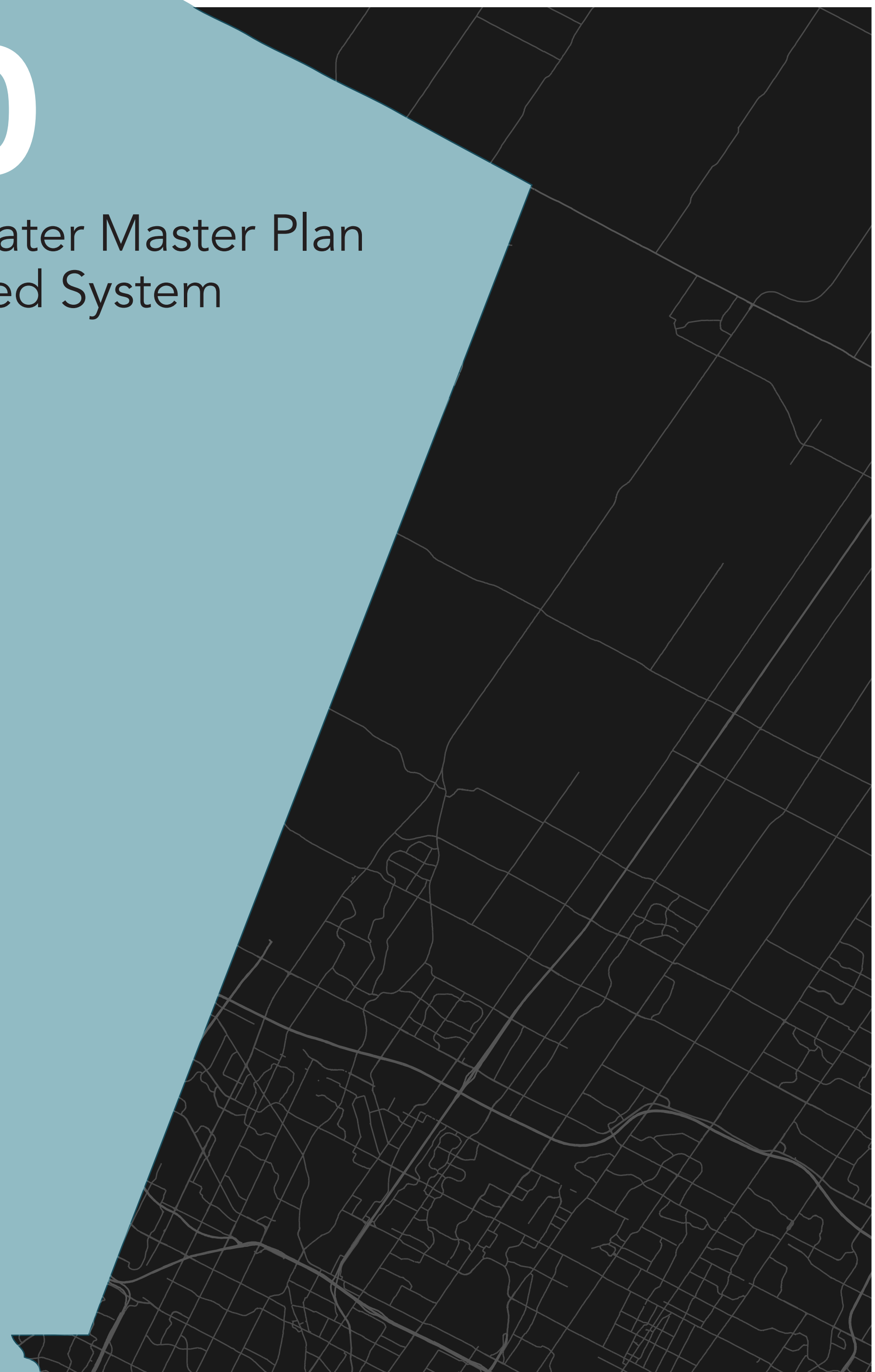
Region of Peel
working with you

2020

Water & Wastewater Master Plan for the Lake-Based System



VOLUME 3

Water Master Plan

Prepared by: GM BluePlan Engineering

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

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

The 2020 Master Plan Report is organized into five volumes:

Volume 1 – Executive Summary

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

Volume 2 – Background and Planning Context

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

Volume 3 – Water Master Plan

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

Volume 4 – Wastewater Master Plan

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

Volume 5 – Public and Agency Consultation

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

The following sections present Volume 3 which is one of five volumes that make up the complete 2020 Water and Wastewater Master Plan Report and should be read in conjunction with the other volumes.

Table of Contents

1.0 Introduction 1
1.1 Background 1
1.2 Water and Wastewater Master Plan Objectives 2
1.3 Problem Opportunity Statement 2
1.4 Study Area 3
2.0 Water System Policy and Criteria 5
2.1 Water Servicing Principles and Policies 5
2.2 Design Criteria – Demands Projections 6
2.2.1 Water Demand Projections 7
2.3 Design Criteria – System Assessment 9
2.3.1 Water Treatment Plants 9
2.3.2 Water Pumping Stations 9
2.3.3 Water Storage Facilities 10
2.3.4 Transmission Mains 11
2.3.5 Distribution Mains 11
2.3.6 Security of Supply 11
2.4 Cost Estimation Framework 12
2.4.1 Unit Rates 12
2.4.2 Final Project Cost 12
2.4.3 Operation and Maintenance 12
3.0 Existing Water Transmission System 14
3.1 Existing Infrastructure 14
3.1.1 Water Treatment Plants 16
3.1.2 Pressure Zones 19
3.1.3 Transmission Mains 19
3.1.4 Water Pumping Stations and Reservoirs 26
3.2 Hydraulic Water Model 30
3.3 Lake-based Water Supply System Schematics 30
4.0 Assessment of Future Water Infrastructure Requirements 32
4.1 Opportunities and Constraints 32
4.1.1 Growth 32
4.1.2 Water Treatment Plants 33
4.1.3 Transmission Mains 33
4.1.4 Pumping Stations and Storage Facilities 33
4.2 Water Demand Requirements 34
4.3 Assessment of Water Infrastructure 35
4.3.1 Water Treatment Plants 35
4.3.2 Transmission Mains 37
4.3.3 Water Pumping Stations 39
4.3.4 Water Storage 40
5.0 Water Servicing Strategy 42
5.1 Objectives 43
5.2 Evaluation Process and Criteria 43

Table of Contents

5.3 Servicing Strategy Development 46
5.3.1 System Wide Servicing Concepts 46
5.3.2 System Wide Servicing Strategies Evaluation 47
5.3.3 Focus Area Servicing Solutions 51
5.3.4 Inter-Regional Agreements 64
6.0 Preferred Water Servicing Strategy 66
6.1 Preferred Servicing Strategy 66
6.2 Capital Program for the Preferred Water Servicing Strategy 67
7.0 Implementation and Lifecycle 80
7.1 Capital Program Implementation 80
7.2 Lifecycle Costing 81
8.0 Intensification and Post-2041 Growth 83
8.1 2041 Intensification 83
8.3 Post-2041 Vision 84

Appendices

Appendix 3A: Design Criteria Memo

Appendix 3B: Cost Estimation Framework Memo

Appendix 3C: Lake-based Water Schematics

Appendix 3D: Detailed Capacity Assessments

Appendix 3E: Strategy Evaluation

Appendix 3F: Standby Power Report

Appendix 3G: Maps

1.0 Introduction

1.1 Background

1.2 Water and Wastewater Master Plan Objectives

1.3 Problem Opportunity Statement

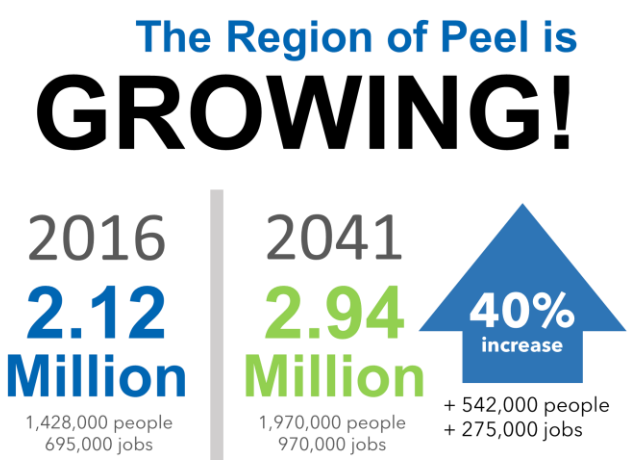
1.4 Study Area

1.0 Introduction

1.1 Background

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

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



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

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

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

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

1.2 Water and Wastewater Master Plan Objectives

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

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

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

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

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

1.3 Problem Opportunity Statement

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

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

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

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

1.4 Study Area

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

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

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

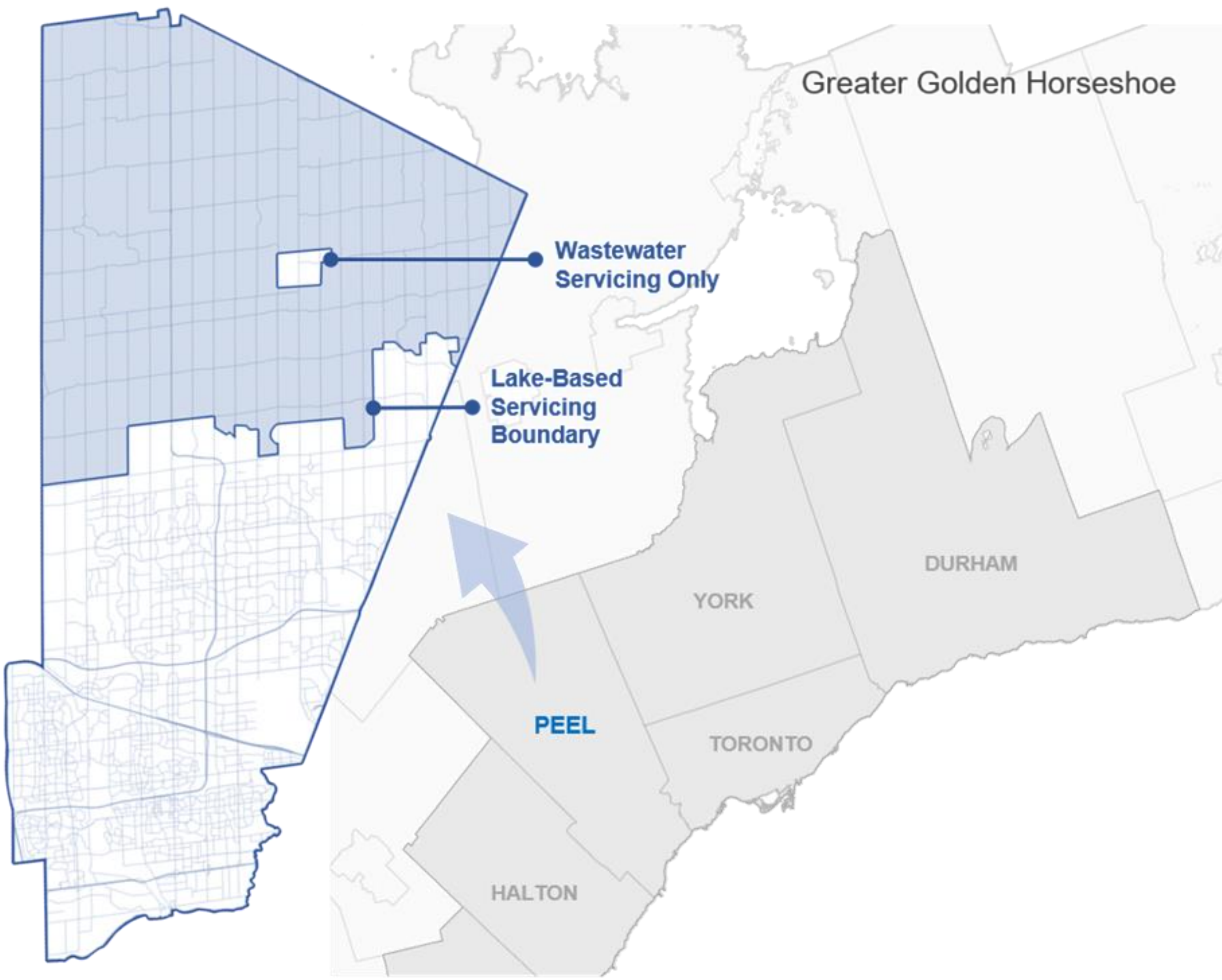


Figure 1 – Study area for the 2020 Water and Wastewater Master Plan.

2.0 Water System Policy and Criteria

2.1 Water Servicing Principles and Policies

2.2 Design Criteria – Demands Projections

2.3 Design Criteria – System Assessment

2.4 Cost Estimation Framework

2.0 Water System Policy and Criteria

Water policies, design criteria, and level of service requirements were updated as part of the 2020 W/WW Master Plan 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.

2.1 Water Servicing Principles and Policies

The Region developed a principles and policies paper during the 2007 Master Plan and updated it as part of the 2013 Master Plan. Through the 2020 W/WW Master Plan, principles and policies were reviewed and updated to guide the development of water servicing strategies.

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

General Water and Wastewater Policies

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

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

Water Policies

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

- W.01: Health and Safety
- W.02: Raw Water Quality
- W.03: Treatment and Distribution Water Quality
- W.04: Water Demand Projections
- W.05: Distribution Requirements
- W.06: Fire Flow Requirements
- W.07: Water Efficiency and Consumption Trends
- W.08: Water Supply and Distribution Security
- W.09: Design Criteria
- W.10: Costing Criteria
- W.11: Pressure Zone Boundaries

The complete list of servicing principles and policies can be found in **Volume 2 – Appendix 2A.**

2.2 Design Criteria – Demands Projections

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

The development of design criteria is an element that has been reviewed during each master plan update and, as a result, has evolved over the years. As such, an analysis of water design criteria was completed by the Region to ensure that the projected water demands are accurate and reflect new trends to support decision making for the sizing and timing of future infrastructure. The Region produced a Design Criteria Memorandum, which is included in **Appendix 3A**. The following is a summary of the findings and recommendations:

- Recent trends in water consumption in the Region of Peel support the reduction of the average day water design criteria from 280 to 265 L/person or employee/day. This represents a reduction of 5.4 percent.
- As part of the Growth Management Initiative, discussions with the development industry have led to the decision of discretizing a single design criterion into separate residential and non-residential components based on serviced population.
- The residential average day water demand will be 270 L/person/day, while employment will be 250 L/employee/day.
- The residential maximum day demand (MDD) peaking factor will be reduced from 2.0 to 1.8, while the non-residential MDD peaking factor will remain unchanged at 1.4.
- The peak hour demand (PHD) peaking factor will also remain unchanged at 3.0.

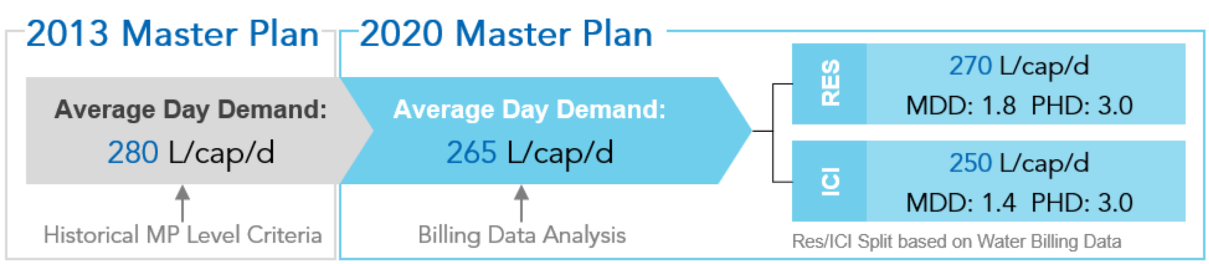


Figure 2 – Water design criteria evolution.

Table 1 provides a summary of the recommended water design criteria. The design criteria were used to identify water infrastructure requirements for the 2020 Master Plan.

Table 1 – Water design criteria for growth within the lake-based water system.

Type of Development	Average Day Demand	Maximum Day Factor	Peak Hour Factor
Residential	270 L/person/day	1.8	3.0
Employment	250 L/employee/day	1.4	3.0

2.2.1 Water Demand Projections

Water demand projections are required in order to establish the capital infrastructure needs to service existing users and future growth. Consistent with previous Master Plans, the Region's water demand projections are calculated based on a "Starting Point" methodology. This methodology uses historical measured (actual) water demands as a basis to calculate a representative starting point that serves as the baseline for projecting future water demands.

2.2.1.1 Starting Point Methodology

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

1. Compile data for the water supplied from each water treatment facility for the past five years.
2. Subtract flow transfers to York Region.
3. Calculate equivalent per capita consumption rate for every year by dividing annual maximum day production by annual total residential serviced population.
4. Calculate the average of the equivalent per capita consumption rate for the past five years (5-year rolling average)
5. Calculate the year's Starting Point by multiplying the year's serviced population by the 5-year rolling average and add back York water demands.

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

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

2.2.1.2 Future Demand Projections

The approach to determine growth demand projections continues to be based on establishing an annual starting point and projecting growth demands from that point forward. Future growth maximum day demands throughout the system are determined by multiplying the residential population and employment growth forecasts by the design criteria presented in **Table 1**.

The future total maximum day demands are then determined by adding the future growth needs to the starting point calculated using the 5-year rolling average methodology and York demands based on the York-Peel Water Servicing Agreement.

The calculation of future maximum day demands can be summarized as follows:

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

Figure 3 presents a graphical representation of the starting point and growth demand projection for the Peel lake-based system. More detailed information about water demand projections is presented in **Section 4.2**.

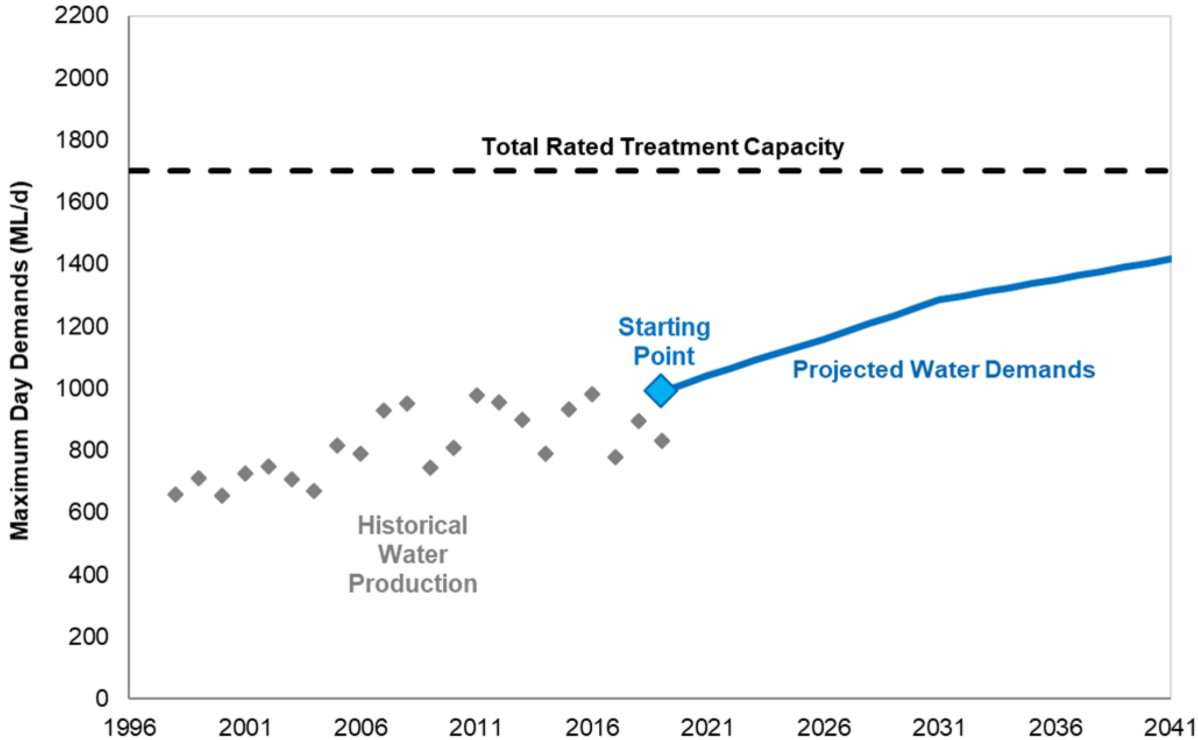


Figure 3 – Water starting point and growth demands projects.

2.3 Design Criteria – System Assessment

2.3.1 Water Treatment Plants

Water treatment plants are generally designed to provide capacity to meet maximum day demand requirements with an additional factor for in-facility uses such as filter backwashing. Consistent with the previous master plan, the following criteria were used in regard to water treatment facility expansions:

- The rated capacity of a water treatment plant is defined as the maximum daily flow that the facility is approved to treat.
- When 90 percent of the plant rated capacity is projected to be reached, an expansion to the treatment plant is required to be in service, noting that different treatment processes have specific design criteria that are applicable
- If an expansion is recommended, further analysis should be conducted to confirm actual timing of the plant expansion project. The age and condition of the plant should be considered as well as the amount of storage in the system that can be used to supply maximum day demand.

Figure 4 – A.P. Kennedy Water Treatment Plant

2.3.2 Water Pumping Stations

Pumping stations are rated on their firm capacity, which is nominally defined as the capacity of the pumping station with the largest pump out of service. For each pressure zone, the pumping stations should be able to:

- Provide peak hour demands in the immediate serviced zones.
- Have capacity to transfer maximum day demands to the upper serviced pressure zones.
- Capacity expansions are required once the pumping station’s firm capacity reaches the required maximum day demand or peak hour demand, depending on high-lift or low-lift requirements.

2.3.3 Water Storage Facilities

Required storage is dictated by the ability to provide the required equalization storage, fire storage and emergency supply to maintain a satisfactory level of service. Reservoir storage capacity at each pumping station is based on the following:

- **Equalization:** 25 percent of the maximum day demand for the upper pressure zones serviced by each pumping station from the reservoir.
- **Fire:** in accordance with the Ministry of Environment, Conservation and Parks guidelines, to a maximum of 378 L/s for 6 hours when the total equivalent population (Residential plus Employment) for each zone is greater than 40,000[2].
- **Emergency:** 25 percent of the equalization requirement plus 25 percent of fire storage for the lower pressure zone at the reservoir's HGL.

Given that Peel's water supply system typically operates under pumped supply, the reservoirs do not supply the pressure zone at the reservoir's hydraulic grade line (HGL). Rather, they float the lower zone and control the operating pressure. As such, the typical storage capacity criteria are also cross-reference against storage volumes required for the pressure zones serviced by that pumping facility. **Figure 5** below presents a sample of storage requirements.

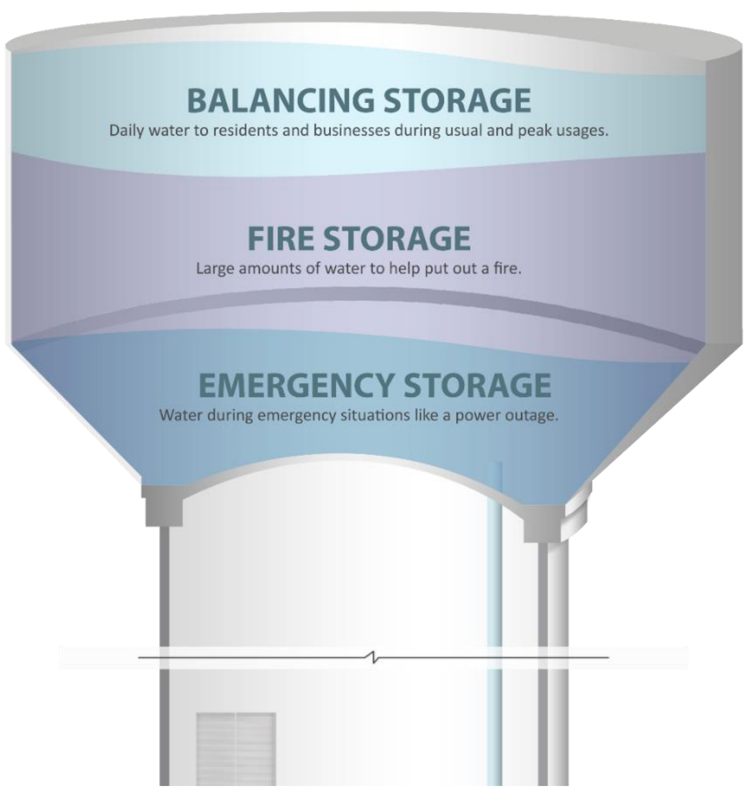


Figure 5 – Sample storage requirements.

2.3.4 Transmission Mains

Transmission mains are designed based on water demands and service levels (e.g., pressure, velocity, head loss), including:

- Convey the combined maximum day demands for the local zone and each subsequent upper zone.
- Transfer flow with an acceptable HGL and typically below 100 psi.
- Maintain velocities within transmission mains below 2.0 m/s.
- Oversizing can be considered in areas where future potential growth post-2041 is expected to occur.

Transmission mains are typically fed from the low-lift pumps, which also directly feed the local distribution system. As such, transmission main maximum flow is based on current pumping capacity, pressure head and the need to operate these pumps with an acceptable HGL.

The Region of Peel's full pipe hydraulic model was utilized to assess the network and to further refine transmission main capacities. Four scenarios (minimum hour, maximum day, peak hour and maximum day plus fire) were evaluated to confirm transmission main requirements.

2.3.5 Distribution Mains

Water mains that are part of the local distribution system are sized based on flow demands and pressure requirements, which include:

- Convey the greater of maximum day demand plus fire flows or peak hour demand.
- Maintain operating pressures in the distribution system between 40 and 100 psi.
- Maintain pressures higher than 40 psi to account for hydraulic losses in the local system.
- Under emergency conditions, it is allowable for pressures to drop to a minimum of 20 psi (140 kPa).

Although the focus of the 2020 Master Plan is on the water transmission system, service impacts to the local distribution system are also considered.

2.3.6 Security of Supply

The Region of Peel's lake-based water system is designed to include multiple facilities servicing the same zone, which provide supply security to the system. In addition to the multiple facilities for supply security, the following key water components are included in the system for further providing sustainable water service to the customers:

- Emergency power supply (standby power).
- Storage facilities.
- Cross pressure zones connections (pressure reducing valves, check valves, etc.).
- Consideration of transmission main twinning to address growth and system security.
- Operational strategy.

2.4 Cost Estimation Framework

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

2.4.1 Unit Rates

The unit cost rates used for this master plan are represented in 2020 dollars and, in general, take into consideration costs of labour and availability of materials in Southern Ontario. The development of these rates was informed by multiple master planning studies and have undergone peer reviews in order to further refine and ensure overall accuracy of the cost estimates. They were also compared to costs of recent capital projects completed within the Region of Peel and the GTA. A summary of the unit costs is provided in **Appendix 3B**.

2.4.2 Final Project Cost

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

- Creek crossings
- Railway and highway crossings
- Utility crossings
- Tunneling requirements
- Location of construction (rural, urban, suburban).

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

More detailed information about the cost estimation framework is provided in **Appendix 3B**.

2.4.3 Operation and Maintenance

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

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

3.0 Existing Water Transmission System

3.1 Existing Infrastructure
3.2 Hydraulic Water Model
3.3 Lake-based Water Supply System Schematics

3.0 Existing Water Transmission System

3.1 Existing Infrastructure

The Region of Peel's lake-based water system services the City of Mississauga, the City of Brampton, and parts of the Town of Caledon. Water is supplied from Lake Ontario by two water treatment plants (WTP) and conveyed by the transmission and distribution systems.

The transmission system consists of two treatment facilities, transmission mains, pumping stations, reservoirs and elevated tanks. Due to the width of the Region's lake-based service area, the transmission system is divided into three main trunk systems: west, central and east. The transmission system provides direct supply to the local water distribution system which consists of the water mains extending down to the water service level for each customer. Combined, all the components of the transmission and distribution systems deliver water to users through seven pressure zones separated by approximately 30-metre intervals of elevation.

The Region of Peel also maintains four municipal groundwater systems servicing rural communities in the Town of Caledon. These municipal groundwater systems are not included in the 2020 Master Plan. **Table 2** and **Figure 6** provides an overview of the Region's existing water lake-based transmission system.

Table 2 – Existing lake-based water transmission facilities.

West Trunk System	Central Trunk System	East Trunk System
Snelgrove Elevated Tank (WS6)	Mayfield West Elevated Tank (CS7)	Bolton Elevated Tank, West Bolton Elevated Tank and Standpipes (BS6)
Alloa Reservoir (WS5) and Pumping Station (LLP6W, HLP7W)	North Brampton Reservoir (CS5) and Pumping Station (LLP6C, HLP7C)	Tullamore Reservoir (ES4) and Pumping Station (LLP5E, HLP6E)
West Brampton Reservoir (WS4) and Pumping Station (LLP5W, HLP6W)	East Brampton Reservoir (CS4) and Pumping Station (LLP5C, HLP6C)	Airport Road Reservoir (ES3) and Pumping Station (LLP4E, HLP5E, York Transfer)
Meadowvale North Reservoir (WS3) and Pumping Station (LLP4W, HLP5W)	Beckett Sproule Reservoir (CS3) and Pumping Station (LLP4C, HLP5C)	Beckett Sproule Transfer Pumping Station
Streetsville Reservoir (WS2) and Pumping Station (LLP3W, HLP4W)	Hanlan Reservoir (CS2) and Pumping Station (LLP3C, HLP4C)	
Herridge Reservoir (WS1) and Pumping Station (HLP3W, LLP2W)	Silverthorn Reservoir (CS1) and Pumping Station (LLP2C, HLP3C)	
	A. P. Kennedy Water Treatment Plant and Pumping Stations (HLP1C, HLP2C)	

**Nomenclature of transmission facilities: (W)-West, (C)-Central, (E)-East, (S)-Storage, (LLP)-Low Lift Pump, (HLP)-High Lift Pump, # - pressure zones serviced by facility*

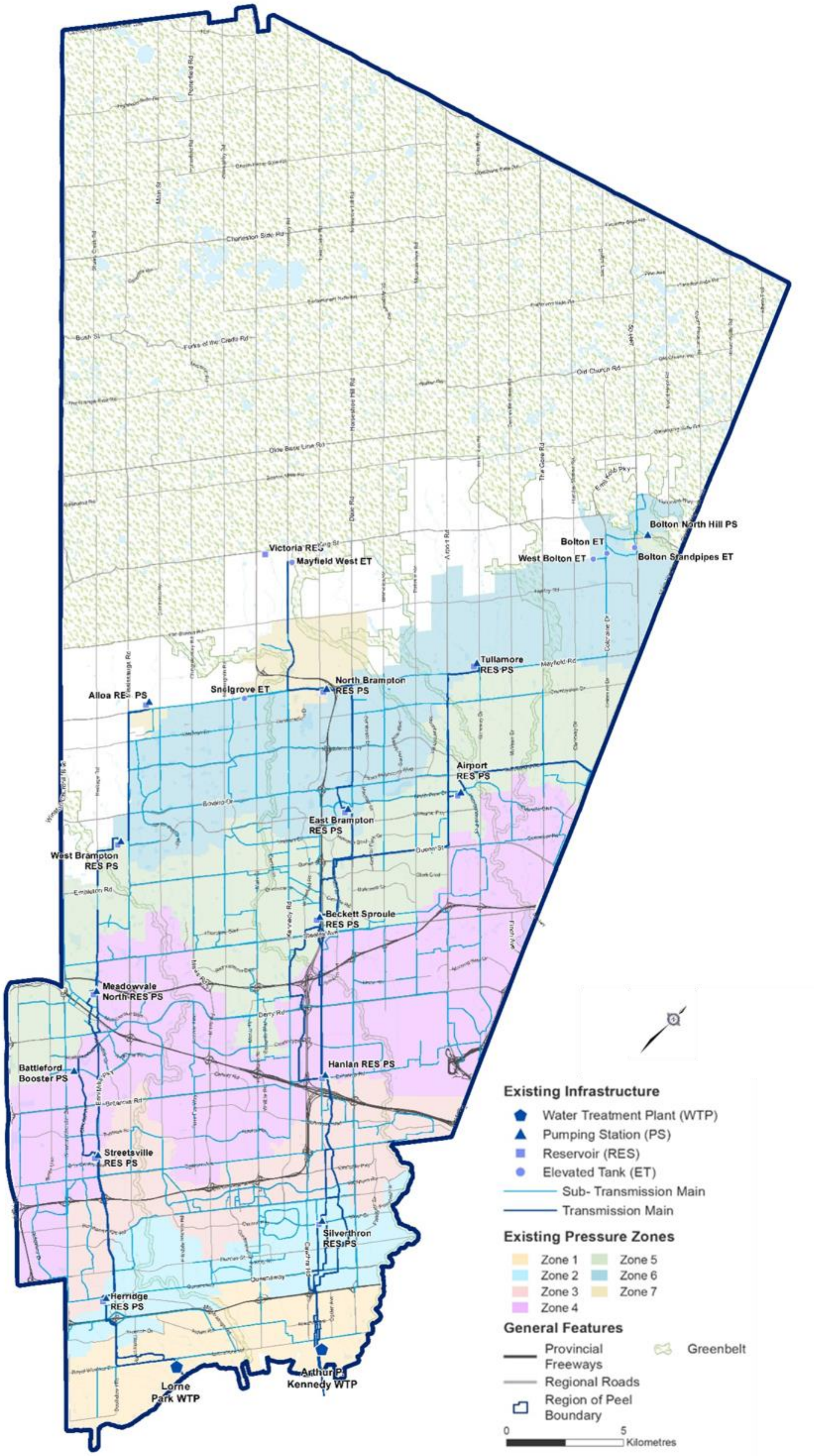


Figure 6 – Existing Region of Peel lake-based water transmission system.

