment Plant (WTP), pumping stations (PS), storage facilities, and trunk watermains. The City owns and operates all distribution infrastructure including watermains, hydrants, main valves, and services. The supply area consists of a single pressure zone of 250 m (Zone 250) noting that this is the hydraulic grade line (HGL).

The City's water system is supplied by the Region's Niagara Falls WTP located in Chippawa. From the Region's WTP, three major trunk mains supply the water system via a looped trunk watermain system. The Niagara Falls water system is interconnected with the DeCew WTP water system to provide additional supply and storage capacity to the City of Thorold to the west and several connections to the Town of Niagara-on-the-Lake (NOTL) in the St. David's area. The water system has connections to the City of Thorold providing the only supply point to Port Robinson East and a secondary connection to South Thorold through the McLeod interconnect.

Pumping is primarily provided at the Niagara Falls WTP high lift pumps (HLP) with additional supplemental pumping in the north of the City from the Kent Avenue Booster Pumping Station (BPS) which is supplied by the Kent Avenue Reservoir, a large inground reservoir. Floating storage is provided by the Lundy's Lane Elevated Tank (ET).

Figure 3-1 presents the existing water system including key facilities.

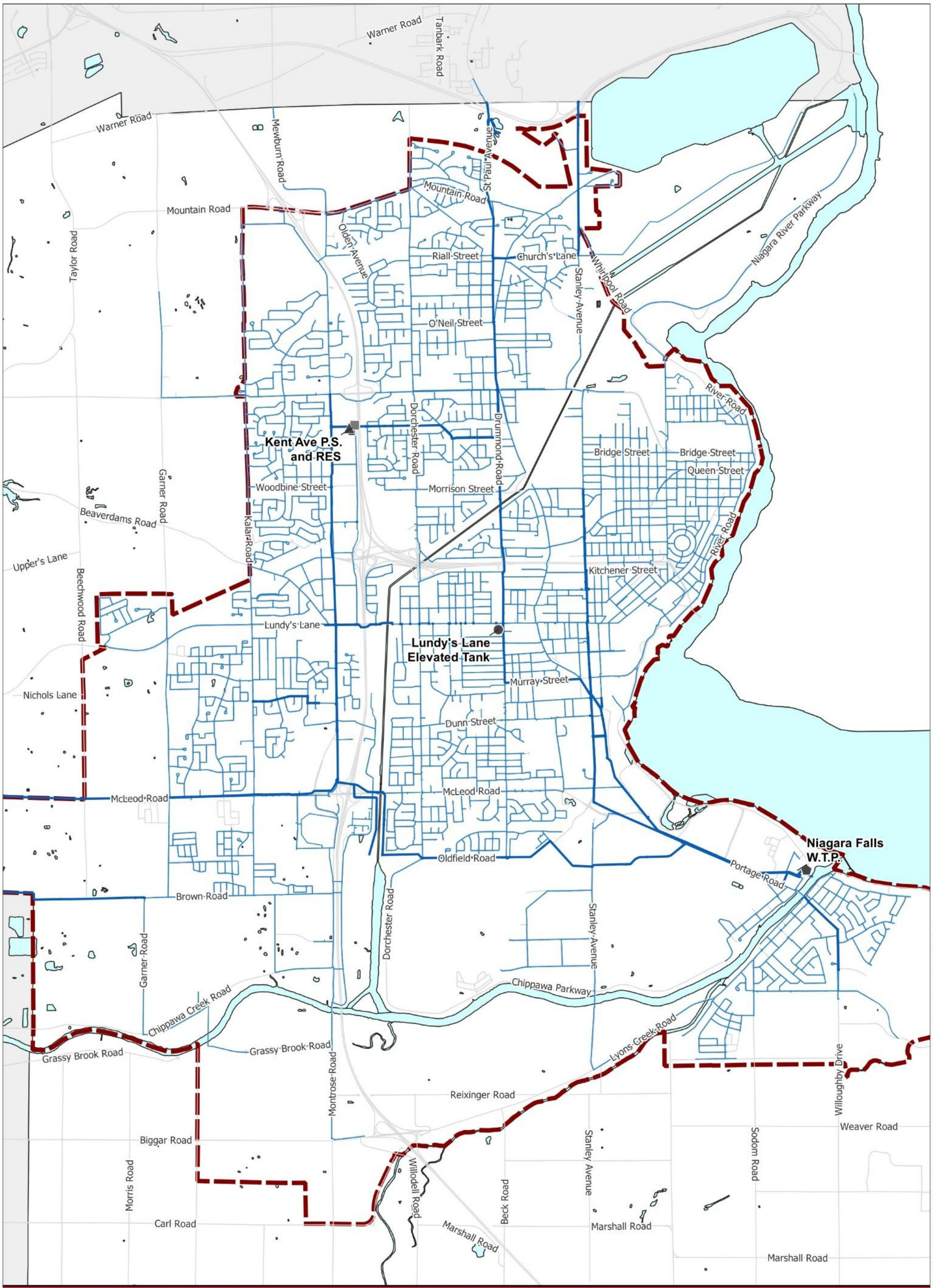

Figure 3-1
Map Title: Existing Water System Infrastructure

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

Client Name:
City of Niagara Falls (Ontario, Canada)

GEI

Last Updated: August 2025
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3.1.1. Water Treatment Plant

The City's water system is supplied by the Niagara Falls WTP, located at 3599 Macklem Street. The WTP is a conventional surface water treatment plant, supplied by Niagara River via the Welland River, with Zebra Mussel control, travelling screens, coagulation, flocculation, sedimentation, filtration, and disinfection. The WTP has a rated maximum day demand capacity of 146.0 MLD.

3.1.2. Pumping Stations

The Region previously provided facility plan drawings and capacities for all Region pumping stations within the City's system. This data was used as the primary source for the Region pumping station geometry and configuration as outlined in **Table 3-1**.

Table 3-1. Water Pumping Stations

Pump Station	Location	Inlet Source (Pressure Zone)	Discharge (Pressure Zone)	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	5/4	146.0	83.2
Kent Avenue Booster Pumping Station	4281 Kent Avenue, Niagara Falls	250 (via Kent Avenue Reservoir)	250	3/2	46.0	57.9

3.1.3. Storage

The Region previously provided facility plan drawings for all Region storage facilities within the City's system. This data was used as the primary source for the storage facility geometry and configuration as outlined in **Table 3-2**. Further, an ongoing environmental assessment (EA) is being undertaken to decommission the existing Lundy's Lane ET and construct a new, larger ET to service the City.

Table 3-2. Water Storage Facilities

Storage Facility	Location	Storage Type	Volume (ML)	Top Water Level (m)
Niagara Falls Water Treatment Plant Reservoir	3599 Macklem Street, Niagara Falls	Pumped Reservoir	14.0	174.3
Kent Avenue Reservoir	4281 Kent Avenue, Niagara Falls	Pumped Reservoir	20.9	196.9
Lundy's Lane Elevated Tank	6280 Lundy's Lane, Niagara Falls	Elevated Tank	2.5	249.6
New Niagara Falls Elevated Tank (ongoing EA)	Ongoing Environmental Assessment to Confirm Location	Elevated Tank	12.0	252.0 m

3.1.4. Regional Trunk Watermains

The Region owns and operates approximately 48 km of transmission watermains within Niagara Falls, varying from 400 mm to 2,400 mm, to convey water from the Niagara Falls WTP to the City of Niagara Falls, and to neighbouring distribution systems within the lower tier municipalities (Thorold and NOTL).

Boundary valves, each with a billing meter, are located at the connection points to other municipality water systems. These billing meters are used by the Region to generate invoices for the lower tier municipalities based on their individual water consumption. Boundary meters and their locations are summarized in **Table 3-3**.

Table 3-3. Boundary Meters

Boundary Meter	Nearest Address	Flow To
McLeod Station Control Valve (Forward Flow and Reverse Flow)	2029 Thorold Townline Road, Thorold	Thorold/ Niagara Falls
Bevan Station Control Valve	5964 Niagara Townline Road, Niagara Falls	Niagara-on-the-Lake
Port Robinson (Total Pipe Flow)	1795 Thorold Townline Road, Thorold	Thorold
Queenston Station Control Valve (Forward Flow and Reverse Flow)	5523 Niagara Townline Road, NOTL	Niagara-on-the-Lake/ Niagara Falls
St. Davids Ave Control Valve (High Pressure and Low Pressure)	1800 St Paul Ave, Niagara Falls	Niagara-on-the-Lake

3.1.5. Local Collection System (City-Owned)

The City owns and operates approximately 483 km of watermains, their distribution is outlined in **Table 3-4**, Table 3-5, **Table 3-6**.

Table 3-4. City-Owned Watermain Material

Material	Length (m)	Percent by Length
Asbestos Cement (AC)	9,300	1.9%
Cast Iron (CI)	131,265	27.2%
Ductile Iron (DI)	92,242	19.1%
Polyvinyl Chloride (PVC)	241,615	50.0%
Other (CPP, Copper, HDPE, PE, Steel)	8,653	1.8%
Unknown	212	0.0%

Table 3-5. City-Owned Watermain Diameter

Diameter	Length (m)	Percent by Length
≤ 100 mm	9,855	2.0%
150 mm	249,479	51.6%
200-250 mm	105,856	21.9%
300-350 mm	115,372	23.9%
400-500 mm	2,441	0.5%
Unknown	284	0.1%

Table 3-6. City-Owned Watermain Age

Age	Length (m)	Percent by Length
Older than 1940	36,796	7.6%
1940-1959	67,564	14.0%
1960-1979	106,226	22.0%
1980-1999	116,568	24.1%
2000-2025	156,132	32.3%

3.2. Existing System Demands

Existing water demands were established through a comprehensive water balance considering production at the WTP, transfers to other municipalities at boundary valves, and water billing records. Through this process, non-revenue water and maximum day peaking factors could be established and confirmed. **Table 3-7** summarizes the City's existing water demands.

Table 3-7. Existing System Demands

Year	Average Day Demand (MLD)	Billed Demand (MLD)	Non-Revenue Water (%)	Maximum Day Demand (MLD)	Maximum Day Demand Peaking Factor
2018	44.8	34.1	24%	74.5	1.66
2019	43.4	31.5	28%	71.8	1.65
2020	40.1	28.0	30%	65.6	1.63
2021	41.1	26.3	36%	63.7	1.55
2022	43.1	29.1	32%	62.7	1.45
5-Year Average	**42.5**	**29.8**	**30%**	**67.6**	**1.59**

3.3. Hydraulic Water Model

The City has an existing water distribution system hydraulic model which was developed and updated in InfoWater Pro. The InfoWater model was developed as an "all-pipe" model consisting of approximately 11,000 watermain segments. The model includes all Region watermains, pumping stations, and reservoirs; further, the existing InfoWater model forms part of the larger integrated DeCew and Niagara Falls WTPs model consisting of approximately 41,400 watermain segments.

The Niagara Falls water model was previously calibrated to approximately 220 hydrant tests (completed in 2019/2020) and the extended period Average Week and Max Week scenarios were validated using the Region's SCADA records. Additional updates were done to the model for both the Niagara Falls and DeCew WTP through the Region's 2021 MSPU. As part of the City's MSP-WWMS, localized demands and Regional infrastructure projects were updated. For a further detailed breakdown, please refer to the Model Methodology Technical Memo for Water in **Appendix A**.

3.4. Assessment of Existing Water Infrastructure

A critical step in the master planning process is the assessment of existing infrastructure to establish baseline conditions for the City's water distribution system. These existing conditions become the basis of future recommendations ensuring that a detailed analysis covers the entirety of the City's water system. Once the existing system conditions were established, the potential impacts of growth demands were assessed to develop and recommend servicing strategies.

3.4.1. Existing System Performance

Existing system hydraulic performance was evaluated using the City's InfoWater model. Existing system minimum pressures, fire flow deficiencies, and maximum velocities are presented in **Figure 3-2**, **Figure 3-3**, and **Figure 3-4** respectively. These LOS performance indicators were used as a basis for the City's preferred water system capital program by flagging areas in the existing system which may require upgrades.

3.4.1.1. Existing System Pressures

The existing system pressures are generally within 50-100 psi; however, due to the Niagara Falls water system operating as a single pressure zone and local variation in elevations there are areas with high pressures outside the 40-100 psi band. The following areas experience pressures above the LOS target of 100 psi:

- Tourist Area along the Niagara River and in the Silvertown area
- Chippewa area
- East of the Hydro Canal along Oldfield Road
- Industrial area along Stanley Avenue, south of Marineland Parkway
- Area southwest of McLeod Road and the Hydro Canal

The localized area of low pressure, due to high ground elevations, is located at the intersection of Lundy's Lane and Drummond Road. These pressures are maintained at approximately 40 psi.

3.4.1.2. Existing Fire Flow Deficiencies

Fire flow deficiencies were identified using a land use based approach as outlined as part of the LOS, **Section 2.3**. These deficiencies are typically along cast iron (CI) watermains as a result of aging watermains. The majority of these deficiencies can be addressed through the City's ongoing renewal program.

3.4.1.3. Existing Maximum Velocities

Maximum velocities within City owned watermains are maintained below the 1.5 m/s threshold.

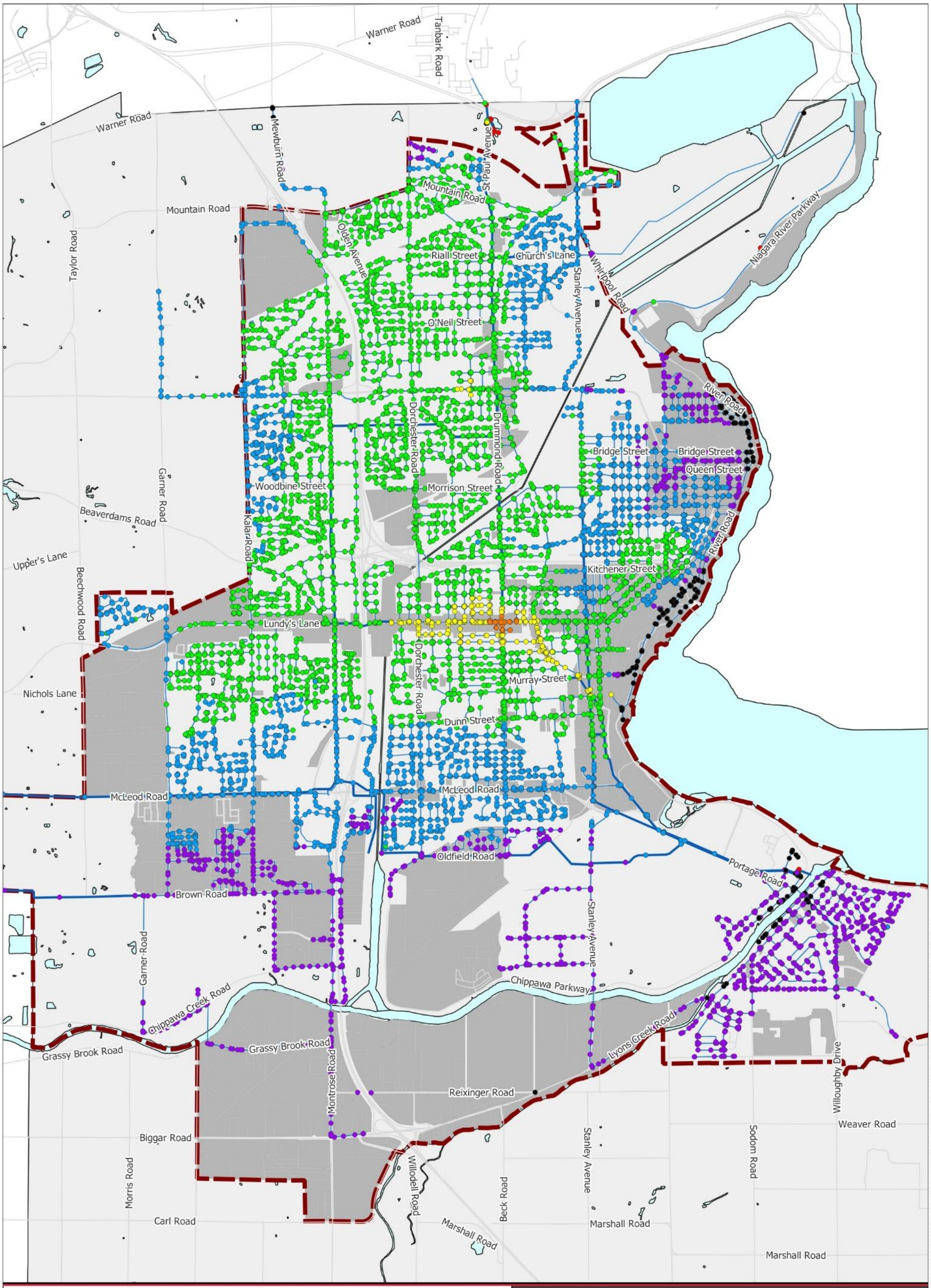

Figure 3-2
Map Title: System Performance - MDD Minimum Prssures (Existing)

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

Client Name:
City of Niagara Falls (Ontario, Canada)

GEI Consultants

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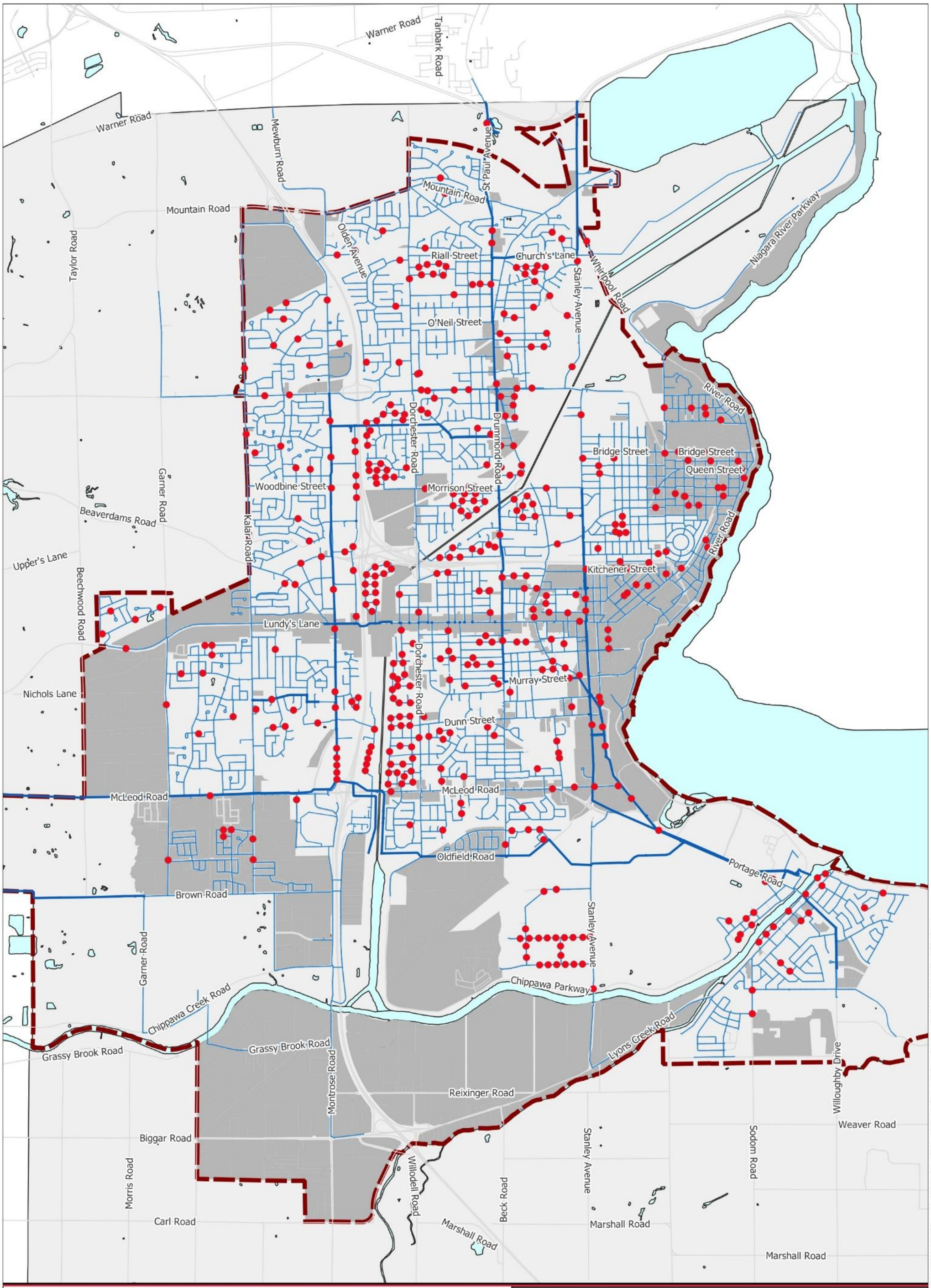

Figure 3-3
Map Title: System Performance - Fire Flow Deficiencies (Existing)

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

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Watermain Velocity
- City-Owned <= 1.5 m/s
- City-Owned > 1.5 m/s

General Features
- Waterbody
- Urban Area Boundary
- Growth Parcels

1,000 2,000 3,000 4,000 m

Figure 3-4
Map Title: System Performance - Maximum Velocity (Existing)

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

Client Name:
City of Niagara Falls (Ontario, Canada)

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3.4.2. Opportunities and Constraints

Existing water system opportunities and constraints were identified through hydraulic analysis results from the City's water model, a review of infrastructure data, and understanding of growth and the Region's MPSU capital projects. Overall, the water system is able to adequately deliver water to customers with some areas of higher or lower levels of service. The following issues, opportunities, and constraints have been identified for the City's existing water system, as further shown in **Figure 3-5**:

- **Pressure**
    - The Niagara Falls system currently operates as a single pressure zone. Due to the topographic variation in the City, the single pressure zone results in areas of high and low pressure.
    - The system experiences high pressures in multiple areas, including the Tourist core near the falls and in South Niagara Falls. High pressures present an increased risk of water loss and watermain breaks.
    - The system experiences low pressures along Lundy's Lane and Stamford Center. Low pressures result in user complaints and potentially reduced fire flow capacity. Addressing low pressures is more complicated as it would require the construction of a local pump station or changing of the system HGL.
    - There is opportunity to consider splitting the City into multiple pressure zones to optimize local HGL; however, due to current system configuration, execution and operation may be difficult.
- **Aging Infrastructure**
    - Due to the trunk loops within the Niagara Falls system, the system generally has good fire flow capacity, with the majority of low fire flow areas being the result of old CI watermains and/or local small diameter networks.
    - The City has large number of old CI watermains which may present higher rates of break and/or leakage and replacement can be prioritized to allow for better overall operation and performance of the distribution system.
    - Watermain replacements can accommodate additional system resiliency through looping or strategic upsizing.
- **Regional Upgrades**
    - The Region is undertaking an EA to replace the existing Lundy's Lane ET with a new ET at a new location and decommissioning the existing Lundy's Lane ET.
- **Greenfield Expansion**
    - Extension of the water system is needed at various extremities to accommodate new development in Greenfield areas.