3.1.1 Water Treatment Plants

The Region of Peel is serviced by two large water treatment plants (WTP): A.P. Kennedy WTP and Lorne Park WTP. The plants are located on the shore of Lake Ontario and are operated by the Ontario Clean Water Agency (OCWA) on behalf of the Region. These facilities provide safe drinking water to customers in the City of Brampton, City of Mississauga and parts of the Town of Caledon.

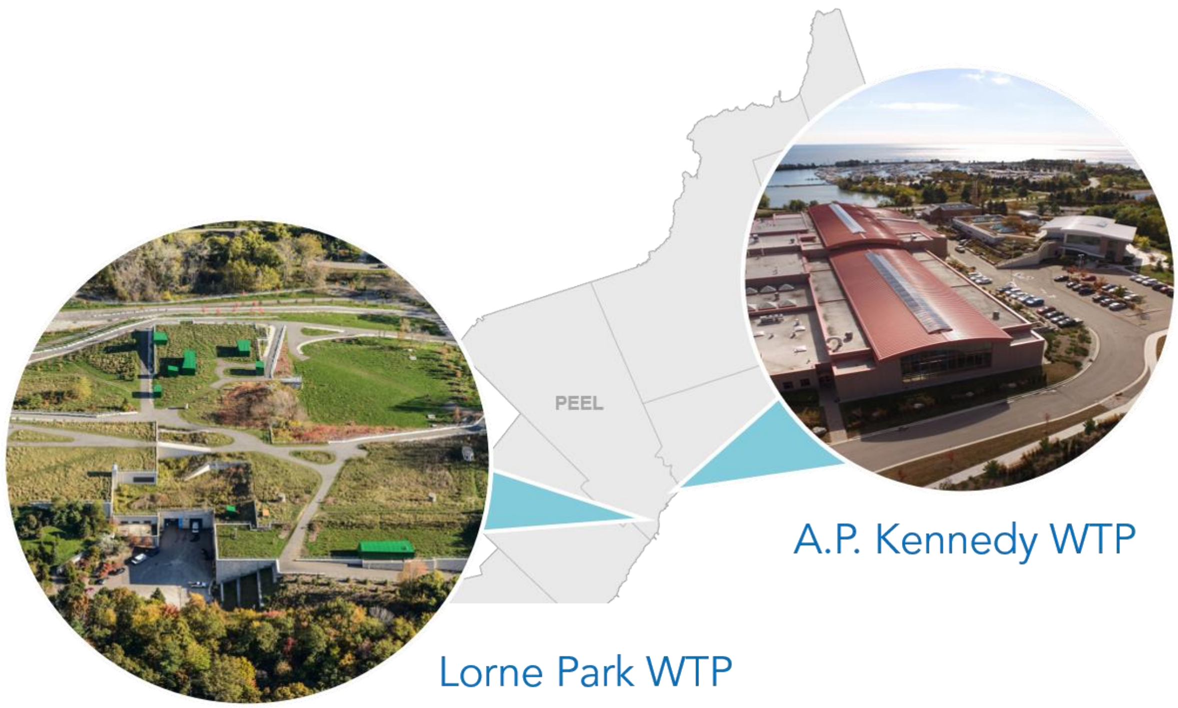


Image: A.P. Kennedy Water Treatment Plant

3.1.1.1 A.P. Kennedy Water Treatment Plant

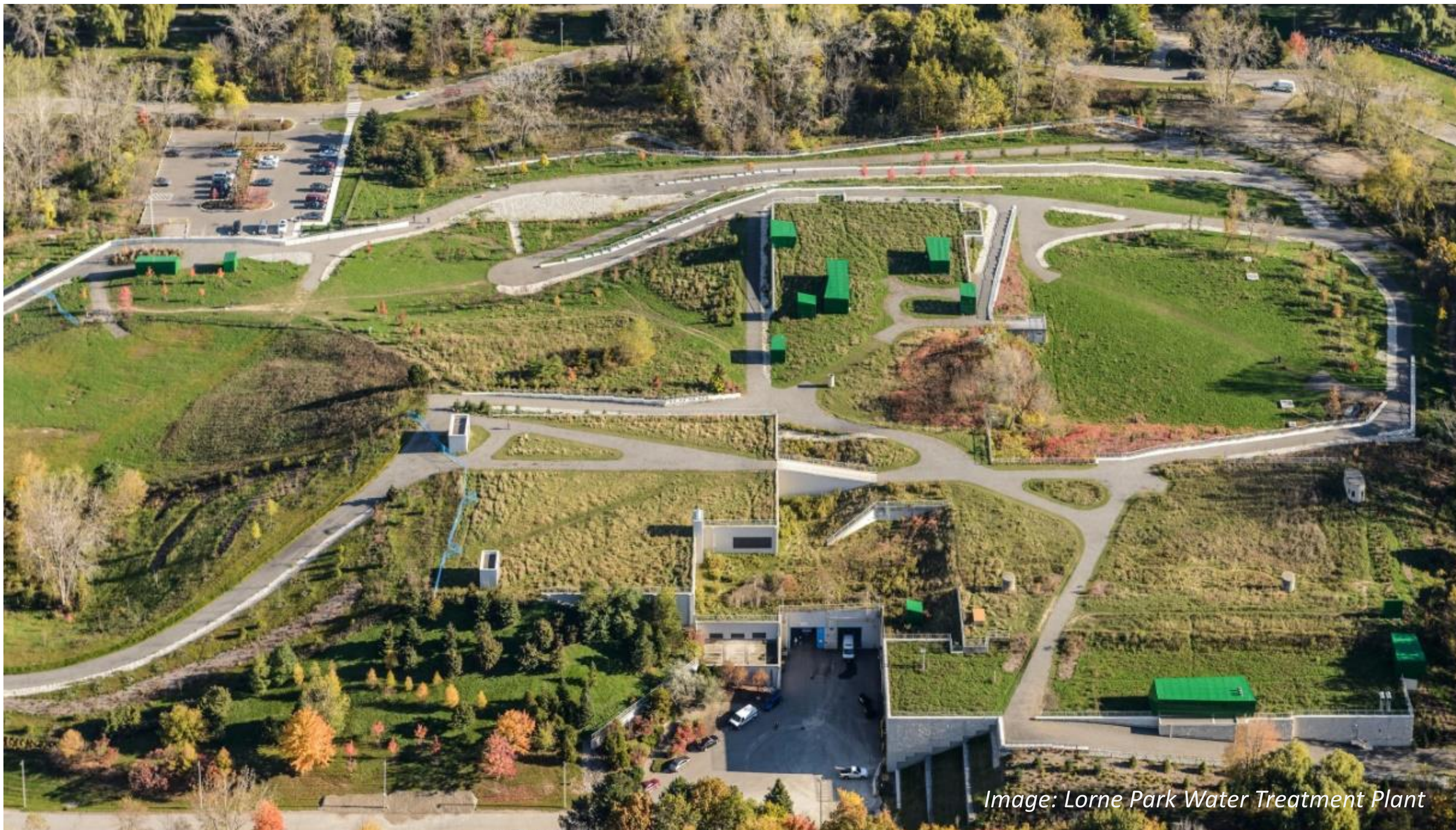
The A.P. Kennedy WTP (formerly the Lakeview WTP) is located in southeast Mississauga, east of Cawthra Road and south of Lakeshore Road East, at the south end of East Avenue.

The A.P. Kennedy WTP treats water through multiple levels of treatment and processes including:

1. Primary Disinfection
   - Conventional Treatment - Coagulation, Flocculation, Sedimentation, Dual Media Filtration
   - OBM1 - Ozone, Biologically Activated Carbon Contactors (BACC) and Membrane Treatment
   - OBUM2 - Ozone, BACC, UV and Membrane Treatment
2. Fluoridation and additional Chlorination
3. Distribution

In 2014, a capacity expansion at the plant was completed. The expansion increased the installed treatment capacity to approximately 1200 million litres of water per day (ML/d), making the A.P. Kennedy WTP one of the largest membrane treatment facilities in the world.

Sourcing water from Lake Ontario, the raw water intake to the plant consists of a 2550-mm diameter pipe extending 2,000 metres into the lake. The pipe has two intake cribs that feed a common intake pipe with an approximate capacity of 1,150 ML/d.



3.1.1.2 Lorne Park Water Treatment Plant

The Lorne Park WTP is located in southwest Mississauga, east of Southdown Road and south of Lakeshore Road West within Jack Darling Memorial Park. The plant uses advanced technology to treat water through multiple levels of treatment and processes including:

1. Primary Disinfection
   – Conventional Treatment - Coagulation, Flocculation, Sedimentation, Dual Media Filtration
   – Membrane, UV and Granular Activated Carbon Contractor (GACC) Treatment
2. Fluoridation and additional Chlorination
3. Distribution

The Lorne Park WTP has an installed treatment capacity of approximately 500 ML/d, consisting of: Plant 1 Conventional Treatment with a capacity of 120 ML/d and Plant 2 Membrane Filtration Plant with a capacity of 380 ML/d.

The Lorne Park WTP raw water intake has a design capacity of 550 ML/d, consisting of: 1230-metre long horseshoe shaped tunnel 1800-mm in diameter, 180 metres of 2,400-mm and 310 metres of 2,100-mm pipes.

3.1.2 Pressure Zones

The Region of Peel transmission and distribution systems deliver water to users through seven pressure zones separated by approximately 30-metre intervals of elevation. **Table 3** presents a summary of the lake-base water system pressure zones.

Table 3 – Lake-based water system pressure zones.

Pressure Zone	Top Water Level	Hydraulic Grade Line	Serviceable Elevation
Zone 1	144.8 m	152.4 m	75.0 – 106.7 m
Zone 2	175.3 m	182.9 m	87.8 – 137.2 m
Zone 3	205.7 m	213.4 m	135.9 – 167.6 m
Zone 4	236.2 m	243.8 m	166.4 – 210.6 m
Zone 5	266.7 m	274.3 m	182.4 – 236.2 m
Zone 6	297.2 m	304.8 m	214.5 – 259.1 m
Zone 7	327.7 m	335.3 m	243.4 – 289.6 m

3.1.3 Transmission Mains

The Region Peel transmission system is divided into three main trunk systems: West, Central and East. In reviewing the flow transfer capability of the transmission main, two important factors are considered; theoretical capacity and actual capacity. The capacity of the transmission main is defined based on the watermain characteristics as follows:

Theoretical capacity

- Size of the transmission main,
- Expected resistance (or energy loss) of the transmission main, and
- Standard/assumed roughness coefficient for a new transmission main.

Actual capacity

- Size of the transmission main,
- Expected resistance (or energy loss) of the transmission main, and
- Roughness coefficient obtained from the calibrated hydraulic model.

3.1.3.2 West Trunk System

WT1: Lorne Park WTP to the Herridge Reservoir (Pressure Zone 1)

1500-mm diameter Pressure Zone 1 transmission main from the Lorne Park WTP to the Herridge Reservoir. The theoretical capacity of this transmission main is approximately 271 ML/d. However, the actual capacity is estimated at approximately 181 ML/d.

WT2S: Lorne Park WTP to the discharge side of the Herridge Pumping Station (Pressure Zone 2)

2100-mm diameter Pressure Zone 2 transmission main from Lorne Park WTP to the Herridge Pumping Station. The theoretical capacity of this transmission main is approximately 657 ML/d. However, the actual capacity is estimated at approximately 695 ML/d.

WT2: Herridge Pumping Station to the Streetsville Reservoir (Pressure Zone 2)

There are two transmission mains from the Herridge Pumping Station to the Streetsville Reservoir: a 1050-mm diameter transmission main and a 1500-mm diameter transmission main. The total theoretical Pressure Zone 2 west transmission capacity is approximately 378 ML/d. However, the actual capacity is estimated at approximately 330 ML/d.

WT3: Streetsville Pumping Station to the Meadowvale North Reservoir (Pressure Zone 3)

There are two transmission mains from the Streetsville Pumping Station to the Meadowvale North Reservoir: a 900-mm diameter transmission main and a 1200-mm diameter transmission main. The total theoretical Pressure Zone 3 west transmission capacity is approximately 222 ML/d. However, the actual capacity is estimated at approximately 211 ML/d.

WT4: Meadowvale North Pumping Station to the West Brampton Reservoir (Pressure Zone 4)

1500-mm diameter Pressure Zone 4 transmission main from Meadowvale North Pumping Station to the West Brampton Reservoir. The theoretical capacity of this transmission main is approximately 271 ML/d. However, the actual capacity is estimated at approximately 230 ML/d.

WT5: West Brampton Pumping Station to the Alloa Reservoir (Pressure Zone 5)

1200-mm diameter Pressure Zone 5 transmission main from West Brampton Pumping Station to the Alloa Reservoir. The theoretical capacity of this transmission main is approximately 151 ML/d. However, the actual capacity is estimated at approximately 150 ML/d.

The west transmission system is shown in **Figure 7**.

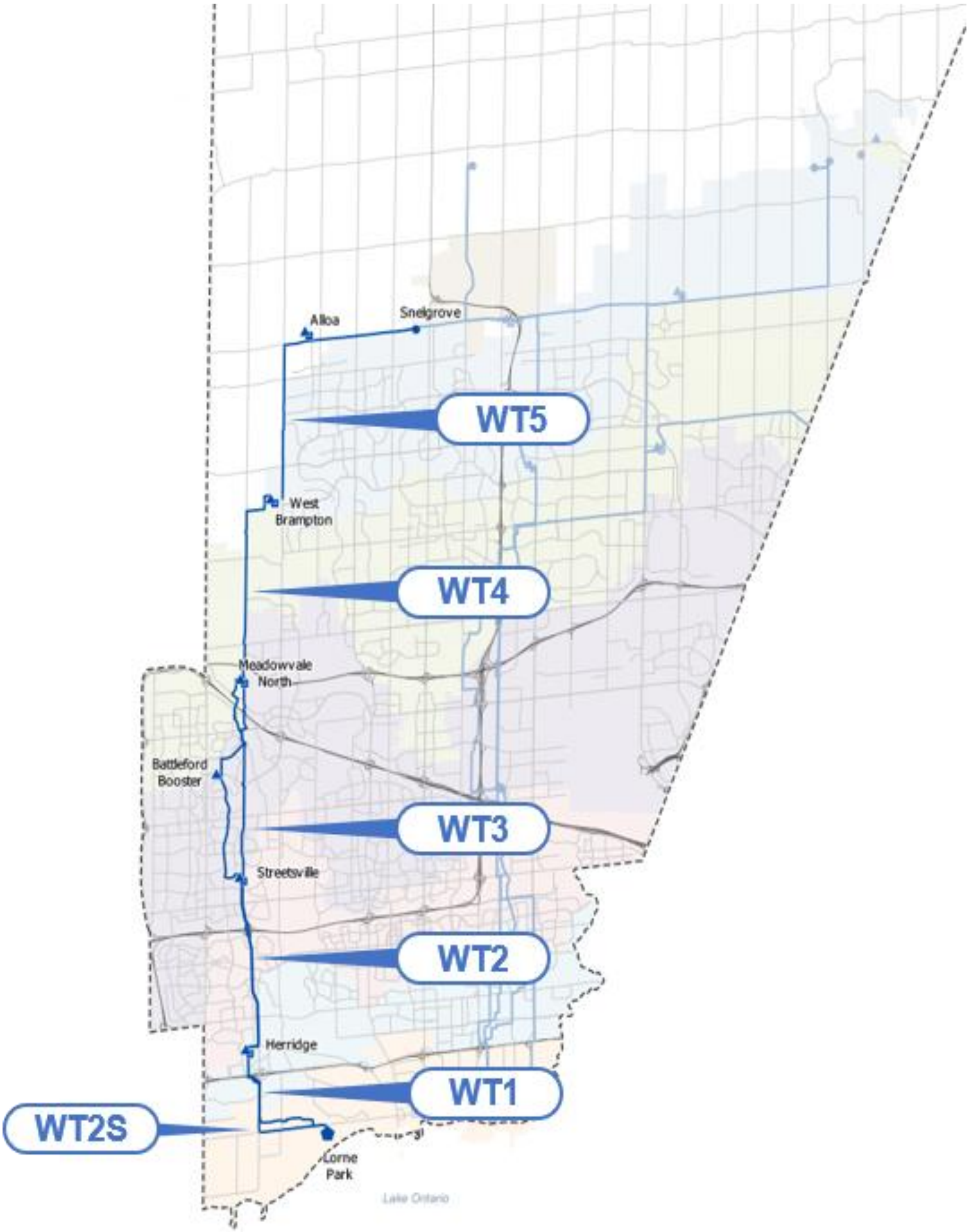


Figure 7 – West transmission system.

3.1.3.3 Central Trunk System

CT1: A.P. Kennedy WTP to the Silverthorn Reservoir (Pressure Zone 1)

There are two transmission mains from the A.P. Kennedy WTP to the Silverthorn Reservoir: a 900-mm diameter transmission main and a 1500-mm diameter transmission main. The total theoretical Pressure Zone 1 central transmission capacity is approximately 342 ML/d. However, the actual capacity is estimated at approximately 279 ML/d.

CT2: Silverthorn Pumping Station to the Hanlan Reservoir (Pressure Zone 2)

1500/1200-mm diameter Pressure Zone 2 transmission main from the Silverthorn Pumping Station to the Hanlan Reservoir. The theoretical transmission capacity of this main is approximately 151 ML/d. However, the actual capacity is estimated at approximately 136 ML/d.

CT2H: A.P. Kennedy WTP to the Hanlan Reservoir (Pressure Zone 2)

There are two transmission mains from the A.P. Kennedy WTP to the Hanlan Reservoir: a 2100-mm/1800-mm diameter transmission main and a 2400-mm diameter transmission main. The total theoretical Pressure Zone 2 central transmission capacity is approximately 1,372 ML/d. However, the actual capacity is estimated at approximately 1,311 ML/d.

CT3: Hanlan Pumping Station to the Beckett Sproule Reservoir (Pressure Zone 3)

There are three transmission mains from the Hanlan Pumping Station to the Beckett Sproule Reservoir: a 1200-mm diameter transmission main, a 1500-mm diameter transmission main a 2100-mm diameter transmission main. The total theoretical Pressure Zone 3 central transmission capacity is approximately 1,080 ML/d. However, the actual capacity is estimated at approximately 1,069 ML/d.

CT4: Beckett Sproule Pumping Station to the East Brampton Reservoir (Pressure Zone 4)

1050-mm diameter Pressure Zone 4 transmission main from the Beckett Sproule Pumping Station to the East Brampton Reservoir. The theoretical transmission capacity of this main is approximately 106 ML/d. However, the actual capacity is estimated at approximately 89 ML/d.

CT5: East Brampton Pumping Station to the North Brampton Reservoir (Pressure Zone 5)

900-mm diameter Pressure Zone 5 transmission main from the East Brampton Pumping Station to the North Brampton Reservoir. The theoretical transmission capacity of this main is approximately 71 ML/d. However, the actual capacity is estimated at 60 ML/d.

CT7: North Brampton Pumping Station to the Mayfield West Elevated Tank (Pressure Zone 7)

600-mm diameter Pressure Zone 7 transmission main from the North Brampton Pumping Station to the Mayfield West Elevated Tank. The theoretical transmission capacity of this main is approximately 24 ML/d. However, the actual capacity is estimated at 26 ML/d.

The central transmission system is shown in **Figure 8**.

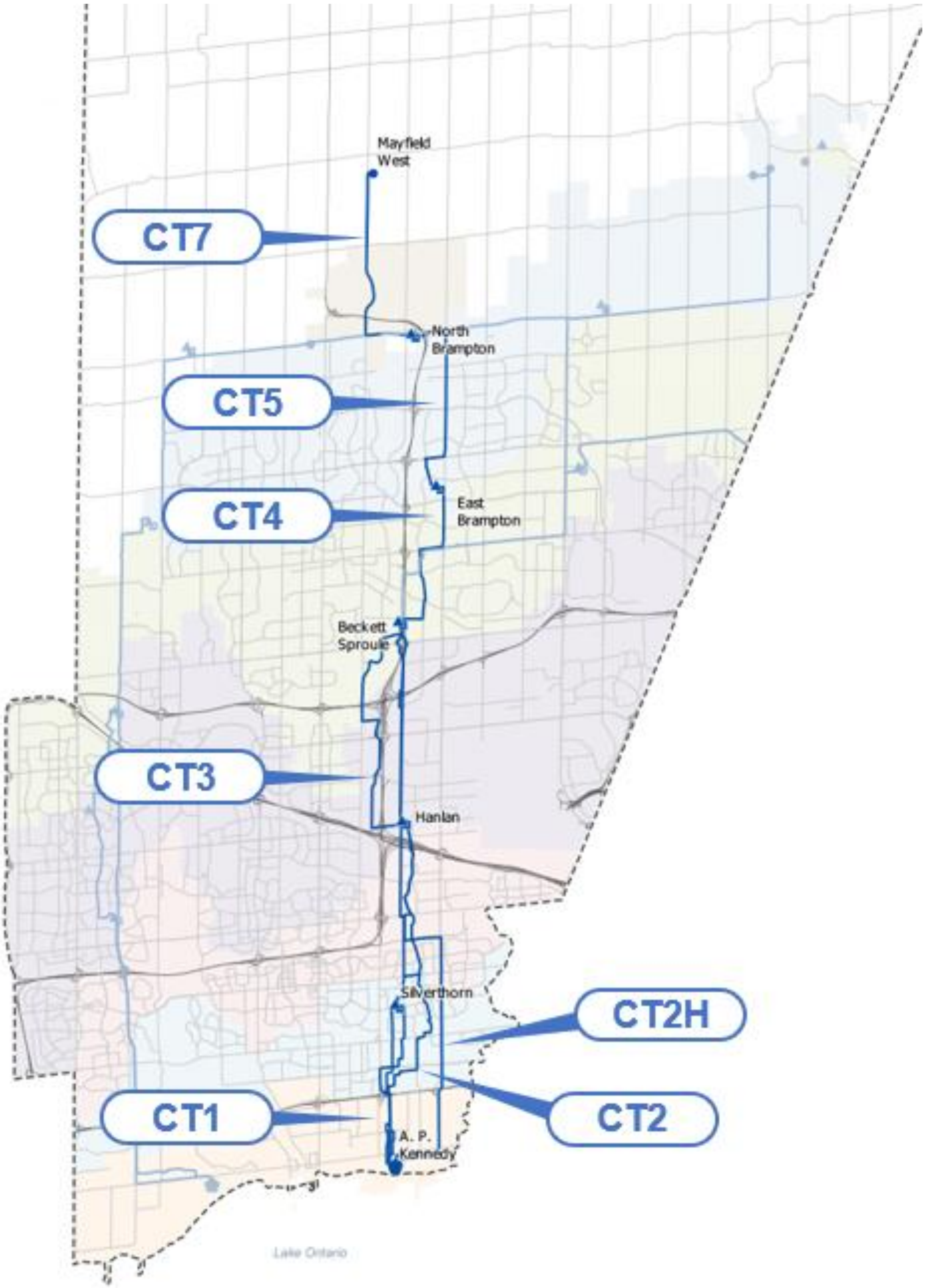


Figure 8 – Central transmission system.

3.1.3.4 East Trunk System

ET3A: Beckett Sproule Transfer Pumping Station to the Airport Road Reservoir (Airport Road Transfer)

2100-mm diameter transmission main from the Beckett Sproule Pumping Station to the Airport Road Reservoir to transfer water from the central to the east transmission system. The theoretical capacity of this transfer main is approximately 657 ML/d. However, the current actual transmission capacity is estimated at approximately 612 ML/d.

ET5Y: Airport Road Pumping Station to York Region (York Transfer)

1800-mm diameter transmission main from the Airport Road Pumping Station to the York-Peel boundary to supply water to York Region as per the York-Peel Water Supply Agreement. The theoretical capacity of this transmission main is 438 ML/d. However, the current actual transmission capacity is estimated at approximately 421 ML/d.

ET4: Airport Road Pumping Station to the Tullamore Reservoir (Pressure Zone 4)

1050-mm diameter Pressure Zone 4 transmission main from the Airport Road Pumping Station to the Tullamore Reservoir. The theoretical and actual transmission capacities of this main is approximately 106 ML/d.

BT6: Tullamore Pumping Station to the Bolton Elevated Tank (Pressure Zone 6)

750-mm diameter Pressure Zone 6 transmission main from the Tullamore Pumping Station to the Bolton Elevated Tanks. The theoretical transmission capacity of this main is approximately 44 ML/d. However, the actual capacity is estimated at 40 ML/d.

The east transmission system is shown in **Figure 9**.

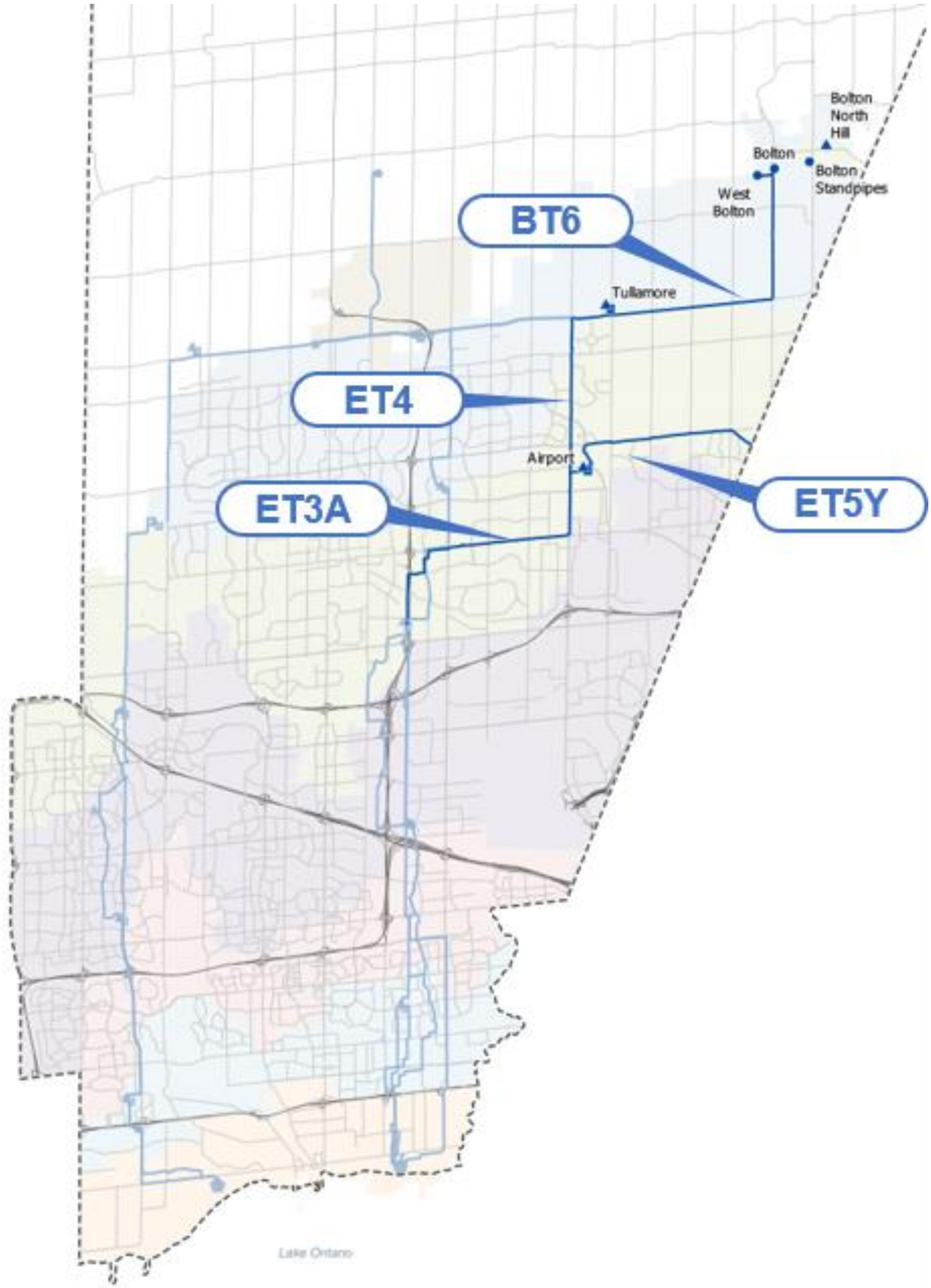


Figure 9 – East transmission system.

3.1.4 Water Pumping Stations and Reservoirs

Table 4 to **Table 7** summarize the existing pumping stations and reservoir facilities in the Region of Peel lake-based water system.

Table 4 – Lake-based water pumping stations (west transmission system).

Facility	Serviced Pressure Zone	No. of Pumps	Installed Capacity (ML/d)	Firm Capacity (ML/d)	Actual Firm Capacity* (ML/d)
Lorne Park Water Treatment Plant	LL in Plant	10	1041	900	n/a
Lorne Park Pumping Station	HLP1W	7	541	450	336
	HLP2W	2	300	150	152
Herridge Pumping Station	LLP2W	8	408	340	309
	HLP3W	4	100	68	48
Streetsville Pumping Station	LLP3W	6	379	289	250
	HLP4W	5	272	204	179
Battleford Pumping Station	4A	4	189	142	n/a
Meadowvale North Pumping Station	LLP4W	6	346	276	226
	HLP5W	6	143	116	97
West Brampton Pumping Station	LLP5W	4	90	60	40
	HLP6W	4	93	62	93
Alloa Pumping Station	LLP6W	3	126	84	80
	HLP7W	3	45	30	27

**Actual Firm Capacity generated from model runs accounts for head losses due to friction*

Table 5 – Lake-based water pumping stations (central transmission system).

Facility	Serviced Pressure Zone	No. of Pumps	Installed Capacity (ML/d)	Firm Capacity (ML/d)	Actual Firm Capacity* (ML/d)
A.P. Kennedy Water Treatment Plant	LL in Plant	11	1,681	1,494	n/a
A. P. Kennedy Pumping Station	HLP1C	5	425	335	282
	HLP2C	7	950	800	998
Silverthorn Pumping Station	LLP2C	5	495	387	192
	HLP3C	3	103	58	58
Hanlan Pumping Station	LLP3C	9	1150	1005	1024
	HLP4C	4	160	103	119
Beckett Sproule Pumping Station	LLP4C	6	390	297	195
	HLP5C	6	255	195	176
East Brampton Pumping Station	LLP5C	4	177	117	100
	HLP6C	4	205	140	109
North Brampton Pumping Station	LLP6C	4	126	90	73
	HLP7C	4	36	26	21

**Actual Firm Capacity generated from model runs accounts for head losses due to friction*

Table 6 – Lake-based water pumping stations (east transmission system).

Facility	Serviced Pressure Zone	No. of Pumps	Installed Capacity (ML/d)	Firm Capacity (ML/d)	Actual Firm Capacity* (ML/d)
Airport Road Pumping Station	York	10	458	402	n/a
	LLP4E	4	182	126	149
	HLP5E	4	180	135	131
Beckett Sproule Transfer Pumping Station	Transfer	4	408	306	2750
Tullamore Pumping Station	LLP5E	3	90	60	48
	HLP6E	4	160	120	120
Bolton North Hill Pumping Station	6B	3	14	9	n/a

**Actual Firm Capacity generated from model runs accounts for head losses due to friction*

Table 7 – Lake-based water system reservoirs.

	Facility Name	Serviced Pressure Zone	Total Reservoir Capacity (ML*)
WEST	Lorne Park Water Treatment Plant	WS1	23
	Herridge Reservoir	WS1	47
	Streetsville Reservoir	WS2	48
	Meadowvale North Reservoir	WS3	55
	West Brampton Reservoir	WS4	40
	Alloa Reservoir	WS5	35
	Snelgrove Elevated Tank	WS6	4
CENTRAL	A.P. Kennedy Water Treatment Plant	CS1	25
	Silverthorn Reservoir	CS1	46
	Hanlan Reservoir	CS2	74
	Beckett Sproule Reservoir	CS3	93
	East Brampton Reservoir	CS4	39
	North Brampton Reservoir	CS5	53
	Mayfield West Elevated Tank	CS7	9
EAST	Airport Road Reservoir	ES3	54
	Tullamore Reservoir	ES4	48
	Bolton Elevated Tanks and Standpipes	BS6	19

**ML: Million Litres*

3.2 Hydraulic Water Model

The Region of Peel's hydraulic water model includes all local distribution mains, transmission mains and water facilities. The first all-pipe hydraulic model for the Region was developed in 2003 and the model was last calibrated in 2013 by *AECOM*. The calibration of the hydraulic model was completed based on field test data and Supervisory Control and Data Acquisition (SCADA) records. The purpose of the calibration was to adjust the modelling parameters such as Hazen William C-factor and minor losses within the water facilities to ensure the modelling results were within a desirable accuracy. The following generalizes the approach applied to the model calibration:

- Updated model with the latest Geographic Information System (GIS) records.
- Conducted flow balance calculation to determine water demands and water demand patterns for model calibration period.
- Conducted demand allocation based on 2010 AquaPeel records.
- Updated model with water demand, patterns, boundary conditions (initial storage level) and pump ON/OFF sequence for model calibration.
- Adjusted modelling parameters to allow the match between observed data and model data are within the desirable accuracy.
- Performed series of internal and external workshops and meetings to ensure accuracy of model results.

Subsequent to the model calibration in 2013, an update of the hydraulic model was performed to reflect the latest infrastructure status as per GIS. The following summarizes the model update activities:

- Local Distribution Network – January 2019
- Water Demand Allocation Update (Scenario 16) – February 2019
- Future Infrastructure Update (phasing and sizing as per Master Plan study) – August 2019

3.3 Lake-based Water Supply System Schematics

The Region of Peel has developed a water supply system schematics tool for evaluating water servicing requirements including immediate pressure zone demands as well as capacity required to service subsequent pressure zones in the lake-based system.

The tool has evolved over several years and contains useful information to assess system capacities and potential constraints including schematics, tables and charts covering system components such as treatment, transmission, pumping and storage. Water schematics were developed for several planning periods including 2041 and post-2041.

The Lake-based Water Supply System Schematics are included in **Appendix 3C**.

4.0 Assessment of Future Water Infrastructure Requirements

4.1 Opportunities and Constraints

4.2 Water Demand Requirements

4.3 Assessment of Water Infrastructure

4.0 Assessment of Future Water Infrastructure Requirements

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

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

4.1 Opportunities and Constraints

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

4.1.1 Growth

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

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

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

4.1.2 Water Treatment Plants

- The A.P. Kennedy WTP is projected to provide sufficient capacity to service 2041 demands. However, the plant may require an increase in treated water storage to support growth.
- The Lorne Park WTP currently has sufficient capacity to service projected 2041 demands.

4.1.3 Transmission Mains

- Additional transmission capacity required to move water north to service upper pressure zones.
- New transmission mains will be required to transfer water to new facilities in the north such as the Victoria Reservoir and the proposed West Caledon Elevated Tank.
- Completion of the Hanlan Transmission Main from the A.P. Kennedy WTP to the Hanlan Reservoir provides the transmission capacity to support growth and meets the requirements of the York-Peel Water Supply Agreement. It has the ancillary benefit of providing for system security and flexibility.

4.1.4 Pumping Stations and Storage Facilities

- Future growth to 2041 increases pumping requirements to move water to upper zones. Additional pumping capacity requirements have been recognized for: Pressure Zone 2, Pressure Zone 5, and transfer from the Beckett Sproule Pumping Station to the Airport Road Reservoir.
- Some pumping stations have been identified with limited site capacity for additional pumps, including: Meadowvale North, East Brampton, and Airport Road.
- Water is supplied to York Region from the Airport Road Pumping Station.
- There is an opportunity to optimize east-west transfers with distribution and pumping for improved level of service and security of supply.
- Additional storage capacity may be required to service Pressure Zone 7.

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

4.2 Water Demand Requirements

Water demand requirements were developed for the system to identify existing and potential future supply deficiencies. Based on the future planning projections and approximate service area boundaries for the west, central and east systems, the maximum day demand projections for the Region's lake-based system, including York flows, are summarized below:

Table 8 – Forecasts of maximum day demands for the lake-based system (ML/d).

Service Area	2019	2021	2026	2031	2036	2041
West Transmission System	294	308	337	367	390	412
Central Transmission System	395	408	434	461	490	518
East Transmission System	73	78	94	108	120	133
Bolton	16	16	17	18	19	21
Peel Total	**779**	**810**	**883**	**954**	**1019**	**1084**
York Region (Agreement)	211	232	277	331	331	331
Peel Total including York	**989**	**1042**	**1159**	**1285**	**1350**	**1415**

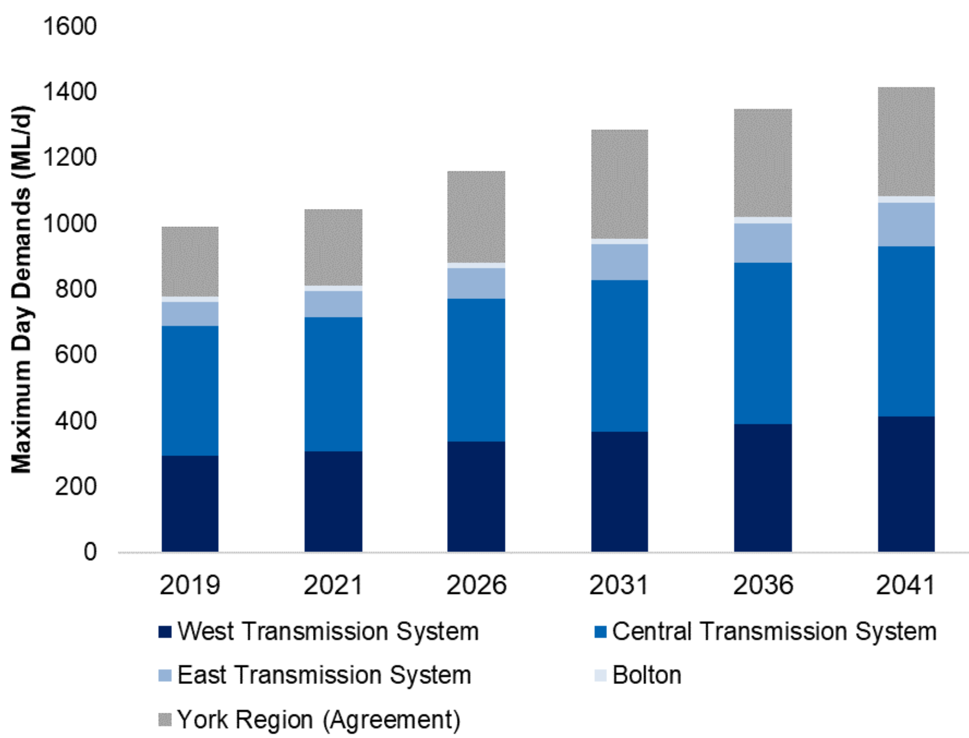


Figure 10 – Forecasts of maximum day demands for the lake-based system (ML/d).

4.3 Assessment of Water Infrastructure

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

4.3.1 Water Treatment Plants

The assessment of water treatment plants capacity indicated that the existing treatment capacity would be sufficient to meet projected growth within the planning horizon. **Table 9**, **Figure 11** and **Figure 12** summarize the projected demands for each water treatment plant based on their service area and results of the treatment capacity assessment. The table and figures below show capacity and demand by WTP service area. Although there are two WTPs and in general, two service areas (West and Central/East) that are serviced by these plants, the interconnectivity between the West and Central/East systems enables the Region to move water between the west and central/east pressure zones in order to optimize available capacity.

Table 9 – Water treatment plants assessment result summary.

Treatment Capacity Assessment	2019	2021	2026	2031	2036	2041
A.P. Kennedy WTP						
Plant Capacity* (ML/d)	1080	1080	1080	1080	1080	1080
Forecasted Demand (ML/d)	695	734	822	918	960	1003
Capacity Surplus(+) / Deficit (-) (ML/d)	**+385**	**+346**	**+258**	**+162**	**+120**	**+77**
Lorne Park WTP						
Plant Capacity* (ML/d)	450	450	450	450	450	450
Forecasted Demand (ML/d)	294	308	337	367	390	412
Capacity Surplus(+) / Deficit (-) (ML/d)	**+156**	**+142**	**+113**	**+83**	**+60**	**+38**

**90 percent of installed treatment capacity.*

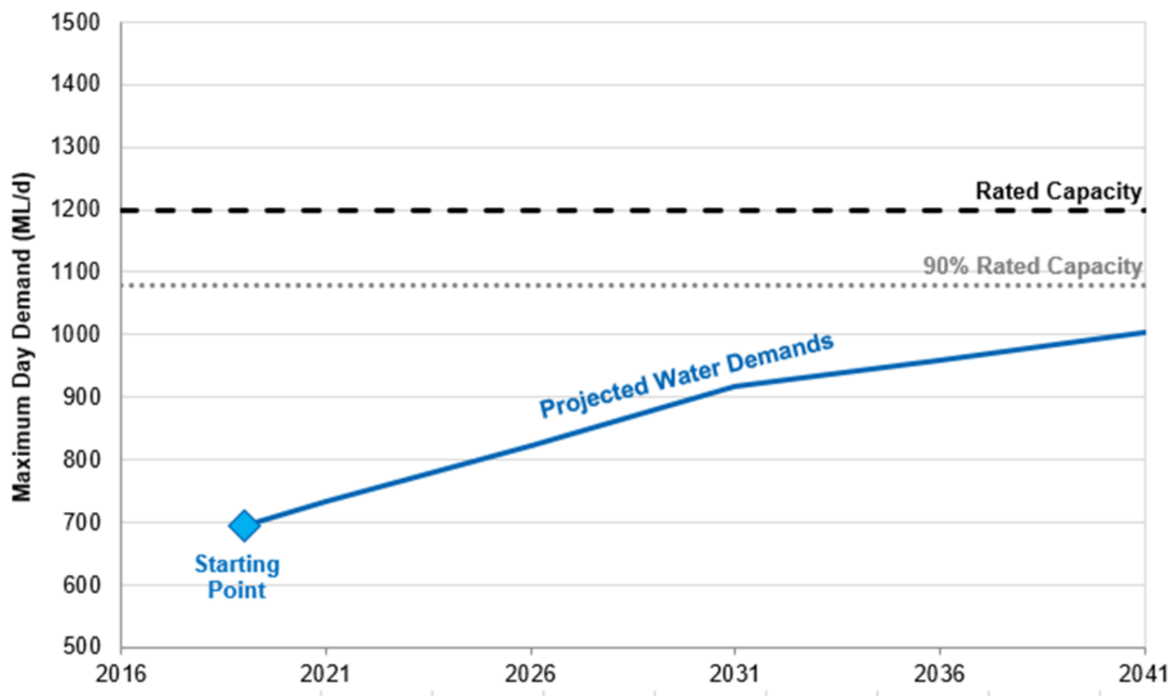


Figure 11 – Projected water demands at A.P Kennedy Water Treatment Plant.

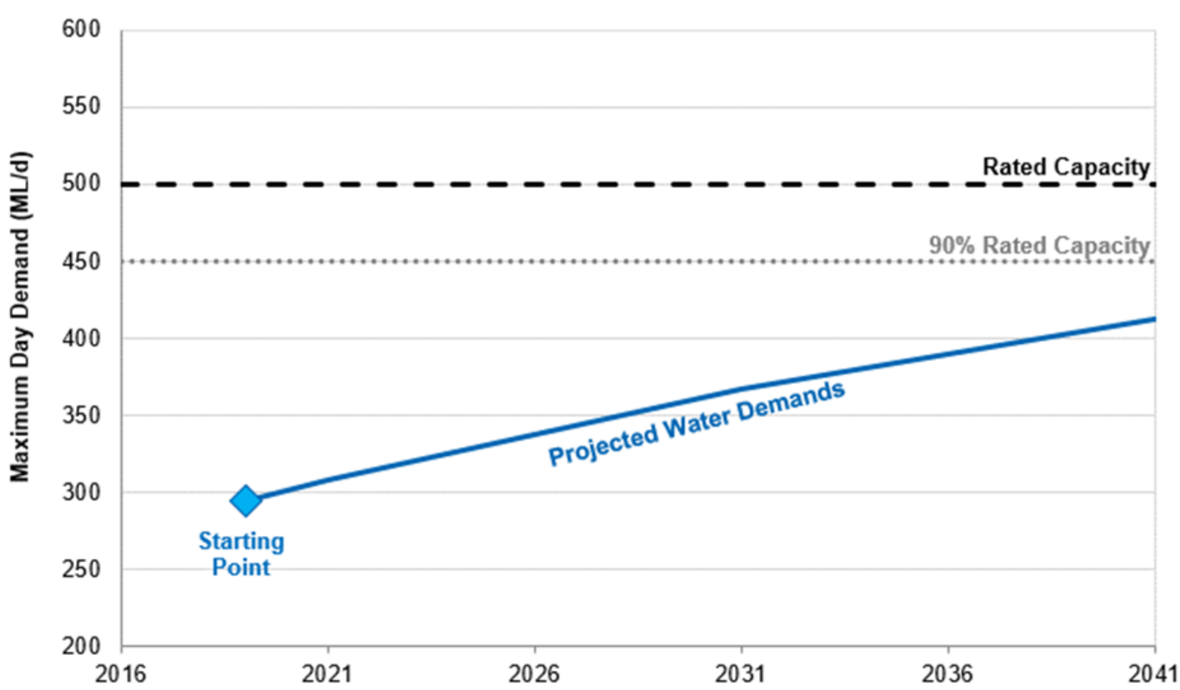


Figure 12 – Projected water demands at Lorne Park Water Treatment Plant.

For more detailed information about the water treatment plants capacity assessment, please refer to **Appendix 3D**.

4.3.2 Transmission Mains

The InfoWater hydraulic model, in combination with the water system schematics were used to evaluate the water system's transmission capacity. The assessments of transmission mains capacity involve the following considerations:

- Location of growth.
- Existing water network.
- Overall supply strategy.
- System security.
- Ability to provide water service beyond planning horizon.

The following existing transmission mains were identified as not being able to supply future demands:

WT2: Herridge Pumping Station to the Streetsville Reservoir (Pressure Zone 2)

The existing Pressure Zone 2 transmission mains from the Herridge Pumping Station to the Streetsville Reservoir will reach their capacity by 2036. Twinning of the existing transmission mains with a new 2100-mm transmission main will be required.

WT3: Streetsville Pumping Station to the Meadowvale North Reservoir (Pressure Zone 3)

The existing Pressure Zone 3 transmission mains from the Streetsville Pumping Station to the Meadowvale North Reservoir will reach their capacity by 2036. Twinning of the existing transmission mains with a new 1800-mm transmission main will be required.

CT4: Beckett Sproule Pumping Station to the East Brampton Reservoir (Pressure Zone 4)

The existing Pressure Zone 4 transmission main from the Beckett Sproule Pumping Station to the East Brampton Reservoir is at capacity. Twinning of the existing transmission main with a new 1500-mm transmission main is required.

Future new transmission mains were identified, including the need for a new transmission main from the North Brampton Pumping Station to the Victoria Reservoir and new transmission main to move water from the Alloa Pumping Station to the proposed West Caledon Elevated Tank.

Table 10 provides a summary of the existing and future transmission mains requirements. For more detailed information, please refer to **Appendix 3D**.

Table 10 – Water transmission mains assessment.

Project Description	Assessment Parameters	2019	2021	2026	2031	2036	2041
Existing Transmission Mains							
East Brampton Transmission Mains	Forecasted Demand (ML/d)	97	105	113	120	129	135
	Existing System Capacity (ML/d)	89	89	89	89	89	89
Streetsville Transmission Main	Forecasted Demand (ML/d)	241	254	282	310	330	350
	Existing System Capacity (ML/d)	330	330	330	330	330	330
Meadowvale North Transmission Mains	Forecasted Demand (ML/d)	145	151	173	195	212	228
	Existing System Capacity (ML/d)	211	211	211	211	211	211
Future Transmission Mains							
Victoria Transmission Main	Forecasted Demand (ML/d)	0	25	26	27	27	28
	Future System Capacity (ML/d)	0	71	71	71	71	71
West Caledon Transmission Main	Forecasted Demand (ML/d)	0	0	6	9	11	13
	Future System Capacity (ML/d)	0	0	0	24	24	24

4.3.3 Water Pumping Stations

Assessment of pumping capacity was based on the ability to provide the firm capacity to meet the required demands in the system. This assessment required comprehensive hydraulic analysis undertaken with the Region's water hydraulic model as well as cross checked using the water system schematics. Utilizing the system head curves developed in the hydraulic model, the actual pumping capacity for each station was identified and used to determine pumping station requirements. Based on the analysis, the following pumping deficiencies were identified:

Lorne Park Pumping Station

Expansion of the Pressure Zone 2 high-lift pumping at the Lorne Park WTP is required. The station requires additional 150 ML/d to service growth.

West Brampton Pumping Station

Expansion of Pressure Zone 5 low-lift pumping is required at the West Brampton Pumping Station. The station requires additional 90 ML/d to service growth.

Expansion of Pressure Zone 6 high-lift pumping is required at the West Brampton Pumping Station. The station requires additional 31 ML/d to service growth.

Becket Sproule Transfer Pumping Station

Additional transfer pumping capacity required at the Becket Sproule Transfer Pumping Station. The station requires two additional 102 ML/d pumps primarily to provide additional water supply for York Region.

Table 11 provides a summary of the above pumping station requirements. For more detailed information, please refer to **Appendix 3D**.

Table 11 – Water pumping stations assessment.

Project Description	Assessment Parameters	2019	2021	2026	2031	2036	2041
Lorne Park WTP Pumping Station – Z2 High-Lift	Forecasted Demand (ML/d)	166	180	210	227	250	274
	Existing System Capacity* (ML/d)	152	152	152	152	152	152
West Brampton Pumping Station - Z5 Low-Lift	Forecasted Demand (ML/d)	62	62	67	99	108	116
	Existing System Capacity* (ML/d)	74	74	74	74	74	74
Beckett Sproule Transfer Pumping Station	Forecasted Demand (ML/d)	300	325	387	457	469	484
	Existing System Capacity* (ML/d)	275	275	275	275	275	275
West Brampton Pumping Station - Z6 High-Lift	Forecasted Demand (ML/d)	52	57	77	88	99	110
	Existing System Capacity* (ML/d)	87	87	87	87	87	87

**Actual capacity determined from system head curves.*

4.3.4 Water Storage

Water storage requirements were assessed using the Water System Schematics, population projections and design criteria. Required storage is dictated by the ability to provide the required equalization storage, fire storage and emergency supply to maintain a satisfactory level of service. Based on the analysis, the following storage deficiencies were identified:

Silverthorn Reservoir

The existing Silverthorne Reservoir will require a capacity expansion to service growth to 2041. A new 25 ML reservoir cell will be required to service projected growth within the reservoir service area.

West Brampton Reservoir

The existing West Brampton Reservoir will require a capacity expansion to service growth to 2041. A new 20 ML reservoir cell will be required to service projected growth within the reservoir service area.

Future storage requirements were identified including the need for new storage to service Pressure Zone 6 Central (Victoria Reservoir) and Pressure Zone 7 West (West Caledon Elevated Tank).

Table 12 provides a summary of the existing and future storage requirements. For more detailed information, please refer to **Appendix 3D**.

Table 12 – Water storage assessment.

Project Description	Assessment Parameters	2019	2021	2026	2031	2036	2041
Existing Water Storage							
Silverthorn Reservoir	Required Capacity (ML)	31	31	43	44	46	49
	Existing Available Capacity (ML)	46	46	46	46	46	46
West Brampton Reservoir	Required Capacity (ML)	31	32	34	44	46	49
	Existing Available Capacity (ML)	40	40	40	40	40	40
Future Water Storage							
Victoria Reservoir	Required Capacity (ML)	0	0	18	19	19	19
	Future Available Capacity (ML)	0	0	40	40	40	40
West Caledon Elevated Tank	Required Capacity (ML)	0	0	0	5	6	8
	Future Available Capacity (ML)	0	0	0	10	10	10

5.0 Water Servicing Strategy

5.1 Objectives
5.2 Evaluation Process and Criteria
5.3 Servicing Strategy Development

5.0 Water Servicing Strategy

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

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

Key changes since the previous master plan include:

- Planning projections to the new 2041 planning horizon.
- Expansion of the future lake-based servicing boundary to areas north of Mayfield Road and west Bolton.
- Changes to Master Plan Evaluation Criteria, including the addition of the Innovation/Adaptation criteria.
- Increased focus on climate change considerations in the Region's decision-making and planning processes.

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

5.1 Objectives

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

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

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

5.2 Evaluation Process and Criteria

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

Servicing concepts, strategies and specific servicing solutions are subject to evaluation of six major areas of impact: technical, environmental, financial, legal/jurisdictional, socio/cultural, and innovation/adaptation. The evaluation criteria and their associated impacts are described in **Table 13.**

Table 13 – Master Plan evaluation criteria.

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

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

5.3 Servicing Strategy Development

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

The Peel Water Strategies consisted of the following:

- **System Wide Servicing Concepts** – address future water supply sources and locations to facilitate servicing of new growth
- **Focus Areas Servicing Solutions** – zone by zone review of infrastructure needs and strategies to address growth within the given pressure zone as well as support growth in the downstream service areas.

5.3.1 System Wide Servicing Concepts

A list of servicing concepts to address existing and future servicing issues was considered at a high level, weighing the advantages and disadvantages of each concept. The initial, strategic concepts were evaluated simplistically, with advantages and disadvantages listed. Based on the evaluation, concepts were either screened out or carried forward in combination for further evaluation. The concepts evaluated are listed below along with the description and detailed evaluation of these concepts can be found in **Appendix 3E.**

Table 14 – Water system wide servicing concepts.

Concept	Carried Forward / Screened Out
Do Nothing	Screened Out ✘
Limit Growth	Screened Out ✘
Build Off Planned 2031 Infrastructure	Carried Forward ✓
Construct New Stream-Based or Groundwater-Based WTP	Carried Forward ✓
Construct New WTP on Shoreline of Lake Ontario	Screened Out ✘
Water Conservation Practices	Carried Forward ✓

5.3.2 System Wide Servicing Strategies Evaluation

Combinations of the concepts carried forward formed various strategies that are generally considered complete system-wide solutions. The descriptions of the strategies are relatively detailed and thus offer greater scope for more detailed evaluation. At this stage, each strategy is subjected to evaluation against the 2020 Master Plan Evaluation Criteria.

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

Strategy 1 – Build off Planned 2031 Infrastructure

- The most recent Water and Wastewater Master Plan was completed in 2013, which recommended a servicing strategy and capital program to meet growth to the 2031 planning horizon. The Region has implemented several of the master plan recommended projects since that time to service growth. This strategy builds off the historically planned 2031 infrastructure by further expanding transmission, storage and pumping to support development of upper zones where growth is projected to continue.
- Increase connectivity within the transmission and distribution systems.
- Continue to implement the Region's water efficiency strategy and conservation program.

Strategy 2 – New Stream-Based Water Treatment Plant

- Modified version of the planned 20431 infrastructure with less expansion of transmission, storage and pumping to support development of upper zones.
- Construct a new stream-based water treatment plant to service growth in the upper pressure zones.
- Provide supply to upper pressure zones from the new stream-based water treatment plant.
- Increase connectivity within the transmission and distribution systems.
- Continue to implement the Region's water efficiency strategy and conservation program.

Strategy 3 – New Groundwater-Based Water Treatment Plant

- Modified version of the planned 2031 infrastructure with less expansion of transmission, storage and pumping to support development of upper zones.
- Construct a new groundwater-based water treatment plant to service growth in the upper pressure zones.
- Provide supply to upper pressure zones from the new groundwater-based water treatment plant.
- Increase connectivity within the transmission and distribution systems.
- Continue to implement the Region's water efficiency strategy and conservation program.

The results of the strategy evaluation show that Strategy 2 and 3, shown schematically in **Figure 14** and **Figure 15,** respectively were screened out and Strategy 1, shown in **Figure 13** was carried forward. The evaluation of the system-wide servicing strategies is presented in **Appendix 3E**.

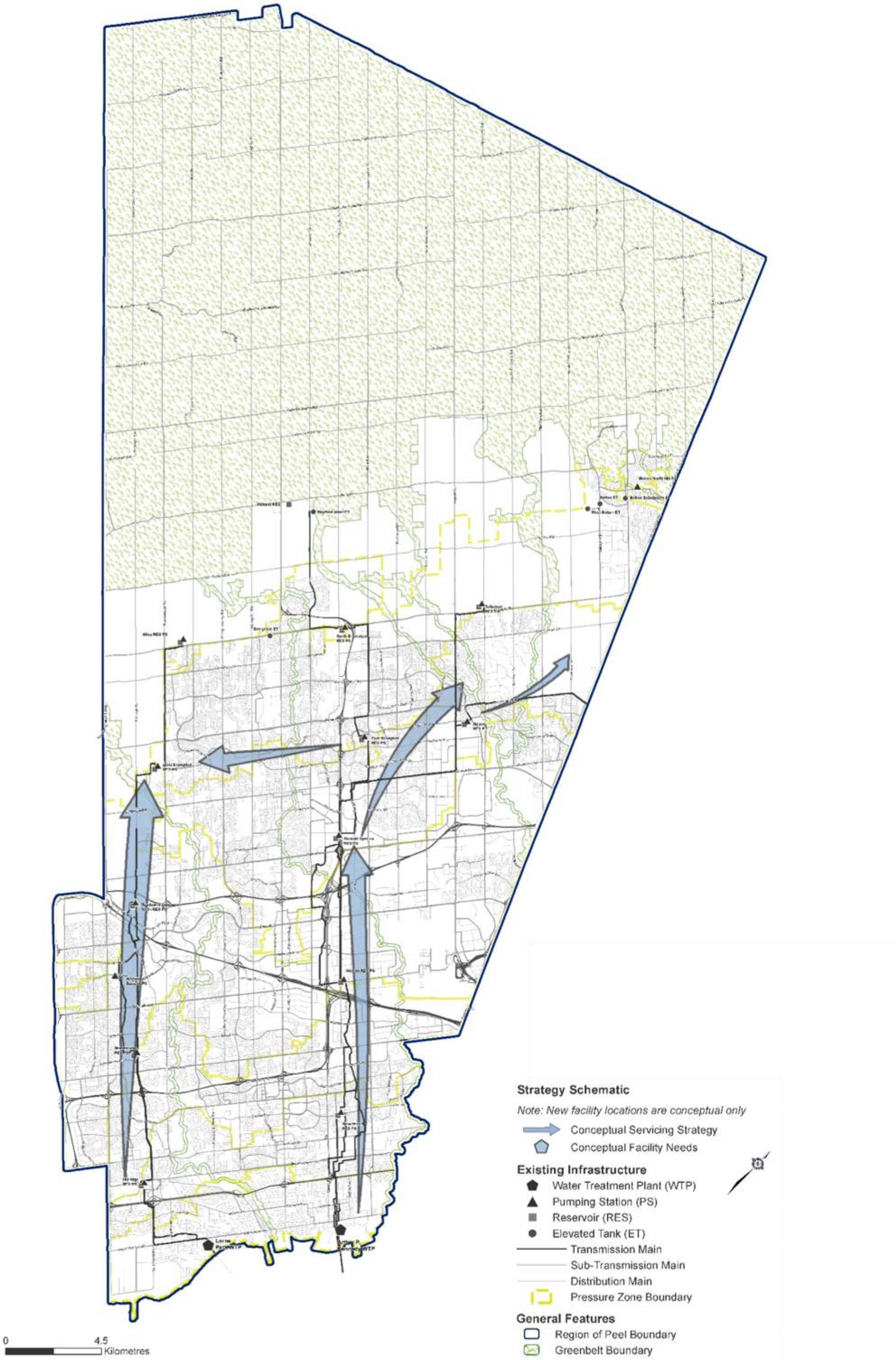


Figure 13 – System wide servicing strategy 1 - Build off planned 2031 infrastructure.

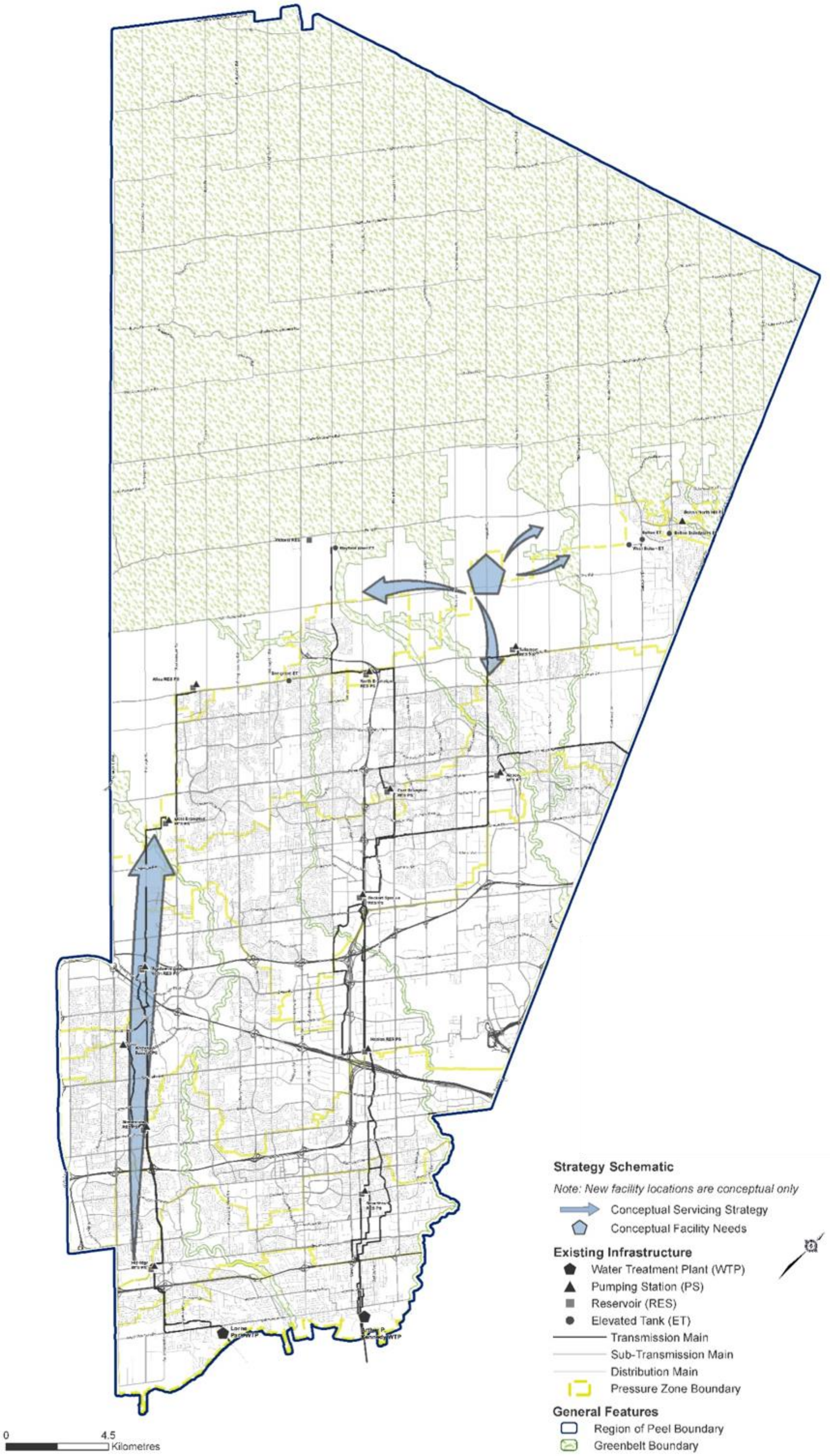


Figure 14 – System wide servicing strategy 2 - New stream-based water treatment plant.

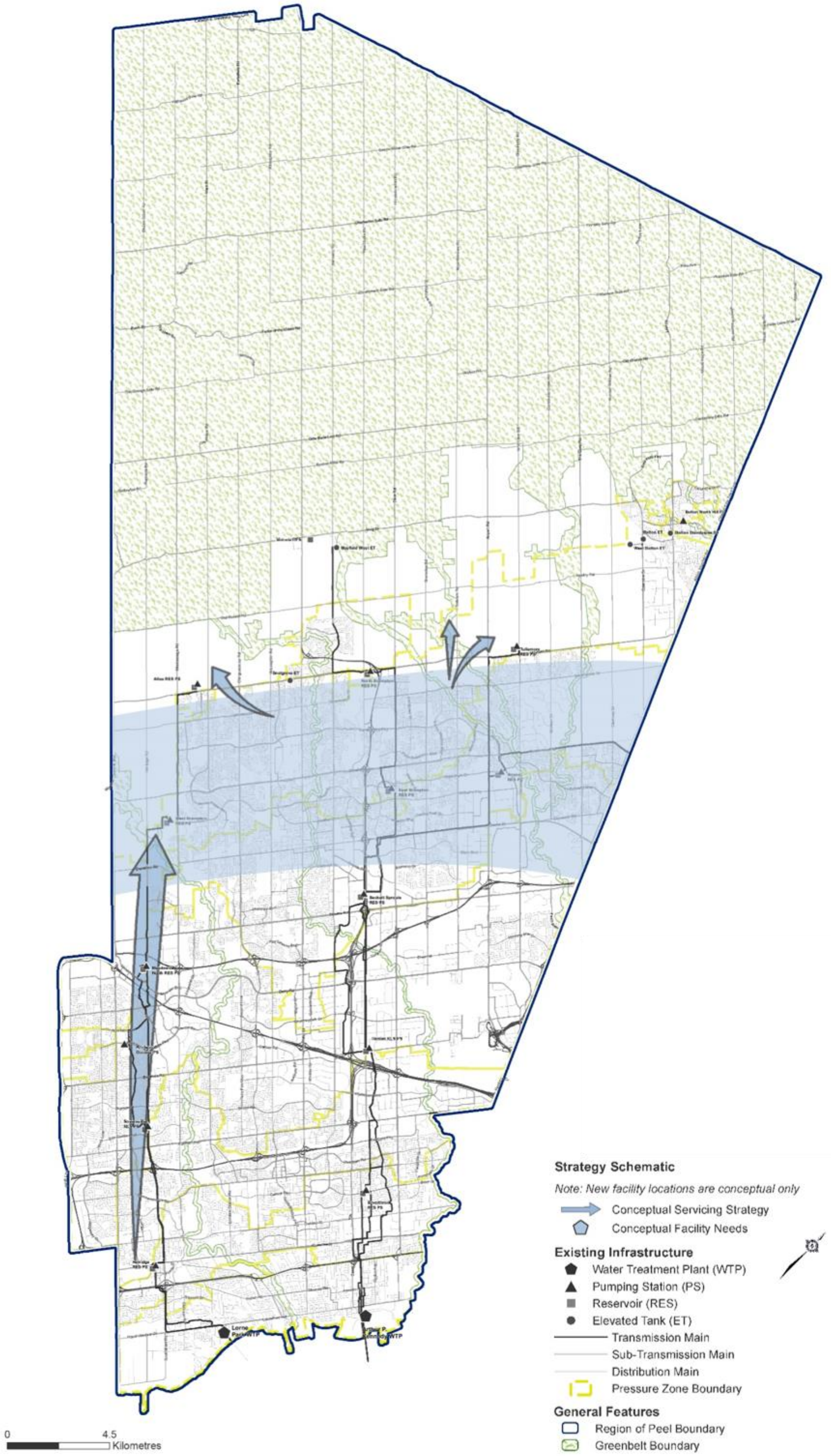


Figure 15 – System wide servicing strategy 3 - New groundwater-based water treatment plant.