Single Pressure Zone
The Niagara Falls system currently operates as a single pressure zone. Due to the topographic variation in the City, the single pressure zone results in areas of high and low pressure.

Greenfield Expansion
Extension of the water system is needed at various extremities to accommodate new development in Greenfield areas.

Low Pressure Areas
High pressures due to higher ground elevations and single pressure zone within the system.

Region Upgrades
Region is undertaking an Environmental Assessment to replace the existing Lundy's Lane Elevated Tank (ET) with a new ET at a new location. The existing Lundy's Lane ET will be decommissioned after the new ET is constructed.

Fire Flow Upgrades
The City has large number of old CI watermains which may present higher rates of break and/or leakage and replacement can be prioritized to allow for better overall operation and performance of the distribution system.

High Pressure Areas
The system experiences high pressures in multiple areas, including the Tourist core near the falls and in South Niagara Falls. High pressures present an increased risk of water loss and watermain breaks.

Kent Ave P.S. and RES

Lundy's Lane Elevated Tank

Niagara Falls W.T.P.

Warner Road
Tanbark Road
Mewburn Road
St. Paul Avenue
Mountain Road
Taylor Road
Olden Avenue
Riall Street
Church's Lane
Whirlpool Road
Niagara River Parkway
Stanley Avenue
O'Neil Street
River Road
Dorchester Road
Drummond Road
Bridge Street
Queen Street
Woodbine Street
Morrison Street
Kalar Road
Upper's Lane
Kitchener Street
Lundy's Lane
Murray Street
Dunn Street
McLeod Road
Oldfield Road
Portage Road
Brown Road
Garner Road
Chippawa Creek Road
Chippawa Parkway
Grassy Brook Road
Montrose Road
Lyons Creek Road
Willoughby Drive
Reixinger Road
Weaver Road
Biggar Road
Morris Road
Willodell Road
Beck Road
Stanley Avenue
Sodom Road
Carl Road
Marshall Road

Regional Water Facility
- Water Treatment Plant (WTP)
- Pumping Station (PS)
- Reservoir (RES)

General Features
- Waterbody
- Urban Area Boundary
- Municipal Boundary

Watermains
- Distribution (< 400mm)
- Transmission (>= 400mm)

1,000 2,000 3,000 4,000 m

Figure 3-5
Map Title: Existing Water System Opportunities and Constraints

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

Client Name:
City of Niagara Falls (Ontario, Canada)

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4. Assessment of Future Water Infrastructure

Following the evaluation of existing system performance, future growth to 2051 and buildout was assessed to understand growth impacts on the local distribution system. In combination with existing system performance, these results were used to develop the servicing strategy.

4.1. Growth Projections

To confirm appropriate projections, the growth forecast was developed through the review of planning data and workshops with City Staff as presented in **Section 4.2** of **Volume 2** of this MSP-WWMS. Through discussions with the City, it was determined that two growth scenarios would be used to estimate future system demands and growth-related water infrastructure needs, consisting of:

- **Interim growth scenario – Growth to 2051**: Consisting of buildout of all existing draft plan areas.
- **City buildout scenario – Growth to Ultimate Buildout**: Consisting of full buildout of the City's Urban Boundary.

Table 4-1 summarizes the 2051 and buildout population projections with growth areas shown in **Figure 4-1**. Additional details regarding growth can be found in **Volume 2**.

Table 4-1. Population Projections

Growth Horizon	Residential	Employment	Total
Existing	96,720	37,857	134,577
2051	178,110	71,911	250,020
Buildout	287,172	117,544	404,716

4.2. Future System Demands

Projected population growth within the City increases water demand across residential, employment, and tourist sectors. Future system average day demand (ADD) and maximum day demand (MDD) were calculated with the planning data as outlined in **Table 4-1** and the design criteria as outlined in **Table 2-1**. The growth allocation applied growth to the identified growth parcels as delineated by the City or along intensification and tourist corridors with projections by traffic zone delineated in the Region's 2021 MSPU. **Table 4-2** summarizes the existing and projected water demands.

Table 4-2. Water Demand Projections

Demand Scenario	Existing	2051	Buildout	Growth to 2051	Growth to Buildout
ADD (L/s)	387.0	742.6	1188.1	355.6	801.2
MDD (L/s)	638.5	1225.2	2376.3	586.7	1602.3

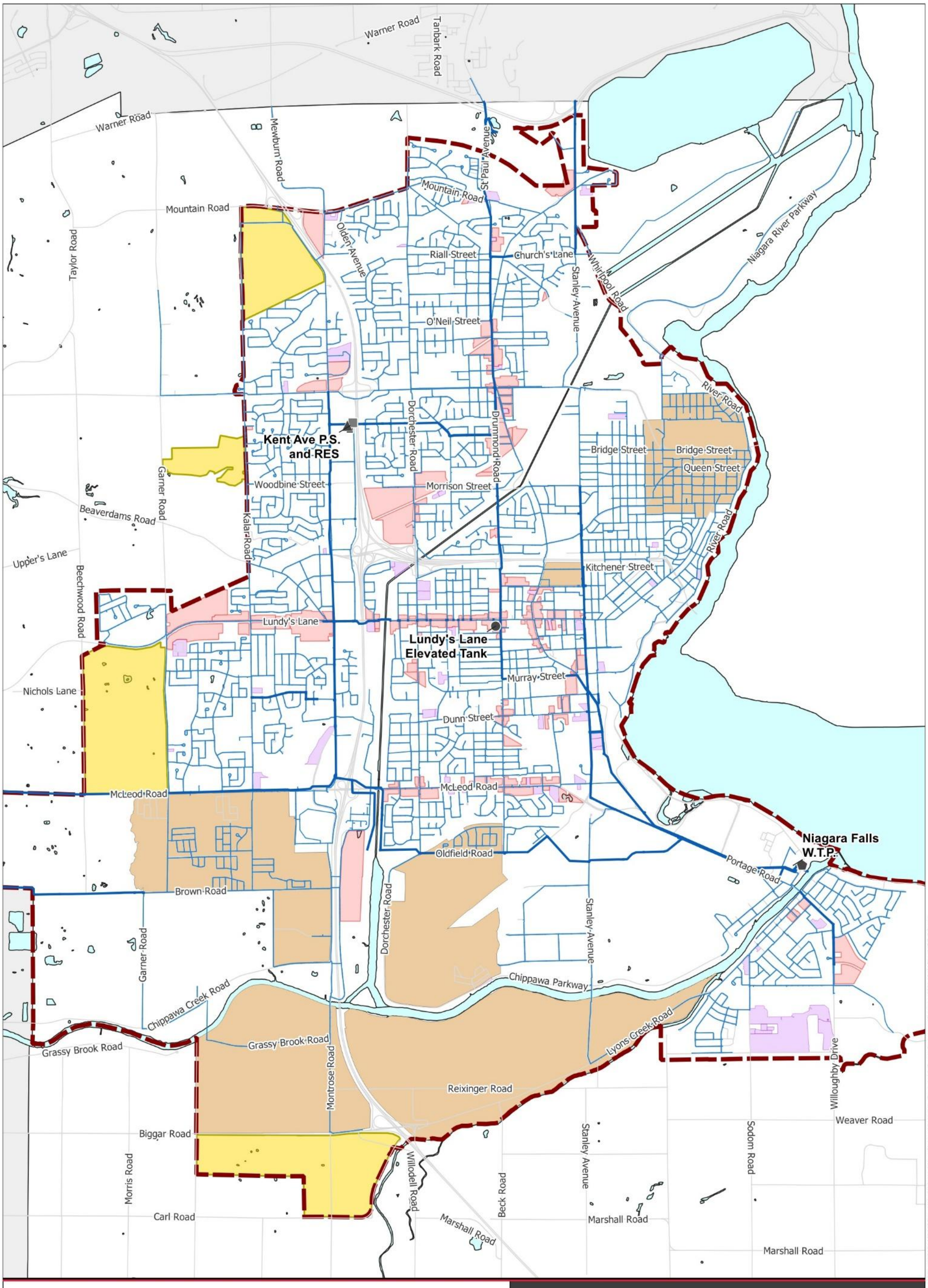

Figure 4-1
Map Title: Growth Area

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

Client Name:
City of Niagara Falls (Ontario, Canada)

GEI Consultants

Last Updated: August 2025
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4.3. Future System Performance

Local improvements are required to address both existing and future system capacity needs. The first step in the detailed analysis of the MSP-WWMS involved assessing the capacity and conditions of the existing infrastructure. Once the existing system conditions were established, the impacts of future growth demand on the water distribution system were analyzed to develop and evaluate potential servicing alternatives and address potential deficiencies and opportunities to improve system resiliency. The LOS targets used in the evaluation of system performance for minimum pressure, fire flow deficiencies, and maximum velocity are shown in **Figure 4-2**, **Figure 4-3**, and **Figure 4-4** respectively.

The future system performance for each of these criteria under 2051, and buildout scenarios are presented in the following sections. Performance figures for the buildout scenario are provided in **Appendix B**.

4.3.1. Future System Minimum Pressures

In general, the City experiences minimum pressures between 40-100 psi with localized areas of high pressure within the tourist area along the Niagara River on River Road due to low ground elevations, and a localized area of low pressure at the intersection of Lundy's Lane and Drummond Road. These minimum pressure results are similar to existing conditions.

4.3.2. Future System Fire Flow Deficiencies

Similar to the evaluation of existing fire flow deficiencies, 2051 deficiencies were identified using a land-use based approach, where the governing land-use at the closest fire hydrant determined the fire flow objectives. It should be noted that additional deficiencies within the existing system are minimally created as a result of growth and rather exacerbated along existing areas of deficiencies due to growth, detailed in **Table 4-3**. These are typically along CI watermains or areas of conveyance constrained by CI watermains.

Table 4-3. Fire Flow Deficiencies Model Results

Scenarios	% of Fire Flow Node Deficiencies
Existing	17.8%
2051 Growth	18.2% (additional 0.4%)
Buildout Growth	18.5% (additional 0.7%)

4.3.3. Maximum Velocities

Maximum velocities are similar between the existing and growth scenario with all velocities below the flag of 1.5 m/s.

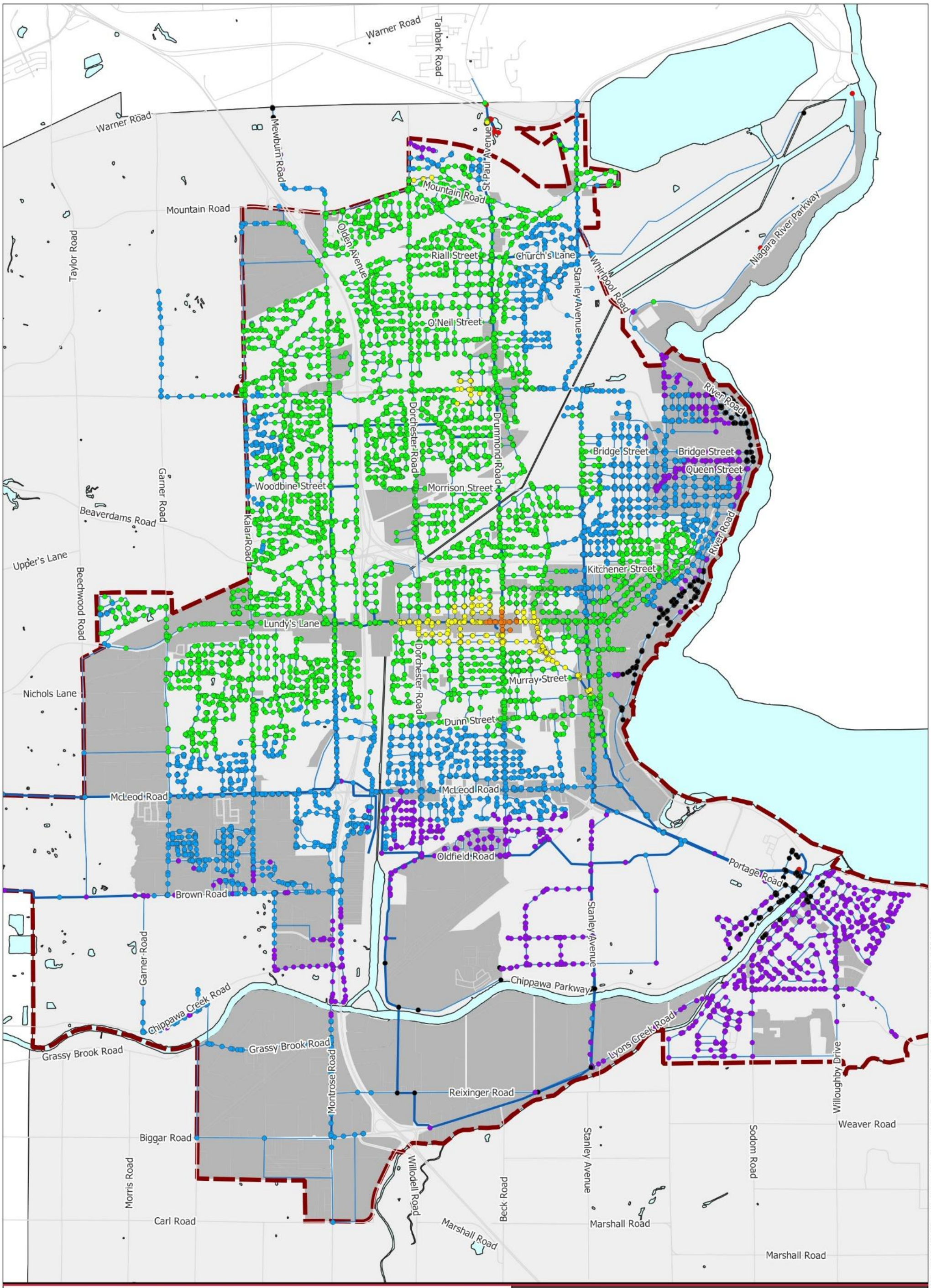

Figure 4-2
Map Title: System Performance - 2051 Growth MDD Minimum Prssures

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Client Name:
City of Niagara Falls (Ontario, Canada)

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Fire Flow Deficiencies
- Additional FF Deficiencies with 2051 Growthn
- Existing FF Deficiencies

Watermains
- Distribution (< 400mm)
- Transmission (>= 400mm)

General Features
- Waterbody
- Urban Area Boundary
- Growth Parcels

1,000 2,000 3,000 4,000 m

Figure 4-3
Map Title: System Performance - Additional Fire Flow Deficiencies (2051 Growth)

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

Client Name:
City of Niagara Falls (Ontario, Canada)

GEI Consultants

Last Updated: August 2025
Document ID: 700000-G-000

Warner Road
Tanbark Road
Warner Road
Mewburn Road
St Paul Avenue
Mountain Road
Mountain Road
Taylor Road
Older Avenue
Riall Street
Church's Lane
Whirlpool Road
Niagara River Parkway
Stanley Avenue
O'Neil Street
River Road
Dorchester Road
Drummond Road
Bridge Street
Bridge Street
Queen Street
Woodbine Street
Morrison Street
Garner Road
Beaverdams Road
Kalar Road
River Road
Upper's Lane
Beechwood Road
Kitchener Street
Lundy's Lane
Dorchester Road
Murray Street
Nichols Lane
Dunn Street
McLeod Road
McLeod Road
Oldfield Road
Portage Road
Brown Road
Garner Road
Stanley Avenue
Chippawa Parkway
Chippawa Creek Road
Grassy Brook Road
Grassy Brook Road
Montrose Road
Lyons Creek Road
Willoughby Drive
Reixinger Road
Weaver Road
Biggar Road
Morris Road
Willodell Road
Beck Road
Stanley Avenue
Sodom Road
Carl Road
Marshall Road
Marshall Road
Marshall Road

Watermain Velocity
- City-Owned <= 1.5 m/s
- City-Owned > 1.5 m/s
- Region-Owned <= 1.5 m/s
- Region-Owned > 1.5 m/s

General Features
- Waterbody
- Urban Area Boundary
- Growth Parcels

N

1,000 2,000 3,000 4,000 m

Figure 4-4
Map Title: System Performance - Maximum Velocity (2051 Growth)

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

Client Name:
City of Niagara Falls (Ontario, Canada)

GEI Consultants

Last Updated: August 2025
Document ID: 700000-G-000

5. Water Servicing Strategy

Water servicing strategies were developed under the context of identifying servicing solutions to address both system-wide and local opportunities and constraints. These alternatives focus on the existing water system while accommodating growth to form an overall water servicing strategy for the City.

As part of the MSP-WWMS, water servicing strategies were reviewed to ensure:

- Best use of existing infrastructure to avoid new infrastructure where possible;
- Minimum cost of new infrastructure;
- Consideration for operations and maintenance costs to ensure financial sustainability;
- Long term reliability and security of the water system;
- Avoidance and minimization of impacts and disruptions to the environment and cultural heritage resources where possible; and,
- Planning for future infrastructure in existing road right-of-ways where possible.

The following sections summarize the water servicing strategies which developed the overall preferred water servicing strategy.

5.1. Regional Strategy

As part of the Region's 2021 MSPU, capital projects were identified as outlined in **Table 5-1**. These capital projects were included in the Region's most recent water model update and carried forward into this model update and future system analysis. It can be noted that the ongoing EA for the new Niagara Falls ET (W-S-004) has refined the location of the ET; as such, this has been carried forward into future scenarios.

Table 5-1. Niagara Region Water Capital Program in Niagara Falls

Master Plan ID	Name	Description	Year
W-D-004	Decommissioning of Lundy's Lane ET	Lundy's Lane ET to be decommissioned and replaced by new ET	2027 - 2031
W-M-007	New transmission main from PRV to Port Robinson Chlorine BPS	New transmission main from PRV to Port Robinson Chlorine BPS	2022 - 2026
W-M-019	New Niagara Falls South feedermain from Dorchester Road to Lyon's Creek Road	New Niagara Falls South feedermain to provide additional supply to new growth areas	2032 - 2051
W-M-020	New Niagara Falls South feedermain along Lyon's Creek Road	New Niagara Falls South feedermain to provide additional supply to new growth areas	2042 - 2051
W-M-021	New Niagara Falls South feedermain along Stanley Avenue	New Niagara Falls South feedermain to provide additional supply to new growth areas	2032 - 2026
W-S-004	New South Niagara Falls ET	New South Niagara Falls ET to replace the Lundy's Lane ET and provide storage	2022 - 2026
W-S-014	In-ground Reservoir Expansion at Niagara Falls WTP	In-ground Reservoir Expansion at Niagara Falls WTP to support buildout growth and CT volume requirements	Post- 2051

5.2. System Wide and Pressure Zone Servicing

The City's water system currently operates under a single pressure zone of 250 m. The water system HGL is governed by the high elevation at the intersection of Lundy's Lane and Drummond Road near the existing Lundy's Lane ET. Due to the high pressure experienced at areas of low elevation, typically at system extremities, there is opportunity to explore alternative pressure zone strategies to maintain optimize HGLs within a smaller pressure band.

Alternative 1: Maintain Existing Pressure Zone

Under Alternative 1, the City would maintain operation as a single pressure zone at 250 m as currently configured. With the decommissioning of the Lundy's Lane ET and construction and operation of the new Niagara Falls ET the HGL, the top water level of the ET, will be maintained at the 250 m HGL. The existing boundaries would be maintained.

Alternative 2: Create New Pressure Zones and Optimize HGL

Under Alternative 2, the City's pressure zone servicing would consider the creation of three new pressure zones, in addition to the primary pressure zone, to provide a minimum pressure of 50 psi and maximum of 100 psi to all areas within the City. This alternative may be implemented as follows:

- Area in the north of the City would be supplied by a minimum of two (2) pressure reducing valves (PRV) and check valves to supplement local fire flows.
- Area adjacent to the Niagara River including downtown, would be supplied by a minimum of two (2) PRVs, a number of check valves to supplement local fire flows, additional watermain looping, and closed valves.
- Area south of McLeod Road including Chippawa would be supplied by minimum of three (3) PRVs, a number of check valves to supplement local fire flows, additional watermain looping, and closed valves.

As these new pressure zones are created, water quality and fire flow constraints will need to be addressed through the construction of new watermains, twinned to existing, bleeder valves where new closed valves are proposed, and check valves to supplement fire flows where PRVs or new looped watermains are not installed.

A brief evaluation of each alternative is provided in **Table 5-2**. Following evaluation and discussion with City staff during technical workshops, primarily due to high associated costs and operational complexity, the City will maintain the existing pressure zone configuration until future needs require adjustment.

Table 5-2. Pressure Zone Boundary Servicing Analysis

	Alternative 1: Maintain Existing Pressure Zone	**Alternative 2: Create New Pressure Zones and Optimize HGL**
Overview	• Existing City to be maintained as a single pressure zone with HGL of 250 m	• Creation of at minimum 3 new pressure zones to accommodate areas of high pressure • All pressure zones to have an optimized HGL • New infrastructure will include, PRVs, new watermains, check valves, bleeder valves etc.
Advantages	• No new infrastructure or operational updates required • Low associated cost • No implementation needed • Majority of the water system within level of service needs for pressure	• All areas within the City are maintained within the pressure level of service • Ability to optimize pressure zone HGLs
Disadvantages	• Areas experience pressures >100 psi above level of service criteria	• High costs associated with necessary works to implement • Operationally more complex with higher operation and maintenance needs

	Alternative 1: Maintain Existing Pressure Zone	Alternative 2: Create New Pressure Zones and Optimize HGL
Recommended Alternative	• Recommended as there are no implementation costs or changes to operations	• Not recommended due to high costs and operational needs

5.3. Linear Distribution System Upgrades

In addition to system wide and pressure zone servicing strategies, local servicing needs target fire flow deficiencies within the local network which can be addressed through the City's renewal program or state of good repair (SOGR) program. As growth to 2051 and buildout is added to the City's existing demands, growth impacts have to potential to further impact existing fire flow deficiencies and can be partially funded through development charges.