5.3.3 Focus Area Servicing Solutions

The lake-based water system is a complex system with multiple components. In addition to the System Wide Servicing Strategy outlined above, the 2020 Master Plan outlines servicing solutions in focus areas where key components of the system are reviewed, and the optimal servicing solutions are identified and presented. Collectively, the System Wide and Focus Area Servicing Solutions combine to form the overall water servicing strategy for the Region of Peel. The following sections summarize key aspects of the water servicing solutions for treatment and each pressure zone in the lake-based system. Additional information is provided in **Appendix 3E**.

5.3.3.1 Treatment

The Region of Peel water treatment plants (WTP) are anticipated to have enough capacity to meet the projected water demands for the Region up to 2041. Therefore, expansion of the treatment capacity at the current facilities has not been identified as part of the preferred water servicing strategy. However, the following treatment upgrade components are incorporated in the servicing strategy:

A.P. Kennedy WTP – New Intake

Currently, a single 2550-mm intake pipe installed in 1991 is providing water from Lake Ontario to the A.P. Kennedy WTP. A new intake pipe and structure at the plant is identified as being required by the end of the planning period (2041). It is anticipated that this project will require the completion of a Schedule C Class Environmental Assessment prior to proceeding with design and implementation.

A.P. Kennedy WTP – Standby Power

Additional standby power has been installed at the existing A.P. Kennedy WTP. The plant is equipped with the standby power units that provide a total energy of 12MW for treatment, base loads and high-lift pumping to the system. For more details, see **Appendix 3F** for standby power report.

A. P. Kennedy WTP – Waste Building Expansion

It is anticipated that this project will require the completion of a Schedule C Class Environmental Assessment prior to proceeding with design and implementation.

A.P. Kennedy WTP – Reservoir Expansion

Both the A.P. Kennedy WTP and the Lorne Park WTP have treated water reservoirs with a capacity of 23 million litres (ML). The Lorne Park WTP reservoir has a capacity to provide 1.3 hours of storage time by 2041 during system-wide maximum day demands. Under the same conditions, the A.P. Kennedy WTP reservoir provides 0.5 hours of storage time. The storage volumes and time are shown in **Table 15**.

The 2020 Master Plan has identified a reservoir expansion of 35 ML at the A.P. Kennedy WTP for the plant to be able to provide a similar level of service as the Lorne Park WTP of 1.3 hours of storage time by 2041 during system-wide maximum day demands. Due to the complexity of this project, it is anticipated that a completion of a Schedule C Class Environmental Assessment will be required prior to proceeding with design and implementation.

Table 15 – Water treated capacity and storage time.

WTP	Service Area	Reservoir Capacity	2041 Maximum Day Demands	2041 Storage Time
Lorne Park	West Zones MDD	23 ML (existing)	436	1.3 hours
A.P. Kennedy	East/Central/York MDD		1,053	
		23 ML (existing)		0.5 hours
		23 ML (existing) + 35 ML (proposed)		1.3 hours

5.3.3.2 Pressure Zone 1

Pressure Zone 1 has projected adequate storage and pumping capacity to 2041. The servicing solutions for this area are centered around increasing connectivity of the distribution system to support projected growth within the pressure zone, including areas such as Inspiration Lakeview, Port Credit Mobility Hub, West Village and Clarkson GO. Pressure Zone 1 is shown in **Figure 16**.

Distribution

Although the focus of the 2020 Master Plan is on the water transmission system, some key distribution projects are considered within this pressure zone such as the Lakeshore Water Distribution Main from the A.P. Kennedy WTP to the Lorne Park WTP.

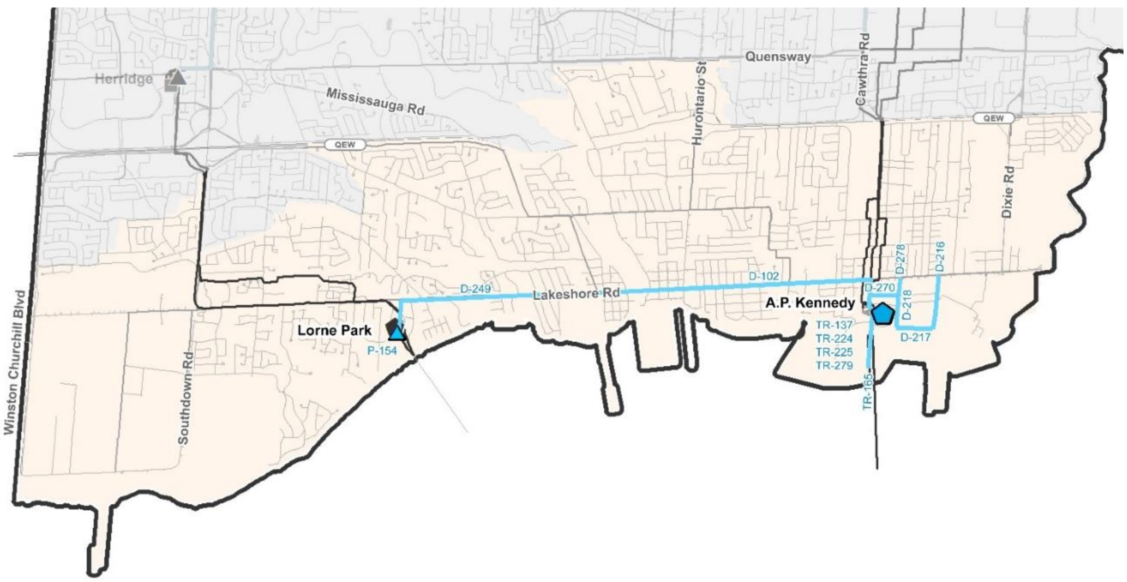


Figure 16 – Pressure Zone 1.

5.3.3.3 Pressure Zone 2

The servicing solutions for Pressure Zone 2 mainly consist of increasing transmission and pumping capacity to move water to the upper pressure zones, supporting growth within intensification areas such as Dundas Connect. Additionally, the solutions support the Queensway Zone 1 / Zone 2 switchover and connection to the Silverthorn Pumping Station. Pressure Zone 2 is shown in **Figure 17**.

Key projects required to achieve the proposed solutions include:

Streetsvillle Transmission Main

Construction of a new transmission main from the Herridge Pumping Station to the Streetsville Reservoir.

Queensway Sub-Transmission Main Extension

Construction of a sub-transmission main on Bloor Street and Cawthra Road from the Silverthorn Pumping Station to The Queensway East.

It is anticipated that the Streetsville Transmission Main and the Queensway Sub-Transmission Main will require the completion of Schedule C and Schedule B Class Environmental Assessments, respectively prior to proceeding with design and implementation; therefore, for the purposes of the Master Plan, detailed options for other alternative routes / alignments were not further explored.

Lorne Park Pumping Station Capacity Expansion

Installation of additional high-lift pumping capacity at the Lorne Park WTP to service development in west Peel will be required. No building expansion is required to increase the pumping capacity and therefore the project can proceed directly to implementation (Schedule A).

Silverthorn Reservoir and Pumping Station Expansion

Construction of major improvements and upgrades at the Silverthorn Reservoir and Pumping Station, including a new 25-ML reservoir cell and pumping equipment improvements to improve hydraulic performance and efficiency for Pressure Zone 2. The proposed upgrades and expansion were subjected to a Schedule B Class Environmental Assessment in 2018[3].

Distribution

Although the focus of the 2020 Master Plan is on the water transmission system, some key distribution projects considered in this pressure zone include the distribution mains along Dundas Street East from Dixie Road to Confederation Parkway.

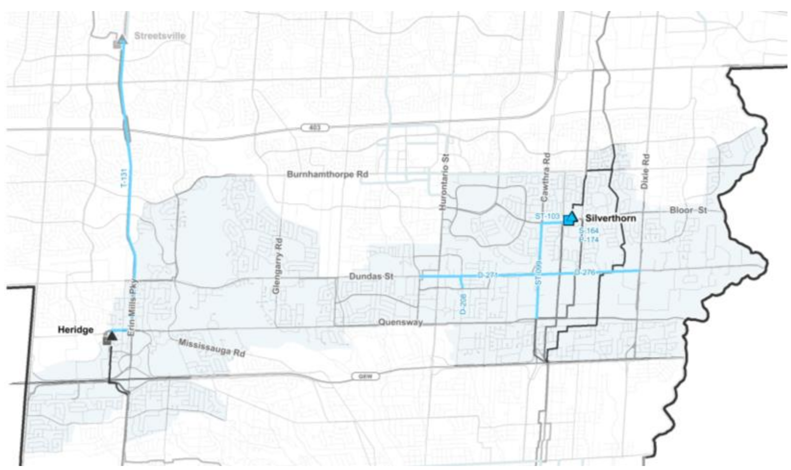


Figure 17 – Pressure Zone 2.

5.3.3.4 Pressure Zone 3

The servicing solutions for Pressure Zone 3 mainly consist of increasing transmission and pumping capacity to move water to the upper pressure zones and support growth within intensification areas such as the Mississauga City Centre and the Hurontario Corridor. Pressure Zone 3 is shown in **Figure 18**.

Key projects required to achieve the proposed solutions include:

Meadowvale North Transmission Main

Construction of a new transmission main from the Streetsville Pumping Station to the Meadowvale North Reservoir. This project will require the completion of a Schedule C Class Environmental Assessment prior to proceeding with design and implementation, and therefore for the purposes of the Master Plan detailed options for other alternative routes/alignments were not further explored.

Burnhamthorpe Road Sub-Transmission Main

Construction of a new sub-transmission main on Burnhamthorpe Road from Cawthra Road to Grand Park Drive. The proposed sub-transmission main was subjected to a Schedule B Class Environmental Assessment in 2015[4]. The EA confirmed the preferred alternative for the Burnhamthorpe watermain including size, material, alignment and construction method.

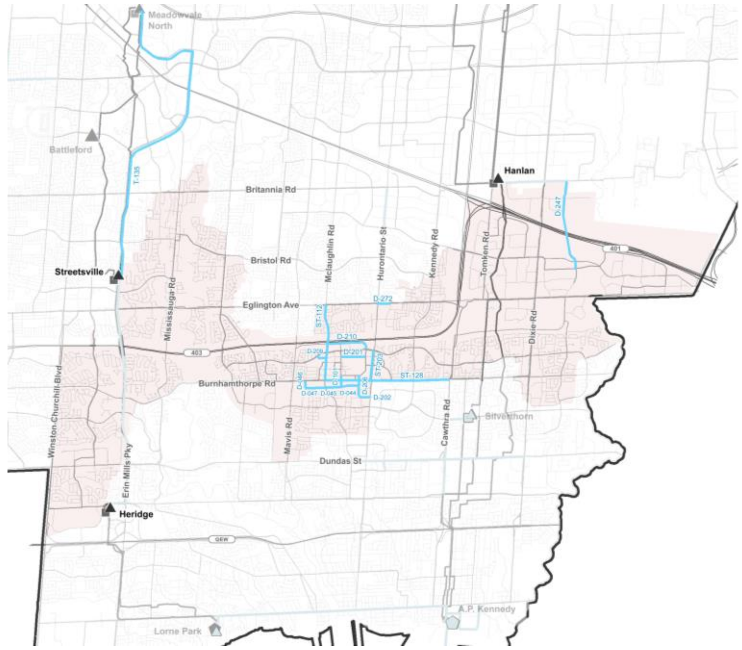


Figure 18 – Pressure Zone 3.

Confederation Parkway Sub-Transmission Main

Construction of a new sub-transmission main on Confederation Parkway from Burnhamthorpe Road West to Eglinton Avenue West to service future growth in the Mississauga City Centre. This project is anticipated to require the completion of a Schedule B Class Environmental Assessment prior to proceeding with design and implementation, and therefore for the purposes of the Master Plan detailed options for other alternative routes/ alignments were not further explored.

Beckett Sproule Transfer Pumping Station Capacity Expansion

Installation of additional transfer pumping capacity at the Beckett Sproule Pumping Station. No building expansions are required to increase the capacity at Beckett Sproule, therefore it can proceed directly to implementation (Schedule A).

Distribution

Although the focus of the 2020 Master Plan is on the water transmission system, some key distribution projects are considered in this pressure zone such as distributions mains in the Mississauga City Centre.

5.3.3.5 Pressure Zone 4

Pressure Zone 4 has projected adequate pumping capacity to 2041. The servicing solutions for Pressure Zone 4 consist mainly of improving the feed to the East Brampton Reservoir and expansion of the West Brampton Reservoir. Pressure Zone 4 is shown in **Figure 19**.

Key projects required to achieve the proposed solutions include:

East Brampton Transmission Main Twinning

Construction of a new transmission main from the Beckett Sproule Pumping Station to East Brampton Reservoir. The proposed transmission main was subjected to a Schedule C Class Environmental Assessment in 2014[5]. The EA confirmed the preferred alternative for the transmission main including size, material, alignment as well as construction methods and mitigation measures.

West Brampton Reservoir Expansion

Expansion of the West Brampton Reservoir with the construction of a third 20-ML reservoir cell to service future development in the Bram West, Huttonville North and Mount Pleasant West secondary plan areas.

Distribution

Although the focus of the Master Plan is on the water transmission system, some key distribution projects are considered in this pressure zone such as distribution mains along Hurontario Street and Queen Street East, among others.

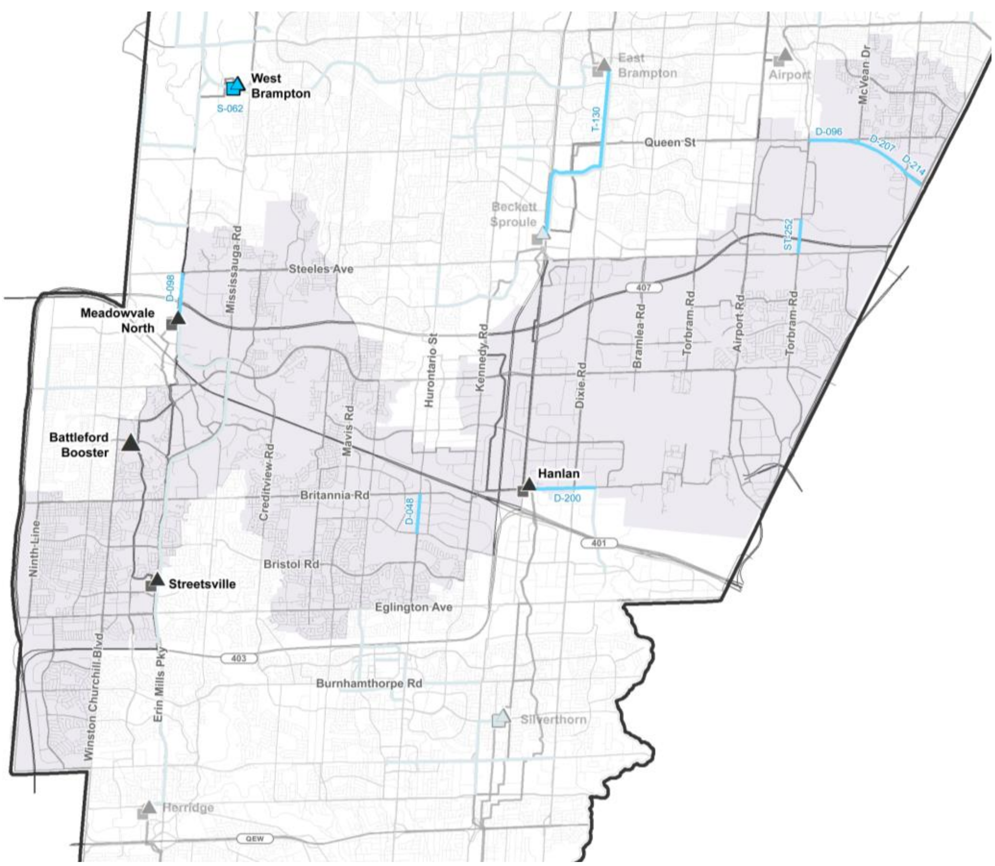


Figure 19 – Pressure Zone 4

5.3.3.6 Pressure Zone 5

The servicing solutions for Pressure Zone 5 consist of extending servicing for future greenfield growth and into the Uptown Brampton growth node, improving connectivity across Pressure Zone 5, and supporting intensification in areas such as Downtown Brampton. Another key aspect of the servicing solution for this pressure zone is the absence of storage facility for Zone 5 East. Equalization, fire and emergency storage for this pressure zone are provided by pumping from Tullamore and Airport pumping stations. Pressure Zone 5 is shown in **Figure 20**.

Key projects required to achieve the proposed solutions in Pressure Zone 5 include:

Central Brampton Sub-Transmission Main

Construction of a new sub-transmission main from the Beckett Sproule Pumping Station to the East Brampton Pumping Station. The proposed sub-transmission main was subjected to a Schedule C Class Environmental Assessment in 2014[5]. The EA confirmed the preferred alternative for the sub-transmission main including size, material, alignment as well as construction methods and mitigation measures.

Williams Parkway Sub-Transmission Main

Construction of a new sub-transmission main on Williams Parkway from the West Brampton Pumping Station to Dixie Road. The proposed sub-transmission main was subjected to a Schedule C Class Environmental Assessment in 2013[6]. The EA confirmed the preferred alternative for the sub-transmission main including size, material, alignment as well as construction method. Due to the overall water main distance, during the Class EA study it was anticipated that the Williams Parkway sub-transmission main will be constructed in phases

Four key sub-transmission projects, required to achieve the proposed solution and that have been identified as Schedule A+ are as follows:

Countryside Drive Sub-Transmission Main

Construction of a new sub-transmission main on Countryside Drive from The Gore Road to Clarkway Drive to service future development in the Highway 427 Industrial Secondary Plan.

Centre Street Sub-Transmission Main

Construction of a new sub-transmission main on Centre Street from Williams Parkway to John Street to service future development in central Brampton.

Goreway Drive Sub-Transmission Main

Construction of a new sub-transmission main on Goreway Drive from Castlemore Road to Countryside Drive to service future development in the Highway 427 Industrial Secondary Plan.

Mayfield Road Sub-Transmission Main

Construction of a new sub-transmission main on Mayfield Road from Innis Lake Road to the North Brampton Reservoir to service future development in northeast Brampton.

West Brampton Pumping Station - Capacity Expansion

Installation of additional low-lift pumping capacity at the West Brampton Pumping Station. No building expansion is required to increase the pumping capacity and therefore the project can proceed directly to implementation (Schedule A).

Distribution

Although the focus of the 2020 Master Plan is on the water transmission system, several distribution projects are included in the Master Plan to support the servicing solutions within Pressure Zone 5. Most of the distribution projects are in growth areas such as Highway 427 Industrial Secondary Plan, Bram West, Uptown Brampton and Brampton Downtown, among others.

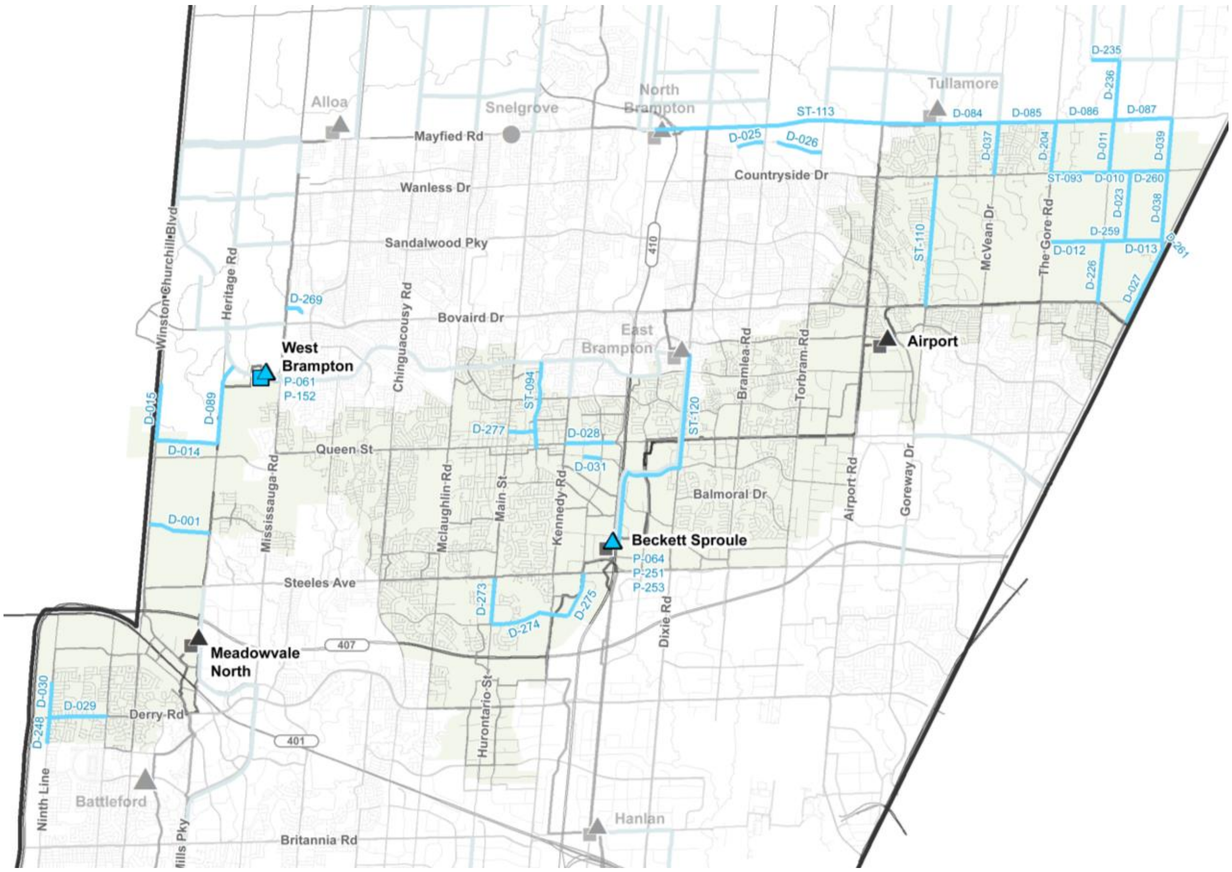


Figure 20 – Pressure Zone 5.

5.3.3.7 Pressure Zone 6

The servicing solutions for Pressure Zone 6 consist of extending servicing into northwest Brampton, adding a secondary feed to west Bolton and providing floating storage with the new Victoria Reservoir. Pressure Zone 6 is shown in **Figure 21**.

Key projects required to achieve the proposed solutions in Pressure Zone 6 include:

West Brampton Pumping Station Capacity Expansion
Installation of additional high-lift pumping capacity at the West Brampton Pumping Station. No building expansion is required to increase the pumping capacity and therefore the project can proceed directly to implementation (Schedule A).

Victoria Reservoir
Construction of a new 40-ML reservoir in the vicinity of King Street and Hurontario Street to provide storage for Pressure Zone 6.

Victoria Transmission and Sub-Transmission Mains
Construction of a new transmission main and a new sub-transmission main from the North Brampton Pumping Station to the Victoria Reservoir

The Victoria Reservoir and associated transmission and sub-transmission mains were subjected to a Schedule C Class Environmental Assessment in 2011[7]. The EA confirmed the preferred storage facility location as well as the preferred route for the water mains including size, material, alignment as well as construction methods and mitigation measures.

Key sub-transmission projects, required to achieve the proposed solution and that have been identified as Schedule A+ are as follows:

Bovaird Drive West Sub-Transmission Main
Construction of a new sub-transmission main on Bovaird Drive West from Mississauga Road to Heritage Road to service future development in the Heritage Heights Secondary Plan.

Mayfield Road Sub-Transmission Main
Construction of a new sub-transmission main on Mayfield Road from Heritage Road to Mississauga Road to service future development in the Mount Pleasant West Secondary Plan.

Heritage Road (North) Sub-Transmission Main
Construction of a new sub-transmission main on Heritage Road from Wanless Drive to Mayfield Road to service future development in the Mount Pleasant West Secondary Plan.

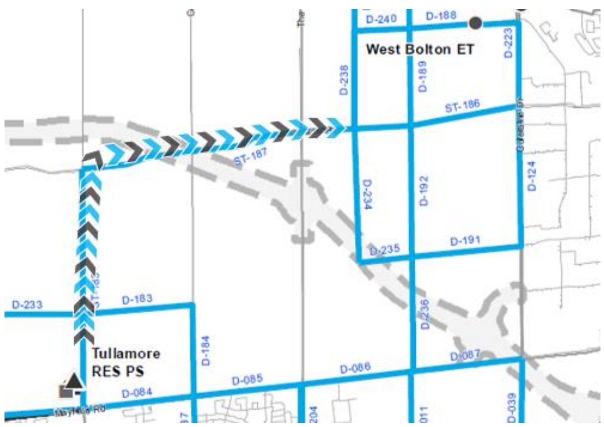
Heritage Road Sub-Transmission Main
Construction of a new sub-transmission main on Heritage Road from the West Brampton Pumping Station to Bovaird Drive to service future development in the Heritage Heights Secondary Plan.

Distribution
Although the focus of the 2020 Master Plan is on the water transmission system, several distribution projects are included in the Master Plan to extend servicing to growth areas such as northwest and northeast Brampton, Tullamore Industrial area and West Bolton.

A key element of the Pressure Zone 6 servicing solution is the need for a secondary feed to west Bolton. The secondary feed to west Bolton is triggered by additional growth in the area identified to 2041.

As part of the 2020 Master Plan two alignment options shown below were considered and further investigated:

Option 1: New Sub-Transmission main along Innis Lake Road and Healy Road

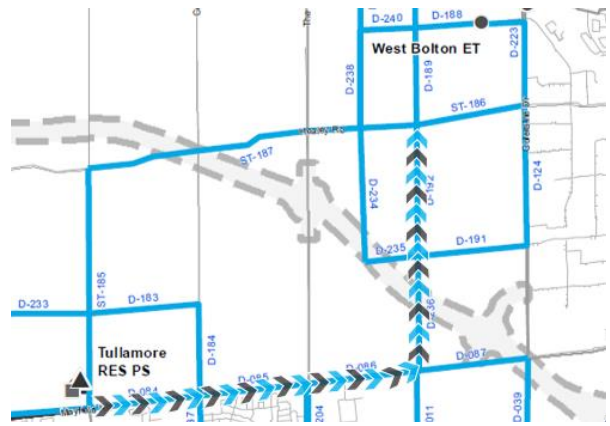


Key Considerations:

- Sub-transmission strategically oversized to support zone 6 post-2041 growth Less potential for traffic and noise disruption
- Lower potential for conflict with existing infrastructure

Carried Forward ✓

Option 2: New Sub-Transmission main along Mayfield Road and Humber Station Road.



Key Considerations:

- Less opportunity to support post-2041 growth due to location and size
- Does not avoid introducing new infrastructure as a new sub-transmission main will be required to connect to future Zone 7 storage
- Higher potential for traffic and noise disruption due to alignment along busier roads

Screened Out ✗

More details on the evaluation of these two options can be found in **Appendix 3E**.

The proposed secondary feed to west Bolton along Innis Lake Road and Healy Road will require the completion of a Schedule B Class Environmental Assessment prior to proceeding with design and implementation. Through the EA process other alignments and options could be evaluated and consideration for size, material, construction methods and mitigation measures should be made.

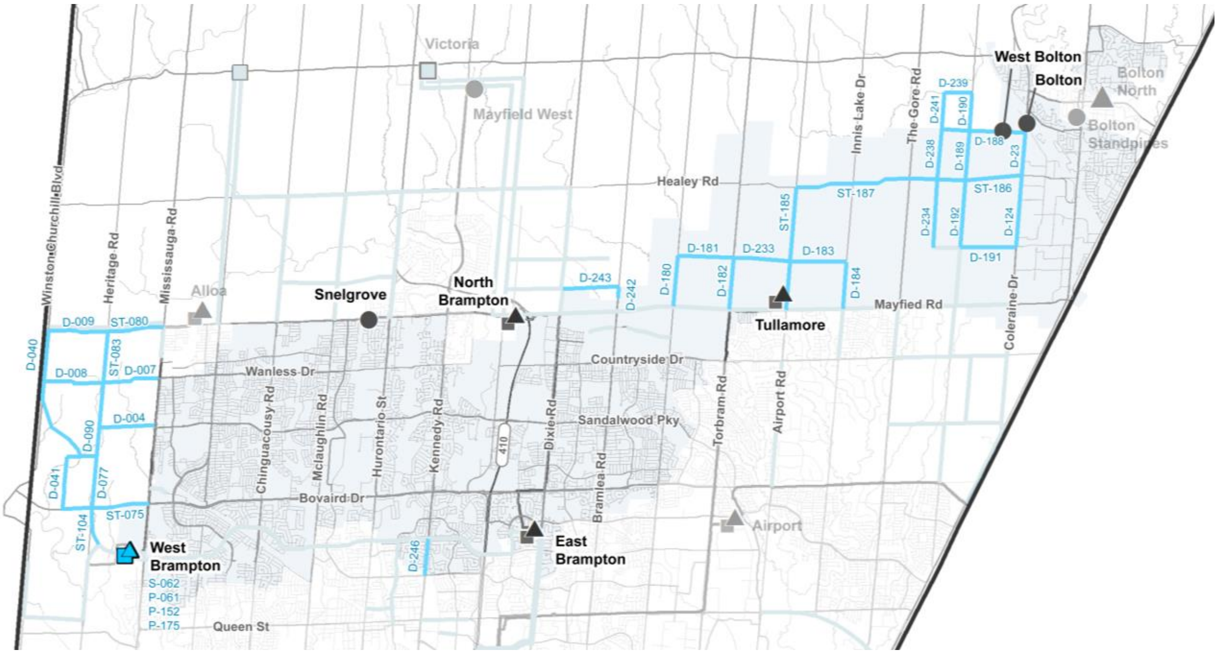


Figure 21 – Pressure Zone 6.

5.3.3.8 Pressure Zone 7

The servicing solutions for Pressure Zone 7 consist of extending servicing to support growth in areas north of Mayfield Road and providing pumped storage until the new Pressure Zone 7 storage is commissioned. Key growth areas in this pressure zone include the Mayfield West developments and the Tullamore Industrial Area. Pressure Zone 7 is shown in **Figure 22**.

A key element of the Pressure Zone 7 servicing solution is the need for storage. This storage requirement is triggered by additional growth to 2041 identified within Pressure Zone 7. As part of the 2020 Master Plan the following storage options were considered and further investigated:

Option 1: New Elevated Tank	Option 2: New In-ground Reservoir
Key Considerations: – Construction in Greenbelt Area, potential to impact environmentally sensitive and protected areas. Less impact than option 2 due to potential location further south. – Potential impact to surrounding prime agricultural areas – Lower impact to groundwater and Source Water Protection than option 2. – Requires new transmission and sub-transmission mains. – Elevated tanks are not typically expanded and constructing new facilities is required to provide additional storage. – Greater impact on visual aesthetics than option 2.	Key Considerations: – Significant construction in greenbelt area, potential to impact environmentally sensitive and protected areas. Higher impact than option 1 due to potential location further north. – Potential impact to surrounding prime agricultural areas – Greater impact to groundwater and source water protection than option 1. – Requires new longer transmission and sub-transmission mains than option 1. – Inground reservoirs can be interconnected for potential expansion if required. – Less impact on visual aesthetics than option 1.
Carried Forward ✓	**Carried Forward** ✓

The proposed storage options, and associated transmission and sub-transmission mains will require the completion of a Schedule C Class Environmental Assessment prior to proceeding with design and implementation. As such, both options for new storage in Zone 7 are considered to be viable and are carried forward at this time. For the purposes of the Mater Plan Capital Program, a cost for the Option 1 – New Elevated Tank was carried. Both options will be reviewed through the EA process. Options for Pressure Zone 7 storage as well as water main alignments should be evaluated with due considerations for location, property requirements, size, material, construction methods, mitigation measures, among others should be made.

Distribution

Although the focus of the Master Plan is on the water transmission system, several distribution projects are included in the Master Plan to support new Greenfield growth north of Mayfield Road.

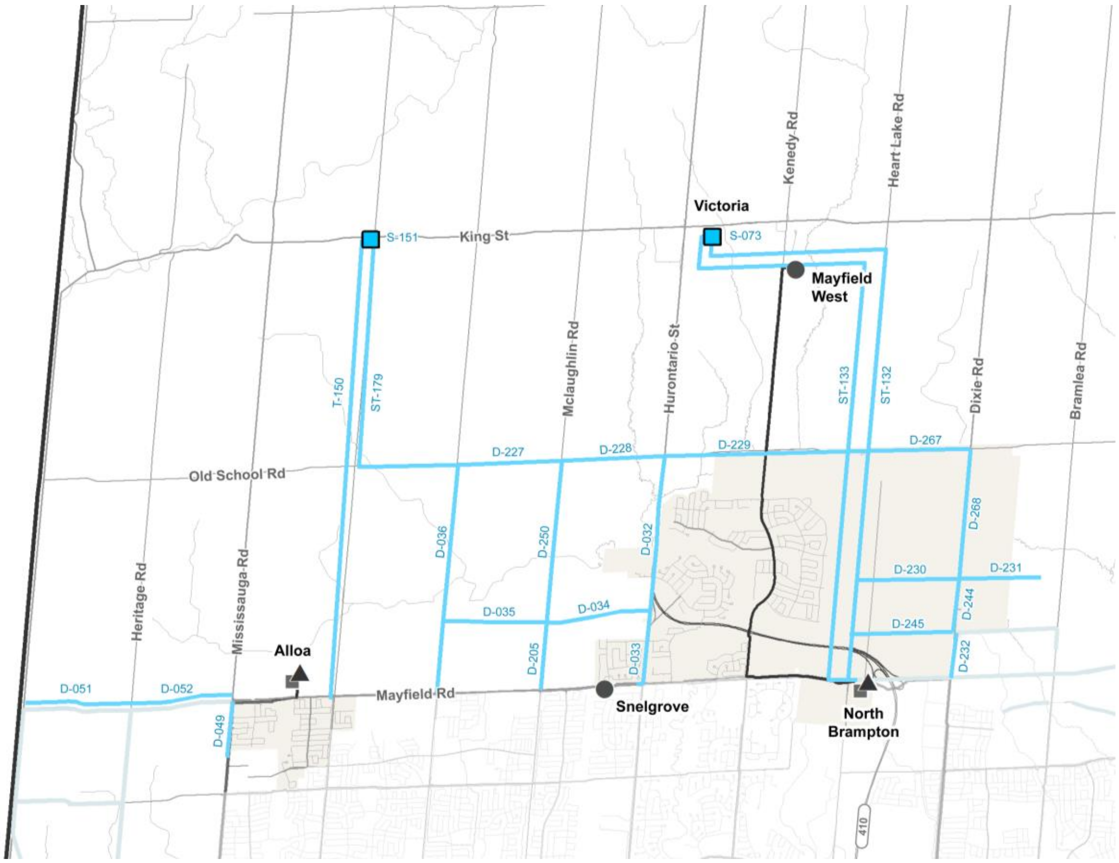


Figure 22 – Pressure Zone 7.

5.3.4 Inter-Regional Agreements

5.3.4.1 York Region Water Servicing

The York water demand requirements are defined in the York-Peel Water Servicing Agreement, Schedule C. The agreement outlines that the 2041 water supply requirement for York Region is 331 ML/d. The maximum day demands as per the York-Peel Servicing Agreement are shown in **Figure 23**.

The York water demand requirements are a key component of the long-term water supply and servicing requirements for the Region of Peel. They are generally reflected in the water supply requirements for the Central and East Transmission Systems. Water supplied to York Region is treated at the A.P. Kennedy WTP and pumped north through the Central Transmission System. It is then transferred to the East Transmission System through the Beckett Sproule Transfer Pumping Station and ultimately pumped to York Region from the Airport Road Pumping Station.

The York water demands requirement is supplied by the A.P. Kennedy WTP. This facility has sufficient capacity to service the required maximum day water demands to 2041, including York demands as per the Agreement.

The 2013 Master Plan identified infrastructure upgrades to meet York's water demand requirements. Some of these upgrades have been implemented while others continue to be valid and are included in the 2020 Master Plan capital program such as the Beckett Sproule Transfer Pumping Station capacity expansion.

A major recent upgrade to the Central and East Transmission Systems was the construction of the 2400-mm Hanlan Transmission Main.

This transmission main will service future growth in Peel as well as York water demand requirements.

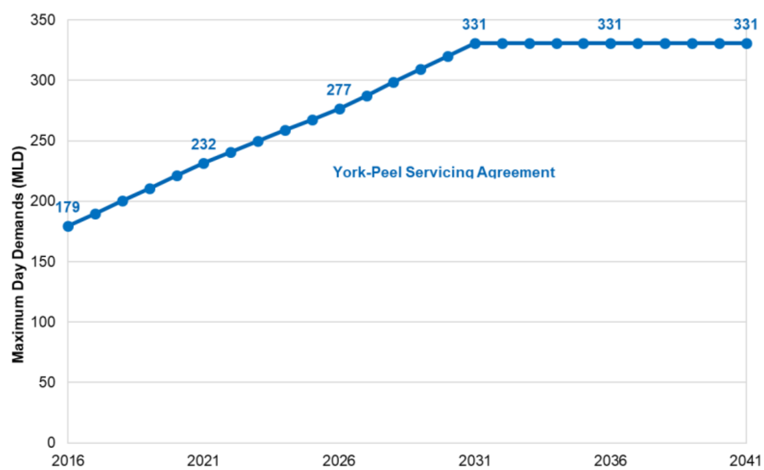


Figure 23 – Maximum day demand (MDD) as per the York-Peel Water Servicing Agreement.

6.0 Preferred Water Servicing Strategy

6.1 Preferred Servicing Strategy

6.2 Capital Program for the Preferred Water Servicing Strategy

6.0 Preferred Water Servicing Strategy

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

6.1 Preferred Servicing Strategy

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

The preferred water servicing strategy is outlined in **Figure 24** and was developed to ensure that:

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

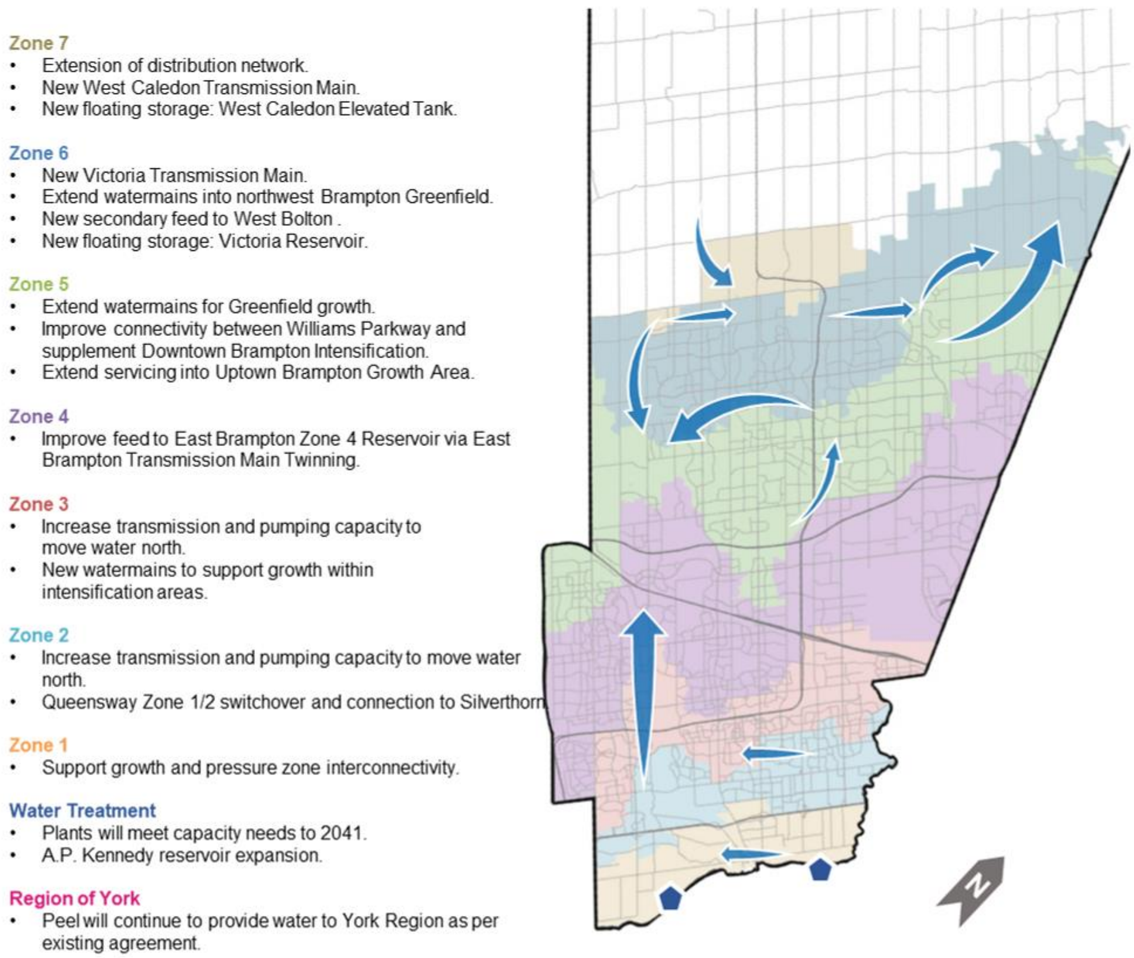


Figure 24 – Preferred water servicing strategy for the lake-based system.

6.2 Capital Program for the Preferred Water Servicing Strategy

As described in previous sections, the preferred Water Servicing Strategy is developed to support servicing needs of the existing and future growths areas within the Region of Peel lake-based system to 2041. The capital costs for each project of the preferred servicing strategy were estimated according to the costing methodology describe in **Section 2.4**. These projects are listed according to their project type (“D” Distribution, “ST” Sub-Transmission, “T” Transmission, “P” Pumping Station, “S” Storage Facility, “TR” Water Treatment Plant) and project number in the capital program map and table.

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

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

The capital program table for the preferred Water Servicing Strategy is shown in **Table 16**.

The capital program map for the preferred Water Servicing Strategy is shown in **Figure 25**. The water capital program map presents the general location and extents of the projects that form the preferred servicing strategy.

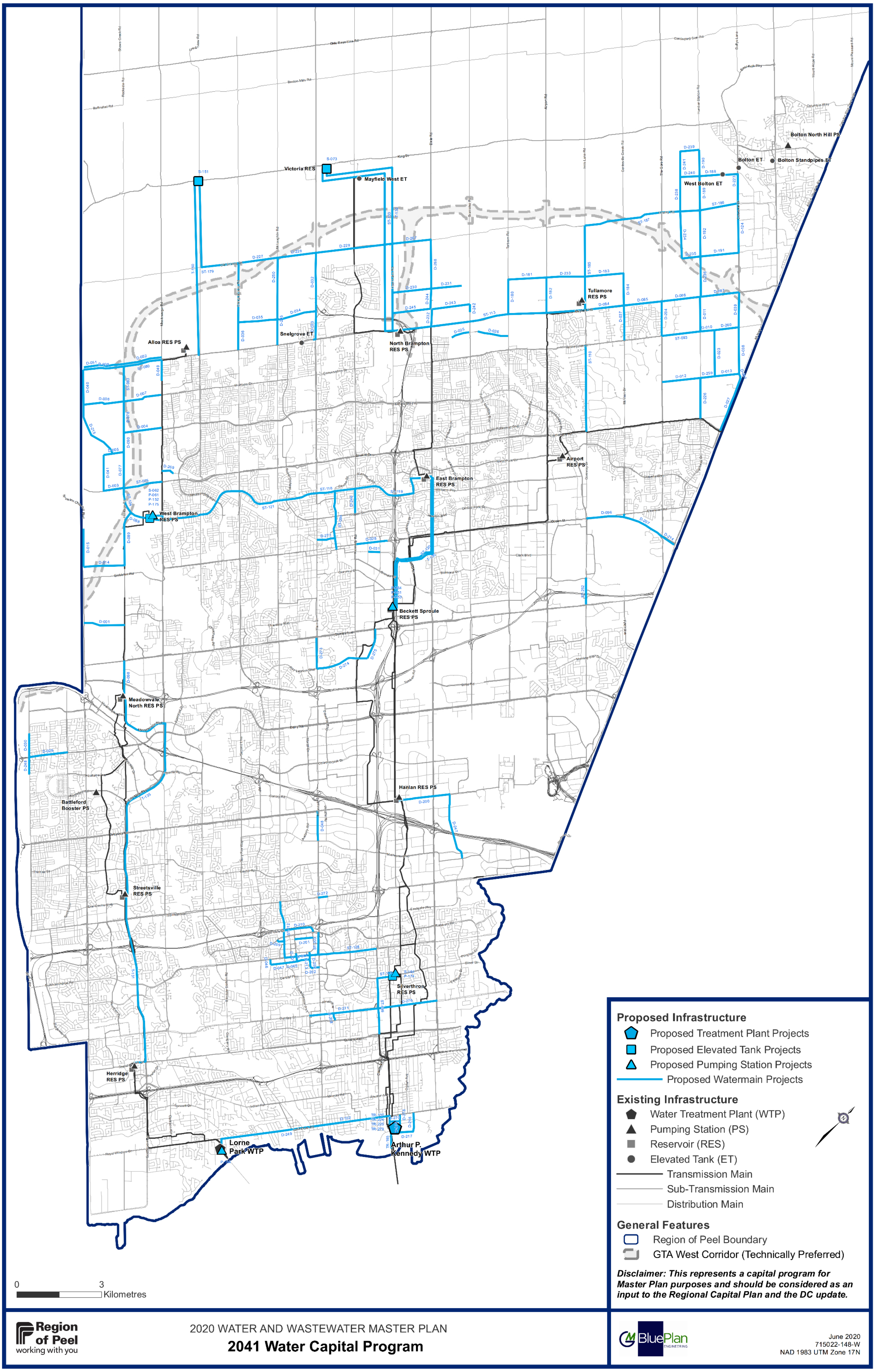


Figure 25 – Preferred water servicing strategy capital program for the lake-based system.

Table 16 – Capital program table for the preferred water servicing strategy.

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Pressure Zone	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
W-D-001	400-mm Water Main - Future Financial Drive (Bram West)	Construction of a 400-mm water main on the future Financial Drive from Heritage Road to Winston Churchill Boulevard.	2023	Brampton	5	Schedule A+	WDM	400 mm	1440	$ 3,647,200
W-D-003	400-mm Water Main - Bovaird Drive West	Construction of a 400-mm water main on Bovaird Drive West from Heritage Road to a future street.	2030	Brampton	6	Schedule A+	WDM	400 mm	690	$ 1,702,400
W-D-004	600-mm Water Main - Future Sandalwood Parkway West	Construction of a 600-mm water main on the future Sandalwood Parkway West from Mississauga Road to Heritage Road.	2032	Brampton	6	Schedule A+	WDM	600 mm	1360	$ 3,701,200
W-D-005	400-mm Water Main - Future Street (Heritage Heights)	Construction of a 400-mm water main on a future street from Heritage Road to 750 metres westerly.	2029	Brampton	6	Schedule A+	WDM	400 mm	750	$ 1,365,000
W-D-007	400-mm Water Main - Wanless Drive	Construction of a 400-mm water main on Wanless Drive from Mississauga Road to Heritage Road.	2034	Brampton	6	Schedule A+	WDM	400 mm	1380	$ 2,809,200
W-D-008	400-mm Water Main - Wanless Drive	Construction of a 400-mm water main on Wanless Drive from Winston Churchill Boulevard to Heritage Road.	2035	Brampton	6	Schedule A+	WDM	400 mm	1470	$ 2,954,100
W-D-009	400-mm Water Main - Mayfield Road	Construction of a 400-mm water main on Mayfield Road from Heritage Road to Winston Churchill Boulevard.	2038	Brampton	6	Schedule A+	WDM	400 mm	1460	$ 4,892,100
W-D-010	600-mm Water Main - Countryside Drive (Highway 427 Industrial)	Construction of a 600-mm water main on Countryside Drive from Clarkway Drive to the future north-south road.	2025	Brampton	5	Schedule A+	WDM	600 mm	500	$ 2,092,300
W-D-011	600-mm Water Main - Clarkway Drive (Highway 427 Industrial)	Construction of a 600-mm water main on Clarkway Drive from Countryside Drive to Mayfield Road.	2026	Brampton	5	Schedule A+	WDM	600 mm	1240	$ 3,230,100
W-D-012	400-mm Water Main - Future East-West Road (Highway 427 Industrial)	Construction of a 400-mm water main on the future east-west road from The Gore Road to Clarkway Drive.	2023	Brampton	5	Schedule A+	WDM	400 mm	1400	$ 2,513,700
W-D-013	400-mm Water Main - Future East-West Road (Highway 427 Industrial)	Construction of a 400-mm water main on the future east-west road from Coleraine Drive to the future north-south road.	2026	Brampton	5	Schedule A+	WDM	400 mm	880	$ 1,153,800
W-D-014	400-mm Water Main - New Road A (Bram West)	Construction of a 400-mm water main on New Road A (Bram West) from Winston Churchill Boulevard to Heritage Road.	2027	Brampton	5	Schedule A+	WDM	400 mm	1480	$ 2,609,600
W-D-015	400-mm Water Main - Winston Churchill Boulevard	Construction of a 400-mm water main on Winston Churchill Boulevard from New Road A (Bram West) to the future Bramwest Parkway.	2028	Brampton	5	Schedule A+	WDM	400 mm	1780	$ 3,451,700
W-D-021	400-mm Water Main - Heart Lake Road (Mayfield West Phase 1)	Construction of a 400-mm water main on Heart Lake Road from Mayfield Road to Abbotside Way.	2019	Caledon	7	Schedule A	WDM	400mm	750	$ 2,500,000
W-D-023	600-mm Water Main - Future Street (Highway 427 Industrial)	Construction of a 600-mm water main on the future north-south road from the future east-west road to Countryside Drive.	2025	Brampton	5	Schedule A+	WDM	600 mm	1640	$ 4,656,100
W-D-025	400-mm Water Main - Future Inspire Boulevard (Countryside Villages)	Construction of a 400-mm water main on the future Inspire Boulevard from Bramalea Road to approximately 700 metres westerly.	2019	Brampton	6	Schedule A+	WDM	400 mm	700	$ 1,568,360
W-D-026	400-mm Water Main - Future Inspire Boulevard (Countryside Villages)	Construction of a 400-mm water main on the future Inspire Boulevard from 310 metres east of Bramalea Road to Torbram Road.	2019	Brampton	6	Schedule A+	WDM	400 mm	1100	$ 1,868,220

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Pressure Zone	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
W-D-027	400-mm Water Main - Highway 50	Construction of a 400-mm water main on Highway 50 from Castlemore Road to Coleraine Drive.	2018	Brampton	5	Schedule A+	WDM	400 mm	1970	$ 3,524,390
W-D-028	400-mm Water Main - Queen Street East	Construction of a 400-mm water main on Queen Street East from Kennedy Road to Highway 410.	2031	Brampton	5	Schedule A+	WDM	400 mm	1220	$ 2,472,200
W-D-029	400-mm Water Main - Derry Road West (Ninth Line Lands)	Construction of a 400-mm water main on Derry Road West from Tenth Line West to Ninth Line.	2024	Mississauga	5	Schedule A+	WDM	400 mm	1370	$ 2,794,400
W-D-030	400-mm Water Main - Ninth Line (Ninth Line Lands)	Construction of a 400-mm water main on Ninth Line from Derry Road West to Terragar Boulevard.	2024	Mississauga	5	Schedule A+	WDM	400 mm	880	$ 2,473,800
W-D-031	400-mm Water Main - Future Clark Boulevard	Construction of a 400-mm water main on future extension of Clark Boulevard from Rutherford Road to Hansen Road South.	2022	Brampton	5	Schedule A+	WDM	400 mm	440	$ 886,700
W-D-032	600-mm Water Main - Hurontario Street	Construction of a 600-mm water main on Hurontario Street from Dougall Avenue to the future east-west road in Mayfield West Phase 2.	2021	Caledon	7	Schedule A+	WDM	600 mm	1740	$ 5,894,900
W-D-033	600-mm Water Main - Hurontario Street	Construction of a 600-mm water main on Hurontario Street from Mayfield Road to the future east-west road in Mayfield West Phase 2.	2021	Brampton Caledon	7	Schedule A+	WDM	600 mm	1050	$ 4,944,500
W-D-034	400-mm Water Main - Future East-West Road (Mayfield West Phase 2)	Construction of a 400-mm water main on the future east-west road in Mayfield West Phase 2 from Hurontario Street to McLaughlin Road.	2019	Caledon	7	Schedule A+	WDM	400 mm	1500	$ 2,520,000
W-D-035	400-mm Water Main - Future East-West Road (Mayfield West Phase 2)	Construction of a 400-mm water main on the future east-west road in Mayfield West Phase 2 from McLaughlin Road to Chinguacousy Road.	2019	Caledon	7	Schedule A+	WDM	400 mm	1360	$ 1,960,000
W-D-036	600-mm Water Main - Chinguacousy Road (Mayfield West Phase 2)	Construction of a 600-mm water main on Chinguacousy Road from Mayfield Road to the future east-west road in Mayfield West Phase 2.	2019	Caledon	7	Schedule A+	WDM	600 mm	950	$ 2,755,000
W-D-037	400-mm Water Main - McVean Drive	Construction of a 400-mm water main on McVean Drive from Countryside Drive to Mayfield Road.	2017	Brampton	5	Schedule A+	WDM	400 mm	1240	$ 3,425,200
W-D-038	400-mm Water Main - Coleraine Drive (Highway 427 Industrial)	Construction of a 400-mm water main on Coleraine Drive from the future east-west road to Countryside Drive.	2023	Brampton	5	Schedule A+	WDM	400 mm	1860	$ 3,100,200
W-D-039	400-mm Water Main - Coleraine Drive (Highway 427 Industrial)	Construction of a 400-mm water main on Coleraine Drive from Countryside Drive to Mayfield Road.	2023	Brampton	5	Schedule A+	WDM	400 mm	1250	$ 2,121,900
W-D-040	400-mm Water Main - Winston Churchill Boulevard	Construction of a 400-mm water main on Winston Churchill Boulevard from Mayfield Road to Wanless Drive.	2036	Brampton	6	Schedule A+	WDM	400 mm	1210	$ 1,882,000
W-D-041	400-mm Water Main - Future Street (Heritage Heights)	Construction of a 400-mm water main on a future street (Heritage Heights) from Bovaird Drive northerly to a future street.	2030	Brampton	6	Schedule A+	WDM	400 mm	1310	$ 2,038,300
W-D-044	Growth-Related Water Mains in the Mississauga City Centre	Construction of several growth-related water mains in the Mississauga City Centre.	2019	Mississauga	3	Schedule A+	WDM	400 mm	460	$ 5,000,000
W-D-045	Growth-Related Water Mains in the Mississauga City Centre	Construction of several growth-related water mains in the Mississauga City Centre.	2019	Mississauga	3	Schedule A+	WDM	400 mm	430	$ 5,000,000
W-D-046	Growth-Related Water Mains in the Mississauga City Centre	Construction of several growth-related water mains in the Mississauga City Centre.	2019	Mississauga	3	Schedule A+	WDM	400 mm	220	$ 5,000,000

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Pressure Zone	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
W-D-047	Growth-Related Water Mains in the Mississauga City Centre	Construction of several growth-related water mains in the Mississauga City Centre.	2019	Mississauga	3	Schedule A+	WDM	400 mm	530	$ 5,000,000
W-D-048	400-mm Water Main - Hurontario Street	Construction of a 400-mm water main on Hurontario Street from Matheson Boulevard to Britannia Road. In coordination with the Hurontario LRT.	2021	Mississauga	4	Schedule A+	WDM	400 mm	1110	$ 3,484,942
W-D-049	400-mm Water Main - Mississauga Road (Mount Pleasant West)	Construction of a 400-mm water main on Mississauga Road from Mayfield Road southerly to a future street.	2032	Brampton	7	Schedule A+	WDM	400 mm	760	$ 2,281,800
W-D-051	400-mm Water Main - Mayfield Road (Mount Pleasant West)	Construction of a 400-mm water main on Mayfield Road from Heritage Road to Winston Churchill Boulevard.	2038	Caledon	7	Schedule A+	WDM	400 mm	1460	$ 4,892,100
W-D-052	600-mm Water Main - Mayfield Road (Mount Pleasant West)	Construction of a 600-mm water main on Mayfield Road from Mississauga Road to Heritage Road.	2038	Brampton	7	Schedule A+	WDM	600 mm	1380	$ 6,768,000
W-P-061	West Brampton Pumping Station - Capacity Expansion	Installation of additional low-lift pumping capacity at the West Brampton Pumping Station.	2028	Brampton	5	Schedule A	PS	45 ML/d	-	$ 1,884,200
W-S-062	West Brampton Reservoir Expansion	Expansion of the West Brampton Reservoir with the construction of a third 20-ML reservoir cell.	2031	Brampton	4	Schedule A	RES	20 ML	-	$ 36,846,800
W-P-064	Beckett Sproule Transfer Pumping Station - Capacity Expansion	Installation of additional transfer pumping capacity at the Beckett Sproule Pumping Station.	2023	Brampton	3	Schedule A	PS	306 ML/d	-	$ 8,007,500
W-S-073	Victoria Reservoir	Construction of a new 40-ML reservoir in the vicinity of King Street and Hurontario Street to provide storage for Pressure Zone 6.	2022	Caledon	6	Schedule C Completed	RES	40 ML	-	$ 60,000,000
W-ST-075	750-mm Water Main - Bovaird Drive West (Heritage Heights)	Construction of a 750-mm water main on Bovaird Drive West from Mississauga Road to Heritage Road.	2027	Brampton	6	Schedule A+	WSTM	750 mm	1400	$ 7,274,300
W-D-077	600-mm Water Main - Heritage Road (Heritage Heights)	Construction of a 600-mm water main on Heritage Road from Bovaird Drive northerly to a future street.	2028	Brampton	6	Schedule A+	WDM	600 mm	1300	$ 3,708,100
W-D-078	600-mm Water Main - Heritage Road (Mount Pleasant West)	Construction of a 600-mm water main on Heritage Road from the future extension of Sandalwood Parkway to Wanless Drive.	2034	Brampton	6	Schedule A+	WDM	600 mm	1140	$ 4,023,000
W-ST-080	750-mm Water Main - Mayfield Road (Mount Pleasant West)	Construction of a 750-mm water main on Mayfield Road from Heritage Road to Mississauga Road.	2038	Brampton	6	Schedule A+	WSTM	750 mm	1380	$ 7,716,300
W-ST-083	750-mm Water Main - Heritage Road (Mount Pleasant West)	Construction of a 750-mm sub-transmission main on Heritage Road from Wanless Drive to Mayfield Road.	2035	Brampton	6	Schedule A+	WSTM	750 mm	1230	$ 4,115,700
W-D-084	600-mm Water Main - Mayfield Road	Construction of a 600-mm water main on Mayfield Road from Goreway Drive to The Gore Road.	2019	Brampton	5	Schedule A+	WDM	600 mm	1400	$ 3,735,980
W-D-085	600-mm Water Main - Mayfield Road	Construction of a 600-mm water main on Mayfield Road from Goreway Drive to The Gore Road.	2019	Brampton	5	Schedule A+	WDM	600 mm	1370	$ 7,126,340
W-D-086	600-mm Water Main - Mayfield Road	Construction of a 600-mm water main on Mayfield Road from The Gore Road to Clarkway Drive.	2019	Brampton	5	Schedule A+	WDM	600 mm	1420	$ 7,568,895
W-D-087	600-mm Water Main - Mayfield Road	Construction of a 600-mm water main on Mayfield Road from Clarkway Drive to Coleraine Drive.	2020	Brampton	5	Schedule A+	WDM	600 mm	1400	$ 6,399,210
W-D-088	600-mm Water Main - Future Williams Parkway (Bram West)	Construction of a 600-mm water main on the future extension of Williams Parkway from Heritage Road to Mississauga Road.	2027	Brampton	5	Schedule A+	WDM	600 mm	1140	$ 2,772,900

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Pressure Zone	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
W-D-089	600-mm Water Main - Heritage Road (Bram West)	Construction of a 600-mm water main on Heritage Road from the future extension of Williams Parkway to the New Road A.	2027	Brampton	5	Schedule A+	WDM	600 mm	1950	$ 8,306,400
W-D-090	600-mm Water Main - Heritage Road (Heritage Heights)	Construction of a 600-mm water main on Heritage Road from a future street to the future extension of Sandalwood Parkway.	2028	Brampton	6	Schedule A+	WDM	600 mm	690	$ 3,874,900
W-ST-093	750-mm Water Main - Countryside Drive (Highway 427 Industrial)	Construction of a 750-mm water main on Countryside Drive from The Gore Road to Clarkway Drive.	2024	Brampton	5	Schedule A+	WSTM	750 mm	1390	$ 6,582,600
W-ST-094	750-mm Water Main - Centre Street	Construction of a 750-mm sub-transmission main on Centre Street from Williams Parkway to John Street.	2026	Brampton	5	Schedule A+	WSTM	750 mm	2300	$ 13,782,200
W-D-096	600-mm Water Main - Queen Street East (Bram East)	Construction of a 600-mm water main on Queen Street East and McVean Drive from Goreway Drive to Ebenezer Road.	2022	Brampton	4	Schedule A+	WDM	600 mm	1360	$ 7,486,700
W-D-098	600-mm Water Main - Heritage Road (Bram West)	Construction of a 600-mm water main on Heritage Road from the Meadowvale North Pumping Station to Steeles Avenue West.	2018	Brampton	4	Schedule A+	WDM	600 mm	1370	$ 4,687,760
W-ST-099	Queensway Sub-Transmission Main Extension	Construction of a 900/1050-mm sub-transmission main on Bloor Street and Cawthra Road from the Silverthorn Pumping Station to The Queensway East.	2026	Mississauga	2	Schedule B	WSTM	900 mm	2480	$ 64,859,700
W-D-101	Growth-Related Water Mains in the Mississauga City Centre	Construction of several growth-related water mains in the Mississauga City Centre.	2019	Mississauga	3	Schedule A+	WDM	600 mm	310	$ 6,292,000
W-D-102	600-mm Water Main - Lakeshore Road	Construction of a 600-mm water main on Lakeshore Road from the A.P. Kennedy Water Treatment Plant to Front Street South.	2032	Mississauga	1	Schedule A+	WDM	600 mm	2470	$ 66,038,500
W-ST-103	Queensway Sub-Transmission Main Extension	Construction of a 900/1050-mm sub-transmission main on Bloor Street and Cawthra Road from the Silverthorn Pumping Station to The Queensway East.	2026	Mississauga	2	Schedule B	WSTM	1050 mm	580	$ 6,369,000
W-ST-104	900-mm Water Main - Heritage Road (Heritage Heights)	Construction of a 900-mm sub-transmission main on Heritage Road from the West Brampton Pumping Station to Bovaird Drive.	2028	Brampton	6	Schedule A+	WSTM	900 mm	1720	$ 8,557,100
W-ST-110	750-mm Water Main - Goreway Drive	Construction of a 750-mm sub-transmission main on Goreway Drive from Castlemore Road to Countryside Drive.	2019	Brampton	5	Schedule A+	WSTM	750 mm	3150	$ 18,818,375
W-ST-112	900-mm Sub-Transmission Main - Confederation Parkway	Construction of a 900-mm sub-transmission main on Confederation Parkway from Burnhamthorpe Road West to Eglinton Avenue West.	2034	Mississauga	3	Schedule B	WSTM	900 mm	2000	$ 45,261,400
W-ST-113	Mayfield Road Sub-Transmission Main	Construction of a 900-mm sub-transmission main on Mayfield Road from Innis Lake Road to the North Brampton Reservoir.	2037	Brampton	5	Schedule A+	WSTM	900 mm	6640	$ 30,762,500
W-ST-118	Williams Parkway Sub-Transmission Main (Phase 1 and Phase 2)	Construction of a 900-mm sub-transmission main on Williams Parkway from Dixie Road to McLaughlin Road. (Section 1 of 2)	2022	Brampton	5	Schedule C Completed	WSTM	900 mm	2800	$ 22,000,000
W-ST-119	Williams Parkway Sub-Transmission Main (Phase 1 and Phase 2)	Construction of a 900-mm sub-transmission main on Williams Parkway from Dixie Road to McLaughlin Road. (Section 2 of 2)	2022	Brampton	5	Schedule C Completed	WSTM	900 mm	3050	$ 51,000,000

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Pressure Zone	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
W-ST-120	Central Brampton Sub-Transmission Main	Construction of a 1200/1050/900-mm sub-transmission main from the Beckett Sproule Pumping Station to the East Brampton Pumping Station.	2024	Brampton	5	Schedule C Completed	WSTM	1200 mm	6070	$ 169,373,000
W-ST-121	Williams Parkway Sub-Transmission Main (Phase 3)	Construction of a 900-mm sub-transmission main on Williams Parkway from the West Brampton Pumping Station to McLaughlin Road.	2024	Brampton	5	Schedule C Completed	WSTM	900 mm	5000	$ 34,549,800
W-D-124	600/400-mm Water Main - Coleraine Drive (Bolton)	Construction of a 600-mm water main on Coleraine Drive from the Bolton Elevated Tank to Healey Road and a 400-mm water main on Coleraine Drive from Healey Road to George Bolton Parkway. (Section 1 of 2)	2019	Caledon	6	Schedule A+	WDM	400 mm	1750	$ 6,840,800
W-ST-128	1500-mm Sub-Transmission Main - Burnhamthorpe Road	Construction of a 1500-mm sub-transmission main on Burnhamthorpe Road from Cawthra Road to Grand Park Drive.	2021	Mississauga	3	Schedule B Completed	WSTM	1500 mm	1750	$ 125,570,000
W-T-130	East Brampton Transmission Main Twinning	Construction of a 1500-mm transmission main from the Beckett Sproule Pumping Station to East Brampton Reservoir.	2024	Brampton	4	Schedule C Completed	WTM	1500 mm	6500	$ 206,300,000
W-T-131	Streetsville Transmission Main	Construction of a 2100-mm transmission main on Erin Mills Parkway from the Herridge Pumping Station to the Streetsville Reservoir.	2028	Mississauga	2	Schedule C	WTM	2100 mm	6600	$ 199,497,800
W-T-132	Victoria Transmission Main	Construction a 900-mm transmission main and a 1200-mm sub-transmission main from the North Brampton Pumping Station to the Victoria Reservoir. (Section 1 of 2)	2022	Caledon	6	Schedule C Completed	WTM	900 mm	8750	$ 107,123,750
W-ST-133	Victoria Transmission Main	Construction a 900-mm transmission main and a 1200-mm sub-transmission main from the North Brampton Pumping Station to the Victoria Reservoir. (Section 2 of 2)	2022	Caledon	6	Schedule C Completed	WSTM	1200 mm	8470	$ 26,000,000
W-T-135	Meadowvale North Transmission Main	Construction of an 1800-mm transmission main from the Streetsville Pumping Station to the Meadowvale North Reservoir.	2031	Mississauga	3	Schedule C	WTM	1800 mm	9300	$ 289,088,200
W-TR-137	A.P. Kennedy Water Treatment Plant - Standby Power	Construction of additional standby power at the treatment facility.	2019	Mississauga		Schedule A	WTP	-	-	$ 6,500,000
W-T-150	West Caledon Transmission Main	Construction of a 750-mm transmission main from the Alloa Pumping Station to the West Caledon Elevated Tank.	2027	Caledon	7	Schedule C	WTM	750 mm	7500	$ 29,926,300
W-S-151	West Caledon Elevated Tank	Construction of a new 10-ML elevated tank in southwest Caledon.	2027	Caledon	7	Schedule C	RES	10 ML	-	$ 18,422,900
W-P-152	West Brampton Pumping Station - Capacity Expansion	Installation of additional low-lift pumping capacity at the West Brampton Pumping Station.	2036	Brampton	5	Schedule A	PS	45 ML/d	-	$ 433,600
W-P-154	Lorne Park Pumping Station - Capacity Expansion	Installation of additional PZ2W high-lift pumping capacity at the Lorne Park Water Treatment Plant.	2031	Mississauga	2	Schedule A	PS	150 ML/d	-	$ 1,579,300
W-S-164	Silverthorn Reservoir and Pumping Station Expansion	Construction of major improvements and upgrades at the Silverthorn Reservoir and Pumping Station.	2023	Mississauga	2	Schedule B Completed	RES	25 ML	-	$ 49,090,000
W-TR-165	A.P. Kennedy Water Treatment Plant - New Intake	Construction of a new intake pipe and structure at the A.P. Kennedy Water Treatment Plant.	2041	Mississauga		Schedule C	WTP	2400 mm	2000	$ 100,000,000
W-P-175	West Brampton Pumping Station - Capacity Expansion	Installation of additional high-lift pumping capacity at the West Brampton Pumping Station.	2028	Brampton	6	Schedule A	PS	31 ML/d	-	$ 1,010,400