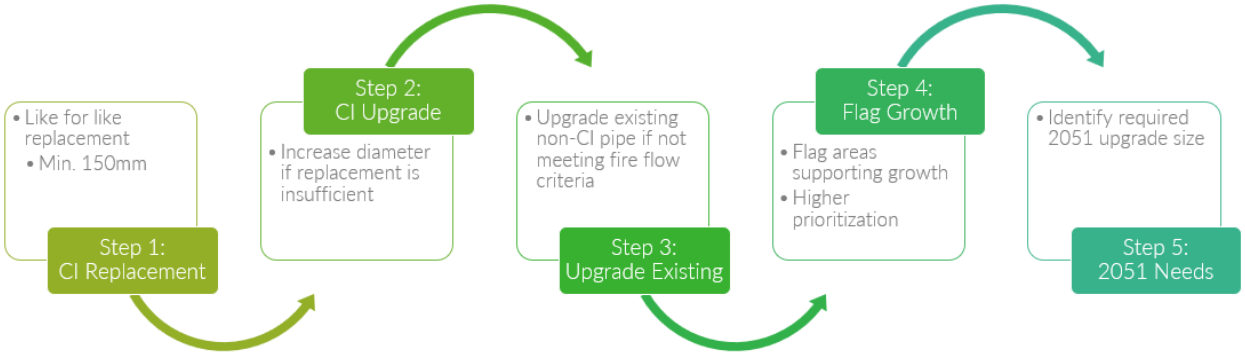
To service growth areas, both greenfield and infill/intensification areas, watermain upgrades or construction of new watermains are necessary. These new watermains include trunk looping to service new greenfield growth areas as well as providing additional local system looping to improve local resiliency. These projects are typically funded through development charges

5.3.1. Methodology – Existing System Deficiencies

To address existing fire flow deficiencies and plan for long-term servicing needs, a five-step evaluation process, as presented in Figure 5-1, was used to identify and prioritize linear watermain upgrades.

- Step 1: Replace existing CI watermains with new pipes, ensuring a minimum diameter of 150 mm replacement to meet baseline servicing standards.
- Step 2: If this replacement does not provide sufficient fire flow capacity, upsize the pipe diameter beyond the minimum requirement.
- Step 3: Focuses on non-CI pipes that do not meet the fire flow criteria. These non-CI pipes are assessed for potential upgrades to improve existing system performance.
- Step 4: Areas identified with supporting future growth are then flagged for higher prioritization due to potential funding opportunities through development charges. These locations may require infrastructure improvements to support increased demand from development.
- Step 5: Confirm the ultimate pipe sizing and upgrade requirements needed to meet projected demands through to the 2051 planning horizon. This ensures that the water system is appropriately sized to address growth needs and will not need potential upsizing later before the end of the service life.

Figure 5-1. Overview of System Upgrade Identification to Address Existing Fire Flow Deficiencies



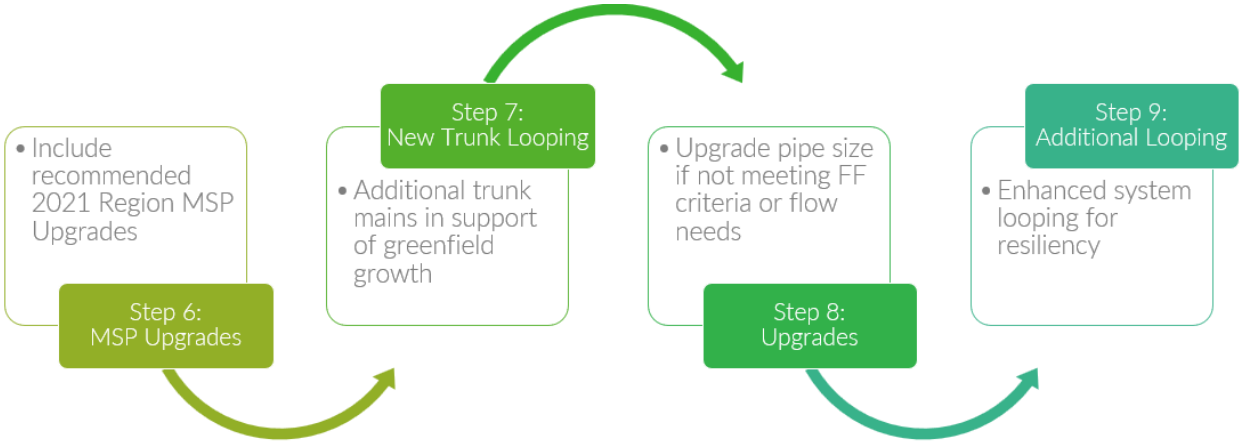
The upgrade strategy focuses on prioritizing infrastructure improvements based on both existing deficiencies and future growth pressures. CI watermain replacements are treated as baseline upgrades, while upsizing and non-CI improvements are targeted for areas with fire flow deficiencies. Growth areas are given higher priority to ensure that servicing capacity aligns with planned development. Long-term needs are addressed through high-level planning to ensure that the system remains resilient through to 2051 and to buildout.

5.3.2. Methodology – Growth Areas and Resiliency Needs

To support future growth and improvements to system resiliency, an additional four-step process evaluation as presented in Figure 5-2 was used to identify and prioritize water infrastructure upgrades.

- Step 6: Incorporation of recommended upgrades from the 2021 Region MSPU which serves as the foundation for system-wide improvements.
- Step 7: New trunk looping is introduced to support greenfield development areas. These additional trunk watermains are planned to extend service coverage needs and improve system connectivity such as looping.
- Step 8: Considerations for watermain upgrades if the fire flow criteria are not met after growth is loaded to the existing infrastructure.
- Step 9: Additional system looping to enhance network resiliency improves local system conveyance.

Figure 5-2. Overview of Servicing Needs Identification to Address Growth Needs



The upgrade strategy focused on aligning local servicing improvements with the Region's planning objectives while addressing the specific needs of greenfield growth areas. By integrating the 2021 Region MSPU recommendations, the City ensured consistency with broader infrastructure planning efforts.

Installing new trunk watermains for looping is prioritized in areas targeted for greenfield development, enabling phased expansion and improved servicing needs. Watermain upgrades are targeted based on fire flow criteria, to ensure that the system has adequate capacity. Additional looping was recommended to strengthen system redundancy, reduce dead ends, and improve pressure balancing across the network.

5.3.3. Prioritization Strategy

The watermain replacement strategy addresses replacement through a prioritized based system. This system aims to ensure that watermains with higher constraints are addressed first to improve the overall water system level of service. This prioritization strategy is outlined as follows:

1. SOGR replacements for CI watermains with diameter <100 mm
2. SOGR replacements for CI watermains with diameter 150-200 mm
    a. Watermains with fire flow deficiency <50% of LOS target
    b. Watermains with fire flow deficiency 50-75% of LOS target
    c. Watermains with fire flow deficiency 75-100% of LOS target
    d. Watermains with no fire flow deficiency
3. SOGR replacements for CI watermains with diameter >250 mm
4. SOGR replacements for Ductile Iron (DI) watermains with diameter 150-200 mm
5. Replace CI watermains to support resiliency needs
6. Replace DI watermains to support resiliency needs

7. Remaining projects
8. Development charges projects (projects driven by growth needs only)

It can be noted that CI watermains are prioritized for replacement first as they present the largest probability of failure to the system. These watermains are typically older with higher break rates and are nearing or are at the end of their estimated service life. In addition, CI watermains typically have high tuberculation which results in a reduction in available fire flow. Replacement of these watermains first (CI with fire flow deficiencies) presents the greatest improvement to overall level of service to customers.

In general, this prioritization can be overlayed with works proposed within each right-of-way to further optimize overall replacements and system improvements.

6. Preferred Water Servicing Strategy

This section outlines the preferred capital program, by addressing existing and future hydraulic deficiencies, supporting forecasted growth demands, and improving overall system performance using the criteria detailed in **Section 2.2**. The preferred upgrades consist of SOGR watermain replacements, upsizing watermains, and new watermains. These improvements are designed to meet the LOS objectives through to 2051 and buildout. All recommended projects are located within existing road rights-of-way or within greenfield growth areas, which are subsequently Schedule A or A+ Environmental Assessment type projects.

6.1. Capital Program

The Water Capital Program was developed through a detailed process of infrastructure sizing and cost estimation to support long-term servicing needs. **Figure 6-1** summarizes the capital program by prioritization project. The full Water Capital Program has been provided to the City as an Excel file detailed by asset, road, and type. A summary of the program, by road, is provided in **Appendix C**.

The recommended projects were sized to meet growth to full buildout requirements, ensuring that infrastructure can accommodate future demand. Cost estimates were derived using unit rates that accounted for factors such as location, construction complexity, materials handling, and whether the work involves new infrastructure or rehabilitation. This costing made consideration for development charges and OB servicing needs as outlined in **Section 2.4**.

The Water Capital Program timeline was based on the City's development charges program and the majority of the projects are near-term upgrades due to growth needs. These timelines were subsequently updated under the consideration that the City spends approximately $7 million per year on watermain replacement while maintaining timelines of projects in the City's current development charges. Unless driven by growth needs, timelines for watermain projects are flexible and can be adjusted to meet funding and staffing capacity availability. The City should continue with their SOGR program to address ongoing watermain deterioration and improve the City's overall LOS.

Table 6-1 presents the summary of the water capital program timeline with the total length and costs.

Table 6-1. Water Capital Program Timeline Summary

Project Timeline	Length (m)	Total Cost	DC Cost	OB Cost	City Cost
0 - 2 years	8,672	$31,927,000	$11,395,650	$3,975,900	$16,555,450
3 - 5 years	10,355	$29,821,000	$11,199,550	$1,126,750	$17,494,700
5 - 10 years	29,219	$88,796,000	$49,935,000	$6,752,200	$32,108,800
>10 years	56,431	$167,212,000	$29,047,900	$8,522,150	$129,641,950
TOTAL	**104,677**	**$317,756,000**	**$101,578,100**	**$20,377,000**	**$195,800,900**

The Water Capital Program has been categorized by the type of upgrade to maintain consistency with the City's development charges. The categories start with addressing existing needs by replacing existing watermains and SOGR projects, followed by improving operational resiliency to strengthen the network, and supporting intensification or new growth areas. Further detailed prioritization was completed for each project which ultimately split into the categories summarized in **Section 5.3.3**. **Table 6-2** presents the summary of the Water Capital Program prioritization categories with the total length and costs.

Table 6-2. Water Capital Program Prioritization Summary

Prioritization Category	Length (m)	Total Cost	DC Cost	OB Cost	City Cost
Type 1: SOGR <100 mm CI	379	$1,742,000	$651,600	-	$1,090,400
Type 2A: SOGR 150-200 mm CI - FF Deficiency <50% Target	12,938	$39,075,000	$5,715,650	-	$33,359,350
Type 2B: SOGR 150-200 mm CI - FF Deficiency 50-75% Target	9,623	$28,422,000	$4,241,050	$94,400	$24,086,550
Type 2C: SOGR 150-200 mm CI - FF Deficiency 75-100% Target	12,074	$36,346,000	$5,243,000	-	$31,103,000
Type 2D: SOGR 150-200 mm CI - No FF Deficiencies	20,419	$61,332,000	$10,619,750	-	$50,712,250
Type 3: SOGR Upsize >250 mm	10,274	$28,910,000	$7,623,000	$233,200	$21,053,800
Type 4: SOGR 150-200 mm DI	4,779	$15,645,000	$3,053,400	-	$12,591,600
Type 5: Resiliency CI Replace	3,059	$14,638,000	$5,848,650	$4,286,350	$4,503,000
Type 6: Resiliency DI Replace	2,112	$6,018,000	$1,190,600	$2,186,400	$2,641,000
Type 7: Remaining Projects	7,480	$26,766,000	$11,289,300	$6,959,300	$8,517,400
DC Projects	21,542	$58,862,000	$46,102,100	$6,617,350	$6,142,550
TOTAL	**104,677**	**$317,756,000**	**$101,578,100**	**$20,377,000**	**$195,800,900**

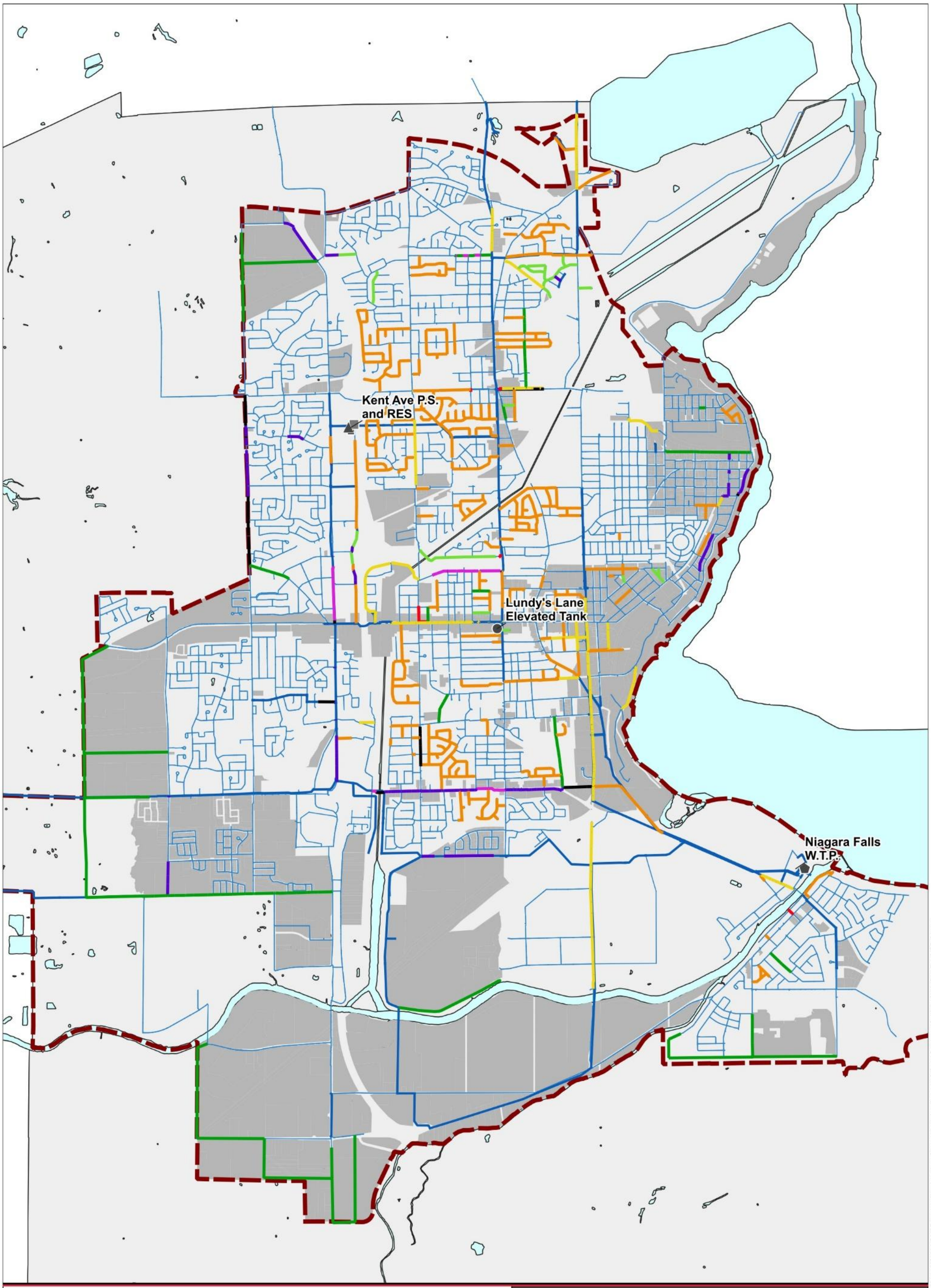


Figure 6-1
Map Title: Water Capital Program (Prioritization)

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

Client Name:
City of Niagara Falls (Ontario, Canada)

GEI Consultants

Last Updated: March 2026
Document ID: 700000-G-000

Document Path: E:\Working\NIAGARA FALLS ON, CITY OF\24020014 - 622071 NF MSP and Wet Weather Mgmt Strategy\5 Work in Progress\GIS and Databases\3. Water\622017-W-FinalMSP-CA.mxd

7. Implementation and Lifecycle

7.1. Capital Program Implementation Plan

The preferred water servicing strategy will support the servicing needs of the City's future growth to 2051 and buildout. The implementation of the program summarizes strategies involving ongoing monitoring and refinements to ensure that infrastructure delivery meets growth priorities and provides watermain replacements to address LOS needs within the existing system.

As the water projects are within existing right-of-ways or along Greenfield growth areas, works have the potential to be aligned with wastewater, stormwater, and road projects to optimize construction costs and minimize disruptions. As these projects do not have Environmental Assessment requirements, they do not require additional lead time beyond detailed design works before construction can commence. The following requirements can be considered during implementation:

- Refinement of infrastructure locations and alignments.
- Identification of preferred construction methodologies, including review and mitigation of potential construction-related impacts (e.g., traffic, noise and vibration, dust, dewatering requirements, service disruptions, etc.).
- Assessment of installation methods (e.g., trenchless vs. open cut) for water infrastructure near or crossing watercourses.
- Completion of additional site-specific supporting investigations as required (e.g., source water protection, geotechnical, hydrogeological, topographic surveys, flood plain analysis, etc.).
- Fulfillment of all provincial, municipal and conservation authority permits and approval requirements.
- Additional engagement with First Nations and Indigenous communities where treaty rights may be impacted by projects.

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

In addition, long term monitoring of project conditions can continue to occur to ensure that key technical, regulatory, and planning needs are considered to ensure the successful delivery of the recommended projects. These monitoring works which may result in changes to the recommended projects include:

- Adjustment to recommendations if LOS targets are adjusted (i.e. fire flow targets).
- Updated growth forecasts or changes in development timing.
- Completion of detail design which may alter scope and/or timing of projects.
- Permitting timelines, ensure that early permitting, as required, to limit delays in implementation.

- Status of funding sources, including development charges, capital reserves, and other funding programs, to assess financial readiness for project implementation.
- Changes to regulatory requirements. The City will monitor updates to federal, provincial and local policies, legislation, and technical guidelines that may influence the planning, design, or delivery of water infrastructure. Where applicable, the City will adapt implementation strategies to maintain compliance and minimize delays associated with new or evolving regulatory requirements.

7.2. Operation and Maintenance Practices.

Effective operation and maintenance (O&M) practices are essential to ensuring the long-term reliability, safety, and performance of the municipal water system. These strategies focus on preserving existing infrastructure, maintaining regulatory compliance, and minimizing service disruptions. The following section identifies key programs and potential recommendations for the City's O&M approach.

In addition to the core O&M practices, there are several studies that may be eligible for potential development charges contribution due to their role in supporting growth and system expansion. These initiatives are instrumental to capacity management, long-term planning, and the integration of new development into the existing water system.

7.2.1. Sampling and Flushing Program

System water quality is typically measured by the system's ability to maintain chlorine residuals. A sample and flushing program ensures that water quality is maintained throughout the distribution system. Sampling verifies compliance with provincial water quality standards, whereas regular flushing removes sediment and stagnant water. The City currently implements a sampling and flushing program and should continue to do so.

There is opportunity to correlate chlorine residual results with water age determined using the City's hydraulic model to better understand areas of potential water quality constraints. Due to the City's general distance from the Niagara Falls WTP, water quality is maintained at adequate levels throughout the City with potential water quality constraints at dead ends without or with minimal services.

7.2.2. Water Meter Replacement Program

Accurate metering is essential for billing, demand management, and system monitoring. The replacement program targets aging or malfunctioning meters to ensure consistent and reliable measurement of water usage across all users.

The City implemented a water meter replacement program approximately five (5) years ago to replace aging water meters. These aging water meters rely on labour intensive methods of collecting water meter reads including manual reads. Through the strategic replacement of these water meters, the City will be able to more effectively collect data.

7.2.3. Valve Turning Program

Routine valve turning is necessary to maintain operability of isolation valves, which are critical during emergency shutdowns and maintenance activities. This program helps prevent valve seizure, ensures system flexibility, and supports rapid response to watermain breaks or other incidents.

The City currently has a valve turning program to ensure that all water valves remain in good operating condition. The program is part of industry best practice, and it is recommended that the City continue the valve turning program.

7.2.4. Development Review Process

The development review process ensures that servicing capacity and infrastructure requirements are evaluated during the planning and approval of new developments. This process helps align growth with available system capacity and identifies where upgrades may be needed.

The City currently undertakes confirmation of system capacity needs through modelling analysis as they relate to developments on an as needed basis. This process should be continued and further refined on an as needed basis.

7.2.5. Non-Revenue Water Program

The City should implement a targeted NRW reduction program to minimize NRW rates. The NRW was calculated for the system, presented in **Table 3-7**, which averages to be 30% over the previous 5 years.

To better manage NRW, it is important to understand the components of NRW, and the factors which influence these components. The City should calculate their NRW each year on a more refined scale, such that ongoing tracking can estimate key areas of improvement. These categories can be broken down into the following categories which align with the American Water Works Association (AWWA) methodology for evaluating NRW:

- Billed unmetered consumption (i.e. public works hydrants)
- Authorized consumption (i.e. municipal facilities)
- Unbilled unmetered authorized consumption (i.e. fire training, fire fighting, hydrant flushing, watermain flushing, water theft)
- Real water losses (i.e. leakage on watermains, leakage on water services)

Noting that a number of these categories requires estimation as a placeholder (i.e. fire department use, flushing, etc.). To reduce the NRW, it is recommended that the Municipality implement the following key activities:

- Leak detection program for watermains;
- Watermain replacement program;

- Improved tracking of unbilled authorized users and development of demand reduction strategies:
    - Fire department
    - Watermain flushing
    - Facility usage
- Development of bulk water user strategy;
- Improved monitoring and enforcement of new construction water uses.

7.2.6. Water Rate Study

A water rate study is a financial planning tool that helps ensure water rates remain fair and sustainable while accounting for both operating costs and capital investment needs. The City currently undergoes regular updates to their water rates on an as needed basis and should continue to conduct water rate studies as necessary to ensure established rates are in line with industry trends and servicing needs.

7.2.7. Hydrant Testing and Pressure Monitoring Program

An ongoing hydrant testing and pressure monitoring program aids in the confirmation of local system capacity and pressures. This data, in turn, can be used to validate hydraulic model assumptions and assess system performance under varying demand conditions. These activities support model calibration and capacity planning as well as providing more accurate local system performance for infill and intensification development applications.

7.2.8. Model Updates

Regular maintenance and updates to the City's hydraulic water model is essential to reflect changes in the system due to growth, infrastructure upgrades, and/or operational adjustments. Varying degrees of model updates can be undertaken at varying intervals to ensure that the results from the model are the most accurate.

- Network update to account for watermain replacements, new development watermains, etc. can be undertaken on a 1-2 year basis.
- Local calibration to hydrant testing and pressure monitoring can be undertaken on an as needed basis, following completion of local hydrant testing due to development, or every 2-3 years to reconfirm local capacities following water replacements.
- Major updates, including SCADA validation and billing updates, can be undertaken on a similar timeline as the update to the Water Master Servicing Plan, approximately every 5 years

7.2.9. Master Plan Studies

The Water Master Servicing Plan provides a strategic framework for long-term infrastructure investment and policy development. This study should be updated every five (5) years, as recommended by the government of Ontario.

Appendix A Water Modelling Methodology

Master Servicing Plan and Wet Weather Management Strategy

Model Methodology – Water

City of Niagara Falls

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Project No. 2402014

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1. Existing Water System Model

The City of Niagara Fall (City) has an existing water distribution system hydraulic model which was developed and updated in InfoWater Pro. The InfoWater model was developed as an "all-pipe" model consisting of approximately 11,000 watermain segments. The model includes all Niagara Region (Region) watermains, pumping stations, and reservoirs; further, the existing InfoWater model forms part of the larger integrated DeCew and Niagara Falls Water Treatment Plant (WTP) model consisting of approximately 41,400 watermain segments. The Niagara Falls water model was previously calibrated to approximately 220 hydrant tests (completed in 2019/2020) and the extended period Average Week and Max Week scenarios were validated using the Region's SCADA records. Additional updates were done to the model for both the Niagara Falls and DeCew WTP through the Region's 2021 Master Servicing Plan Update (MSPU). As part of the City's ongoing Master Servicing Plan and Wet Weather Management Strategy (MSP-WWMS), localized demands and Regional infrastructure projects were updated within the model.

1.1. Model Update Objectives

The City's project Terms of Reference (ToR) identified the following as the minimum criteria for consideration in the development/upgrade of the City's hydraulic models:

- Maintain compatibility with the Region's water and wastewater models, such that the information can be easily integrated and shared.
- Incorporate all Region owned pipes and facilities.
- Incorporate any system changes since the last updates to the models including network improvements (through replacement and rehabilitation) and additions.
- Incorporate any refinements to the model data utilizing updated network information provided by the City as a result of recent infrastructure investigation and condition assessments.
- Certain planned and committed future projects and system enhancements are known and should be incorporated into a future conditions model for evaluation in the various growth projection scenarios. While the specific timing of these projects is not fixed, the subsequent scenario analyses will provide some guidance on prioritization based on modelled impacts. These include:
    - Committed City and Region capital projects.
    - Recommended tanks and storage facilities removal and / or optimization (where appropriate).
    - South Niagara Falls Wastewater Solutions recommendations (new 30 MLD Wastewater Treatment Plant, Montrose Trunk Sewer, South Thorold, decommissioning of SPS) per Niagara Region's ongoing capital project.
    - Proposed Chippawa Trunk Sewer from the new WWTP along Lyons Creek to drain the Chippawa catchment as recommended in the most recent Region MSPU.

Further, the project ToR anticipated scope of work for all model updates includes the following key tasks:

- Utilize existing hydraulic models as a basis for the model updates to leverage effort previously undertaken to establish topology, include facilities and provide validation.
- Incorporate new system elements as provided by the City.
- Synchronize updated network attribute data as provided by the City.
- Confirm facility data including pump attributes and storage capacity.
- Confirm a wastewater flow loading procedure for the model and update all manhole flows.
- Confirm a stormwater flow loading procedure for the model and update all manhole/ catch basin flows.
- Confirm a water demand loading procedure for the model and update all node/junction demands.
- Utilize City contour data sets to attempt to determine overland flow/drainage patterns.
- Utilize orthophotography of the City to establish sub-catchment parameters such as impervious area.
- Assumptions for the hydraulic parameters are to be presented, reviewed and documented.
- Orthophotography should also be utilized to provide information on drainage features including ponds.
- Establish baseline stormwater model runs.
- Calibration of all 3 models using flow data gathered historically and throughout the study.
- Validate the results of the new existing condition models with the current model and with available system flow monitoring results.
- Confirm operational parameters for the water, wastewater, and stormwater systems and update any control settings in the model.
- Identify a future workplan to be completed as part of a separate project to enhance and calibrate the stormwater model, including an implementation plan and design for storm sewer flow monitoring, including location, software, hardware and schedule. Some recent, localized monitoring will be made available from the City following award.

1.2. Model Update Scope

Based on the City's stated modelling objectives and taking into consideration the existing state of the City's model, the scope of the water model update consisted of the following:

- An "all-pipe" network including all Region and City owned watermains and facilities,
- Appropriate controls for all facilities to allow for EPS system modelling under a greater range of demand conditions, and
- External connections and contributions from the City of Thorold and the Town of Niagara-On-The-Lake.

The model maintains the current "system segmentation" methodology where it currently exists. The model update focused on the following key areas:

- Water network update to include new network GIS and system expansions.
- Update of facilities to include:
  - New facilities and facilities decommissioning,
  - Facility upgrade and modification, and
  - Facility control update.

1.2.1. Network Update

The update to the water system network reflects current system condition includes verifying, flagging, and updating any discrepancy between the GIS and model network. The primary areas of focus included the following:

- Addition of new watermains,
- Identification of and removal of abandoned watermains, and
- Flagging discrepancies within the existing network for confirmation with the City.

1.2.2. Facility and Control Update

All Region owned facilities were recently updated as part of the Region's 2021 MSPU. As such, the facility update will consist of re-confirming the capacities and storage geometries. For any facilities that have undergone recent upgrades/rehab, the update included an update of the following for the effected pumping and storage facilities:

- Confirm pump station capacities,
- Confirm storage configurations, and
- Confirmation of operational controls.

1.2.3. System Demand Update

An update of the water demand allocation used water billing records for the spatial distribution of demands as well as the Region's SCADA records to confirm total demands (including non-revenue demands), peaking factors, and daily diurnal patterns.

1.2.4. Model Calibration & Validation

The calibration and validation of the model is typically completed through the following:

- EPS facility performance, and
- Static Hydrant Testing.

It can be noted that model calibration and validation was recently completed as part of the 2020 model update and Region's 2021 MSPU. As such, no calibration or validation was necessary for this assignment as the previous updates captured system operations and capacities.

1.2.5. Growth Demand Allocation

Growth demands were applied to the model based on the anticipated growth within the City through a similar methodology as the water demand update. The growth demands were established through a combination of TAZ-identified growth populations and growth blocks provided by the City.

1.3. Software Selection

As this is an update to the existing model, the model update will be competed using InfoWater Pro and Innovyze modelling software.

2. Data Sources

The following sections outline the data sources that were used to update the InfoWater Pro model.

2.1. Water Network

The City's water GIS data, which includes watermains and valves, was used as the basis of the network update and primary sources of watermain geometry, including diameters and material for new watermains and to validate the model's existing parameters.

2.2. Region Owned Facilities

The Region previously provided facility plan drawings and capacities for all Region pumping stations and storage facilities within the City's system. This data was used as the primary source for all Region owned facility geometry and configurations.

2.3. Demand Data

2.3.1. Water Billing Data

Water billing was received from the City for the years 2018-2022. The water usage by billing meter was spatially allocated to parcel by address which was used as the basis for the spatial allocation of average day demands.

2.3.2. SCADA Data

Region SCADA data was previously received from the Region for the years 2018-2020. This SCADA data was used to validate system operations such that an accurate representation of system operations could be established.

Average water flows into and from the Niagara Falls system were received from the Region for the years 2018 to 2022. In combination with the water billing data, these flows were used to confirm system water usage and determine non-revenue water (NRW) rates. The supply balance of the City's water usage was through the water meters outlined as follows:

- 1D6 McLeod Station Control Valve (Forward Flow and Reverse Flow)
- 1D1 Bevan Station Control Valve
- 1D2 Port Robinson (Total Pipe Flow)
- 1D5 Queenston Station CV (Forward Flow and Reverse Flow)
- 1T1 Niagara Falls Water Treated Water Line #1
- 1T2 Niagara Falls Water Treated Water Line #2
- 1D3 St Davids Ave CV (High Pressure and Low Pressure)

2.4. Hydrant Testing

Hydrant testing was previously completed within the City in 2019/2020 which covered approximately 220 hydrant tests. The water model was subsequently updated using these tests which confirmed local capacity with a high degree of both accuracy and City-wide distribution. As such, additional local calibration was not necessary at the time of this model update.

3. Hydraulic Model Update

3.1. Network Update

The water network update and validation was completed through comparison of City provided GIS and model watermains by ID. Following the addition of new watermains and update to any materials and diameters, the water network was further validated using the following assumptions:

- Cross-reference the baseline model network against GIS water network to identify network discrepancies:
  - Discrepancy review will be completed using “spatial overlay” to account for system segmentation in select areas
  - Discrepancy review will consist of:
    - Elements present in model but not in GIS
    - Elements present in GIS but not in model
    - Difference in element hydraulic parameters
    - Size
    - Material
    - Age
    - Difference in network topology (connectivity)
- Update the model network as follows:
  - Pipes included in the GIS but not the model – pipes to be added to the model
  - Elements in the model but not in the GIS:
    - If elements are associated to a water system facility – elements will be reviewed as part of the facility update
    - If elements are not associated to a water system facility – elements to be removed
  - Elements with updated attribution – update water model based on GIS attributes:
    - The existing models utilize the Region GIS IDs as primary model IDs:
    - Both the Region and City IDs will be retained
    - The Region ID will be the primary model ID and City ID will be included as a reference
  - Differences in network connectivity:
    - If elements are associated to a water system facility – elements will be reviewed as part of the facility update
    - If elements are not associated to a water system facility – manual verification of connectivity will be completed and updated as required

Table 3-1 summarizes a comparison of the updated GIS with the existing model flagging the extent of differences to review for the model update. Currently the complete extent of the City's network City's water network is included the water system model. It should be noted that there are some discrepancies between the model and the City's GIS network due to varied segmentation of pipes. The initial water model build, and subsequent updates have generally maintained existing segmentation and IDs of the GIS network which includes reference to both Region and City IDs.

Table 3-1. Water Model Comparison

Watermains	Existing Model	Updated GIS
Total number of pipes	41,426	38,970
Consistent Objects	36,123	36,123
IDs not in other dataset	5,303	2,847
Different Diameter (%)	1% (501)	1% (501)
Different Material (%)	27% (9,898)	<1% (76)
Different Install Year (%)	5% (1,767)	5% (1,767)
Different Ownership (%)	<1% (32)	<1% (171)

3.2. Facility Update

Facilities within the City's distribution system were re-evaluated and updated based on facility site plan drawings and ECA's and included the following:

- Reviewing available data to identify the general facility parameters including:
  - Facility configuration,
  - Number of pumps,
  - Pump rated capacity and curves, and
  - Storage geometry.

As required the updated model and documentation process included the following:

- Complete a SCADA data analysis to identify facility operational controls and set points noting that due to the recent update to the water model operations, using 2020 SCADA, and no new facilities or upgrades to existing facilities, the SCADA analysis was not completed for this model update.
- Develop facility summary, including:
  - Facility capacity and configuration
  - Facility operational controls and set points

3.2.1. Water Treatment

The City of Niagara Falls is supplied by the Niagara Falls WTP, located at 3599 Macklem Street. The WTP is a conventional surface water treatment plant, supplied by Niagara River via the Welland River, with Zebra Mussel control, travelling screens, coagulation, flocculation, sedimentation, filtration, and disinfection. The WTP has a rated maximum day demand capacity of 146.0 MLD.

3.2.2. Pumping Stations

The Region previously provided facility plan drawings and capacities for all Region pumping stations within the City's system. This data was used as the primary source for the Region pumping station geometry and configuration as outlined in **Table 3-2**.

Table 3-2. Water Pumping Stations

Pump Station	Location	Inlet Source (Pressure Zone)	Discharge (Pressure Zone)	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	5/4	146.0	83.2
Kent Avenue Booster Pumping Station	4281 Kent Avenue, Niagara Falls	250 (via Kent Avenue Reservoir)	250	3/2	46.0	57.9

3.2.3. Storage

The Region previously provided facility plan drawings for all Region storage facilities within the City's system. This data was used as the primary source for the storage facility geometry and configuration as outlined in **Table 3-3**. Further, an ongoing environmental assessment (EA) is being undertaken to decommission the existing Lundy's Lane Elevated Tank (ET) and construct a new, larger ET to service the City of Niagara Falls.

Table 3-3. Water Storage Facilities

Storage Facility	Location	Storage Type	Volume	Top Water Level (m)
Niagara Falls Water Treatment Plant Reservoir	3599 Macklem Street, Niagara Falls	Pumped Reservoir	14.0	174.3
Kent Avenue Reservoir	4281 Kent Avenue, Niagara Falls	Pumped Reservoir	20.9	196.9
Lundy's Lane Elevated Tank	6280 Lundy's Lane, Niagara Falls	Elevated Tank	2.5	249.6
New Niagara Falls Elevated Tank (cons. 2026)	Ongoing Environmental Assessment to Confirm Location	Elevated Tank	12.0	252.0 m

3.2.4. Boundary Meters

The City provided information on the boundary meters within the City's distribution which supply adjacent municipalities from the Niagara Falls WTP, as shown in **Table 3-4**.

Table 3-4. Boundary Meters

Boundary Meter	Nearest Address	Flow To
McLeod Station Control Valve (Forward Flow and Reverse Flow)	2029 Thorold Townline Road, Thorold	Thorold/ Niagara Falls
Bevan Station Control Valve	5964 Niagara Townline Road, Niagara Falls	Niagara-on-the-Lake
Port Robinson (Total Pipe Flow)	1795 Thorold Townline Road, Thorold	Thorold
Queenston Station Control Valve (Forward Flow and Reverse Flow)	5523 Niagara Townline Road, NOTL	Niagara-on-the-Lake/ Niagara Falls
St. Davids Ave Control Valve (High Pressure and Low Pressure)	1800 St Paul Ave, Niagara Falls	Niagara-on-the-Lake

3.2.5. Region Master Servicing Plan Update Capital Projects

As part of the Region's 2021 MSPU, capital projects were identified outlined in **Table 3-5**. These capital projects were included in the Region's most recent water model update and carried forward into this model update. It can be noted that the ongoing EA for the new Niagara Falls ET (W-S-004) has refined the location of the ET and future HGL of the pressure zone; as such, this has been carried forward into future scenarios.

Table 3-5. Niagara Region Water Capital Program in Niagara Falls

Master Plan ID	Name	Description	Year
W-D-004	Decommissioning of Lundy's Lane ET	Lundy's Lane ET to be decommissioned and replaced by new ET	2027 - 2031
W-M-007	New transmission main from PRV to Port Robinson Chlorine BPS	New transmission main from PRV to Port Robinson Chlorine BPS	2022 - 2026
W-M-019	New Niagara Falls South feedermain from Dorchester Road to Lyon's Creek Road	New Niagara Falls South feedermain to provide additional supply to new growth areas	2032 - 2051
W-M-020	New Niagara Falls South feedermain along Lyon's Creek Road	New Niagara Falls South feedermain to provide additional supply to new growth areas	2042 - 2051
W-M-021	New Niagara Falls South feedermain along Stanley Avenue	New Niagara Falls South feedermain to provide additional supply to new growth areas	2032 - 2026
W-S-004	New South Niagara Falls ET	New South Niagara Falls ET to replace the Lundy's Lane ET and provide storage	2022 - 2026
W-S-014	In-ground Reservoir Expansion at Niagara Falls WTP	In-ground Reservoir Expansion at Niagara Falls WTP to support buildout growth and CT volume requirements	Post- 2051

3.3. Demand Allocation

The following section outlines the general methodology used to characterize system demand. In general, parcel-based water demands were defined using the assigned parcel water billing demand and adjusted to match the observed SCADA supply water balance.

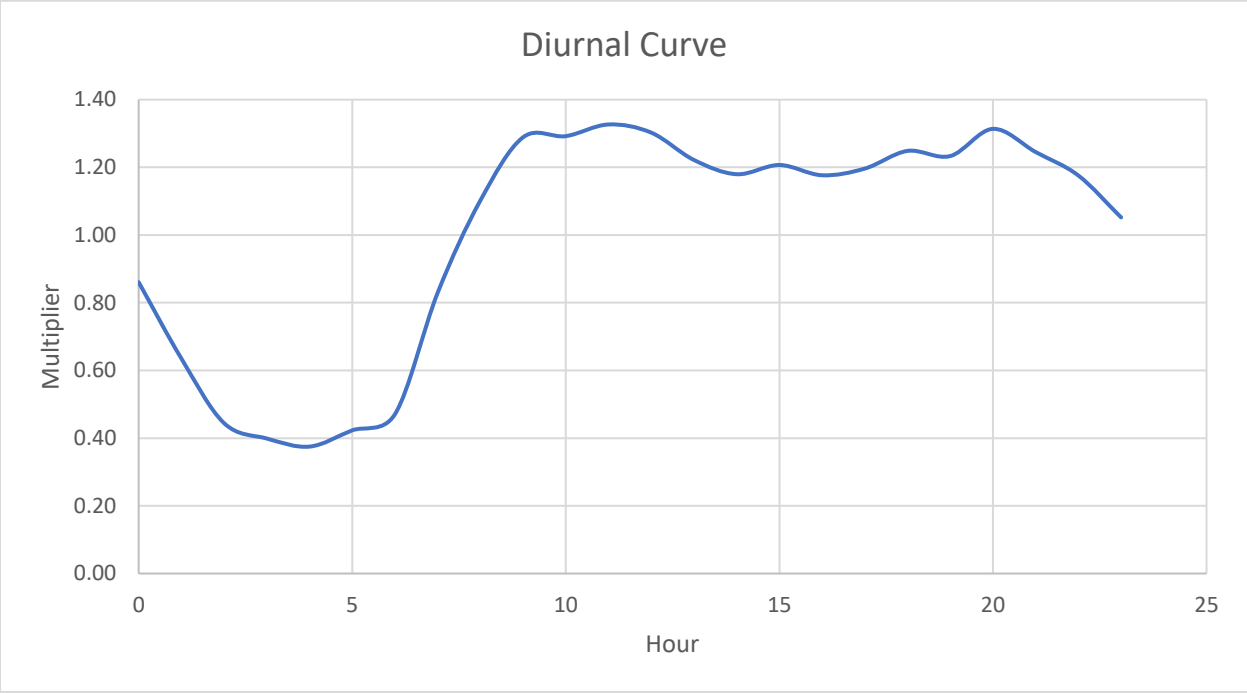
3.3.1. Establishment of Typical Water Demand

The water demands were established using billing meter records provided from by the City on an individualized water meter basis for the past five years (2018-2022). Future growth was applied to this starting point based on the agreed upon MSP-WWMS design criteria.

3.3.1.1. Diurnal Profile

A diurnal pattern was previously developed though a SCADA review and applied to each demand node in the model. This diurnal pattern was established based on the boundary supply/export flow rates and storage levels by converting to a change in volume per hour. A diurnal curve, shown in **Figure 3-1**, reflects the system's daily consumption in 1-hour intervals over a 24-hour period.

Figure 3-1. Niagara Falls WTP Diurnal Curve

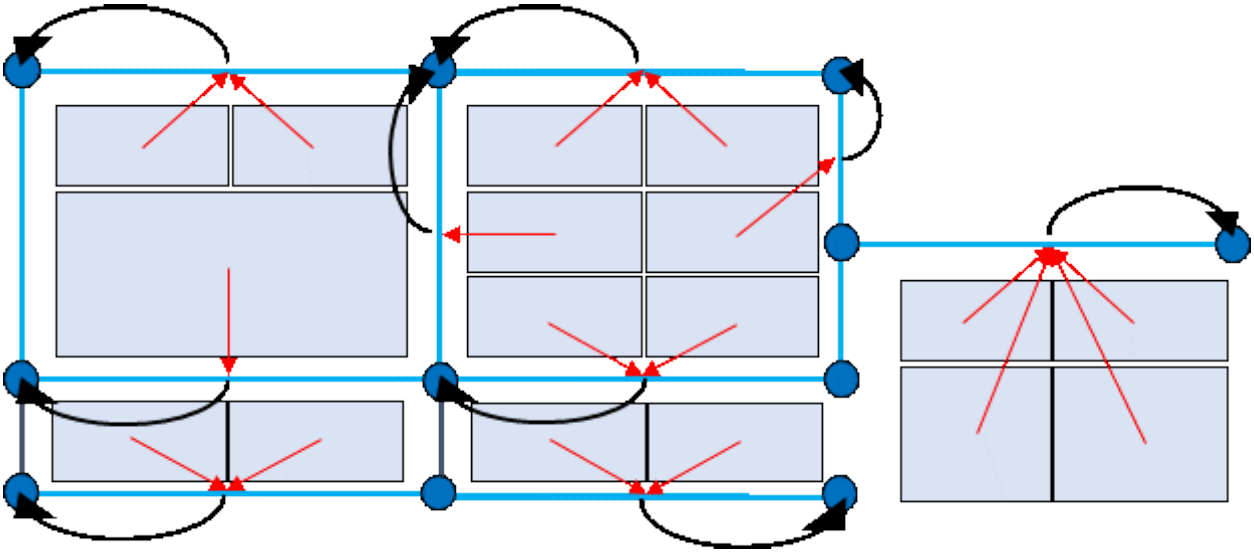


3.3.1.2. Water Demand Allocation

Water billing records were allocated to existing parcels, based on available address information associated with billing meters, as the base water demand and used in combination with SCADA Records to estimate NRW.

- Parcels were allocated to the closest node using the methodology shown in **Figure 3-2**
- Base demand represents 100% of the average billing records;
- Non-revenue water (NRW) rate was estimated by cross-referencing production records against billing records with non-revenue demands being distributed evenly across the system; and,
- Diurnal patterns were based on an average curve developed from SCADA records. Diurnal patterns will be adjusted to Average Day vs. Max Day demand scenarios.

Figure 3-2. Process for Allocating System Demands



3.3.1.3. System Demand Analysis

Billing data, provided by the City from 2018-2022, describes yearly water consumption within the City and was used to calculate an Average Day Demand (ADD) of 16.1 MLD for residential land-use and 13.7 MLD for non-residential land-use, as shown in **Table 3-6**.

NRW was calculated based on the difference between the water balance flows (based on flows into and out of the Niagara Falls distribution system) and local billing data. The average NRW from the available years of billing data (2018-2022) was 12.7 MLD (approximately 30%).

Table 3-6. Historic Water Use

Year	Niagara Falls WTP Average Day Demand (MLD)	Billing: Residential (MLD)	Billing: Employment (MLD)	Non-revenue Water (MLD)	
2018	44.8	17.8	16.3	10.8	24%
2019	43.4	15.7	15.8	11.9	28%
2020	40.1	16.3	11.7	12.2	30%
2021	41.1	15.5	10.8	14.8	36%
2022	43.1	15.2	13.9	14.0	32%
5-Year Average	**42.5**	**16.1**	**13.7**	**12.7**	**30%**

3.3.1.4. Peaking Factor

The Maximum Day Demand (MDD) peaking factor was determined using the same water balance for the City's water distribution system. **Table 3-7** presents the MDD peaking factors as calculated over the previous 5-years noting that a peaking factor of 1.59 is in line with the Region's 2021 MSPU peaking factor of 1.6 which was applied to the system's MDD demands (exclusive of NRW).