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Pressure Zone	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
W-ST-179	600-mm Water Main - Chinguacousy Road/Creditview Road	Construction of a 600-mm sub-transmission main on Chinguacousy Road/Creditview Road from the future West Caledon Elevated Tank to future east-west road in Mayfield West Phase 2.	2027	Caledon	7	Schedule C	WSTM	600 mm	6500	$ 20,680,000
W-D-180	400-mm Water Main - Torbram Road (Tullamore Industrial)	Construction of a 400-mm water main on Torbram Road from Mayfield Road northerly to a future street.	2036	Caledon	6	Schedule A+	WDM	400 mm	1300	$ 3,838,200
W-D-181	400-mm Water Main - Future Street (Tullamore Industrial)	Construction of a 400-mm water main on a future street north of Mayfield Road from Torbram Road to Airport Road.	2036	Caledon	6	Schedule A+	WDM	400 mm	1360	$ 2,100,900
W-D-182	400-mm Water Main - Airport Road (Tullamore Industrial)	Construction of a 400-mm water main on Airport Road from Mayfield Road northerly to a future street.	2036	Caledon	6	Schedule A+	WDM	400 mm	1300	$ 2,202,500
W-D-183	400-mm Water Main - Future Street (Tullamore Industrial)	Construction of a 400-mm water main on a future street north of Mayfield Road from Innis Lake Road to Centreville Creek Road.	2036	Caledon	6	Schedule A+	WDM	400 mm	1360	$ 3,235,000
W-D-184	400-mm Water Main - Centreville Creek Road (Tullamore Industrial)	Construction of a 400-mm water main on Centerville Creek Road from Mayfield Road to 1300 metres northerly.	2036	Caledon	6	Schedule A+	WDM	400 mm	1300	$ 3,838,200
W-ST-185	750-mm Water Main - Innis Lake Road	Construction of a 750-mm sub-transmission main on Innis Lake Road from the Tullamore Pumping Station to Healey Road.	2032	Caledon	6	Schedule A+	WSTM	750 mm	3000	$ 8,746,100
W-ST-186	600-mm Water Main - Healey Road (Bolton West)	Construction of a 600-mm sub-transmission main on Healy Road from Humber Station Road to Coleraine Drive.	2026	Caledon	6	Schedule A+	WSTM	600 mm	1350	$ 3,842,700
W-ST-187	600-mm Water Main - Healey Road	Construction of a 600-mm sub-transmission main on Healy Road from Innis Lake Road to Humber Station Road.	2031	Caledon	6	Schedule A+	WSTM	600 mm	4160	$ 14,992,500
W-D-188	400-mm Water Main - Future Street (Bolton West)	Construction of a 400-mm water main on a future street north of Healey Road from West Bolton Elevated Tank to Humber Station Road.	2026	Caledon	6	Schedule A+	WDM	400 mm	810	$ 1,070,200
W-D-189	400-mm Water Main - Humber Station Road (Bolton West)	Construction of a 400-mm water main on Humber Station Road from Healey Road to a future street northerly.	2027	Caledon	6	Schedule A+	WDM	400 mm	1220	$ 2,074,900
W-D-190	400-mm Water Main - Humber Station Road (Bolton West)	Construction of a 400-mm water main on Humber Station Road from a future street north of Healey Road to approximately 1200 metres northerly.	2028	Caledon	6	Schedule A+	WDM	400 mm	1200	$ 1,867,000
W-D-191	400-mm Water Main - Future Street (Bolton West)	Construction of a 400-mm water main on a future street north of Mayfield Road from Humber Station Road to Coleraine Drive.	2026	Caledon	6	Schedule A+	WDM	400 mm	1350	$ 2,086,300
W-D-192	400-mm Water Main - Humber Station Road (Bolton West)	Construction of a 400-mm water main on Humber Station Road from a future street north of Mayfield Road to Healey Road.	2026	Caledon	6	Schedule A+	WDM	400 mm	1650	$ 3,242,500
W-D-200	600-mm Water Main - Britannia Road East	Construction of a 600-mm water main on Britannia Road East from the Hanlan Pumping Station to Atlantic Drive.	2020	Mississauga	3	Schedule A+	WDM	600 mm	2000	$ 10,357,733
W-D-201	Growth-Related Water Mains in the Mississauga City Centre	Construction of several growth-related water mains in the Mississauga City Centre.	2019	Mississauga	3	Schedule A+	WDM	400 mm	640	$ 3,900,000
W-D-202	Growth-Related Water Mains in the Mississauga City Centre	Construction of several growth-related water mains in the Mississauga City Centre.	2019	Mississauga	3	Schedule A+	WDM	400 mm	300	$ 5,000,000

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Pressure Zone	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
W-ST-203	750-mm Water Main - Hurontario Street (Mississauga City Centre)	Construction of a 750-mm sub-transmission main on Hurontario Street from Burnhamthorpe Road to Rathburn Road.	2019	Mississauga	3	Schedule A+	WSTM	750 mm	780	$ 8,161,000
W-D-204	400-mm Water Main - The Gore Road	Construction of a 400-mm water main on The Gore Road from Mayfield Road to north of Countryside Drive.	2018	Brampton	5	Schedule A+	WDM	400 mm	1100	$ 2,687,000
W-D-205	400-mm Water Main - McLaughlin Road (Mayfield West Phase 2)	Construction of a 400-mm water main on McLaughlin Road from Mayfield Road to 1800 metres northerly to the creek.	2019	Caledon	7	Schedule A+	WDM	400 mm	1800	$ 2,699,200
W-D-206	400-mm Water Main - Kariya Drive (Mississauga City Centre)	Construction of a 400-mm water main on Kariya Drive from Webb Drive to Elm Drive West.	2024	Mississauga	3	Schedule A+	WDM	400 mm	300	$ 4,444,000
W-D-207	400-mm Water Main - Queen Street East (Bram East)	Construction of a 400-mm water main on Queen Street East from McVean Drive to the Gore Road.	2024	Brampton	4	Schedule A+	WDM	400 mm	1400	$ 4,786,100
W-D-208	400-mm Water Main - Camilla Road	Construction of a 400-mm water main on Camilla Road from Dundas Street East to King Street East.	2027	Mississauga	2	Schedule A+	WDM	400 mm	260	$ 628,400
W-D-209	400-mm Water Main - Future Square One Drive Extension	Construction of a 400-mm water main on the future extension of Square One Drive from Rathburn Road West to Confederation Parkway.	2021	Mississauga	3	Schedule A+	WDM	400 mm	320	$ 743,600
W-D-210	400-mm Water Main - Centre View Drive (Mississauga City Centre)	Construction of a 400-mm water main on Centre View Drive from Confederation Parkway to Duke of York Boulevard.	2028	Mississauga	3	Schedule A+	WDM	400 mm	360	$ 2,575,900
W-D-213	Growth-Related Water Mains in the Mississauga City Centre	Construction of several growth-related water mains in the Mississauga City Centre.	2019	Mississauga	3	Schedule A+	WDM	600 mm	300	$ 5,444,000
W-D-214	400-mm Water Main - Queen Street East (Bram East)	Construction of a 400-mm water main on Queen Street East from The Gore Road to Highway 50.	2028	Brampton	4	Schedule A+	WDM	400 mm	630	$ 1,763,300
W-D-215	400-mm Water Main - Future Street (Heritage Heights)	Construction of a 400-mm water main on a future street from Wanless Drive southeasterly to a future street.	2030	Brampton	6	Schedule A+	WDM	400 mm	2170	$ 2,703,500
W-D-216	400-mm Water Main - Hydro Road (Inspiration Lakeview)	Construction of a 400-mm water main on Hydro Road from Lakeshore Road East to the future Street A.	2031	Mississauga	1	Schedule A+	WDM	400 mm	660	$ 969,200
W-D-217	400-mm Water Main - Future Street (Inspiration Lakeview)	Construction of a 400-mm water main on the future Street A from the future Street F to the future Street H.	2031	Mississauga	1	Schedule A+	WDM	400 mm	470	$ 718,200
W-D-218	400-mm Water Main - Lakefront Promenade (Inspiration Lakeview)	Construction of a 400-mm water main on Lakefront Promenade from Rangeview Road to the future Street A.	2031	Mississauga	1	Schedule A+	WDM	400 mm	570	$ 849,800
W-D-223	600/400-mm Water Main - Coleraine Drive (Bolton)	Construction of a 600-mm water main on Coleraine Drive from the Bolton Elevated Tank to Healey Road and a 400-mm water main on Coleraine Drive from Healey Road to George Bolton Parkway. (Section 2 of 2)	2019	Caledon	6	Schedule A+	WSTM	600 mm	1540	$ 5,329,000
W-TR-224	A.P. Kennedy Water Treatment Plant - Reservoir Expansion	Construction of a new 35-million-litre treated water reservoir at the A.P. Kennedy Water Treatment Plant.	2031	Mississauga		Schedule A+	WTP	35 ML	-	$ 68,275,000
W-TR-225	A.P. Kennedy Water Treatment Plant - Waste Building Expansion	Expansion of the Waste Building at the A.P. Kennedy Water Treatment Plant.	2036	Mississauga		Schedule A+	WTP	-	-	$ 26,450,000
W-D-226	600-mm Water Main - Clarkway Drive	Construction of a 600-mm water main on Clarkway Drive from Castlemore Road northerly to the future east-west road.	2022	Brampton	5	Schedule A+	WDM	600 mm	1450	$ 3,931,615

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Pressure Zone	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
W-D-227	400-mm Water Main - Old School Road (Mayfield West Phase 3)	Construction of a 400-mm water main on Old School Road from Chinguacousy Road to McLaughlin Road.	2036	Caledon	7	Schedule A+	WDM	400 mm	1400	$ 4,786,100
W-D-228	400-mm Water Main - Old School Road (Mayfield West Phase 3)	Construction of a 400-mm water main on Old School Road from McLaughlin Road to Hurontario Street.	2036	Caledon	7	Schedule A+	WDM	400 mm	1390	$ 2,826,500
W-D-229	400-mm Water Main - Old School Road (Mayfield West Phase 3)	Construction of a 400-mm water main on Old School Road from Hurontario Street to Heart Lake Road.	2036	Caledon	7	Schedule A+	WDM	400 mm	2720	$ 6,863,800
W-D-230	400-mm Water Main - Future Street (Mayfield West Phase 4)	Construction of a 400-mm water main on a future street from Heart Lake Road to Dixie Road, north of Mayfield Road.	2031	Caledon	7	Schedule A+	WDM	400 mm	1380	$ 1,754,700
W-D-231	400-mm Water Main - Future Street (Mayfield West Phase 4)	Construction of a 400-mm water main on a future street from Dixie Road to Bramalea Road, north of Mayfield Road.	2033	Caledon	7	Schedule A+	WDM	400 mm	1370	$ 1,742,500
W-D-232	400-mm Water Main - Dixie Road (Mayfield West Phase 4)	Construction of a 400-mm water main on Dixie Road from Mayfield Road to 1,340 metres northerly.	2031	Caledon	6	Schedule A+	WDM	400 mm	1340	$ 3,690,800
W-D-233	400-mm Water Main - Future Street (Tullamore Industrial)	Construction of a 400-mm water main on a future street from Airport Road to Innis Lake Road, north of Mayfield Road.	2036	Caledon	6	Schedule A+	WDM	400 mm	1380	$ 2,122,000
W-D-234	400-mm Water Main - Future Street (Bolton West)	Construction of a 400-mm water main on a future street from Healy Road to approximately 1680 metres southerly, east of Humber Station Road.	2032	Caledon	6	Schedule A+	WDM	400 mm	1680	$ 2,482,100
W-D-235	400-mm Water Main - Future Street (Bolton West)	Construction of a 400-mm water main on a future street from Humber Station Road to 660 metres westerly.	2032	Caledon	6	Schedule A+	WDM	400 mm	660	$ 3,059,500
W-D-236	400-mm Water Main - Humber Station Road (Bolton West)	Construction of a 400-mm water main on Humber Station Road from Mayfield Road to 1450 metres northerly.	2024	Caledon	6	Schedule A+	WDM	400 mm	1450	$ 6,950,800
W-D-238	400-mm Water Main - Future Street (Bolton West)	Construction of a 400-mm water main on a future street from Healey Road to 1220 metres northerly, west of Humber Station Road.	2036	Caledon	6	Schedule A+	WDM	400 mm	1220	$ 1,562,900
W-D-239	400-mm Water Main - Future Street (Bolton West)	Construction of a 400-mm water main on a future street from Humber Station Road to 680 metres westerly, south of King Street.	2036	Caledon	6	Schedule A+	WDM	400 mm	680	$ 913,100
W-D-240	400-mm Water Main - Future Street (Bolton West)	Construction of a 400-mm water main on a future street from Humber Station Road to 680 metres westerly.	2036	Caledon	6	Schedule A+	WDM	400 mm	680	$ 913,100
W-D-241	400-mm Water Main - Future Street (Bolton West)	Construction of a 400-mm water main on a future street from future street north of Healey Road to 910 metres northerly, west of Humber Station Road.	2036	Caledon	6	Schedule A+	WDM	400 mm	910	$ 1,189,500
W-D-242	400-mm Water Main - Bramalea Road (Mayfield West Phase 4)	Construction of a 400-mm water main on Bramalea Road from north of Mayfield Road to 290 metres northerly.	2033	Caledon	6	Schedule A+	WDM	400 mm	290	$ 1,410,200
W-D-243	400-mm Water Main - Future Street (Mayfield West Phase 4)	Construction of a 400-mm water main on a future street from Dixie Road to Bramalea Road.	2032	Caledon	6	Schedule A+	WDM	400 mm	1360	$ 2,098,500
W-D-244	400-mm Water Main - Dixie Road (Mayfield West Phase 1)	Construction of a 400-mm water main on Dixie Road from the future Abbotside Way to 720 metres northerly.	2021	Caledon	7	Schedule A+	WDM	400 mm	720	$ 1,272,600

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Pressure Zone	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
W-D-245	400-mm Water Main - Future Street (Mayfield West Phase 4)	Construction of a 400-mm water main on a future street from Dixie Road to Heart Lake Road, north of Mayfield Road.	2031	Caledon	7	Schedule A+	WDM	400 mm	1400	$ 1,779,200
W-D-246	600-mm Water Main - Kennedy Road North	Construction of a 600-mm water main on Kennedy Road North from Williams Parkway to Vodden Street East.	2021	Brampton	5	Schedule A+	WDM	600 mm	900	$ 3,912,578
W-D-247	600-mm Water Main - Atlantic Drive/Creekbank Road	Construction of a 600-mm water main on Atlantic Drive and the future Creekbank Road from Britannia Road East to Sismet Road.	2027	Mississauga	3	Schedule A+	WDM	600 mm	1500	$ 12,452,700
W-D-248	400-mm Water Main - Ninth Line (Ninth Line Lands)	Construction of a 400-mm water main on Ninth Line from Derry Road West to 620 metres southerly.	2025	Mississauga	5	Schedule A+	WDM	400 mm	620	$ 2,057,600
W-D-249	600-mm Water Main - Lakeshore Road West	Construction of a 600-mm water main on Lakeshore Road West from the Lorne Park Water Treatment Plant to Front Street South.	2024	Mississauga	1	Schedule A+	WDM	600 mm	2950	$ 12,714,789
W-D-250	400-mm Water Main - McLaughlin Road (Mayfield West Phase 3)	Construction of a 400-mm water main on McLaughlin Road from Old School Road to the south side of the Etobicoke Creek.	2036	Caledon	7	Schedule A+	WDM	400 mm	1380	$ 2,809,200
W-P-251	Beckett Sproule Pumping Station - Surge Suppression System	Installation of a new surge suppression system at the Beckett Sproule Pumping Station.	2021	Brampton		Schedule A	PS	-	-	$ 10,868,800
W-ST-252	600-mm Water Main - Goreway Drive	Construction of a 600-mm water main on Goreway Drive from Intermodal Drive to Steeles Avenue East.	2026	Brampton	4	Schedule A+	WSTM	600 mm	950	$ 5,609,500
W-P-253	Beckett Sproule Pumping Station - Improvements and Upgrades	Construction of improvements and upgrades at the Beckett Sproule and East Brampton Pumping Stations.	2021	Brampton		Schedule A	PS	n/a	-	$ 38,589,700
W-D-259	600-mm Water Main - Future East-West Road (Highway 427 Industrial)	Construction of a 600-mm water main on the future east-west road from Clarkway Drive to the future north-south road.	2025	Brampton	5	Schedule A	WDM	600 mm	500	$ 1,071,200
W-D-260	400-mm Water Main - Countryside Drive (Highway 427 Industrial)	Construction of a 400-mm water main on Countryside Drive from Coleraine Drive to the future north-south road.	2026	Brampton	5	Schedule A	WDM	400 mm	880	$ 1,528,900
W-D-261	400-mm Water Main - Future Street (Highway 427 Industrial)	Construction of a 400-mm water main on a future street from Highway 50 to Coleraine Drive.	2024	Brampton	5	Schedule A	WDM	400 mm	200	$ 1,228,300
W-D-267	400-mm Water Main - Old School Road (Mayfield West Phase 1)	Construction of a 400-mm water main on Old School Road from Heart Lake Road to Dixie Road.	2021	Caledon	7	Schedule A	WDM	400 mm	1390	$ 1,949,566
W-D-268	400-mm Water Main - Dixie Road (Mayfield West Phase 1)	Construction of a 400-mm water main on Dixie Road from Old School Road to 2620 metres southerly.	2021	Caledon	7	Schedule A	WDM	400 mm	1900	$ 3,749,372
W-D-269	400-mm Water Main - Future Lagerfeld Drive (Mount Pleasant)	Construction of a 400-mm water main on the future extension of Lagerfeld Drive from Mississauga Road to Creditview Road.	2023	Brampton	6	Schedule A	WDM	400 mm	500	$ 697,800
W-D-270	600-mm Water Main - Rangeview Road (Inspiration Lakeview)	Construction of a 600-mm water main on Rangeview Road from East Avenue to Lakefront Promenade.	2031	Mississauga	1	Schedule A+	WDM	600 mm	480	$ 1,123,200
W-D-271	600-mm Water Main - Dundas Street East	Construction of a 600-mm water main on Dundas Street from Cawthra Road to Confederation Parkway.	2032	Mississauga	2	Schedule A+	WDM	600 mm	2470	$ 10,555,000
W-D-272	400-mm Water Main - Eglinton Avenue East	Construction of a 400-mm water main on Eglinton Avenue East from Hurontario Street to Sorrento Drive.	2021	Mississauga	4	Schedule A+	WDM	400 mm	350	$ 1,750,600

Master Plan ID	Project Name	Project Description	Year in Service	Municipality	Pressure Zone	Class EA	Project Type	Size/Capacity	Length (m)	Total Estimated Cost ($2020)
W-D-273	600-mm Water Main - Hurontario Street	Construction of a 600-mm water main on Hurontario Street from Steeles Avenue to County Court Boulevard.	2039	Brampton	5	Schedule A+	WDM	600 mm	1000	$ 6,229,700
W-D-274	600-mm Water Main - County Court Boulevard and Future Street	Construction of a 600-mm water main on County Court Boulevard and a future street from Hurontario Street to the future alignment of First Gulf Boulevard.	2039	Brampton	5	Schedule A+	WDM	600 mm	2000	$ 8,441,000
W-D-275	600-mm Water Main - Future First Gulf Boulevard	Construction of a 600-mm water main on the future alignment of First Gulf Boulevard from Steeles Avenue East to a future street.	2039	Brampton	5	Schedule A+	WDM	600 mm	1000	$ 5,744,300
W-D-276	600-mm Water Main - Dundas Street East	Construction of a 600-mm water main on Dundas Street East from Cawthra Road to Dixie Road.	2032	Mississauga	2	Schedule A+	WDM	600 mm	2300	$ 10,054,900
W-D-277	600-mm Water Main - Church Street East	Construction of a 600-mm water main on Church Street East from Centre Street North to Main Street.	2025	Brampton	5	Schedule A+	WDM	600 mm	650	$ 14,147,500
W-D-278	400-mm Water Main - Lakefront Promenade (Inspiration Lakeview)	Construction of a 400-mm water main on Lakefront Promenade from Lakeshore Road East to Rangeview Road.	2031	Mississauga	1	Schedule A+	WDM	400 mm	260	$ 471,300
W-TR-279	A.P. Kennedy Water Treatment Plant - Yard Piping Improvements	Various yard piping improvements at the A.P. Kennedy Water Treatment Plant to facilitate new infrastructure.	2022	Mississauga		-	WTP	-	-	$ 8,000,000
Total Program - 2041										**$2,473,508,575**

7.0 Implementation and Lifecycle

7.1 Capital Program Implementation

7.2 Lifecycle Costing

7.0 Implementation and Lifecycle

7.1 Capital Program Implementation

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

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

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

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

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

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

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

7.2 Lifecycle Costing

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

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

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

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

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

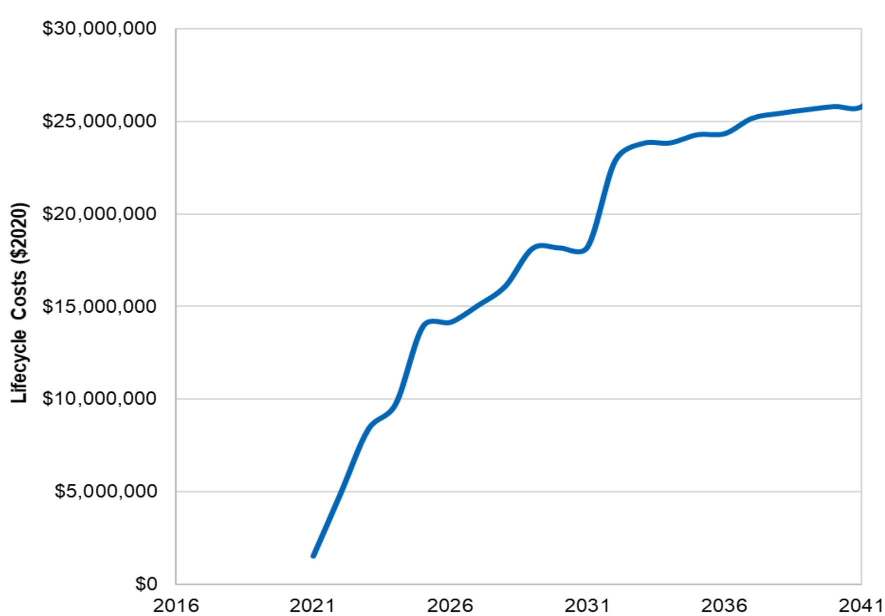


Figure 26 – Approximate annual cost for the operation and maintenance of new water master plan infrastructure.

8.0 Intensification and Post-2041 Growth

8.1 2041 Intensification
8.2 Post-2041 Vision

8.0 Intensification and Post-2041 Growth

8.1 2041 Intensification

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

There are several locations within the Region that will have focused intensification and infill growth. Through this master plan, these areas were reviewed for their existing servicing capacity, projected 2041 population and employment projections and subsequent water demands. While the 2020 Master Plan Capital Program is focused on servicing the approved 2041 growth, high level impacts of enhanced intensification development beyond 2041 projections were reviewed. It should be noted that these areas may require further detailed analysis to determine precise servicing needs as the detailed growth projections are finalized and the development applications are received.

The following areas that were identified to be key intensification areas include, but are not limited to:

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

8.3 Post-2041 Vision

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

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

Post-2041 growth is anticipated at two levels: intensification and greenfield growth. It is expected that post-2041 greenfield growth will most likely occur as extensions further north into Caledon within Pressure Zones 6 and 7 and potentially establishing a new lake-based Pressure Zone 8. Additional extensions to the transmission and distribution network and new facilities will be required to service post-2041 areas. In addition, facility upgrades to move the water north as well as treatment upgrades may be required as growth increases beyond the 2041 targets.

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

Figure 27 shows a conceptual representation of post-2041 water servicing.

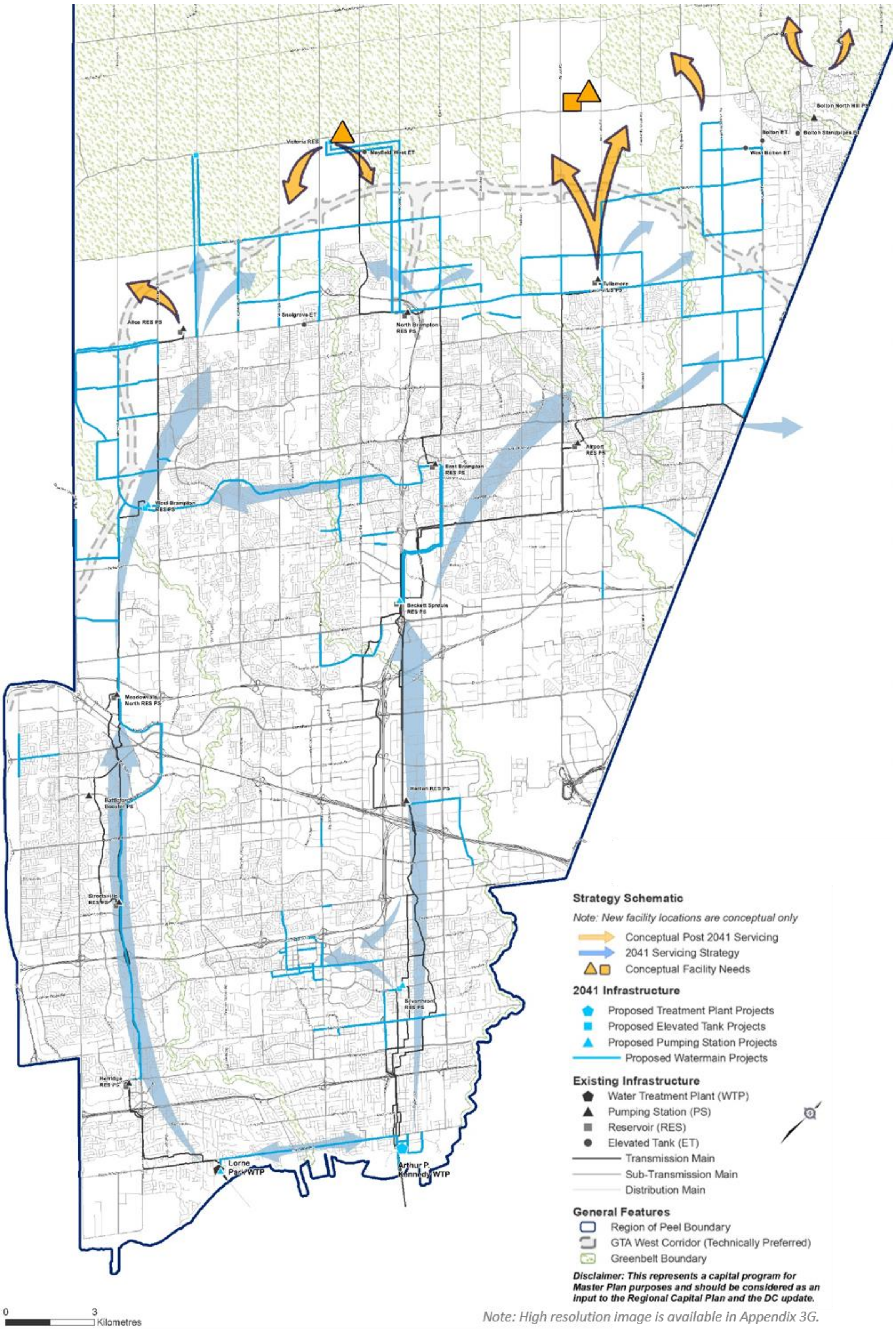


Figure 27 – Post-2041 water servicing strategy.

References

[1] A Place to Grow, Growth Plan for the Greater Golden Horseshoe, 2019
[2] Design Guidelines for Drinking-Water Systems, 2008
[3] Silverthorn Reservoir and Pumping Station Expansion Class Environmental Assessment. Final Project File Report. https://www.peelregion.ca/pw/water/environ-assess/pdf/EA-silverthorn-pumping-station-report.pdf
[4] Burnhamthorpe Road Watermain Class Environmental Assessment. Project File Report. https://www.peelregion.ca/pw/water/environ-assess/pdf/burnhamthorpe-rd/burnhamthorpe-project-report.pdf
[5] East Brampton Watermains Municipal Class Environmental Assessment Study. Environmental Study Report. https://www.peelregion.ca/pw/water/environ-assess/pdf/east-brampton/east-bram-esr-june2014.pdf
[6] West Brampton Watermain (Zone 5 Subtransmission Main) Schedule C Class Environmental Assessment. Environmental Study Report. (https://www.peelregion.ca/pw/water/environ-assess/pdf/west-brampton/West-Brampton-WM-ESR.pdf
[7] Zone 6 Reservoir and Feedermain Class Environmental Assessment. Environmental Study Report. https://www.peelregion.ca/pw/construction/bram/pdf/10-1966-zone-6-res-FM-class-EA.pdf

3A

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 3A

Design Criteria Memo

Region of Peel
working with you

Public Works

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

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

The memorandum is structured as follows:

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

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

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

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

BACKGROUND

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

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

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

STARTING POINT METHODOLOGY

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

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

EXISTING WATER DESIGN CRITERIA

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

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

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

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

Area-Based Water Design Criteria

The average day water demand criteria for non-residential users was extensively reviewed as part of a growth management exercise. While the details of this analysis

Region of Peel
working with you

Public Works

are not discussed in this document, the findings suggest that area-based design criteria will not make a significant difference in the 2041 water demand projection, overall sizing of facilities and could in fact present more challenges than benefits. It was agreed that further consideration of area-based design criteria will not be pursued, at this time.