Table 3-7. Maximum Day Peaking Factors

Year	Average Day Demand (MLD)	Maximum Day Demand (MLD)	Maximum Day Demand Peaking Factor
2018	44.8	74.5	1.66
2019	43.4	71.8	1.65
2020	40.1	65.6	1.63
2021	41.1	63.7	1.55
2022	43.1	62.7	1.45
5-Year Average	**42.5**	**67.6**	**1.59**

3.4. Water Growth Demand Allocation

Growth population and employment projections were be provided in the following formats:

- Growth blocks (more discreet than TAZs)
- Intensification corridors
- TAZs
- Excel table summarizing total growth by growth area and TAZ

Population and employment numbers to each watermain was be calculated using the following process:

- Growth blocks and intensification corridors will be allocated first to existing municipal parcels proportionally based on area-weighted basis.
- TAZs will be overlaid with the growth area shapefile
    - Where growth in the TAZ exceeds the growth blocks, the remaining growth will likely be distributed across the zone as infill/intensification allowance
- For TAZs with no corresponding growth area shapes, all growth will be assumed to be proportionally applied to existing area within the urban boundary
- For TAZs partially in the urban boundary, all growth will be assumed to occur within the urban boundary with no growth outside the urban boundary
- For TAZs entirely outside the urban boundary, growth will only be applied to existing service areas proportionally based on area-weighted basis or total service area within the TAZ

For unassigned growth shapes, a manual review of existing service network, topographic, and existing natural and physical features will be reviewed, and growth will be assigned to individual watermains based on likely service connection

4. Model Calibration and Validation

The model calibration and validation considered the adjustment of various parameters within the model such that the system performance accurately is represented in the model. This is achieved through both a SCADA validation to confirm facility operations and a local capacity calibration using hydrant testing. This process was largely completed in recent model updates in 2019/2020 through the water model update and in 2021/2022 through the Region's 2021 MSPU. The following sections provide a summary of the updates previously completed.

4.1. Facility Control Validation

A SCADA review was previously completed in 2019/2020 as part of the water model update and further updated in 2021/2022 as part of the Region's 2021 MSPU. This review evaluated and updated the system control narrative and model controls. This process considered the comparison of SCADA and model extended period simulation (EPS) results, over 5 days during an average week in 2020. This comparison ensured that the model was accurately predicting WTP flow rates, reservoir level and cycles, and other general system performance.

In general, the system control narrative is as follows:

- Two pumps are typically operated at the Niagara Falls WTP (317 L/s, 631 L/s) with controls based on levels in the Lundy's Lane ET
- One pump typically operates at the Kent Avenue Booster Pumping Station (BPS) (266 L/s) through a combination of timed controls and level controls within the Kent Reservoir
- Remaining pumps at both the Niagara Falls WTP and Kent Avenue BPS applied additional level controls based on levels in the Lundy's Lane ET

4.1.1. Niagara Falls WTP Control Validation

The Niagara Falls system operates at an HGL of 250 m. The system is supplied by the Niagara Falls WTP, with pumping activity controlled by water levels in the floating storage at the Lundy's Lane ET. It should be noted that the Niagara Falls WTP is typically operated manually, as such, model controls were based on maintaining the typical operating range. Facility controls are detailed in **Table 4-1** and model vs. SCADA results are shown in **Figure 4-1** to **Figure 4-3**.

Table 4-1. Niagara Falls WTP Pump Controls

Pump	Status	Level in Lundy's Lane ET	Note
Niagara Falls WTP Pump 1	Status: On Status: Off	<35% >40%	Assumed controls (typically off)
Niagara Falls WTP Pump 2	Status: On Status: Off	<35% >40%	Assumed controls (typically off)
Niagara Falls WTP Pump 3	Status: On Status: Off	<25% >35%	Assumed controls (typically off)
Niagara Falls WTP Pump 4	Setting: 0.92 Setting: 0.85	>92% <92%	Typical operations based on SCADA
Niagara Falls WTP Pump 5	Setting: 0.95 Setting: 0.90 Status: Off	<87% <92% and >87% >92%	Typical operations based on SCADA

Figure 4-1. Niagara Falls WTP Model Validation – Discharge Flow

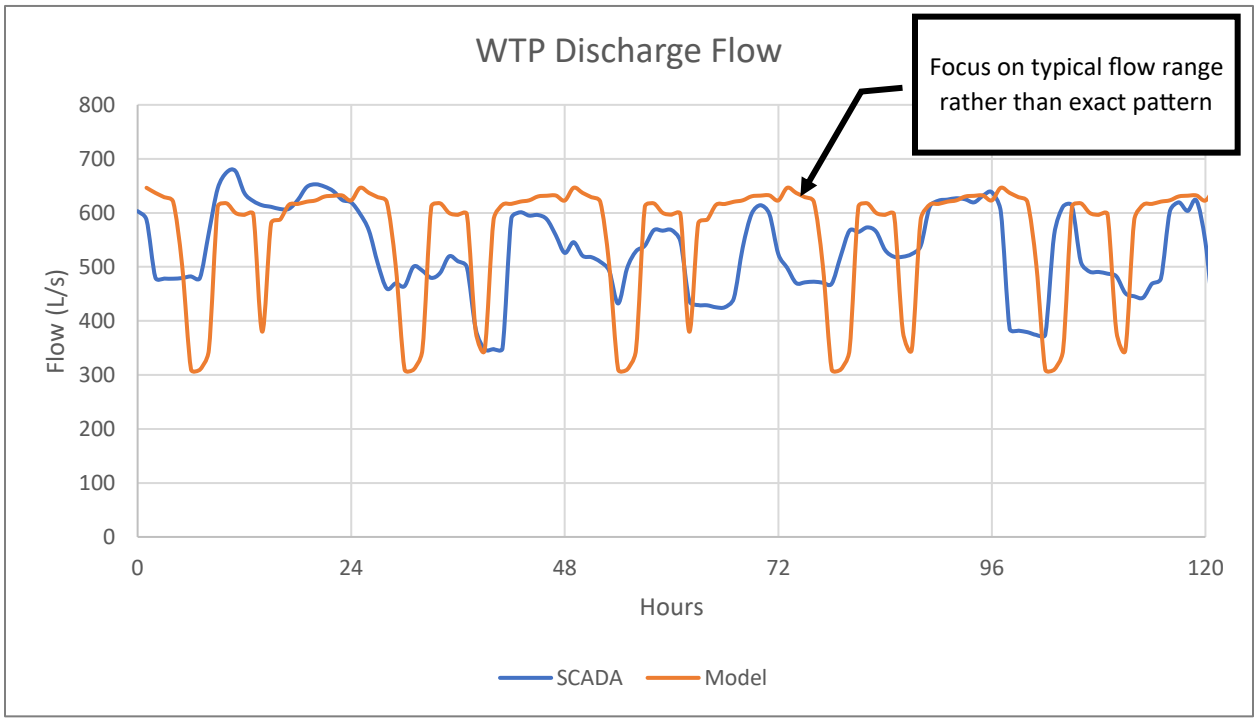


Figure 4-2. Niagara Falls WTP Model Validation – Discharge Pressure

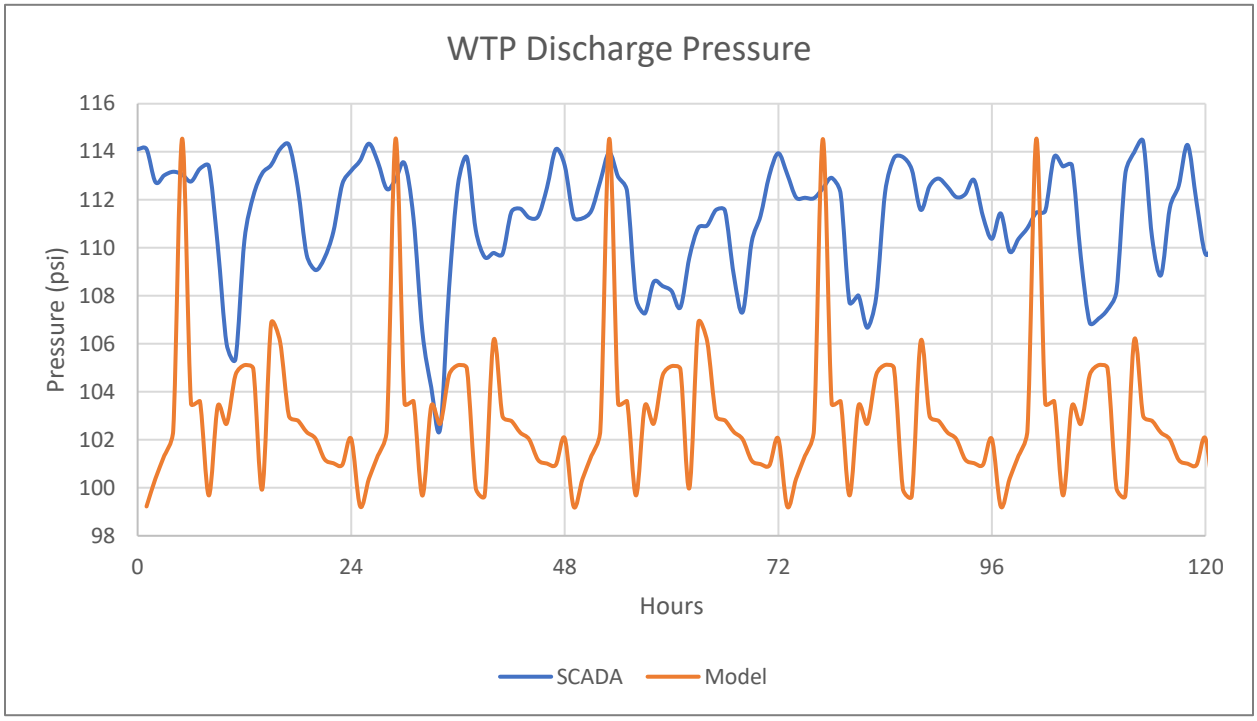
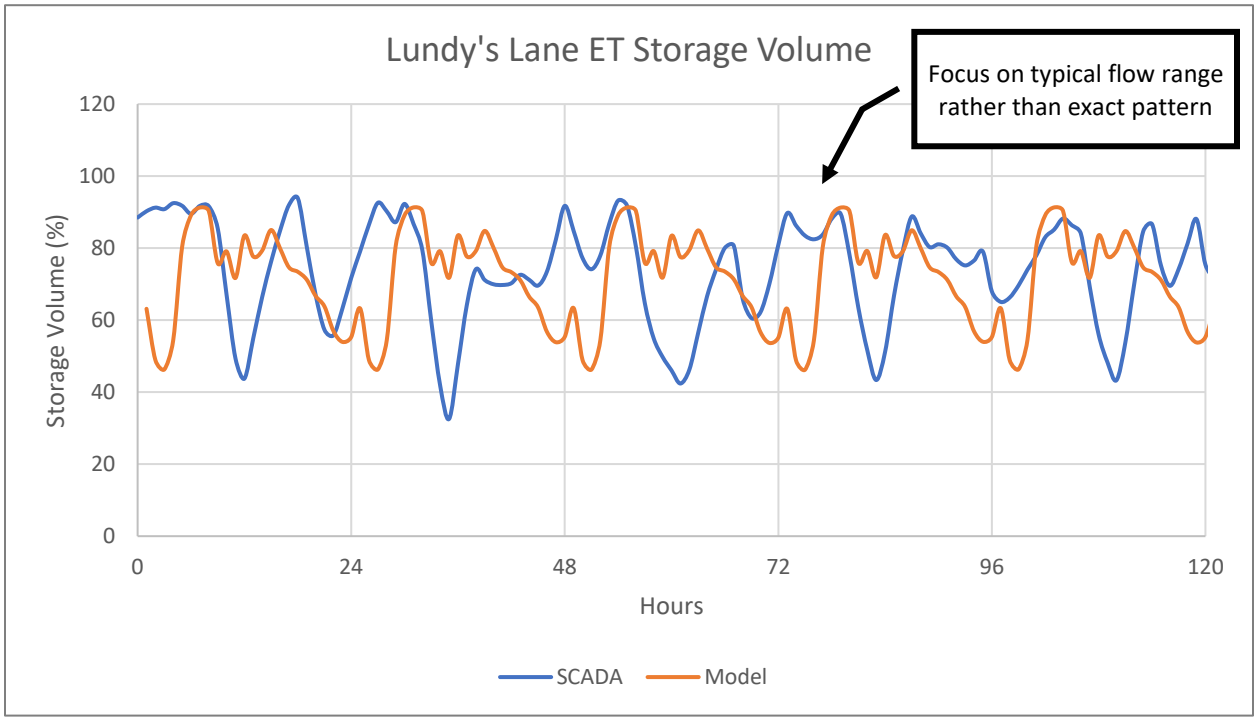


Figure 4-3. Lundy's Lane ET Model Validation – Storage Volumes



4.1.2. Kent Avenue BPS and Reservoir Control Validation

The Kent Avenue Reservoir is a pumped reservoir, with pumping activity at the Kent BPS on timed controls and level controls of the reservoir. Facility controls are detailed in **Table 4-2** and model vs. SCADA results are shown in **Figure 4-4** to **Figure 4-7**.

Table 4-2. Kent Avenue BPS Pump Controls

Pump	Status	Level in Lundy's Lane ET	Kent Reservoir	Note
Kent Avenue BPS Pump 1	Status: On Status: Off	-	At clock time 10 <80%	Typical operations based on SCADA
Kent Avenue BPS Pump 2	Status: On Status: Off	<25% >35%	-	Assumed controls (typically off)
Kent Avenue BPS Pump 3	Status: On Status: Off	<25% >35%	-	Assumed controls (typically off)