Analysis of Water Treatment Flows

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

Analysis of Billing Data

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

Table 1. Water Billing Analysis Summary

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

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

Discretization of Residential and Non-Residential Water Design Criteria

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

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

Table 2. Proposed Region of Peel Water Design Criteria

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

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

EXISTING WASTEWATER DESIGN CRITERIA

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

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

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

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

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

Region of Peel
working with you

Public Works

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

Analysis of Wastewater Treatment Flows

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

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

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

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

Analysis of Local Sub-Drainage Area Flows

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

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

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

Discretization of Residential and Non-Residential Wastewater Design Criteria

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

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

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

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

SUMMARY AND RECOMMENDATIONS

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

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

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

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

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

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

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

Region of Peel working with you

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

Water Design Criteria Average Day

South Peel System

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

5 yr average 244.29 L/cap/d

Lakeview

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

Lorne Park

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

Region of Peel
working with you

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

Wastewater Design Criteria Average Day

South Peel System

Year	Residential Population (South Peel)	No. of Employees (South Peel)	Total Population	Average Daily Flow, MLD (excl. York & Toronto)	Per Capita Flow (L/cap/d)
2007	1,177,517	565,818	1,743,335	479.98	275.32
2008	1,208,615	586,508	1,795,123	521.26	290.37
2009	1,226,639	589,475	1,816,114	502.83	276.87
2010	1,240,559	593,303	1,833,862	482.01	262.84
2011	1,270,860	597,136	1,867,996	537.24	287.60
2012	1,301,162	600,970	1,902,131	536.07	281.83
2013	1,331,463	604,803	1,936,266	557.90	288.13
2014	1,353,423	619,856	1,973,279	590.69	299.35
2015	1,375,384	634,909	2,010,293	567.66	282.38
2016	1,397,344	649,962	2,047,306	581.54	284.05
2017					
				10 yr average	282.87
				5 yr average	287.15

G.E. Booth

Year	Residential Population (East)	No. of Employees (East)	Total Population	Average Daily Flow, MLD (excl. York & Toronto)	Per Capita Flow (L/cap/d)
2007	686,815	433,874	1,120,689	306.61	306.61
2008	707,485	450,328	1,157,813	323.41	323.41
2009	719,035	449,219	1,168,254	324.11	324.11
2010	727,504	451,666	1,179,170	339.06	339.06
2011	755,442	450,395	1,205,836	401.66	376.98
2012	783,380	449,123	1,232,503	395.35	375.83
2013	811,318	447,852	1,259,170	429.00	402.65
2014	820,400	457,530	1,277,930	425.13	425.13
2015	829,482	467,209	1,296,691	378.55	378.55
2016	838,564	476,887	1,315,451	398.67	380.10
2017					
				10 yr average	363.24
				5 yr average	392.45

Clarkson

Year	Residential Population (West)	No. of Employees (West)	Total Population	Average Daily Flow, MLD (excl. York & Toronto)	Per Capita Flow (L/cap/d)
2007	490,703	131,944	622,647	173.24	278.23
2008	501,130	136,180	637,310	197.80	310.37
2009	507,604	140,256	647,860	187.47	289.37
2010	513,055	141,637	654,692	177.27	270.77
2011	515,418	146,741	662,160	160.25	242.02
2012	517,782	151,846	669,628	160.24	239.29
2013	520,145	156,951	677,096	155.24	229.28
2014	533,023	162,326	695,349	165.56	238.10
2015	545,902	167,700	713,602	189.11	265.01
2016	558,780	173,075	731,855	201.44	275.24
2017					
				10 yr average	263.77
				5 yr average	249.38

3B

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 3B

Cost Estimation Framework Memo

Cost Estimation Framework

2020 Water and Wastewater Master Plan

Prepared by:
GM BluePlan Engineering for:

The Regional Municipality of Peel

Project No. 715022

May 2020

Table of Contents

1 INTRODUCTION 4

2 REGION OF PEEL'S COST ESTIMATION FRAMEWORK 5

2.1 Approach and Methodology 5
2.2 Project Type 7
2.3 Cost Estimate Classification 7
2.4 Project Complexity 8
2.5 Unit Rates 10
2.6 Construction Uplift 11
2.7 Additional Construction Costs 11
2.8 Construction Provisional Allowance 11
2.9 Other Project Costs 12
2.10 Project Contingency 13

List of Tables

Table 1. Cost Estimation Classes 7
Table 2. Project Complexity Descriptions 8
Table 3. Construction Uplift Descriptions 11
Table 4. Additional Cost Components 12
Table 5. Project Contingency 13

List of Figures

Figure 1. Cost Estimation Process Flow Diagram (Sample – Water) 6

List of Appendices

Appendix A – Cost Estimation Spreadsheet Template

Appendix B – Cost Estimate Classes

Appendix C – Data Confidence and Availability for Cost Estimate Classes

Appendix D – Updated Unit Rates

1 INTRODUCTION

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

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

The primary aims of this task are to:

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

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

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

2 REGION OF PEEL'S COST ESTIMATION FRAMEWORK

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

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

2.1 Approach and Methodology

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

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

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

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

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

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

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

The following sections describe the methodology for each cost component.

Step 1. Define Project Type

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

Step 2. Define Project Classification

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

Step 3. Define Project Complexity

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

Step 4. Define Project Details

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

Step 5. Calculate Total Construction Cost

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

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

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

+

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

Construction Environment		
Greenfield	Suburban	Urban
0%	10%	20%

=

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

❸ = ❶ + ❷

+

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

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

Project Complexity		
Low	Moderate	High
10%	15%	20%

+

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

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

Provisional & Allowance
10%

=

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

❻ = ❸+ ❹ + ❺

Step 6. Calculate Soft Costs

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

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

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

+

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

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

+

❾ ENGINEERING/DESIGN (INTERNAL)

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

+

❿ DESIGN/CONTRACT ADMINISTRATION (EXTERNAL)

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

+

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

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

=

⓬ TOTAL SOFT COSTS (GROWTH)

⓬ = ❼ + ❽ + ❾ + ❿ + ⓫

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

⓯ ENGINEERING & CONSTRUCTION ADMINISTRATION C
Account 37323 — 4%

+

⓰ DEVELOP INSPECTORS C
Account 37321 — 4%

+

⓱ MISC EXP - CAP PROJ
Account 23879 — 14%

=

⓲ TOTAL SOFT COSTS (NON-GROWTH)

⓲ = ⓯ + ⓰ + ⓱

Step 7. Calculate Project Contingency

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

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

Step 8. Calculate Total Project Cost

⓮ TOTAL PROJECT COSTS

⓮ = ❻ + ⓬ + ⓭

Step 9. Determine Funding Source(s)

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

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

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

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

Step 10. Assemble Capital Project in the Database

❻ is entered as the CONSTRUCTION component

⓬ is entereed as the DESIGN/SOFT COST component

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

2.2 Project Type

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

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

2.3 Cost Estimate Classification

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

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

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

Table 1. Cost Estimation Classes

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

2.4 Project Complexity

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

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

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

Table 2. Project Complexity Descriptions

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

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

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

2.5 Unit Rates

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

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

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

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

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

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

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

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

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

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

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

2.6 Construction Uplift

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

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

Table 3. Construction Uplift Descriptions

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

2.7 Additional Construction Costs

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

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

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

2.8 Construction Provisional Allowance

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

2.9 Other Project Costs

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

Table 4. Additional Cost Components

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

2.10 Project Contingency

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

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

Table 5. Project Contingency

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

Appendix A – Cost Estimation Spreadsheet Template

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

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

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

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

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

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

COST ESTIMATION SPREADSHEET

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

COST ESTIMATE SUMMARY - FOR PHASING ESTIMATING ONLY

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

Appendix B – Cost Estimate Classes

CLASS 5 ESTIMATE: Order of Magnitude Estimate	
Description: Includes high level cost estimate with a long-term project horizon. Desktop level analysis based on previous similar projects and engineer's informed approximation formed on limited available information. **Example of Typical Study/Design Level:** Master Plan, Infrastructure Plan, Capital Budgeting **End Usage:** Concept screening and feasibility; used at an early stage in absence of better information.	**Estimating Methods Used:** Experience and judgement, historical values, rules of thumb, factor estimating base on similar projects, among other basic calculations. **Expected Accuracy Range:** Low Complexity → High Complexity +/- 40% → +/- 70%

CLASS 4 ESTIMATE: Planning Cost Estimate	
Description: Includes high level cost estimate with a long-term project horizon. Desktop level analysis based on preliminary investigations, anticipated project needs, and engineer's best judgement based on limited available information. **Example of Typical Study/Design Level:** Master Plan, Infrastructure Plan, Capital Budgeting **End Usage:** Concept screening; justification for project planning funding. Useful for planning purposes in preparation for project pre-design. Shall be included in Capital Projects List.	**Estimating Methods Used:** An approximate method of estimating using an inclusive "all in" unit rates, typically based on historic data. (e.g. sewer cost per meter) **Expected Accuracy Range:** Low Complexity → High Complexity +/- 20% → +/- 40%

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

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

<table>
<tr><th colspan="2">CLASS 1 ESTIMATE: Detailed Design Cost Estimate</th></tr>
<tr>
<td>Description:
This class will generate a cost estimate representing the Engineer's final estimate based on completed plans. The estimated cost will reflect current market conditions in the constructing community. The goal of this cost estimate is to match the median bid received during the bidding process.

Example of Typical Study/Design Level:
Detailed Design

End Usage:
Final cost review in preparation for construction; tender ready.</td>
<td>Estimating Methods Used:
Project specific costs based on detailed study of work methods, resources and materials. For example, material costs based on current supplier quotes. All project components costed individually.

Expected Accuracy Range:
Low Complexity → High Complexity
+/- 5% → +/- 10%</td>
</tr>
</table>

Appendix C – Data Confidence and Availability for Cost Estimate Classes

Linear Projects

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

Vertical Projects

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

Appendix D – Updated Unit Rates

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

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

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

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

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

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

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

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

Anticipated trenchless methodology is as follows:

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

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

Facilities

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

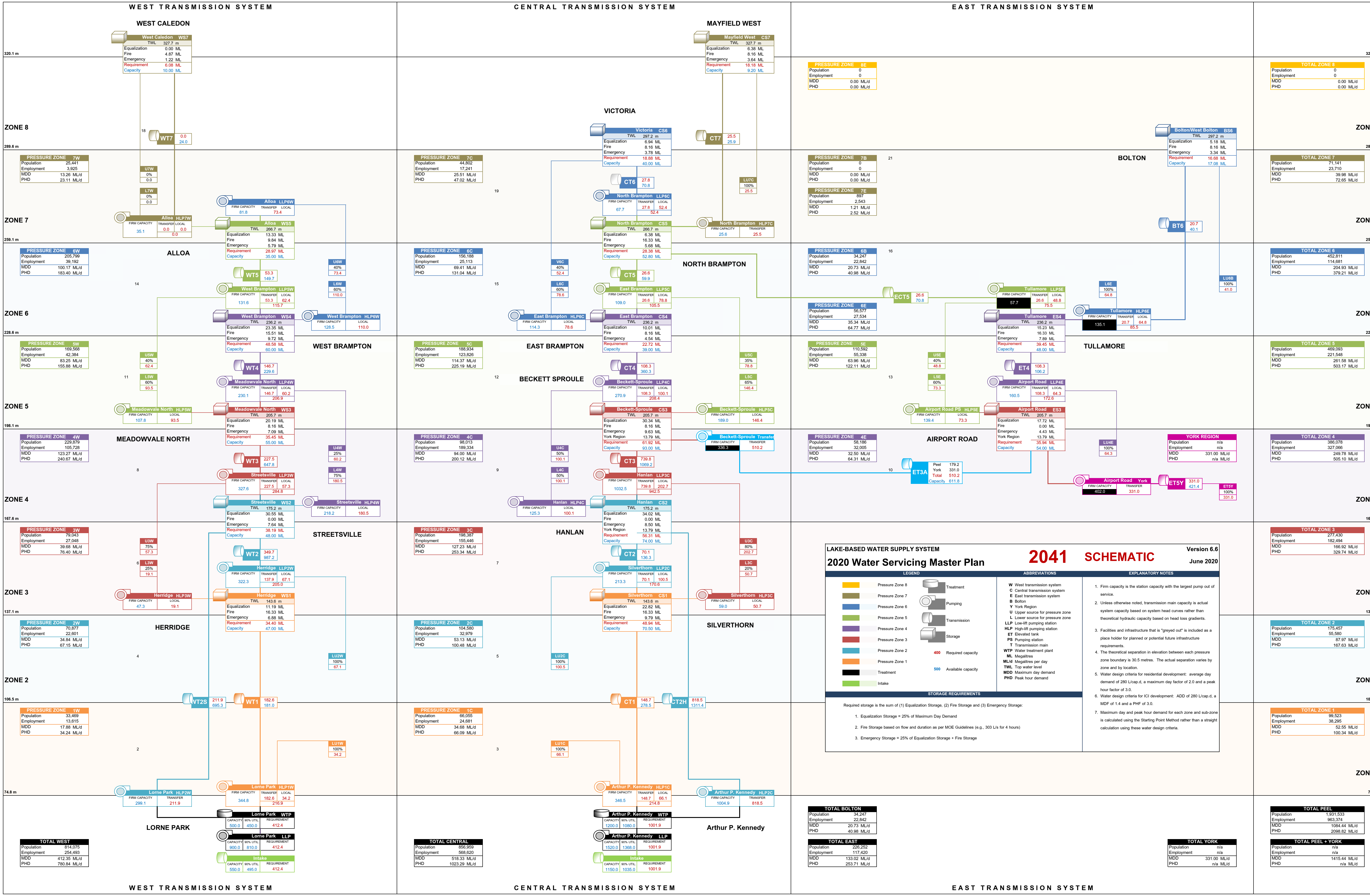
Notes: Unit rate is intended to provide the base construction cost for a basic pumping facility. These costs are not assumed to account for force mains (for WWPS) or overflow storage tanks (WWPS) or unique items such as deep wet wells (WWPS), extensive architectural features or extensive site works.

3C

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 3C

Lake-based Water Schematics



WEST TRANSMISSION SYSTEM
CENTRAL TRANSMISSION SYSTEM
EAST TRANSMISSION SYSTEM
WEST CALEDON
MAYFIELD WEST
VICTORIA
BOLTON
ALLOA
NORTH BRAMPTON
WEST BRAMPTON
EAST BRAMPTON
TULLAMORE
BECKETT SPROULE
MEADOWVALE NORTH
AIRPORT ROAD
STREETSVILLE
HANLAN
HERRIDGE
SILVERTHORN
LORNE PARK
Arthur P. Kennedy
ZONE 8
ZONE 7
ZONE 6
ZONE 5
ZONE 4
ZONE 3
ZONE 2
ZONE 1
LAKE-BASED WATER SUPPLY SYSTEM
2020 Water Servicing Master Plan
2041
SCHEMATIC
Version 6.6
June 2020
LEGEND
Pressure Zone 8
Pressure Zone 7
Pressure Zone 6
Pressure Zone 5
Pressure Zone 4
Pressure Zone 3
Pressure Zone 2
Pressure Zone 1
Treatment
Intake
Treatment
Pumping
Transmission
Storage
400 Required capacity
500 Available capacity
ABBREVIATIONS
W West transmission system
C Central transmission system
E East transmission system
B Bolton
Y York Region
U Upper source for pressure zone
L Lower source for pressure zone
LLP Low-lift pumping station
HLP High-lift pumping station
ET Elevated tank
PS Pumping station
T Transmission main
WTP Water treatment plant
ML Megalitres
ML/d Megalitres per day
TWL Top water level
MDD Maximum day demand
PHD Peak hour demand
EXPLANATORY NOTES
1. Firm capacity is the station capacity with the largest pump out of service.
2. Unless otherwise noted, transmission main capacity is actual system capacity based on system head curves rather than theoretical hydraulic capacity based on head loss gradients.
3. Facilities and infrastructure that is "greyed out" is included as a place holder for planned or potential future infrastructure requirements.
4. The theoretical separation in elevation between each pressure zone boundary is 30.5 metres. The actual separation varies by zone and by location.
5. Water design criteria for residential development: average day demand of 280 L/cap.d, a maximum day factor of 2.0 and a peak hour factor of 3.0.
6. Water design criteria for ICI development: ADD of 280 L/cap.d, a MDF of 1.4 and a PHF of 3.0.
7. Maximum day and peak hour demand for each zone and sub-zone is calculated using the Starting Point Method rather than a straight calculation using these water design criteria.
STORAGE REQUIREMENTS
Required storage is the sum of (1) Equalization Storage, (2) Fire Storage and (3) Emergency Storage:
1. Equalization Storage = 25% of Maximum Day Demand
2. Fire Storage based on flow and duration as per MOE Guidelines (e.g., 303 L/s for 4 hours)
3. Emergency Storage = 25% of Equalization Storage + Fire Storage

3D

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 3D

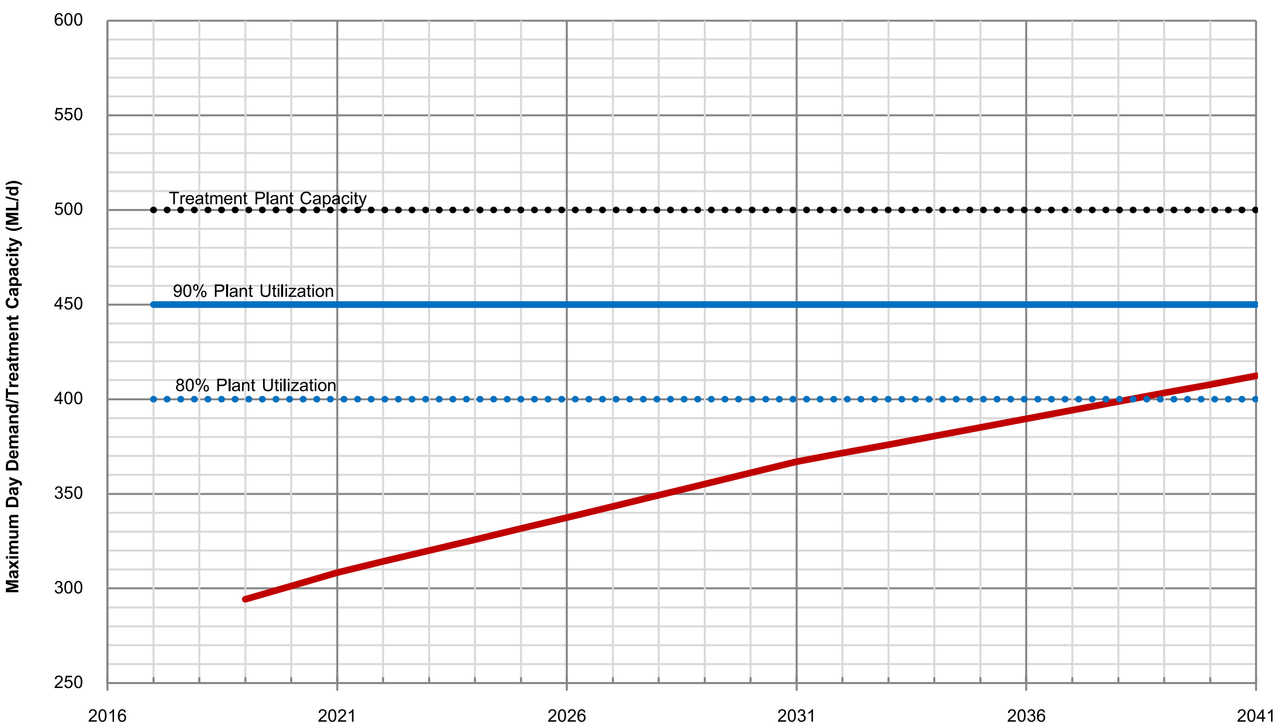
Detailed Capacity Assessments

TREATMENT

LORNE PARK WATER TREATMENT PLANT

Treatment Facility	Treatment Type	Treatment Capacity (ML/d)
Conventional (Filters 1 to 4)	Conventional Treatment (CVT) - Flocculation, Sedimenta	120
OBM	Ozone, Biologically Active Carbon (BAC) Contactor, Mem	380

		2019	2021	2026	2031	2036	2041
WEST	**Forecasted Demand (ML/d)**	**294**	**308**	**337**	**367**	**390**	**412**
	Installed Treatment Capacity (ML/	500	500	500	500	500	500
	95% Plant Utilization (ML/d)	475	475	475	475	475	475
	90% Plant Utilization (ML/d)	**450**	**450**	**450**	**450**	**450**	**450**
		ok	ok	ok	ok	ok	ok

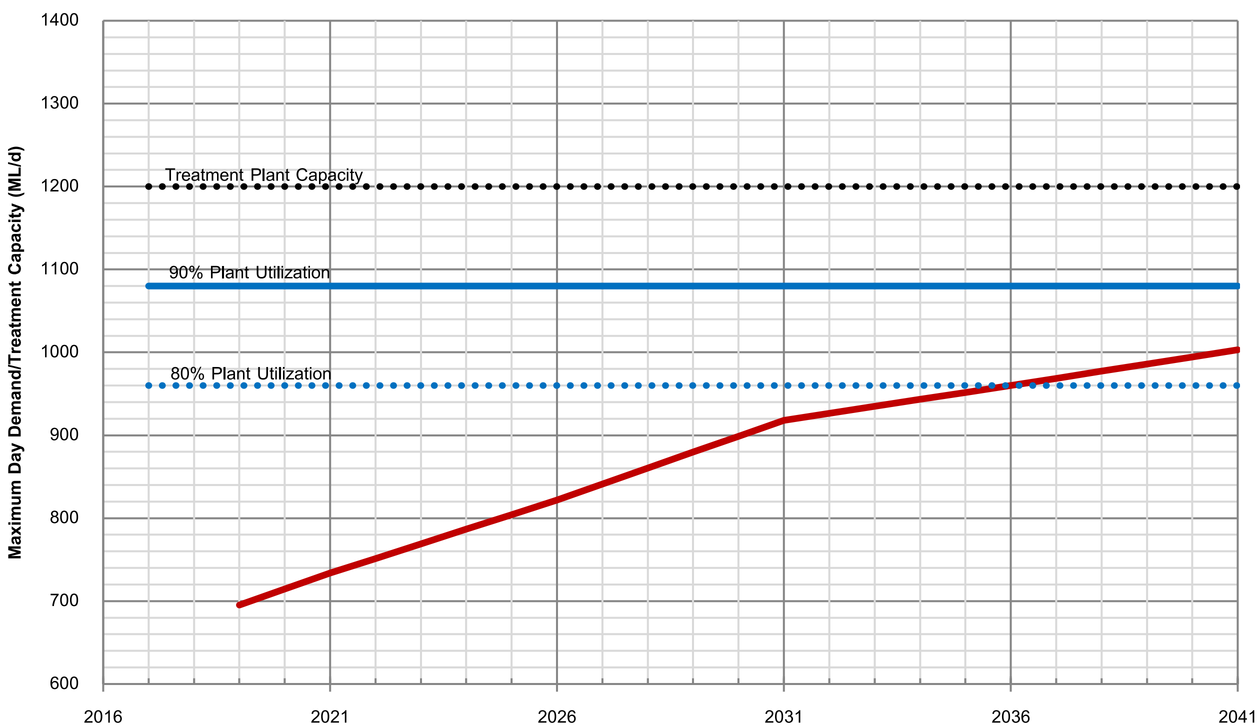


TREATMENT

LORNE PARK WATER TREATMENT PLANT

Treatment Facility	Treatment Type	Treatment Capacity (ML/d)
Conventional (Filters 1 to 8) Conventional (Filters 9 to 16)	Conventional Treatment (CVT) - Flocculation, Sedimenta Conventional Treatment (CVT) - Flocculation, Sedimenta	440
OBM1	Ozone, Biologically Active Carbon (BAC) Contactor, Mem	400
OBUM2	Ozone, Biologically Active Carbon (BAC) Contactor, UV F	400
OBUM2 Expansion	Ozone, Biologically Active Carbon (BAC) Contactor, Mem	70
OBM3	Ozone, Biologically Active Carbon (BAC) Contactor, Mem	400

		2019	2021	2026	2031	2036	2041
WEST	**Forecasted Demand (ML/d)**	**695**	**734**	**822**	**918**	**960**	**1003**
	Installed Treatment Capacity (ML/	1200	1200	1200	1200	1200	1200
	95% Plant Utilization (ML/d)	1140	1140	1140	1140	1140	1140
	90% Plant Utilization (ML/d)	**1080**	**1080**	**1080**	**1080**	**1080**	**1080**
		ok	ok	ok	ok	ok	ok



TRANSMISSION tables of available vs. required capacity

WEST TRANSMISSION SYSTEM

ALLOA to WEST CALEDON

WT7	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	West Caledon 750 PZ7	n/a	2026	750	44	24	n/a

WT7	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	0.0	6.2	9.2	10.9	13.3
Total Theoretical Capacity (ML/d)	0	0	44	44	44
Total Actual System Capacity (ML/d)	0	0	24	24	24
	ok	not ok	ok	ok	ok

WEST BRAMPTON to ALLOA

WT5	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	Alloa 1200 PZ5	PRP-5	2018	1200	151	150	129

WT5	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	33.0	33.7	41.0	47.0	53.3
Total Theoretical Capacity (ML/d)	151	151	151	151	151
Total Actual System Capacity (ML/d)	150	150	150	150	150
	ok	ok	ok	ok	ok

MEADOWVALE NORTH to WEST BRAMPTON

WT4	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	West Brampton 1500 PZ4	27	2011	1500	271	230	110
	West Brampton 1200 PZ4	n/a	Post-2041	1200	151	151	n/a

WT4	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	78.3	92.5	119.8	133.5	146.7
Total Theoretical Capacity (ML/d)	271	271	271	271	271
Total Actual System Capacity (ML/d)	230	230	230	230	230
	ok	ok	ok	ok	ok

STREETSVILLE to MEADOWVALE NORTH

WT3	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	Meadowvale North 900 PZ3	11	1989	900	71	60	110
	Meadowvale North 1200 PZ3	17	2014	1200	151	151	130
	Meadowvale North 1500 PZ3	n/a	2029	1800	438	437	130

WT3	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	150.6	172.9	195.4	211.9	227.5
Total Theoretical Capacity (ML/d)	222	222	660	660	660
Total Actual System Capacity (ML/d)	211	211	648	648	648
	ok	ok	ok	ok	ok

HERRIDGE to STREETSVILLE

WT2	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	Streetsville 1050 PZ2	4	1971	1050	106	87	106
	Streetsville 1500 PZ2	14	2003	1500	271	243	117
	Streetsville 1500 PZ2	n/a	2028	2100	657	657	130

WT2	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	253.7	282.3	310.0	329.9	349.7
Total Theoretical Capacity (ML/d)	378	378	1035	1035	1035
Total Actual System Capacity (ML/d)	330	330	987	987	987
	ok	ok	ok	ok	ok

LORNE PARK TO HERRIDGE

WT2S	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	Streetsville 2100 PZ2	19	2013	2100	657	695	138

WT2S	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	180.3	209.5	227.3	250.3	274.0
Total Theoretical Capacity (ML/d)	657	657	657	657	657
Total Actual System Capacity (ML/d)	695	695	695	695	695
	ok	ok	ok	ok	ok

LORNE PARK to HERRIDGE

WT1	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	Herridge 1500 PZ1	9	1978	1500	271	181	108

WT1	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	153.1	150.3	162.0	162.0	162.0
Total Theoretical Capacity (ML/d)	271	271	271	271	271
Total Actual System Capacity (ML/d)	181	181	181	181	181
	ok	ok	ok	ok	ok

LORNE PARK INTAKE

Lorne Park Intake	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	1800/2400mm Intake (L = 1590 m)	n/a	1978	1800/2100/2400	550	550	77
	New Intake	n/a	Post-2041	?	?	?	n/a

Lorne Park Intake	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	308.4	337.4	367.0	389.6	412.4
Total Theoretical Capacity (ML/d)	550	550	550	550	550
Total Actual System Capacity (ML/d)	550	550	550	550	550
90% Utilization (ML/d)	495	495	495	495	495
	ok	ok	ok	ok	ok

*Based on a HL gradient of 1 m/km

TRANSMISSION tables of available vs. required capacity

CENTRAL TRANSMISSION SYSTEM

NORTH BRAMPTON to MAYFIELD WEST

	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
CT7	Mayfield West 600 PZ7	25	2010	600	24	26	138

CT7		2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	11.2	27.9	33.1	42.2	47.0
	Total Theoretical Capacity (ML/d)	24	24	24	24	24
	Total Actual System Capacity (ML/d)	26	26	26	26	26
		ok	not ok	not ok	not ok	not ok

NORTH BRAMPTON to VICTORIA

	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
CT6	Victoria 900 PZ6	n/a	2022	900	71	71	130

CT6		2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	25.4	26.1	26.8	27.2	27.8
	Total Theoretical Capacity (ML/d)	0	71	71	71	71
	Total Actual System Capacity (ML/d)	0	71	71	71	71
		not ok	ok	ok	ok	ok

EAST BRAMPTON to NORTH BRAMPTON

	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
CT5	North Brampton 900 PZ5	10	1983	900	71	60	110

CT5		2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	36.6	20.5	22.3	25.0	26.6
	Total Theoretical Capacity (ML/d)	71	71	71	71	71
	Total Actual System Capacity (ML/d)	60	60	60	60	60
		ok	ok	ok	ok	ok

BECKETT SPROULE to EAST BRAMPTON

	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
CT4	East Brampton 1050 PZ4	8	1983	1050	106	89	109
	East Brampton 1500 PZ4	n/a	2022	1500	271	271	130

CT4		2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	105	113	120	129	135
	Total Theoretical Capacity (ML/d)	106	378	378	378	378
	Total Actual System Capacity (ML/d)	89	360	360	360	360
		not ok	ok	ok	ok	ok

HANLAN to BECKETT SPROULE

	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
CT3	Beckett Sproule 1200 PZ3	6	1969	1200	151	151	130
	Beckett Sproule 1500 PZ3	16	1992	1500	271	261	125
	Beckett Sproule 2100 PZ3	26	2013	2100	657	657	130

CT3		2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	528.7	625.0	709.7	738.4	766.5
	Total Theoretical Capacity (ML/d)	1080	1080	1080	1080	1080
	Total Actual System Capacity (ML/d)	1069	1069	1069	1069	1069
		ok	ok	ok	ok	ok

Arthur P. Kennedy to HANLAN

	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
CT2H	Hanlan 2100/1800 PZ2	12	1996	1800	438	378	112
	Hanlan 2400 PZ2	29	2018	2400	934	934	130

CT2H		2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	635.6	703.3	777.9	805.6	835.3
	Total Theoretical Capacity (ML/d)	1372	1372	1372	1372	1372
	Total Actual System Capacity (ML/d)	1311	1311	1311	1311	1311
		ok	ok	ok	ok	ok

SILVERTHORN to HANLAN

	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
CT2	Hanlan 1500/1200 PZ2	5	1971	1200	151	136	117

CT2		2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	4.2	41.0	57.7	63.5	67.2
	Total Theoretical Capacity (ML/d)	151	151	151	151	151
	Total Actual System Capacity (ML/d)	136	136	136	136	136
		ok	ok	ok	ok	ok

Arthur P. Kennedy to SILVERTHORN

	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
CT1	Silverthorn 900 PZ1	1	1964	900	71	57	105
	Silverthorn 1500 PZ1	2	1970	1500	271	221	106

CT1		2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	72.1	91.6	109.8	121.1	131.9
	Total Theoretical Capacity (ML/d)	342	342	342	342	342
	Total Actual System Capacity (ML/d)	279	279	279	279	279
		ok	ok	ok	ok	ok

Arthur P. Kennedy INTAKE

	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
Arthur P. Kennedy Intake	760mm Intake (L = 850 metres)	n/a	Decommiss. 1962	760	0	n/a	n/a
	1676mm Intake (L = 1030 metres)	n/a	Decommiss. 1991	1676	0	n/a	n/a
	2550mm Intake (L = 1950 metres)	n/a	1991	2550	1095	1150	137
	New Intake	n/a	2041	2400	934	934	?

Arthur P. Kennedy Intake		2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	733.3	821.3	917.6	959.1	1001.9
	Total Theoretical Capacity (ML/d)	1095	1095	1095	1095	2029
	Total Actual System Capacity (ML/d)	1150	1150	1150	1150	2084
	90% Utilization (ML/d)	1035	1035	1035	1035	1876
		ok	ok	ok	ok	ok

TRANSMISSION tables of available vs. required capacity

EAST TRANSMISSION SYSTEM

TULLAMORE to BOLTON

BT6	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	Bolton 750 PZ6	24	2002	750	44	40	119
	Bolton 600 PZ6	n/a	Post-2041	600	24	24	n/a

TULLAMORE to BOLTON

BT6	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	16.5	17.4	18.2	19.4	20.7
Total Theoretical Capacity (ML/d)	44	44	44	44	44
Total Actual System Capacity (ML/d)	40	40	40	40	40
	ok	ok	ok	ok	ok

TULLAMORE to NORTH BRAMPTON

ECT5	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	North Brampton 900 PZ5	n/a	2026	900	71	71	130

TULLAMORE to NORTH BRAMPTON

ECT5	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	0.0	20.5	22.3	25.0	26.6
Total Theoretical Capacity (ML/d)	0	71	71	71	71
Total Actual System Capacity (ML/d)	0	71	71	71	71
	ok	ok	ok	ok	ok

AIRPORT ROAD to TULLAMORE

ET4	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	Tullamore 1050 PZ4	PRP-4	2013	1050	106	106	130
	Tullamore 1200 PZ4	n/a	Post-2041	1200	151	151	n/a

AIRPORT ROAD to TULLAMORE

ET4	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	38.6	50.9	60.5	69.7	81.7
Total Theoretical Capacity (ML/d)	106	106	106	106	106
Total Actual System Capacity (ML/d)	106	106	106	106	106
	ok	ok	ok	ok	ok

AIRPORT ROAD to YORK REGION

ET5Y Transfer	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	York 1800 Transfer	23	2005	1800	438	421	125

AIRPORT ROAD to YORK REGION

ET5Y	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	231.8	276.7	331.0	331.0	331.0
Total Theoretical Capacity (ML/d)	438	438	438	438	438
Total Actual System Capacity (ML/d)	421	421	421	421	421
	ok	ok	ok	ok	ok

BECKETT SPROULE to AIRPORT ROAD

ET3A Transfer	Transmission Main	OCWA TM ID	Year in Service	Diameter (mm)	Theor. Capacity* (ML/d)	Actual Capacity* (ML/d)	Actual C-factor
	Airport Road 2100 Transfer	13	2004	2100	657	612	121

BECKETT SPROULE to AIRPORT ROAD

ET3A	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	325.4	407.8	479.2	494.3	510.2
Total Theoretical Capacity (ML/d)	657	657	657	657	657
Total Actual System Capacity (ML/d)	612	612	612	612	612
	ok	ok	ok	ok	ok

STORAGE tables of available vs. required capacity

WEST TRANSMISSION SYSTEM

PRESSURE ZONE 7W

Zone	Station	Facility	Facility No.	Year in Service	Total Volume (ML)
Proposed construction: **2029**	WS7	West Caledon Elevated Tank	n/a	2027	10.0
		TOTAL			10.0

WS7		2021	2026	2031	2036	2041
Emergency storage	WS7 Emergency	0.0	0.0	0.8	0.8	1.2
Fire storage (PZ7W)	WS7 Fire 7W	0.0	0.0	3.1	3.1	4.9
Equalization storage (PZ7W)	WS7 Equalization 7W	0.0	0.0	0.0	0.0	0.0
Total Required Storage (ML)	WS7 Total	0.0	0.0	3.8	3.8	6.1
Total Available Storage (ML)		0.0	0.0	10.0	10.0	10.0
		OK	OK	OK	OK	OK

PRESSURE ZONE 6W

Zone	Station	Facility	Facility No.	Year in Service	Total Volume (ML)
Initially constructed: **1976**; Proposed decommissioning: **2022**	WS6	Snelgrove Elevated Tank	P526001	1976	3.8
		TOTAL			3.8

* To be decommissioned in 2022 after the Victoria Reservoir is in service.