Figure 4-4. Kent Avenue BPS Model Validation – Discharge Flows

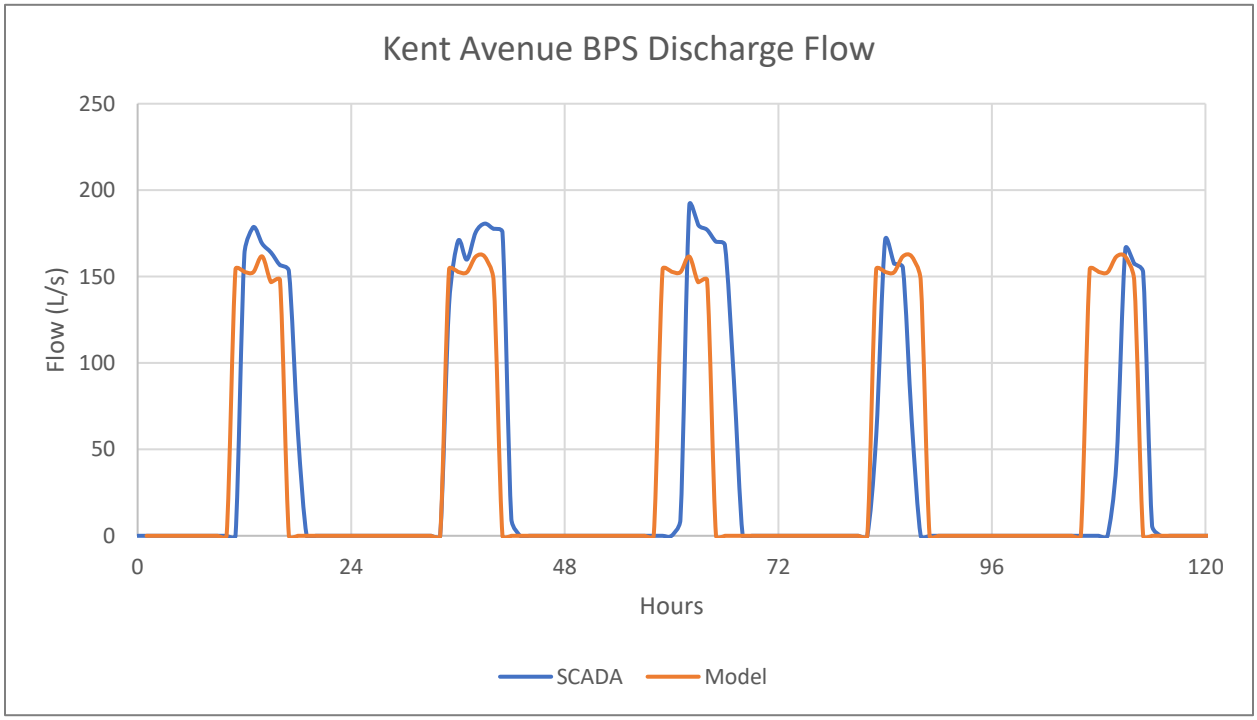


Figure 4-5. Kent Avenue BPS Model Validation – Discharge Pressure

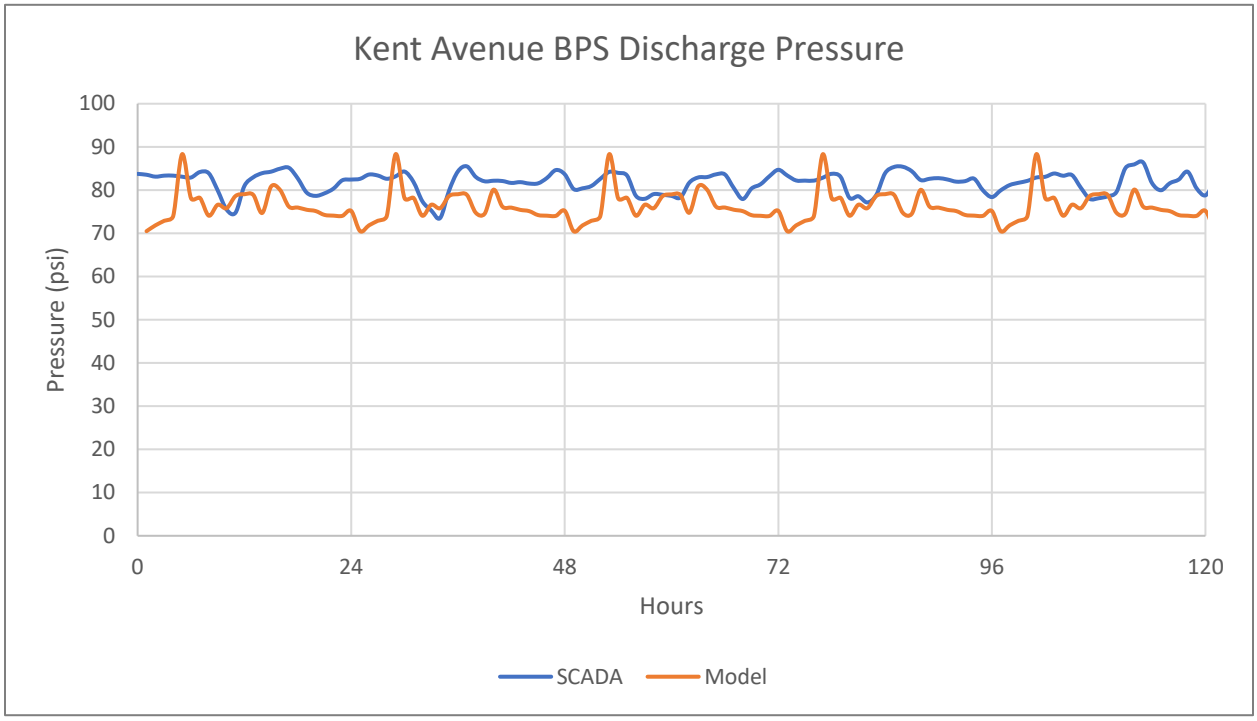


Figure 4-6. Kent Avenue Reservoir Model Validation – Inflow

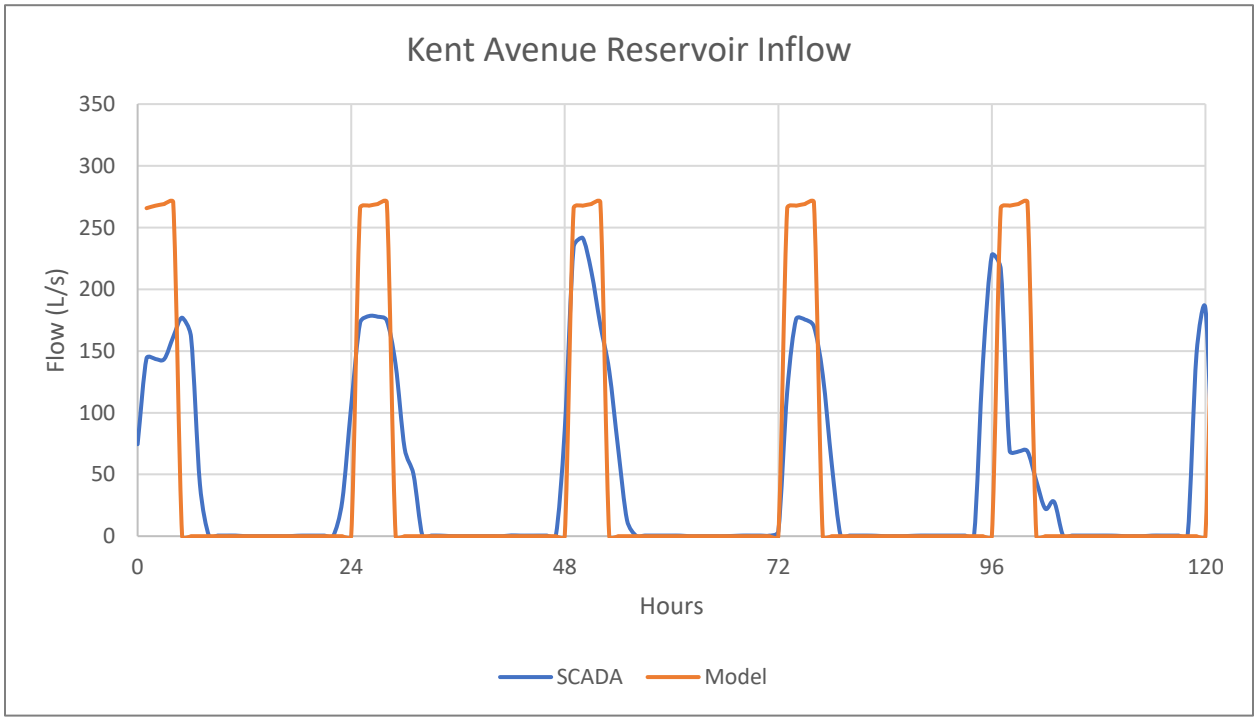


Figure 4-7. Kent Avenue BPS Model Validation – Reservoir Levels

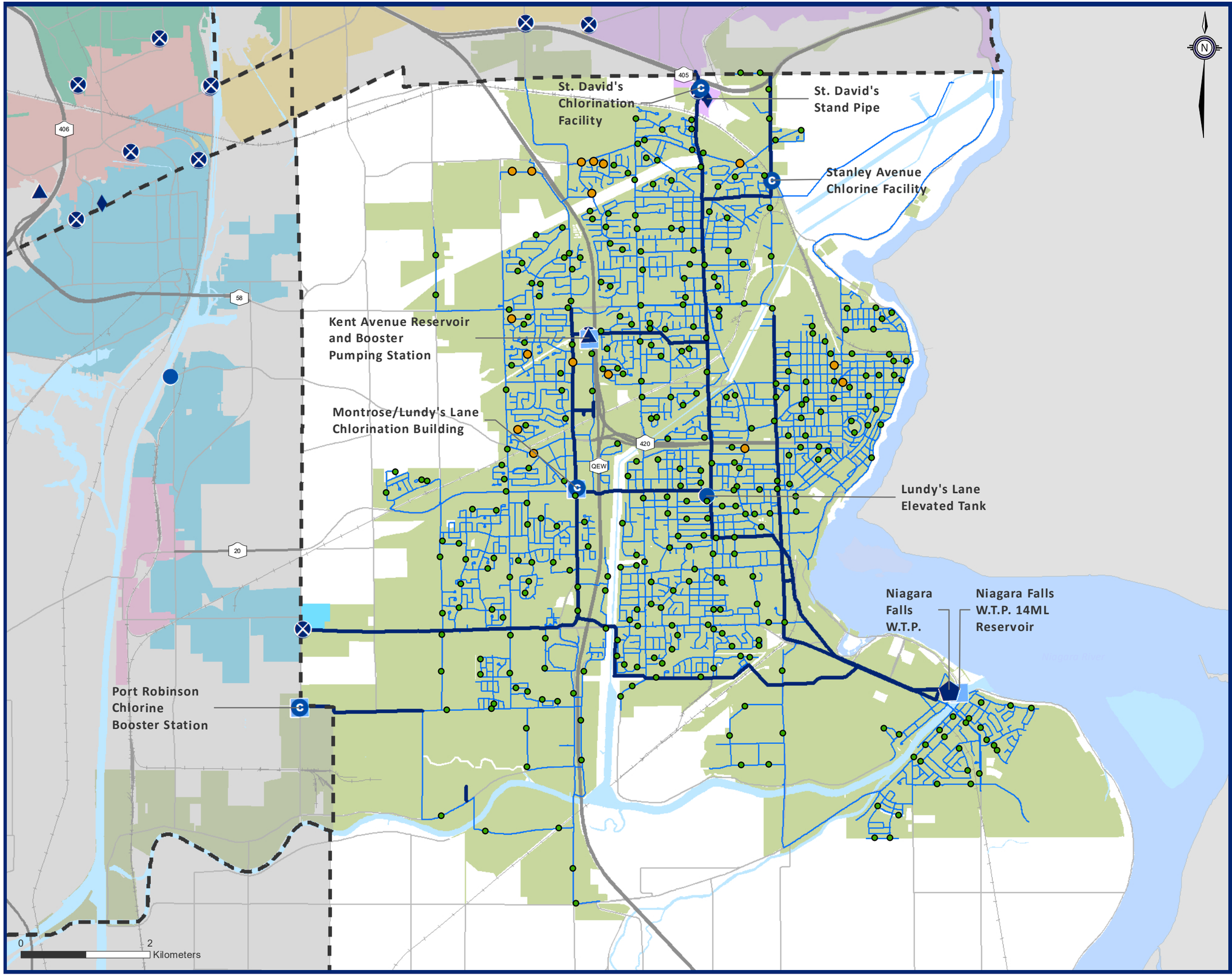
4.2. Steady State Calibration

The water model was calibrated to over 220 hydrant tests in 2019/2020, as part of the model update, to evaluate local capacity and system losses. The locations for the tests were selected based on spatial distribution, watermain material, and watermain diameter coverage in order to test a representative cross-section of the existing system. Due to the coverage and recent timing of this historic calibration, additional hydrant testing and calibration were not completed as part of this model update.

The hydrant testing results were used to calibrate the model, by comparing the modelled and field static and residual pressure results. The target for calibration was ±5 psi for difference in static pressure and pressure drop. **Figure 4-8** to **Figure 4-9** present the results of the model calibration. **Table 4-3** presents a summary of the hydrant testing results exceeding the ±5 psi threshold noting that the system is very well calibrated. Further, a number of these areas with high differences were retested to confirm results and it is likely that a closed valve or partially closed valve is skewing the calibration.

Table 4-3. Model Calibration Results

Monitoring Hydrant	Percent of Hydrant Tests with Static Pressure Difference > 5 psi	Percent of Hydrant Tests with Pressure Drop Difference > 5 psi
Monitoring Hydrant 1	3%	8%
Monitoring Hydrant 2	3%	8%



City of Niagara Falls
MSPWWMS

Water Network

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Pumping Station
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve
- Local Watermain
- Regional Watermain

Water Pressure Zones

- 164
- 168
- 180
- 200
- 227
- 250
- 257

General Features

- Highway
- Arterial Roads
- Railway
- Municipal Boundary
- Waterbody

Model and Field Comparison

- Higher Model HGL (> 7 psi)
- Higher Model HGL (5 to 7 psi)
- Good (+/- 5 psi)
- Lower Model HGL (5 to 7 psi)
- Lower Model HGL (> 7 psi)

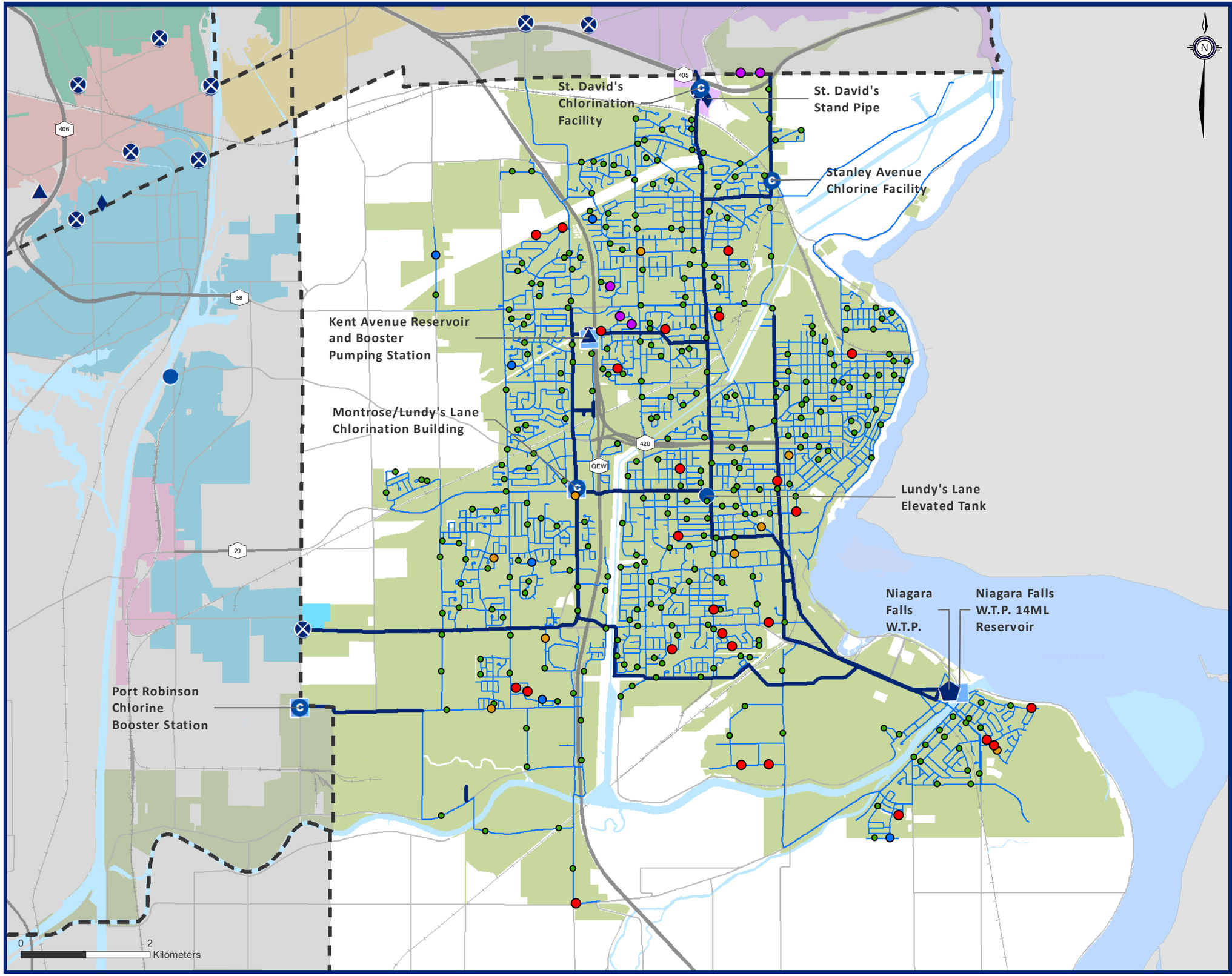
Figure 4-8

City of Niagara Falls

Hydrant Testing Model Validation
2018 Water System Model Update
Static HGL Comparison

GEI Consultants

May 2024
622071
NAD 1983 UTM Zone 17N



City of Niagara Falls
MSPWWMS

Water Network

- Water Treatment Plant
- Reservoir
- Elevated Tank
- Pumping Station
- Standpipe
- Chlorine Facility
- Pressure Reducing Valve
- Local Watermain
- Regional Watermain

Water Pressure Zones

- 164
- 168
- 180
- 200
- 227
- 250
- 257

General Features

- Highway
- Arterial Roads
- Railway
- Municipal Boundary
- Waterbody

Model and Field Comparison

- More Pressure Drop in Model (> 7 psi)
- More Pressure Drop in Model (5 to 7 psi)
- Good (+/- 5 psi)
- Less Pressure Drop in Model (5 to 7 psi)
- Less Pressure Drop in Model (> 7 psi)

Figure 4-9

City of Niagara Falls

Hydrant Testing Model Validation
2018 Water System Model Update
One Port Pressure Drop Comparison

GEI Consultants

May 2024
622071
NAD 1983 UTM Zone 17N

Appendix B Buildout Performance Maps

MDD Minimum Pressures
- < 40 psi
- 40 - 50 psi
- 50 - 60 psi
- 60 - 80 psi
- 80 - 90 psi
- 90 - 100 psi
- > 100 psi

Watermains
- Distribution (< 400mm)
- Transmission (>= 400mm)

General Features
- Waterbody
- Urban Area Boundary
- Growth Parcels

1,000 2,000 3,000 4,000 m

Appendix B
Map Title: System Performance - MDD Minimum Prssures (Buildout Growth)

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

Client Name:
City of Niagara Falls (Ontario, Canada)

GEI Consultants

Last Updated: March 2026
Document ID: 700000-G-000

Document Path: B:\Working\NIAGARA FALLS ON, CITY OF\2402014 - 622071 NF MSP and Wet Weather Mgmt Strategy\5 Work in Progress\GIS and Databases\3. Water\622017-W-FinalMSP-CA.qgz

Fire Flow Deficiencies

- Additional FF Deficiencies with 2051 Growthn
- Existing FF Deficiencies

Watermains

- Distribution (< 400mm)
- Transmission (>= 400mm)

General Features

- Waterbody
- Urban Area Boundary
- Growth Parcels

1,000 2,000 3,000 4,000 m

Appendix B
Map Title: System Performance - Additional Fire Flow Deficiencies (Buildout Growth)

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

Client Name:
City of Niagara Falls (Ontario, Canada)

GEI Consultants

Last Updated: March 2026
Document ID: 700000-G-000

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Watermain Velocity
- City-Owned <= 2 m/s
- City-Owned > 2 m/s
- Region-Owned <= 2m/s
- Region-Owned > 2m/s

General Features
- Waterbody
- Urban Area Boundary
- Growth Parcels

1,000 2,000 3,000 4,000 m

Appendix B
Map Title: System Performance - Maximum Velocity (Buildout Growth)

Project Name:
Master Servicing Plan and Wet Weather Management Strategy

Client Name:
City of Niagara Falls (Ontario, Canada)

GEI Consultants

Last Updated: March 2026
Document ID: 700000-G-000

Document Path: B:\Working\NIAGARA FALLS ON, CITY OF\2402014 - 622071 NF MSP and Wet Weather Mgmt Strategy\5 Work in Progress\GIS and Databases\3. Water\622017-W-FinalMSP-CA.qgz

Appendix C Water Capital Program Summary

Road Name	Project No	Prioritization	Project Type	Project Timelines	Length (m)	Total Cost	DC Share	OB Share	DC Cost	OB Cost	City (Benefit to Existing) Cost ($)
Adams Avenue	A_1	2A	Addresses Existing Needs	10+	304	$895,000	10%	0	$89,500	-	$805,500
Addison Avenue	A_1	4	Addresses Existing Needs	10+	113	$335,000	10%	0%	$33,500	-	$301,500
Ailanthus Avenue	J_8	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	3-5	3	$10,000	75%	25%	$5,000	$2,500	$2,500
Ailanthus Avenue	G_21	DC	Triggered by Growth and Supports Existing Users	5-10	552	$1,502,000	75%	0%	$1,126,500	-	$375,500
Ailanthus Avenue	G_21	DC	Triggered by Growth and Supports Existing Users	5-10	333	$904,000	90%	0%	$813,600	-	$90,400
Ainslie Crescent	A_1	2A	Addresses Existing Needs	10+	96	$282,000	10%	0%	$28,200	-	$253,800
Alex Avenue	A_1	2D	Addresses Existing Needs	10+	16	$47,000	10%	0%	$4,700	-	$42,300
Alex Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	116	$340,000	75%	0%	$255,000	-	$85,000
Allendale Avenue	D_1	3	Addresses Existing Needs and Supports Growth Needs	0-2	226	$664,000	25%	0%	$166,000	-	$498,000
Allendale Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	24	$71,000	75%	0%	$53,250	-	$17,750
Allendale Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	284	$832,000	50%	0%	$416,000	-	$416,000
Allendale Avenue	F_13	3	Addresses Existing Needs and Supports Growth Needs	10+	148	$403,000	50%	0%	$201,500	-	$201,500
Alpine Drive	I_3	7	Supports Growth Needs and Operational Resiliency	10+	211	$575,000	50%	40%	$57,500	$230,000	$287,500
Amelia Crescent	A_1	2A	Addresses Existing Needs	10+	305	$898,000	10%	0%	$89,800	-	$808,200
Appleford Avenue	A_1	4	Addresses Existing Needs	10+	429	$1,265,000	10%	0%	$126,500	-	$1,138,500
Argyll Crescent	A_1	2A	Addresses Existing Needs	10+	386	$1,136,000	10%	0%	$113,600	-	$1,022,400
Arlington Avenue	A_1	2D	Addresses Existing Needs	5-10	303	$890,000	10%	0%	$89,000	-	$801,000
Arthur Street	A_1	2D	Addresses Existing Needs	10+	273	$1,119,000	10%	0%	$111,900	-	$1,007,100
Badger Road	I_6	5	Supports Growth Needs and Operational Resiliency	0-2	204	$554,000	50%	40%	$55,400	$221,600	$277,000
Badger Road	I_6	7	Supports Growth Needs and Operational Resiliency	0-2	7	$1,623,000	50%	40%	$162,300	$649,200	$811,500
Baker Crescent	A_1	2C	Addresses Existing Needs	10+	221	$651,000	10%	0%	$65,100	-	$585,900
Banting Avenue	A_1	DC	Triggered by Growth and Supports Existing Users	0-2	354	$965,000	75%	0%	$723,750	-	$241,250
Barker Street	D_1	2A	Addresses Existing Needs and Supports Growth Needs	5-10	114	$336,000	25%	0%	$84,000	-	$252,000
Barton Crescent	A_1	2A	Addresses Existing Needs	10+	69	$202,000	10%	0%	$20,200	-	$181,800
Beaverdams Road	G_2	DC	Triggered by Growth and Supports Existing Users	0-2	522	$1,739,000	75%	0%	$1,304,250	-	$434,750
Beechwood Road	H_5	DC	Supports New Growth Areas	5-10	3303	$8,669,000	100%	10%	$7,802,100	$866,900	-
Beechwood-Garner	H_12	DC	Supports New Growth Areas	5-10	1084	$2,937,000	100%	10%	$2,643,300	$293,700	-
Bellevue Street	A_1	4	Addresses Existing Needs	10+	812	$2,365,000	10%	0%	$236,500	-	$2,128,500
Bellevue Street	B_1	4	Addresses Existing Needs	10+	203	$1,268,000	10%	0%	$126,800	-	$1,141,200
Bellevue Street	B_1	1	Addresses Existing Needs	0-2	13	$36,000	10%	0%	$3,600	-	$32,400
Betty Avenue	A_1	2D	Addresses Existing Needs	10+	152	$448,000	10%	0%	$44,800	-	$403,200
Biggar Road	H_1	DC	Supports New Growth Areas	5-10	900	$2,438,000	100%	10%	$2,194,200	$243,800	-
Biggar-Montrose	H_6	DC	Supports Growth Needs and Operational Resiliency	10+	3011	$8,157,000	100%	40%	$4,894,200	$3,262,800	-
Bracken Street	A_1	2A	Addresses Existing Needs	10+	287	$842,000	10%	0%	$84,200	-	$757,800
Briarwood Avenue	A_1	2C	Addresses Existing Needs	10+	580	$1,706,000	10%	0%	$170,600	-	$1,535,400
Bridge Street	G_33	DC	Triggered by Growth and Supports Existing Users	0-2	880	$2,393,000	75%	25%	$1,196,500	$598,250	$598,250
Bridge Street	G_33	DC	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	10+	175	$479,000	75%	25%	$239,500	$119,750	$119,750
Bridge Street	G_33	DC	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	5-10	13	$37,000	75%	25%	$18,500	$9,250	$9,250
Bridgewater Street	B_1	2A	Addresses Existing Needs	10+	449	$1,319,000	10%	0%	$131,900	-	$1,187,100
Brookfield Avenue	A_1	2A	Addresses Existing Needs	10+	600	$1,766,000	10%	0%	$176,600	-	$1,589,400
Brookfield Avenue	D_1	2A	Addresses Existing Needs and Supports Growth Needs	5-10	84	$246,000	50%	0%	$123,000	-	$123,000
Brookfield Avenue	D_1	2A	Addresses Existing Needs and Supports Growth Needs	5-10	155	$769,000	25%	0%	$192,250	-	$576,750
Brown Road	G_27	DC	Triggered by Growth and Supports Existing Users	5-10	700	$2,029,000	75%	0%	$1,521,750	-	$507,250
Buchner Place	D_1	4	Addresses Existing Needs and Supports Growth Needs	5-10	92	$270,000	75%	0%	$202,500	-	$67,500
Cabot Drive	A_1	2C	Addresses Existing Needs	10+	241	$708,000	10%	0%	$70,800	-	$637,200
Cadham Street	A_1	2D	Addresses Existing Needs	10+	103	$305,000	10%	0%	$30,500	-	$274,500
Caledonia Street	A_1	2B	Addresses Existing Needs	10+	566	$1,664,000	10%	0%	$166,400	-	$1,497,600
Cambridge Street	A_1	2B	Addresses Existing Needs	10+	329	$967,000	10%	0%	$96,700	-	$870,300
Camelot Crescent	A_1	2A	Addresses Existing Needs	10+	85	$252,000	10%	0%	$25,200	-	$226,800
Carlton Avenue	G_3	DC	Triggered by Growth and Supports Existing Users	5-10	295	$800,000	75%	0%	$600,000	-	$200,000

Road Name	Project No	Prioritization	Project Type	Project Timelines	Length (m)	Total Cost	DC Share	OB Share	DC Cost	OB Cost	City (Benefit to Existing) Cost ($)
Carlton Avenue	G_3	DC	Triggered by Growth and Supports Existing Users	5-10	83	$224,000	90%	0%	$201,600	-	$22,400
Carolyn Avenue	A_1	2A	Addresses Existing Needs	10+	493	$1,457,000	10%	0%	$145,700	-	$1,311,300
Carroll Avenue	B_1	2B	Addresses Existing Needs	10+	94	$552,000	10%	0%	$55,200	-	$496,800
Carroll Avenue	E_1	2B	Addresses Existing Needs and Supports Growth Needs	5-10	97	$263,000	50%	0%	$131,500	-	$131,500
Carroll Avenue	E_1	2B	Addresses Existing Needs and Supports Growth Needs	5-10	164	$446,000	75%	0%	$334,500	-	$111,500
Carroll Avenue	E_1	2B	Addresses Existing Needs and Supports Growth Needs	5-10	45	$124,000	25%	0%	$31,000	-	$93,000
Centre Street	D_1	4	Addresses Existing Needs and Supports Growth Needs	5-10	40	$118,000	25%	0%	$29,500	-	$88,500
Charlotte Street	A_1	2B	Addresses Existing Needs	10+	45	$133,000	10%	0%	$13,300	-	$119,700
Cherrywood Road	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	109	$321,000	25%	0%	$80,250	-	$240,750
Cherrywood Road	D_1	2D	Addresses Existing Needs and Supports Growth Needs	0-2	11	$33,000	25%	0%	$8,250	-	$24,750
Church's Lane	A_1	2D	Addresses Existing Needs	0-2	1089	$2,958,000	10%	0%	$295,800	-	$2,662,200
Clare Crescent	A_1	2A	Addresses Existing Needs	10+	493	$1,453,000	10%	0%	$145,300	-	$1,307,700
Clark Avenue	F_6	3	Addresses Existing Needs and Supports Growth Needs	0-2	285	$837,000	25%	0%	$209,250	-	$627,750
Clark Avenue	F_6	3	Addresses Existing Needs and Supports Growth Needs	0-2	49	$145,000	75%	0%	$108,750	-	$36,250
Claude Avenue	A_1	2D	Addresses Existing Needs	10+	41	$121,000	10%	0%	$12,100	-	$108,900
Close Avenue	A_1	2D	Addresses Existing Needs	10+	45	$133,000	10%	0%	$13,300	-	$119,700
Coach Drive	A_1	2B	Addresses Existing Needs	10+	338	$993,000	10%	0%	$99,300	-	$893,700
Coholan Street	A_1	2D	Addresses Existing Needs	10+	509	$1,497,000	10%	0%	$149,700	-	$1,347,300
Coholan Street	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	148	$434,000	75%	0%	$325,500	-	$108,500
Concord Crescent	A_1	2D	Addresses Existing Needs	10+	59	$174,000	10%	0%	$17,400	-	$156,600
Confederation Avenue	A_1	2D	Addresses Existing Needs	10+	96	$282,000	10%	0%	$28,200	-	$253,800
Crawford Street	A_1	2C	Addresses Existing Needs	10+	630	$1,855,000	10%	0%	$185,500	-	$1,669,500
Cropp Street	A_1	2B	Addresses Existing Needs	10+	98	$288,000	10%	0%	$28,800	-	$259,200
Cullimore Avenue	A_1	2B	Addresses Existing Needs	10+	145	$429,000	10%	0%	$42,900	-	$386,100
Cummington Sq East	B_1	2B	Addresses Existing Needs	10+	76	$225,000	10%	0%	$22,500	-	$202,500
Darcy Crescent	A_1	2C	Addresses Existing Needs	10+	364	$1,071,000	10%	0%	$107,100	-	$963,900
David Avenue	A_1	2A	Addresses Existing Needs	10+	397	$1,168,000	10%	0%	$116,800	-	$1,051,200
Dayman Avenue	A_1	2C	Addresses Existing Needs	10+	81	$238,000	10%	0%	$23,800	-	$214,200
Demetre Crescent	A_1	2B	Addresses Existing Needs	10+	126	$370,000	10%	0%	$37,000	-	$333,000
Depew Avenue	G_15	DC	Triggered by Growth and Supports Existing Users	5-10	31	$380,000	75%	0%	$285,000	-	$95,000
Depew Avenue	G_15	DC	Triggered by Growth and Supports Existing Users	5-10	160	$433,000	90%	0%	$389,700	-	$43,300
Dianne Street	A_1	2C	Addresses Existing Needs	10+	76	$225,000	10%	0%	$22,500	-	$202,500
Dirdene Street	A_1	2C	Addresses Existing Needs	10+	94	$276,000	10%	0%	$27,600	-	$248,400
Division Street	G_17	DC	Triggered by Growth and Supports Existing Users	5-10	221	$603,000	75%	0%	$452,250	-	$150,750
Dock Street	A_1	1	Addresses Existing Needs	0-2	52	$154,000	10%	0%	$15,400	-	$138,600
Dolphin Street	A_1	2C	Addresses Existing Needs	10+	278	$817,000	10%	0%	$81,700	-	$735,300
Dorchester Road	I_7	5	Supports Growth Needs and Operational Resiliency	0-2	172	$468,000	50%	40%	$46,800	$187,200	$234,000
Dorchester Road	A_1	1	Addresses Existing Needs	0-2	61	$179,000	10%	0%	$17,900	-	$161,100
Dorchester Road	D_1	1	Addresses Existing Needs and Supports Growth Needs	0-2	1	$4,000	25%	0%	$1,000	-	$3,000
Dorchester Road	D_1	1	Addresses Existing Needs and Supports Growth Needs	0-2	116	$656,000	75%	0%	$492,000	-	$164,000
Dorchester Road	I_7	5	Supports Growth Needs and Operational Resiliency	10+	317	$862,000	50%	40%	$86,200	$344,800	$431,000
Dorchester Road	A_1	3	Addresses Existing Needs	3-5	807	$2,373,000	10%	0%	$237,300	-	$2,135,700
Dorchester Road	A_1	2D	Addresses Existing Needs	10+	1	$2,000	10%	0%	$200	-	$1,800
Doreen Drive	A_1	2B	Addresses Existing Needs	10+	550	$1,615,000	10%	0%	$161,500	-	$1,453,500
Drake Avenue	A_1	2C	Addresses Existing Needs	10+	199	$587,000	10%	0%	$58,700	-	$528,300
Drummond Road	A_1	2C	Addresses Existing Needs	0-2	449	$1,323,000	10%	0%	$132,300	-	$1,190,700
Duke Avenue	A_1	2B	Addresses Existing Needs	10+	233	$686,000	10%	0%	$68,600	-	$617,400
Dunn Street	A_1	2B	Addresses Existing Needs	10+	344	$1,010,000	10%	0%	$101,000	-	$909,000
Dunn Street	I_6	2B	Supports Growth Needs and Operational Resiliency	0-2	87	$236,000	50%	40%	$23,600	$94,400	$118,000
Elberta Avenue	A_1	2D	Addresses Existing Needs	10+	192	$565,000	10%	0%	$56,500	-	$508,500

Road Name	Project No	Prioritization	Project Type	Project Timelines	Length (m)	Total Cost	DC Share	OB Share	DC Cost	OB Cost	City (Benefit to Existing) Cost ($)
Elgin Street	D_1	2C	Addresses Existing Needs and Supports Growth Needs	5-10	43	$126,000	75%	0%	$94,500	-	$31,500
Elgin Street	D_1	2C	Addresses Existing Needs and Supports Growth Needs	5-10	118	$347,000	50%	0%	$173,500	-	$173,500
Elgin Street	D_1	2C	Addresses Existing Needs and Supports Growth Needs	5-10	11	$34,000	25%	0%	$8,500	-	$25,500
Ellis Lane	D_1	3	Addresses Existing Needs and Supports Growth Needs	5-10	129	$380,000	75%	0%	$285,000	-	$95,000
Ellis Street	J_4	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	5-10	11	$34,000	75%	25%	$17,000	$8,500	$8,500
Ellis Street	J_4	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	0-2	65	$177,000	75%	25%	$88,500	$44,250	$44,250
Ellis Street	J_4	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	3-5	6	$17,000	75%	25%	$8,500	$4,250	$4,250
Ellsworth Place	A_1	2C	Addresses Existing Needs	10+	83	$245,000	10%	0%	$24,500	-	$220,500
Emery Street	A_1	2D	Addresses Existing Needs	10+	147	$434,000	10%	0%	$43,400	-	$390,600
Emery Street	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	85	$567,000	25%	0%	$141,750	-	$425,250
Emery Street	G_22	2D	Triggered by Growth and Supports Existing Users	5-10	170	$462,000	90%	0%	$415,800	-	$46,200
Emery Street	G_22	2D	Triggered by Growth and Supports Existing Users	5-10	72	$197,000	75%	0%	$147,750	-	$49,250
Erie Avenue	J_4	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	0-2	93	$570,000	75%	25%	$285,000	$142,500	$142,500
Erie Avenue	J_4	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	3-5	155	$422,000	75%	25%	$211,000	$105,500	$105,500
Erie Avenue	J_4	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	5-10	52	$142,000	75%	25%	$71,000	$35,500	$35,500
Ferguson Street	G_35	DC	Triggered by Growth and Supports Existing Users	10+	83	$226,000	75%	0%	$169,500	-	$56,500
Fernwood Crescent	A_1	2B	Addresses Existing Needs	10+	135	$397,000	10%	0%	$39,700	-	$357,300
Fingland Street	A_1	2D	Addresses Existing Needs	10+	500	$1,468,000	10%	0%	$146,800	-	$1,321,200
Finlay Avenue	A_1	2D	Addresses Existing Needs	10+	154	$453,000	10%	0%	$45,300	-	$407,700
Florence Avenue	A_1	2D	Addresses Existing Needs	10+	90	$265,000	10%	0%	$26,500	-	$238,500
Franklin Avenue	A_1	2D	Addresses Existing Needs	5-10	88	$259,000	10%	0%	$25,900	-	$233,100
Frederica Street	I_4	5	Supports Growth Needs and Operational Resiliency	10+	11	$31,000	50%	40%	$3,100	$12,400	$15,500
Frederica Street	I_4	6	Supports Growth Needs and Operational Resiliency	10+	170	$463,000	50%	40%	$46,300	$185,200	$231,500
Frederica Street	I_4	5	Supports Growth Needs and Operational Resiliency	5-10	8	$23,000	50%	40%	$2,300	$9,200	$11,500
Frederica Street	I_4	6	Supports Growth Needs and Operational Resiliency	5-10	668	$1,813,000	50%	40%	$181,300	$725,200	$906,500
Freeman Street	B_1	2C	Addresses Existing Needs	10+	832	$2,266,000	10%	0%	$226,600	-	$2,039,400
Frontenac Street	A_1	2D	Addresses Existing Needs	10+	470	$1,387,000	10%	0%	$138,700	-	$1,248,300
Fruitbelt Parkway	B_1	2A	Addresses Existing Needs	10+	347	$1,238,000	10%	0%	$123,800	-	$1,114,200
Gail Avenue	A_1	2D	Addresses Existing Needs	10+	258	$761,000	10%	0%	$76,100	-	$684,900
Gainsborough Avenue	A_1	2D	Addresses Existing Needs	5-10	303	$891,000	10%	0%	$89,100	-	$801,900
Garner Road	J_1	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	10+	420	$1,141,000	75%	25%	$570,500	$285,250	$285,250
Glenayr Avenue	A_1	2C	Addresses Existing Needs	10+	292	$859,000	10%	0%	$85,900	-	$773,100
Glendoone Street	A_1	2C	Addresses Existing Needs	5-10	256	$753,000	10%	0%	$75,300	-	$677,700
Glengary Street	A_1	2C	Addresses Existing Needs	5-10	256	$753,000	10%	0%	$75,300	-	$677,700
Glengate/Maplewood Avenue	B_1	2B	Addresses Existing Needs and Supports Growth Needs	10+	99	$270,000	25%	0%	$67,500	-	$202,500
Glengate/Maplewood Avenue	E_1	2B	Addresses Existing Needs and Supports Growth Needs	5-10	73	$197,000	25%	0%	$49,250	-	$147,750
Glengate/Maplewood Avenue	E_1	2B	Addresses Existing Needs and Supports Growth Needs	5-10	12	$32,000	75%	0%	$24,000	-	$8,000
Goodsir Crescent	A_1	2B	Addresses Existing Needs	10+	92	$271,000	10%	0%	$27,100	-	$243,900
Grand Niagara Drive	H_8	DC	Supports New Growth Areas	5-10	1252	$3,103,000	100%	10%	$2,792,700	$310,300	-
Grey Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	188	$553,000	25%	0%	$138,250	-	$414,750
Grey Avenue	A_1	2D	Addresses Existing Needs	5-10	168	$493,000	10%	0%	$49,300	-	$443,700
Hagar Avenue	A_1	2A	Addresses Existing Needs	10+	502	$1,479,000	10%	0%	$147,900	-	$1,331,100
Harold Street	B_1	2D	Addresses Existing Needs	10+	254	$692,000	10%	0%	$69,200	-	$622,800
Harvard Avenue	A_1	2D	Addresses Existing Needs	10+	194	$571,000	10%	0%	$57,100	-	$513,900
Harvey Street	A_1	2A	Addresses Existing Needs	10+	168	$495,000	10%	0%	$49,500	-	$445,500
Hawkins Street	A_1	2C	Addresses Existing Needs	5-10	341	$1,005,000	10%	0%	$100,500	-	$904,500
Hawkins Street	D_1	2C	Addresses Existing Needs and Supports Growth Needs	5-10	89	$262,000	75%	0%	$196,500	-	$65,500

Road Name	Project No	Prioritization	Project Type	Project Timelines	Length (m)	Total Cost	DC Share	OB Share	DC Cost	OB Cost	City (Benefit to Existing) Cost ($)
Heather Avenue	A_1	2A	Addresses Existing Needs	10+	225	$663,000	10%	0%	$66,300	-	$596,700
Hennepin Crescent	A_1	2D	Addresses Existing Needs	10+	396	$1,166,000	10%	0%	$116,600	-	$1,049,400
Heritage Drive	A_1	4	Addresses Existing Needs	10+	563	$1,978,000	10%	0%	$197,800	-	$1,780,200
Heximer Avenue	A_1	2A	Addresses Existing Needs	10+	400	$1,491,000	10%	0%	$149,100	-	$1,341,900
Heximer Avenue	B_1	2A	Addresses Existing Needs	10+	198	$539,000	10%	0%	$53,900	-	$485,100
High Street	A_1	2D	Addresses Existing Needs	5-10	113	$333,000	10%	0%	$33,300	-	$299,700
Hillcrest Crescent	A_1	2A	Addresses Existing Needs	10+	586	$1,723,000	10%	0%	$172,300	-	$1,550,700
Hillsdale Avenue	A_1	2D	Addresses Existing Needs	10+	246	$724,000	10%	0%	$72,400	-	$651,600
Hunter Street	E_1	4	Addresses Existing Needs and Supports Growth Needs	5-10	221	$650,000	75%	0%	$487,500	-	$162,500
Hunter Street	E_1	7	Addresses Existing Needs and Supports Growth Needs	5-10	2	$7,000	25%	0%	$1,750	-	$5,250
Hunter Street	E_1	4	Addresses Existing Needs and Supports Growth Needs	5-10	12	$35,000	25%	0%	$8,750	-	$26,250
Hunter Street	D_1	4	Addresses Existing Needs and Supports Growth Needs	5-10	17	$50,000	25%	0%	$12,500	-	$37,500
Hunter Street	D_1	4	Addresses Existing Needs and Supports Growth Needs	5-10	88	$258,000	75%	0%	$193,500	-	$64,500
Isaac Street	A_1	2D	Addresses Existing Needs	10+	86	$255,000	10%	0%	$25,500	-	$229,500
Johnson Drive	A_1	4	Addresses Existing Needs	10+	239	$702,000	10%	0%	$70,200	-	$631,800
Kalar Road	J_1	5	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	0-2	16	$43,000	75%	25%	$21,500	$10,750	$10,750
Kalar Road	J_1	5	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	10+	537	$1,459,000	75%	25%	$729,500	$364,750	$364,750
Kalar Road	J_2	5	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	10+	690	$2,194,000	75%	25%	$1,097,000	$548,500	$548,500
Kalar Road	J_1	6	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	10+	8	$25,000	75%	25%	$12,500	$6,250	$6,250
Kalar Road	J_2	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	10+	784	$2,134,000	75%	25%	$1,067,000	$533,500	$533,500
Kalar Road	H_10	DC	Supports New Growth Areas	5-10	1103	$3,121,000	100%	10%	$2,808,900	$312,100	-
Kalar Road	H_11	DC	Supports New Growth Areas	5-10	937	$2,540,000	100%	10%	$2,286,000	$254,000	-
Kalar Road	C_1	3	Addresses Existing Needs	10+	13	$36,000	10%	0%	$3,600	-	$32,400
Keiffer Street	A_1	2D	Addresses Existing Needs	10+	202	$593,000	10%	0%	$59,300	-	$533,700
Keith Street	A_1	2A	Addresses Existing Needs	10+	648	$1,904,000	10%	0%	$190,400	-	$1,713,600
Keith Street	D_1	2A	Addresses Existing Needs and Supports Growth Needs	5-10	108	$316,000	25%	0%	$79,000	-	$237,000
Ker Street	A_1	2B	Addresses Existing Needs	10+	324	$953,000	10%	0%	$95,300	-	$857,700
Ker Street	D_1	2B	Addresses Existing Needs and Supports Growth Needs	5-10	175	$516,000	50%	0%	$258,000	-	$258,000
Ker Street	D_1	2B	Addresses Existing Needs and Supports Growth Needs	5-10	2	$6,000	75%	0%	$4,500	-	$1,500
Kingston Avenue	A_1	2D	Addresses Existing Needs	10+	92	$270,000	10%	0%	$27,000	-	$243,000
Kinsmen Court	I_5	7	Supports Growth Needs and Operational Resiliency	10+	513	$1,396,000	50%	40%	$139,600	$558,400	$698,000
Kinsmen Court	I_5	7	Supports Growth Needs and Operational Resiliency	10+	60	$163,000	75%	50%	$40,750	$81,500	$40,750
Kitchener Street	D_1	2A	Addresses Existing Needs and Supports Growth Needs	5-10	178	$840,000	75%	0%	$630,000	-	$210,000
Kitchener Street	D_1	2A	Addresses Existing Needs and Supports Growth Needs	0-2	282	$828,000	75%	0%	$621,000	-	$207,000
Kitchener Street	D_1	2A	Addresses Existing Needs and Supports Growth Needs	0-2	93	$272,000	50%	0%	$136,000	-	$136,000
Kitchener Street	D_1	2A	Addresses Existing Needs and Supports Growth Needs	0-2	16	$47,000	25%	0%	$11,750	-	$35,250
Kitchener Street	D_1	2A	Addresses Existing Needs and Supports Growth Needs	5-10	83	$244,000	50%	0%	$122,000	-	$122,000
Kitchener Street	D_1	2A	Addresses Existing Needs and Supports Growth Needs	5-10	18	$56,000	25%	0%	$14,000	-	$42,000
Law Avenue	A_1	2D	Addresses Existing Needs	10+	252	$740,000	10%	0%	$74,000	-	$666,000
Leeming Street	A_1	2D	Addresses Existing Needs	10+	208	$612,000	10%	0%	$61,200	-	$550,800
Leonard Avenue	A_1	2C	Addresses Existing Needs	10+	178	$527,000	10%	0%	$52,700	-	$474,300
Leonard Avenue	D_1	2C	Addresses Existing Needs and Supports Growth Needs	5-10	74	$217,000	25%	0%	$54,250	-	$162,750
Linwood Crescent	A_1	2D	Addresses Existing Needs	10+	112	$329,000	10%	0%	$32,900	-	$296,100
London Court	A_1	2B	Addresses Existing Needs	10+	74	$218,000	10%	0%	$21,800	-	$196,200
Longhurst Avenue	A_1	2D	Addresses Existing Needs	10+	190	$560,000	10%	0%	$56,000	-	$504,000
Lorne Street	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	72	$210,000	25%	0%	$52,500	-	$157,500
Loyalist Avenue	A_1	4	Addresses Existing Needs	10+	151	$445,000	10%	0%	$44,500	-	$400,500
Lundy's Lane	F_8	3	Addresses Existing Needs and Supports Growth Needs	3-5	1249	$2,959,000	50%	0%	$1,479,500	-	$1,479,500
Lundy's Lane	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	8	$23,000	25%	0%	$5,750	-	$17,250
Lundy's Lane	D_1	1	Addresses Existing Needs and Supports Growth Needs	0-2	114	$336,000	25%	0%	$84,000	-	$252,000

Road Name	Project No	Prioritization	Project Type	Project Timelines	Length (m)	Total Cost	DC Share	OB Share	DC Cost	OB Cost	City (Benefit to Existing) Cost ($)
Macdonald Avenue	D_1	4	Addresses Existing Needs and Supports Growth Needs	0-2	66	$194,000	25%	0%	$48,500	-	$145,500
Macdonald Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	0-2	77	$227,000	25%	0%	$56,750	-	$170,250
Macdonald Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	0-2	59	$173,000	75%	0%	$129,750	-	$43,250
Macdonald Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	0-2	5	$17,000	50%	0%	$8,500	-	$8,500
Main Street	A_1	2A	Addresses Existing Needs	0-2	296	$872,000	10%	0%	$87,200	-	$784,800
Main Street	D_1	2A	Addresses Existing Needs and Supports Growth Needs	0-2	201	$590,000	25%	0%	$147,500	-	$442,500
Main Street	D_1	2A	Addresses Existing Needs and Supports Growth Needs	0-2	5	$16,000	75%	0%	$12,000	-	$4,000
Main Street Chippawa	A_1	2D	Addresses Existing Needs	10+	68	$202,000	10%	0%	$20,200	-	$181,800
Maitland Street	A_1	4	Addresses Existing Needs	10+	20	$60,000	10%	0%	$6,000	-	$54,000
Maitland Street	D_1	4	Addresses Existing Needs and Supports Growth Needs	5-10	202	$592,000	50%	0%	$296,000	-	$296,000
Maplewood Avenue	A_1	2C	Addresses Existing Needs	10+	274	$806,000	10%	0%	$80,600	-	$725,400
Margaret Street	A_1	2A	Addresses Existing Needs	10+	480	$1,415,000	10%	0%	$141,500	-	$1,273,500
Marlborough Place	A_1	2B	Addresses Existing Needs	0-2	387	$1,139,000	10%	0%	$113,900	-	$1,025,100
May Avenue	E_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	5	$14,000	75%	0%	$10,500	-	$3,500
May Avenue	E_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	147	$401,000	25%	0%	$100,250	-	$300,750
May Avenue	E_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	88	$240,000	50%	0%	$120,000	-	$120,000
Mayfair Drive	A_1	4	Addresses Existing Needs	10+	2	$7,000	10%	0%	$700	-	$6,300
Maywood Street	A_1	2B	Addresses Existing Needs	10+	290	$854,000	10%	0%	$85,400	-	$768,600
McColl Drive	A_1	2B	Addresses Existing Needs	10+	350	$1,030,000	10%	0%	$103,000	-	$927,000
McGill Street	A_1	2D	Addresses Existing Needs	10+	414	$1,219,000	10%	0%	$121,900	-	$1,097,100
McGrail Avenue	E_1	2B	Addresses Existing Needs and Supports Growth Needs	5-10	129	$380,000	25%	0%	$95,000	-	$285,000
McGrail Avenue	E_1	2B	Addresses Existing Needs and Supports Growth Needs	5-10	147	$433,000	75%	0%	$324,750	-	$108,250
Mcleod Road	J_8	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	5-10	1376	$7,980,000	75%	25%	$3,990,000	$1,995,000	$1,995,000
Mcleod Road	J_8	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	10+	361	$1,213,000	75%	25%	$606,500	$303,250	$303,250
Mcleod Road	J_8	6	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	3-5	238	$800,000	75%	25%	$400,000	$200,000	$200,000
Mcleod Road	J_8	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	3-5	160	$537,000	75%	25%	$268,500	$134,250	$134,250
Mcleod Road	J_8	6	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	5-10	192	$647,000	75%	25%	$323,500	$161,750	$161,750
Mcleod Road	J_8	5	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	0-2	475	$5,295,000	75%	25%	$2,647,500	$1,323,750	$1,323,750
Mcleod Road	J_1	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	10+	19	$52,000	75%	25%	$26,000	$13,000	$13,000
Mcleod Road	D_1	2D	Addresses Existing Needs and Supports Growth Needs	0-2	30	$89,000	75%	0%	$66,750	-	$22,250
Mcleod Road	D_1	2D	Addresses Existing Needs and Supports Growth Needs	0-2	308	$1,533,000	25%	0%	$383,250	-	$1,149,750
Mcleod Road	G_30	DC	Triggered by Growth and Supports Existing Users	5-10	790	$2,140,000	75%	0%	$1,605,000	-	$535,000
Mcleod Road	J_8	5	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	5-10	12	$1,713,000	75%	25%	$856,500	$428,250	$428,250
McMicking Street	A_1	2A	Addresses Existing Needs	10+	562	$1,653,000	10%	0%	$165,300	-	$1,487,700
McMillan Drive	A_1	2B	Addresses Existing Needs	10+	512	$1,505,000	10%	0%	$150,500	-	$1,354,500
Meadowvale Drive	B_1	2A	Addresses Existing Needs	10+	442	$1,203,000	10%	0%	$120,300	-	$1,082,700
Merritt Avenue	A_1	2A	Addresses Existing Needs	10+	414	$1,217,000	10%	0%	$121,700	-	$1,095,300
Mitchell Avenue	A_1	2D	Addresses Existing Needs	10+	64	$188,000	10%	0%	$18,800	-	$169,200
Montrose Road	I_5	5	Supports Growth Needs and Operational Resiliency	0-2	39	$108,000	50%	40%	$10,800	$43,200	$54,000
Montrose Road	I_5	5	Supports Growth Needs and Operational Resiliency	10+	1	$4,000	50%	40%	$400	$1,600	$2,000
Montrose Road	I_5	6	Supports Growth Needs and Operational Resiliency	10+	306	$832,000	50%	40%	$83,200	$332,800	$416,000
Montrose Road	I_5	6	Supports Growth Needs and Operational Resiliency	0-2	368	$1,000,000	50%	40%	$100,000	$400,000	$500,000
Montrose Road	I_5	7	Supports Growth Needs and Operational Resiliency	10+	8	$23,000	50%	40%	$2,300	$9,200	$11,500
Montrose Road	I_5	7	Supports Growth Needs and Operational Resiliency	0-2	25	$69,000	50%	40%	$6,900	$27,600	$34,500
Montrose Road	J_6	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	5-10	664	$1,803,000	75%	25%	$901,500	$450,750	$450,750
Montrose Road	B_1	2D	Addresses Existing Needs	10+	338	$919,000	10%	0%	$91,900	-	$827,100
Montrose Road	B_1	7	Addresses Existing Needs	10+	2	$7,000	10%	0%	$700	-	$6,300
Montrose Road	H_4	DC	Supports New Growth Areas	10+	928	$2,345,000	100%	10%	$2,110,500	$234,500	-
Morden Drive	A_1	2D	Addresses Existing Needs	10+	500	$1,790,000	10%	0%	$179,000	-	$1,611,000
Morrison Street	A_1	2B	Addresses Existing Needs	10+	298	$875,000	10%	0%	$87,500	-	$787,500

Road Name	Project No	Prioritization	Project Type	Project Timelines	Length (m)	Total Cost	DC Share	OB Share	DC Cost	OB Cost	City (Benefit to Existing) Cost ($)
Morrison Street	B_1	2B	Addresses Existing Needs	10+	163	$480,000	10%	0%	$48,000	-	$432,000
Morse Avenue	A_1	2D	Addresses Existing Needs	10+	170	$500,000	10%	0%	$50,000	-	$450,000
Murray Street	F_12	3	Addresses Existing Needs and Supports Growth Needs	5-10	248	$673,000	25%	0%	$168,250	-	$504,750
Murray Street	A_1	2D	Addresses Existing Needs	10+	871	$2,562,000	10%	0%	$256,200	-	$2,305,800
Murray Street	B_1	4	Addresses Existing Needs	10+	5	$14,000	10%	0%	$1,400	-	$12,600
Murray Street	B_1	2D	Addresses Existing Needs	10+	142	$386,000	10%	0%	$38,600	-	$347,400
Murray Street	E_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	207	$565,000	25%	0%	$141,250	-	$423,750
Niagara River Parkway	D_1	3	Addresses Existing Needs and Supports Growth Needs	0-2	364	$1,068,000	25%	0%	$267,000	-	$801,000
Niagara River Parkway	D_1	3	Addresses Existing Needs and Supports Growth Needs	0-2	220	$646,000	75%	0%	$484,500	-	$161,500
North Street	A_1	2D	Addresses Existing Needs	10+	187	$552,000	10%	0%	$55,200	-	$496,800
Norton Street	A_1	2B	Addresses Existing Needs	10+	94	$277,000	10%	0%	$27,700	-	$249,300
Oakwood Drive	A_1	2B	Addresses Existing Needs	10+	183	$496,000	10%	0%	$49,600	-	$446,400
Odessa Court	A_1	2D	Addresses Existing Needs	10+	89	$262,000	10%	0%	$26,200	-	$235,800
Oldfield Road	J_7	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	3-5	658	$1,784,000	75%	25%	$892,000	$446,000	$446,000
Oldfield Road	J_7	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	5-10	119	$324,000	75%	25%	$162,000	$81,000	$81,000
Ontario Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	312	$919,000	75%	0%	$689,250	-	$229,750
Ontario Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	17	$52,000	25%	0%	$13,000	-	$39,000
Ort Road	G_29	DC	Triggered by Growth and Supports Existing Users	0-2	255	$691,000	75%	0%	$518,250	-	$172,750
Paisley Avenue	A_1	2D	Addresses Existing Needs	10+	220	$648,000	10%	0%	$64,800	-	$583,200
Palis Crescent	A_1	2A	Addresses Existing Needs	10+	179	$526,000	10%	0%	$52,600	-	$473,400
Parkdale Street	A_1	2B	Addresses Existing Needs	10+	326	$960,000	10%	0%	$96,000	-	$864,000
Parklawn Crescent	A_1	2B	Addresses Existing Needs	10+	124	$366,000	10%	0%	$36,600	-	$329,400
Patten Crescent	A_1	2D	Addresses Existing Needs	10+	110	$323,000	10%	0%	$32,300	-	$290,700
Peer Street	A_1	3	Addresses Existing Needs	5-10	268	$787,000	10%	0%	$78,700	-	$708,300
Peer Street	D_1	3	Addresses Existing Needs and Supports Growth Needs	5-10	88	$259,000	25%	0%	$64,750	-	$194,250
Peer Street	D_1	3	Addresses Existing Needs and Supports Growth Needs	5-10	214	$630,000	75%	0%	$472,500	-	$157,500
Peer Street	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	137	$404,000	25%	0%	$101,000	-	$303,000
Peer Street	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	1	$3,000	75%	0%	$2,250	-	$750
Peer Street	E_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	4	$13,000	25%	0%	$3,250	-	$9,750
Perkins Street	D_1	2B	Addresses Existing Needs and Supports Growth Needs	5-10	27	$79,000	50%	0%	$39,500	-	$39,500
Perkins Street	D_1	2B	Addresses Existing Needs and Supports Growth Needs	5-10	164	$483,000	75%	0%	$362,250	-	$120,750
Pettit Avenue	A_1	2B	Addresses Existing Needs	10+	954	$2,808,000	10%	0%	$280,800	-	$2,527,200
Piva Avenue	A_1	2D	Addresses Existing Needs	10+	141	$414,000	10%	0%	$41,400	-	$372,600
Portage Road	C_6	3	Addresses Existing Needs	10+	431	$1,271,000	10%	0%	$127,100	-	$1,143,900
Portage Road	C_6	3	Addresses Existing Needs	5-10	2	$6,000	10%	0%	$600	-	$5,400
Portage Road	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	274	$804,000	75%	0%	$603,000	-	$201,000
Portage Road	A_1	2D	Addresses Existing Needs	10+	886	$2,602,000	10%	0%	$260,200	-	$2,341,800
Portage Road	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	293	$860,000	25%	0%	$215,000	-	$645,000
Portage Road	G_36	DC	Triggered by Growth and Supports Existing Users	10+	174	$476,000	75%	0%	$357,000	-	$119,000
Queensway Gardens	A_1	2D	Addresses Existing Needs	5-10	167	$491,000	10%	0%	$49,100	-	$441,900
Riall Street	G_34	DC	Triggered by Growth and Supports Existing Users	10+	195	$528,000	75%	0%	$396,000	-	$132,000
Riall Street	G_34	DC	Triggered by Growth and Supports Existing Users	10+	103	$280,000	50%	40%	$28,000	$112,000	$140,000
Riall Street	I_1	6	Supports Growth Needs and Operational Resiliency	10+	161	$438,000	50%	40%	$43,800	$175,200	$219,000
Riall Street	I_1	7	Supports Growth Needs and Operational Resiliency	10+	7	$21,000	50%	40%	$2,100	$8,400	$10,500
River Lane	J_9	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	5-10	488	$1,327,000	75%	25%	$663,500	$331,750	$331,750
River Road	J_5	5	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	5-10	28	$77,000	75%	25%	$38,500	$19,250	$19,250
River Road	J_5	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	3-5	345	$937,000	75%	25%	$468,500	$234,250	$234,250
River Road	J_5	7	Supports Growth Needs and Operational Resiliency; Directly Services Growth Areas	5-10	319	$864,000	75%	25%	$432,000	$216,000	$216,000
Robinson Street	D_1	2C	Addresses Existing Needs and Supports Growth Needs	3-5	155	$457,000	75%	0%	$342,750	-	$114,250
Robinson Street	D_1	2C	Addresses Existing Needs and Supports Growth Needs	3-5	419	$1,575,000	25%	0%	$393,750	-	$1,181,250

Road Name	Project No	Prioritization	Project Type	Project Timelines	Length (m)	Total Cost	DC Share	OB Share	DC Cost	OB Cost	City (Benefit to Existing) Cost ($)
Robinson Street	F_7	2C	Addresses Existing Needs and Supports Growth Needs	3-5	10	$377,000	25%	0%	$94,250	-	$282,750
Robinson Street	F_6	2C	Addresses Existing Needs and Supports Growth Needs	3-5	129	$380,000	25%	0%	$95,000	-	$285,000
Rodney Street	A_1	2D	Addresses Existing Needs	10+	126	$371,000	10%	0%	$37,100	-	$333,900
Rolling Acres Crescent	A_1	2B	Addresses Existing Needs	3-5	194	$569,000	10%	0%	$56,900	-	$512,100
Rolling Acres Drive	A_1	2C	Addresses Existing Needs	3-5	143	$419,000	10%	0%	$41,900	-	$377,100
Rolling Acres Drive	A_1	2C	Addresses Existing Needs	10+	528	$1,867,000	10%	0%	$186,700	-	$1,680,300
Scholfield Street	B_1	7	Addresses Existing Needs	10+	168	$383,000	10%	0%	$38,300	-	$344,700
Scholfield Street	B_1	4	Addresses Existing Needs	10+	219	$497,000	10%	0%	$49,700	-	$447,300
Scott Street	A_1	2B	Addresses Existing Needs	10+	431	$1,269,000	10%	0%	$126,900	-	$1,142,100
Secord Place	B_1	7	Addresses Existing Needs	10+	99	$269,000	10%	0%	$26,900	-	$242,100
Sheldon Street	A_1	2C	Addresses Existing Needs	10+	739	$2,175,000	10%	0%	$217,500	-	$1,957,500
Shirley Avenue	A_1	2A	Addresses Existing Needs	10+	514	$1,510,000	10%	0%	$151,000	-	$1,359,000
Sidney Street	A_1	2C	Addresses Existing Needs	10+	168	$493,000	10%	0%	$49,300	-	$443,700
Simcoe Street	D_1	2C	Addresses Existing Needs and Supports Growth Needs	5-10	162	$477,000	25%	0%	$119,250	-	$357,750
Simcoe Street	D_1	2C	Addresses Existing Needs and Supports Growth Needs	5-10	104	$304,000	75%	0%	$228,000	-	$76,000
Simcoe Street	D_1	2C	Addresses Existing Needs and Supports Growth Needs	5-10	29	$86,000	50%	0%	$43,000	-	$43,000
Sinnicks Avenue	G_6	DC	Triggered by Growth and Supports Existing Users	10+	907	$2,762,000	75%	0%	$2,071,500	-	$690,500
Sodom Road	G_25	DC	Triggered by Growth and Supports Existing Users	3-5	200	$542,000	90%	0%	$487,800	-	$54,200
Sootheran Drive	A_1	2C	Addresses Existing Needs	10+	107	$315,000	10%	0%	$31,500	-	$283,500
Sophia Avenue	A_1	2D	Addresses Existing Needs	10+	71	$209,000	10%	0%	$20,900	-	$188,100
Springdale Avenue	A_1	2A	Addresses Existing Needs	10+	54	$160,000	10%	0%	$16,000	-	$144,000
Street Clair Avenue	D_1	2C	Addresses Existing Needs and Supports Growth Needs	5-10	16	$47,000	25%	0%	$11,750	-	$35,250
Street Clair Avenue	D_1	2C	Addresses Existing Needs and Supports Growth Needs	5-10	160	$468,000	50%	0%	$234,000	-	$234,000
Street James Avenue	A_1	2D	Addresses Existing Needs	10+	173	$507,000	10%	0%	$50,700	-	$456,300
Street Paul Avenue	C_3	3	Addresses Existing Needs	5-10	221	$601,000	10%	0%	$60,100	-	$540,900
Street Paul Avenue	F_1	3	Addresses Existing Needs and Supports Growth Needs	5-10	313	$849,000	75%	0%	$636,750	-	$212,250
Stanley Avenue	F_7	3	Addresses Existing Needs and Supports Growth Needs	3-5	167	$492,000	25%	0%	$123,000	-	$369,000
Stanley Avenue	F_7	3	Addresses Existing Needs and Supports Growth Needs	3-5	191	$560,000	75%	0%	$420,000	-	$140,000
Stanley Avenue	D_1	3	Addresses Existing Needs and Supports Growth Needs	3-5	247	$728,000	25%	0%	$182,000	-	$546,000
Stanley Avenue	D_1	3	Addresses Existing Needs and Supports Growth Needs	3-5	42	$125,000	75%	0%	$93,750	-	$31,250
Stanley Avenue	A_1	3	Addresses Existing Needs	3-5	2066	$6,073,000	10%	0%	$607,300	-	$5,465,700
Stanley Avenue	C_4	3	Addresses Existing Needs	5-10	694	$1,886,000	10%	0%	$188,600	-	$1,697,400
Stanley Avenue	F_2	3	Addresses Existing Needs and Supports Growth Needs	5-10	123	$653,000	25%	0%	$163,250	-	$489,750
Stanley Avenue	F_2	3	Addresses Existing Needs and Supports Growth Needs	5-10	73	$199,000	50%	0%	$99,500	-	$99,500
Stanley Avenue	F_2	3	Addresses Existing Needs and Supports Growth Needs	5-10	47	$127,000	75%	0%	$95,250	-	$31,750
Stanley Avenue	B_1	4	Addresses Existing Needs	10+	175	$769,000	10%	0%	$76,900	-	$692,100
Stevens Street	A_1	2D	Addresses Existing Needs	10+	343	$1,010,000	10%	0%	$101,000	-	$909,000
Strohan Street	B_1	4	Addresses Existing Needs	10+	457	$1,243,000	10%	0%	$124,300	-	$1,118,700
Summer Street	A_1	2D	Addresses Existing Needs	10+	124	$367,000	10%	0%	$36,700	-	$330,300
Summer Street	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	133	$392,000	50%	0%	$196,000	-	$196,000
Summer Street	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	3	$10,000	25%	0%	$2,500	-	$7,500
Sunnylea Crescent	A_1	2A	Addresses Existing Needs	10+	247	$726,000	10%	0%	$72,600	-	$653,400
Sunset Avenue	A_1	2D	Addresses Existing Needs	10+	76	$226,000	10%	0%	$22,600	-	$203,400
Sussex Drive	A_1	2D	Addresses Existing Needs	10+	151	$445,000	10%	0%	$44,500	-	$400,500
Swayze Drive	C_2	3	Addresses Existing Needs	5-10	592	$1,609,000	10%	0%	$160,900	-	$1,448,100
Swayze Drive	D_1	4	Addresses Existing Needs	10+	8	$23,000	10%	0%	$2,300	-	$20,700
Swayze Drive	D_1	4	Addresses Existing Needs and Supports Growth Needs	5-10	147	$432,000	50%	0%	$216,000	-	$216,000
Swayze Drive	D_1	4	Addresses Existing Needs and Supports Growth Needs	5-10	1	$5,000	25%	0%	$1,250	-	$3,750
Temperance Avenue	A_1	2D	Addresses Existing Needs	10+	197	$581,000	10%	0%	$58,100	-	$522,900
Temperance Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	61	$178,000	25%	0%	$44,500	-	$133,500

Road Name	Project No	Prioritization	Project Type	Project Timelines	Length (m)	Total Cost	DC Share	OB Share	DC Cost	OB Cost	City (Benefit to Existing) Cost ($)
Terrace Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	170	$501,000	75%	0%	$375,750	-	$125,250
Terrace Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	6	$20,000	25%	0%	$5,000	-	$15,000
Terrace Avenue	D_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	68	$201,000	50%	0%	$100,500	-	$100,500
Theresa Street	A_1	2D	Addresses Existing Needs	10+	542	$1,597,000	10%	0%	$159,700	-	$1,437,300
Thornhill Crescent	A_1	2D	Addresses Existing Needs	10+	44	$130,000	10%	0%	$13,000	-	$117,000
Thorold Stone Road	I_2	5	Supports Growth Needs and Operational Resiliency	10+	370	$1,324,000	50%	40%	$132,400	$529,600	$662,000
Thorold Stone Road	I_2	5	Supports Growth Needs and Operational Resiliency	10+	178	$483,000	75%	50%	$120,750	$241,500	$120,750
Thorold Stone Road	A_1	1	Addresses Existing Needs	0-2	9	$341,000	10%	0%	$34,100	-	$306,900
Thorold Stone Road	C_8	3	Supports Growth Needs and Operational Resiliency	0-2	215	$583,000	50%	40%	$58,300	$233,200	$291,500
Thorold Stone Road	C_7	3	Addresses Existing Needs	5-10	531	$1,256,000	30%	0%	$376,800	-	$879,200
Thorold Stone Road	C_7	1	Addresses Existing Needs	0-2	13	$36,000	10%	0%	$3,600	-	$32,400
Thorold Stone Road	I_2	7	Supports Growth Needs and Operational Resiliency	10+	25	$70,000	50%	40%	$7,000	$28,000	$35,000
Thorold Stone Road	A_1	3	Addresses Existing Needs	10+	11	$32,000	10%	0%	$3,200	-	$28,800
Thorold Stone Road	A_1	2D	Addresses Existing Needs	5-10	8	$23,000	10%	0%	$2,300	-	$20,700
Thorold Stone Road	A_1	2D	Addresses Existing Needs	10+	326	$960,000	10%	0%	$96,000	-	$864,000
Thorold Stone Road	B_1	2D	Addresses Existing Needs	5-10	354	$1,039,000	10%	0%	$103,900	-	$935,100
Thorold Stone Road	B_1	2D	Addresses Existing Needs	10+	38	$113,000	10%	0%	$11,300	-	$101,700
Valley Way	A_1	2A	Addresses Existing Needs	10+	8	$23,000	10%	0%	$2,300	-	$20,700
Valley Way	B_1	2A	Addresses Existing Needs	10+	227	$671,000	10%	0%	$67,100	-	$603,900
Valour Crescent	A_1	2B	Addresses Existing Needs	10+	133	$392,000	10%	0%	$39,200	-	$352,800
Vine Street	A_1	2A	Addresses Existing Needs	5-10	145	$427,000	10%	0%	$42,700	-	$384,300
Vine Street	B_1	2A	Addresses Existing Needs	10+	60	$164,000	10%	0%	$16,400	-	$147,600
Vine Street	B_1	2A	Addresses Existing Needs	5-10	205	$601,000	10%	0%	$60,100	-	$540,900
Vine Street	D_1	2A	Addresses Existing Needs and Supports Growth Needs	5-10	208	$611,000	25%	0%	$152,750	-	$458,250
Virginia Street	E_1	4	Addresses Existing Needs and Supports Growth Needs	5-10	143	$389,000	75%	0%	$291,750	-	$97,250
Virginia Street	E_1	4	Addresses Existing Needs and Supports Growth Needs	5-10	1	$3,000	25%	0%	$750	-	$2,250
Wallace Crescent	A_1	2A	Addresses Existing Needs	10+	68	$199,000	10%	0%	$19,900	-	$179,100
Waterloo Drive	A_1	2C	Addresses Existing Needs	10+	529	$1,555,000	10%	0%	$155,500	-	$1,399,500
Waters Avenue	A_1	2B	Addresses Existing Needs	10+	118	$348,000	10%	0%	$34,800	-	$313,200
Wellington Street	A_1	2D	Addresses Existing Needs	10+	215	$949,000	10%	0%	$94,900	-	$854,100
Wendy Drive	A_1	2D	Addresses Existing Needs	10+	243	$715,000	10%	0%	$71,500	-	$643,500
Wentworth Avenue	A_1	2D	Addresses Existing Needs	10+	123	$362,000	10%	0%	$36,200	-	$325,800
West Of QEW	B_1	7	Addresses Existing Needs	10+	253	$692,000	10%	0%	$69,200	-	$622,800
West Of QEW	B_1	2D	Addresses Existing Needs	10+	1426	$3,875,000	10%	0%	$387,500	-	$3,487,500
West Of QEW	B_1	4	Addresses Existing Needs	10+	354	$1,678,000	10%	0%	$167,800	-	$1,510,200
West Of QEW	E_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	86	$528,000	25%	0%	$132,000	-	$396,000
West Of QEW	E_1	2D	Addresses Existing Needs and Supports Growth Needs	5-10	152	$413,000	50%	0%	$206,500	-	$206,500
Whitman Avenue	A_1	2C	Addresses Existing Needs	10+	427	$1,254,000	10%	0%	$125,400	-	$1,128,600
Willick Road	G_32	DC	Triggered by Growth and Supports Existing Users	3-5	1000	$2,709,000	75%	0%	$2,031,750	-	$677,250
Willick Road	G_31	DC	Triggered by Growth and Supports Existing Users	3-5	1000	$2,710,000	75%	0%	$2,032,500	-	$677,500
Wills Street	A_1	2A	Addresses Existing Needs	10+	454	$1,335,000	10%	0%	$133,500	-	$1,201,500
Wilson Crescent	A_1	2C	Addresses Existing Needs	10+	550	$1,619,000	10%	0%	$161,900	-	$1,457,100
Wilson Crescent	D_1	2C	Addresses Existing Needs and Supports Growth Needs	5-10	80	$234,000	25%	0%	$58,500	-	$175,500
Wiltshire Boulevard	A_1	2C	Addresses Existing Needs	3-5	771	$2,266,000	10%	0%	$226,600	-	$2,039,400
Windermere Road	A_1	2B	Addresses Existing Needs	10+	183	$539,000	10%	0%	$53,900	-	$485,100
Winston Street	A_1	2C	Addresses Existing Needs	10+	398	$1,174,000	10%	0%	$117,400	-	$1,056,600
Woodland Boulevard	A_1	2C	Addresses Existing Needs	10+	390	$1,147,000	10%	0%	$114,700	-	$1,032,300
Yale Crescent	A_1	2B	Addresses Existing Needs	10+	94	$279,000	10%	0%	$27,900	-	$251,100
York Drive	A_1	2D	Addresses Existing Needs	10+	134	$398,000	10%	0%	$39,800	-	$358,200