WS6		2021	2026	2031	2036	2041
Emergency storage	WS6 Emergency	0.6	0.0	0.0	0.0	0.0
Fire storage (PZ6W)	WS6 Fire 6W	2.4	0.0	0.0	0.0	0.0
Total Required Storage (ML)	WS6 Total	3.1	0.0	0.0	0.0	0.0
Total Available Storage (ML)		3.8	0.0	0.0	0.0	0.0
		OK				

PRESSURE ZONE 5W

Zone	Station	Facility	Facility No.	Year in Service	Total Volume (ML)
Initially constructed: **2018**; Proposed expansion: **Post-2041**	WS5	Alloa Reservoir Cell 1	RSV22810	2018	17.5
		Alloa Reservoir Cell 2	RSV22820	2018	17.5
		Alloa Reservoir Cell 3	RSV22830	Post-2041	17.5
		TOTAL			35.0

WS5		2021	2026	2031	2036	2041
Emergency storage	WS5 Emergency	4.5	5.8	4.9	5.3	5.8
Fire storage (PZ7W)	WS5 Fire 7W	1.7	2.4	0.5	0.5	0.9
Fire storage (PZ6W)	WS5 Fire 6W	0.0	4.1	4.1	4.1	4.1
Fire storage (PZ5W)	WS5 Fire 5W	8.2	8.2	4.9	4.9	4.9
Equalization storage (PZ7W)	WS5 Equalization 7W	0.7	1.6	2.3	2.7	3.3
Equalization storage (PZ6W)	WS5 Equalization 6W	7.5	6.9	8.0	9.0	10.0
Total Required Storage (ML)	WS5 Total	22.7	28.8	24.7	26.6	29.0
Total Available Storage (ML)		35.0	35.0	35.0	35.0	35.0
		OK	OK	OK	OK	OK

PRESSURE ZONE 4W

Zone	Station	Facility	Facility No.	Year in Service	Total Volume (ML)
Initially constructed: **2011**; Proposed expansion: **2028**	WS4	West Brampton Reservoir Cell 1	P523001	2011	20.0
		West Brampton Reservoir Cell 2	P523001	2011	20.0
		West Brampton Reservoir Cell 3	P523001	2028	20.0
		TOTAL			40.0

WS4		2021	2026	2031	2036	2041
Emergency storage	WS4 Emergency	6.3	6.7	8.8	9.3	9.7
Fire storage (PZ6W)	WS4 Fire 6W	5.7	4.1	4.1	4.1	4.1
Fire storage (PZ5W)	WS4 Fire 5W	0.0	0.0	3.3	3.3	3.3
Fire storage (PZ4W)	WS4 Fire 4W	8.2	8.2	8.2	8.2	8.2
Equalization storage (PZ6W)	WS4 Equalization 6W	7.5	10.3	11.9	13.5	15.0
Equalization storage (PZ5W)	WS4 Equalization 5W	3.8	4.4	7.8	8.1	8.3
Total Required Storage (ML)	WS4 Total	31.5	33.7	44.0	46.4	48.6
Total Available Storage (ML)		40.0	40.0	60.0	60.0	60.0
		OK	OK	OK	OK	OK

PRESSURE ZONE 3W

Zone	Station	Facility	Facility No.	Year in Service	Total Volume (ML)
Initially constructed: **1989**; Expanded: **2002**	WS3	Meadowvale North Reservoir Cell 1	P513001	1989	12.5
		Meadowvale North Reservoir Cell 2	P513001	1989	12.5
		Meadowvale North Reservoir Cell 3	P513001	2002	15.0
		Meadowvale North Reservoir Cell 4	P513001	2002	15.0
		TOTAL			55.0

WS3		2021	2026	2031	2036	2041
Emergency storage	WS3 Emergency	6.6	7.1	6.8	6.9	7.1
Fire storage (PZ5W)	WS3 Fire 5W	0.0	0.0	0.0	0.0	0.0
Fire storage (PZ3W)	WS3 Fire 3W	8.2	8.2	8.2	8.2	8.2
Equalization storage (PZ5W)	WS3 Equalization 5W	11.5	13.2	11.6	12.1	12.5
Equalization storage (PZ4W)	WS3 Equalization 4W	6.6	6.9	7.3	7.5	7.7
Total Required Storage (ML)	WS3 Total	32.8	35.3	33.8	34.7	35.4
Total Available Storage (ML)		55.0	55.0	55.0	55.0	55.0
		OK	OK	OK	OK	OK

PRESSURE ZONE 2W

Zone	Station	Facility	Facility No.	Year in Service	Total Volume (ML)
Initially constructed: **1989**; Expanded: **2011**; Proposed expansion: **Post-2041**	WS2	Streetsville Reservoir Cell 1	P512001	1971	23.0
		Streetsville Reservoir Cell 2	P512001	2011	25.0
		Streetsville Reservoir Cell 3	n/a	Post-2041	20.0
		TOTAL			48.0

WS2		2021	2026	2031	2036	2041
Emergency storage	WS2 Emergency	6.4	6.8	7.2	7.4	7.6
Fire storage (PZ2W)	WS2 Fire 2W	0.0	0.0	0.0	0.0	0.0
Equalization storage (PZ4W)	WS2 Equalization 4W	19.9	20.8	21.8	22.5	23.1
Equalization storage (PZ3W)	WS2 Equalization 3W	5.9	6.5	6.8	7.0	7.4
Total Required Storage (ML)	WS2 Total	32.2	34.2	35.8	36.9	38.2
Total Available Storage (ML)		48.0	48.0	48.0	48.0	48.0
		OK	OK	OK	OK	OK

PRESSURE ZONE 1W

Zone	Station	Facility	Facility No.	Year in Service	Total Volume (ML)
Initially constructed: **1965**; Expanded: **1989**	WS1	Herridge South Reservoir	P511001	1972	32.0
		Herridge North Reservoir	P511001	1989	15.0
		TOTAL			47.0

WS1		2021	2026	2031	2036	2041
Emergency storage	WS1 Emergency	6.2	6.6	6.6	6.7	6.9
Fire storage (PZ2W)	WS1 Fire 2W	8.2	8.2	8.2	8.2	8.2
Fire storage (PZ1W)	WS1 Fire 1W	6.3	8.2	8.2	8.2	8.2
Equalization storage (PZ3W)	WS1 Equalization 3W	2.5	2.2	2.3	2.3	2.5
Equalization storage (PZ2W)	WS1 Equalization 2W	7.7	7.8	7.9	8.3	8.7
Total Required Storage (ML)	WS1 Total	30.9	32.9	33.2	33.7	34.4
Total Available Storage (ML)		47.0	47.0	47.0	47.0	47.0
		OK	OK	OK	OK	OK

STORAGE tables of available vs. required capacity

CENTRAL TRANSMISSION SYSTEM

PRESSURE ZONE 7C

Initially constructed: **2010**

CS7

Facility	Facility No.	Year in Service	Total Volume (ML)
Mayfield West Elevated Tank	P580001	2010	9.2
TOTAL			9.2

PRESSURE ZONE 7C

CS7		2021	2026	2031	2036	2041
Emergency storage	CS7 Emergency	2.1	2.5	3.1	3.5	3.6
Fire storage (PZ7C)	CS7 Fire 7C	5.7	6.3	8.2	8.2	8.2
Equalization storage (PZ7C)	CS7 Equalization 7C	2.8	3.7	4.4	5.7	6.4
Total Required Storage (ML)	**CS7 Total**	**10.7**	**12.5**	**15.7**	**17.3**	**18.2**
Total Available Storage (ML)		**9.2**	**9.2**	**9.2**	**9.2**	**9.2**
		NOT OK	NOT OK	NOT OK	NOT OK	NOT OK

PRESSURE ZONE 6C

Proposed construction: **2021**

CS6

Facility	Facility No.	Year in Service	Total Volume (ML)
Victoria Reservoir Cell 1	n/a	2022	20.0
Victoria Reservoir Cell 2	n/a	2022	20.0
TOTAL			40.0

PRESSURE ZONE 6C

CS6		2021	2026	2031	2036	2041
Emergency storage	CS6 Emergency	3.6	3.7	3.7	3.7	3.8
Fire storage (PZ6C)	CS6 Fire 6C	8.2	8.2	8.2	8.2	8.2
Equalization storage (PZ6C)	CS6 Equalization 6C	6.4	6.5	6.7	6.8	6.9
Total Required Storage (ML)	**CS6 Total**	**18.1**	**18.4**	**18.6**	**18.7**	**18.9**
Total Available Storage (ML)		**0.0**	**40.0**	**40.0**	**40.0**	**40.0**
		NOT OK	OK	OK	OK	OK

PRESSURE ZONE 5C

Initially constructed: **1983**
Expanded: **1992**

CS5

Facility	Facility No.	Year in Service	Total Volume (ML)
North Brampton Reservoir Cell 1	P517001	1983	11.4
North Brampton Reservoir Cell 2	P517001	1983	11.4
North Brampton Reservoir Cell 3	P517001	1992	15.0
North Brampton Reservoir Cell 4	P517001	1992	15.0
TOTAL			52.8

PRESSURE ZONE 5C

CS5		2021	2026	2031	2036	2041
Emergency storage	CS5 Emergency	2.0	5.0	5.2	5.5	5.7
Fire storage (PZ7C)	CS5 Fire 7C	0.0	0.0	0.0	0.0	0.0
Fire storage (PZ6C)	CS5 Fire 6C	0.0	0.0	0.0	0.0	0.0
Fire storage (PZ5C)	CS5 Fire 5C	8.2	8.2	8.2	8.2	8.2
Fire storage (PZ5E)	CS5 Fire 5E	0.0	8.2	8.2	8.2	8.2
Equalization storage (PZ7C)	CS5 Equalization 7C	0.0	3.7	4.4	5.7	6.4
Equalization storage (PZ6C)	CS5 Equalization 6C	0.0	0.0	0.0	0.0	0.0
Total Required Storage (ML)	**CS5 Total**	**10.2**	**25.0**	**25.9**	**27.5**	**28.4**
Total Available Storage (ML)		**52.8**	**52.8**	**52.8**	**52.8**	**52.8**
		OK	OK	OK	OK	OK

PRESSURE ZONE 4C

Initially constructed: **1973**
Expanded: **1989**

CS4

Facility	Facility No.	Year in Service	Total Volume (ML)
East Brampton Reservoir Cell 1	P510001	1973	9.5
East Brampton Reservoir Cell 2	P510001	1973	9.5
East Brampton Reservoir Cell 3	P510001	1989	10.0
East Brampton Reservoir Cell 4	P510001	1989	10.0
TOTAL			39.0

PRESSURE ZONE 4C

CS4		2021	2026	2031	2036	2041
Emergency storage	CS4 Emergency	3.9	4.1	4.3	4.4	4.5
Fire storage (PZ6C)	CS4 Fire 6C	0.0	0.0	0.0	0.0	0.0
Fire storage (PZ4C)	CS4 Fire 4C	8.2	8.2	8.2	8.2	8.2
Equalization storage (PZ6C)	CS4 Equalization 6C	0.0	0.0	0.0	0.0	0.0
Equalization storage (PZ5C)	CS4 Equalization 5C	7.6	8.3	8.9	9.4	10.0
Total Required Storage (ML)	**CS4 Total**	**19.7**	**20.5**	**21.3**	**22.0**	**22.7**
Total Available Storage (ML)		**39.0**	**39.0**	**39.0**	**39.0**	**39.0**
		OK	OK	OK	OK	OK

PRESSURE ZONE 3C

Initially constructed: **1966**
Expanded: **2010**

CS3

Facility	Facility No.	Year in Service	Total Volume (ML)
Beckett Sproule Reservoir Cell 1	P516001	1966	22.5
Beckett Sproule Reservoir Cell 2	P516001	1966	22.5
Beckett Sproule Reservoir Cell 3	P516001	2010	24.0
Beckett Sproule Reservoir Cell 4	P516001	2010	24.0
TOTAL			93.0

PRESSURE ZONE 3C

CS3		2021	2026	2031	2036	2041
York Region	CS3 York Region	9.7	11.5	13.8	13.8	13.8
Emergency storage	CS3 Emergency	8.2	8.6	8.9	9.3	9.6
Fire storage (PZ3C)	CS3 Fire 3C	8.2	8.2	8.2	8.2	8.2
Equalization storage (PZ5C)	CS3 Equalization 5C	14.2	15.3	16.5	17.5	18.6
Equalization storage (PZ4C)	CS3 Equalization 4C	10.4	10.7	11.1	11.4	11.8
Total Required Storage (ML)	**CS3 Total**	**50.5**	**54.3**	**58.5**	**60.1**	**61.9**
Total Available Storage (ML)		**93.0**	**93.0**	**93.0**	**93.0**	**93.0**
		OK	OK	OK	OK	OK

PRESSURE ZONE 2C

Initially constructed: **1969**
Expanded: **2004, 2012**

CS2

Facility	Facility No.	Year in Service	Total Volume (ML)
Hanlan South Reservoir	P515001	1966	45.0
Hanlan North Reservoir	P515001	2004	25.0
Balancing Reservoir	P515001	2004	4.0
Hanlan West Reservoir Cell 1	n/a	Post-2041	20.0
Hanlan West Reservoir Cell 2	n/a	Post-2041	20.0
TOTAL			74.0

PRESSURE ZONE 2C

CS2		2021	2026	2031	2036	2041
York Region	CS2 York Region	9.7	11.5	13.8	13.8	13.8
Emergency storage	CS2 Emergency	9.0	7.5	7.9	8.2	8.5
Fire storage (PZ2C)	CS2 Fire 2C	8.2	0.0	0.0	0.0	0.0
Equalization storage (PZ4C)	CS2 Equalization 4C	10.4	10.7	11.1	11.4	11.8
Equalization storage (PZ3C)	CS2 Equalization 3C	17.4	19.1	20.4	21.3	22.3
Total Required Storage (ML)	**CS2 Total**	**54.6**	**48.8**	**53.2**	**54.6**	**56.3**
Total Available Storage (ML)		**74.0**	**74.0**	**74.0**	**74.0**	**74.0**
		OK	OK	OK	OK	OK

PRESSURE ZONE 1C

Initially constructed: **1964**
Proposed expansion: **2022**

CS1

Facility	Facility No.	Year in Service	Total Volume (ML)
Silverthorn Reservoir (Old) Cell 1	P514001	1964	22.7
Silverthorn Reservoir (Old) Cell 2	P514001	1964	22.7
Silverthorn Reservoir (New)	n/a	2023	25.0
TOTAL			45.5

PRESSURE ZONE 1C

CS1		2021	2026	2031	2036	2041
Emergency storage	CS1 Emergency	6.3	8.5	8.7	9.2	9.8
Fire storage (PZ2C)	CS1 Fire 2C	0.0	8.2	8.2	8.2	8.2
Fire storage (PZ1C)	CS1 Fire 1C	8.2	8.2	8.2	8.2	8.2
Equalization storage (PZ3C)	CS1 Equalization 3C	7.5	8.2	8.8	9.1	9.5
Equalization storage (PZ2C)	CS1 Equalization 2C	9.5	9.6	9.8	11.5	13.3
Total Required Storage (ML)	**CS1 Total**	**31.4**	**42.6**	**43.6**	**46.2**	**48.9**
Total Available Storage (ML)		**45.5**	**70.5**	**70.5**	**70.5**	**70.5**
		OK	OK	OK	OK	OK

STORAGE tables of available vs. required capacity

EAST TRANSMISSION SYSTEM

PRESSURE ZONE 7B

Proposed construction: **2030, 2036**

BS7

Facility	Facility No.	Year in Service	Total Volume (ML)
North Bolton Elevated Tank	n/a	Post-2041	10.0
Castlederg Elevated Tank	n/a	Post-2041	10.0
TOTAL			20.0

PRESSURE ZONE 7B

BS7

		2021	2026	2031	2036	2041
Emergency storage	BS7 Emergency	0.0	0.0	0.0	0.0	0.0
Fire storage (PZ7B)	BS7 Fire 7B	0.0	0.0	0.0	0.0	0.0
Equalization storage (PZ7B)	BS7 Equalization 7B	0.0	0.0	0.0	0.0	0.0
Total Required Storage (ML)	**BS7 Total**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Available Storage (ML)		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
		OK	OK	OK	OK	OK

7E 20

PRESSURE ZONE 7E

Proposed construction: **Post-2041**

ES7

Facility	Facility No.	Year in Service	Total Volume (ML)
East Caledon Elevated Tank	n/a	Post-2041	10.0
TOTAL			10.0

PRESSURE ZONE 7E

ES7

		2021	2026	2031	2036	2041
Emergency storage	ES7 Emergency	0.0	0.0	0.0	0.0	0.0
Fire storage (PZ8E)	ES7 Fire 8E	0.0	0.0	0.0	0.0	0.0
Fire storage (PZ7E)	ES7 Fire 7E	0.0	0.0	0.0	0.0	0.0
Equalization storage (PZ8E)	ES7 Equalization 8E	0.0	0.0	0.0	0.0	0.0
Equalization storage (PZ7E)	ES7 Equalization 7E	0.0	0.0	0.0	0.0	0.0
Total Required Storage (ML)	**ES7 Total**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Available Storage (ML)		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
		OK	OK	OK	OK	OK

6B 17

PRESSURE ZONE 6B

Initially constructed: **1986**

Initially constructed: **2014**

BS6

Facility	Facility No.	Year in Service	Total Volume (ML)
Bolton Elevated Tank	P517001	1986	4.5
West Bolton Elevated Tank	P53001	2014	9.1
Bolton Standpipe No. 1	?	?	4.5
Bolton Standpipe No. 2	?	?	0.6
TOTAL			18.8

PRESSURE ZONE 6B

BS6

		2021	2026	2031	2036	2041
Emergency storage	BS6 Emergency	3.1	3.1	3.2	3.3	3.3
Fire storage (PZ6B)	BS6 Fire 6B	8.2	8.2	8.2	8.2	8.2
Equalization storage (PZ6B)	BS6 Equalization 6B	4.1	4.3	4.5	4.8	5.2
Total Required Storage (ML)	**BS6 Total**	**15.4**	**15.6**	**15.9**	**16.3**	**16.7**
Total Available Storage (ML)		**17.1**	**17.1**	**17.1**	**17.1**	**17.1**
		OK	OK	OK	OK	OK

5E 13

PRESSURE ZONE 5E

Proposed construction: **Post-2041**

ES5

Facility	Facility No.	Year in Service	Total Volume (ML)
Sandhill Reservoir Cell 1	n/a	Post-2041	15.0
Sandhill Reservoir Cell 2	n/a	Post-2041	15.0
Sandhill Reservoir Cell 3	n/a	Post-2041	15.0
Sandhill Reservoir Cell 4	n/a	Post-2041	15.0
TOTAL			60.0

PRESSURE ZONE 5E

ES5

		2021	2026	2031	2036	2041
Emergency storage	ES5 Emergency	0.0	0.0	0.0	0.0	0.0
Fire storage (PZ8E)	ES5 Fire 8E	0.0	0.0	0.0	0.0	0.0
Fire storage (PZ7E)	ES5 Fire 7E	0.0	0.0	0.0	0.0	0.0
Fire storage (PZ6E)	ES5 Fire 6E	0.0	0.0	0.0	0.0	0.0
Fire storage (PZ5E)	ES5 Fire 5E	0.0	0.0	0.0	0.0	0.0
Equalization storage (PZ8E)	ES5 Equalization 8E	0.0	0.0	0.0	0.0	0.0
Equalization storage (PZ7E)	ES5 Equalization 7E	0.0	0.0	0.0	0.0	0.0
Equalization storage (PZ6E)	ES5 Equalization 6E	0.0	0.0	0.0	0.0	0.0
Total Required Storage (ML)	**ES5 Total**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Available Storage (ML)		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
		OK	OK	OK	OK	OK

4E 10

PRESSURE ZONE 4E

Initially constructed: **2013**

ES4

Facility	Facility No.	Year in Service	Total Volume (ML)
Tullamore Reservoir Cell 1	P527001	2013	24.0
Tullamore Reservoir Cell 2	P527001	2013	24.0
TOTAL			48.0

PRESSURE ZONE 4E

ES4

		2021	2026	2031	2036	2041
Emergency storage	ES4 Emergency	5.0	5.7	6.7	7.2	7.9
Fire storage (PZ6E)	ES4 Fire 6E	3.6	6.3	8.2	8.2	8.2
Fire storage (PZ5E)	ES4 Fire 5E	2.9	0.0	0.0	0.0	0.0
Fire storage (PZ4E)	ES4 Fire 4E	8.2	8.2	8.2	8.2	8.2
Equalization storage (PZ6E)	ES4 Equalization 6E	2.1	3.5	4.9	6.4	8.8
Equalization storage (PZ5E)	ES4 Equalization 5E	3.4	4.9	5.7	6.1	6.4
Total Required Storage (ML)	**ES4 Total**	**25.2**	**28.5**	**33.6**	**36.1**	**39.5**
Total Available Storage (ML)		**48.0**	**48.0**	**48.0**	**48.0**	**48.0**
		OK	OK	OK	OK	OK

3E 23

PRESSURE ZONE 3E

Initially constructed: **2003**

Expanded: **2014**

ES3

Facility	Facility No.	Year in Service	Total Volume (ML)
Airport Road Reservoir Cell 1A	P518001	2003	8.5
Airport Road Reservoir Cell 1B	P518001	2003	8.5
Airport Road Reservoir Cell 2A	P518001	2003	8.5
Airport Road Reservoir Cell 2B	P518001	2003	8.5
Airport Road Reservoir Cell 3A	P518001	2014	20
TOTAL			54.0

PRESSURE ZONE 3E

ES3

		2021	2026	2031	2036	2041
York Region	ES3 York Region	9.7	11.5	13.8	13.8	13.8
Emergency storage	ES3 Emergency	4.8	3.7	4.1	4.3	4.4
Fire storage (PZ5E)	ES3 Fire 5E	5.3	0.0	0.0	0.0	0.0
Equalization storage (PZ5E)	ES3 Equalization 5E	6.4	7.3	8.5	9.2	9.6
Equalization storage (PZ4E)	ES3 Equalization 4E	7.4	7.7	7.9	8.0	8.1
Total Required Storage (ML)	**ES3 Total**	**33.5**	**30.2**	**34.3**	**35.2**	**35.9**
Total Available Storage (ML)		**54.0**	**54.0**	**54.0**	**54.0**	**54.0**
		OK	OK	OK	OK	OK

PUMPING tables of available vs. required capacity

WEST TRANSMISSION SYSTEM

ALLOA PUMPING STATION

HLP7W

Pump No.	5	6	7	8
Tag No.	HLP12910	HLP12920	HLP12930	HLP12940
Year in Service	2018	2018	2018	Future
Year to be Decommissioned	9999	9999	9999	9999
Load (HP)	300	300	300	300
Pump Rated Capacity (ML/d)	**15**	**15**	**15**	**15**

HLP7W	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	3.7	5.4	6.2	9.2	10.9	13.3
Installed Station Capacity (ML/d)	45	45	45	45	45	45
Theoretical Firm Capacity (ML/d)	30	30	30	30	30	30
Actual Firm Capacity (ML/d)	27	27	28	32	34	35
	OK	OK	OK	OK	OK	OK

LLP6W

Pump No.	1	2	3	4
Tag No.	LLP12810	LLP12820	LLP12830	LLP12840
Year in Service	2018	2018	2018	2099
Year to be Decommissioned	9999	9999	9999	9999
Load (HLP)	350	350	350	350
Pump Rated Capacity (ML/d)	**42**	**42**	**42**	**42**

LLP6W	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	52.3	56.5	51.2	58.8	66.3	73.4
Installed Station Capacity (ML/d)	126	126	126	126	126	126
Theoretical Firm Capacity (ML/d)	84	84	84	84	84	84
Actual Firm Capacity (ML/d)	80	80	80	81	82	82
	OK	OK	OK	OK	OK	OK

WEST BRAMPTON PUMPING STATION

HLP6W

Pump No.	1	2	3	4	5	6
Tag No.	HLP10610	HLP10620	HLP10630	HLP10640	HLP10650	HLP10660
Year in Service	2011	2011	*2028*	9999	2011	2011
Year to be Decommissioned	9999	9999	9999	9999	9999	9999
Load (HP)	500	500	500	500	300	300
Pump Rated Capacity (ML/d)	**31**	**31**	**31**	**31**	**16**	**16**

Refer W-P-175 to P3; no mentioiing of second Capacity Expansion at P4

HLP6W	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	52.3	56.5	76.8	88.2	99.4	110.0
Installed Station Capacity (ML/d)	93	93	93	124	124	124
Theoretical Firm Capacity (ML/d)	62	62	62	93	93	93
Actual Firm Capacity (ML/d)	93	87	87	121	126	129
	OK	OK	OK	OK	OK	OK

LLP5W

Pump No.	1	2	3	4*	5*	4*	5*
Tag No.	LLP10510	LLP10520	LLP10530	LLP10540	LLP10550	LLP10540	LLP10550
Year in Service	2011	2011	*2028*	2011	2011	*2036*	2099
Year to be Decommissioned	9999	9999	9999	*2035*	2098	9999	9999
Load (HP)	250	250	250	125	125	?	?
Pump Rated Capacity (ML/d)	**30**	**30**	**45**	**15**	**15**	**45**	**45**

Refer W-P-061 for P3

Refer W-P-152 for P4; no mentioning of P4 Replacement

LLP5W	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	62.3	62.2	66.9	99.2	107.5	115.7
Installed Station Capacity (ML/d)	90	90	90	135	165	165
Theoretical Firm Capacity (ML/d)	60	60	60	90	120	120
Actual Firm Capacity (ML/d)	40	74	74	103	131	132
	NOT OK	OK	OK	OK	OK	OK

MEADOWVALE NORTH PUMPING STATION

HLP5W

Pump No.	1	2	3	10	11	12
Tag No.	HLP10110	HLP10210	HLP10310	HLP11010	HLP11110	HLP11210
Year in Service	1989	1989	1989	2002	2002	2010
Year to be Decommissioned	9999	9999	9999	9999	9999	9999
Load (HP)	200	400	400	350	300	500
Pump Rated Capacity (ML/d)	**14**	**27**	**27**	**25**	**25**	**25**

HLP5W	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	76.5	87.7	99.5	87.3	90.8	93.5
Installed Station Capacity (ML/d)	143	143	143	143	143	143
Theoretical Firm Capacity (ML/d)	116	116	116	116	116	116
Actual Firm Capacity (ML/d)	97	106	106	107	104	108
	OK	OK	OK	OK	OK	OK

LLP4W

Pump No.	4	5	6	7	8	9
Tag No.	LLP10410	LLP10510	LLP10610	LLP10710	LLP10810	LLP10910
Year in Service	1989	1989	1989	2002	2010	2010
Year to be Decommissioned	9999	9999	9999	9999	9999	9999
Load (HP)	500	450	450	400	600	600
Pump Rated Capacity (ML/d)	**55**	**55**	**46**	**50**	**70**	**70**

LLP4W	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	135.5	130.5	147.1	176.8	192.0	206.9
Installed Station Capacity (ML/d)	346	346	346	346	346	346
Theoretical Firm Capacity (ML/d)	276	276	276	276	276	276
Actual Firm Capacity (ML/d)	226	230	229	229	230	230
	OK	OK	OK	OK	OK	OK

STREETSVILLE PUMPING STATION

HLP4W

Pump No.	2	3	4	9	10	11	12	13
Tag No.	HLP10020	HLP10030	HLP10040	HLP10090	HLP10410	HLP10420	HLP10430	HLP10440
Year in Service	1979	1979	1979	2004	Future	2014	Future	2014
Year to be Decommissioned	9999	9999	2014	9999	9999	9999	9999	9999
Load (HP)	400	600	9999	1050	9999	1000	9999	1000
Pump Rated Capacity (ML/d)	**23**	**45**	**9999**	**68**	**9999**	**68**	**9999**	**68**

HLP4W	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	143.2	156.6	163.8	170.9	175.6	180.5
Installed Station Capacity (ML/d)	272	272	272	272	272	272
Theoretical Firm Capacity (ML/d)	204	204	204	204	204	204
Actual Firm Capacity (ML/d)	179	204	206	213	215	218
	OK	OK	OK	OK	OK	OK

LLP3W

Pump No.	1	5	6	7	8	14	15	16	17
Tag No.	LLP10010	LLP10050	LLP10060	LLP10070	LLP10080	LLP10450	LLP10460	LLP10470	LLP10480
Year in Service	2004	1990	1990	1996	1996	Future	Future	2099	2014
Year to be Decommissioned	9999	9999	9999	9999	9999	9999	9999	9999	9999
Load (HP)	335	250	400	700	700	9999	9999	700	1000
Pump Rated Capacity (ML/d)	**36**	**36**	**55**	**90**	**90**	**9999**	**9999**	**90**	**72**

LLP3W	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	190.6	196.8	223.8	248.4	266.4	284.8
Installed Station Capacity (ML/d)	379	379	379	379	379	379
Theoretical Firm Capacity (ML/d)	289	289	289	289	289	289
Actual Firm Capacity (ML/d)	250	237	243	328	328	328
	OK	OK	OK	OK	OK	OK

PUMPING tables of available vs. required capacity

HERRIDGE PUMPING STATION

HLP3W					
	Pump No.	**1**	**2**	**3**	**4**
	Tag No.	HLP11101	HLP11102	HLP11103	HLP11104
	Year in Service	1972	1972	1972	1972
	Year to be Decommissioned	9999	9999	9999	9999
	Load (HP)	400	600	400	300
	Pump Rated Capacity (ML/d)	**22**	**32**	**23**	**23**

HLP3W		2019	2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	**19.5**	**19.8**	**17.0**	**17.7**	**18.2**	**19.1**
	Installed Station Capacity (ML/d)	100	100	100	100	100	100
	Theoretical Firm Capacity (ML/d)	68	68	68	68	68	68
	Actual Firm Capacity (ML/d)	**48**	**44**	**44**	**47**	**47**	**47**
		OK	OK	OK	OK	OK	OK

LLP2W												
	Pump No.	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
	Tag No.	LLP11105	LLP11106	LLP11107	LLP11108	LLP11109	LLP11110	LLP11111	LLP11112	LLP11113	LLP11114	LLP11115
	Year in Service	1972	1987	1972	1972	1972	1972	1989	2004	Future	Future	Future
	Year to be Decommissioned	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
	Load (HP)	600	550	200	250	350	350	775	600	9999	9999	9999
	Pump Rated Capacity (ML/d)	**68**	**68**	**27**	**36**	**36**	**36**	**68**	**68**	**9999**	**9999**	**9999**

LLP2W		2019	2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	**134.7**	**133.3**	**133.3**	**144.3**	**143.8**	**142.9**
	Installed Station Capacity (ML/d)	408	408	408	408	408	408
	Theoretical Firm Capacity (ML/d)	340	340	340	340	340	340
	Actual Firm Capacity (ML/d)	**309**	**309**	**308**	**322**	**322**	**322**
		OK	OK	OK	OK	OK	OK

LORNE PARK PUMPING STATION

HLP2W					
	Pump No.	**8**	**9**	**10**	**11**
	Tag No.	HLP87400	HLP87410	HLP87420	HLP87430
	Year in Service	2013	2013	***2031***	2099
	Year to be Decommissioned	9999	9999	9999	9999
	Load (HP)	4250	4250	4250	4250
	Pump Rated Capacity (ML/d)	**150**	**150**	**150**	**150**

Refer W-P-154 to P10; High Lift Zone 2 information not shown on schematic

HLP2W		2019	2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	**165.5**	**180.3**	**209.5**	**227.3**	**250.3**	**274.0**
	Installed Station Capacity (ML/d)	300	300	300	450	450	450
	Theoretical Firm Capacity (ML/d)	150	150	150	300	300	300
	Actual Firm Capacity (ML/d)	**152**	**152**	**152**	**298**	**299**	**299**
		NOT OK	**NOT OK**	**NOT OK**	OK	OK	OK

HLP1W								
	Pump No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	Tag No.	HLP87100	HLP87110	HLP87120	HLP87130	HLP87140	HLP87150	HLP87160
	Year in Service	1978	2011	1978	1978	1978	2000	2000
	Year to be Decommissioned	9999	9999	9999	9999	9999	9999	9999
	Load (HP)	1100	900	850	1100	1300	1100	600
	Pump Rated Capacity (ML/d)	**91**	**64**	**68**	**91**	**91**	**91**	**46**

HLP1W		2019	2021	2026	2031	2036	2041
	Forecasted Demand (ML/d)	**179.6**	**180.0**	**180.0**	**193.1**	**194.8**	**196.2**
	Installed Station Capacity (ML/d)	541	541	541	541	541	541
	Theoretical Firm Capacity (ML/d)	450	450	450	450	450	450
	Actual Firm Capacity (ML/d)	**336**	**344**	**344**	**344**	**344**	**345**
		OK	OK	OK	OK	OK	OK

PUMPING tables of available vs. required capacity

CENTRAL TRANSMISSION SYSTEM

VICTORIA PUMPING STATION

LLP7C

Pump No.	
Tag No.	
Year in Service	
Year to be Decommissioned	
Load (HP)	
Pump Rated Capacity (ML/d)	

LLP7C

	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	0.0	0.0	0.0	0.0	0.0	0.0
Installed Station Capacity (ML/d)	0	0	0	0	0	0
Theoretical Firm Capacity (ML/d)	0	0	0	0	0	0
Actual Firm Capacity (ML/d)	0	0	0	0	0	0
	OK	OK	OK	OK	OK	OK

NORTH BRAMPTON PUMPING STATION

HLP7C

Pump No.	1	2	3*	4*	3*	4*
Tag No.	HLP11710	HLP11720	HLP11730	HLP11740	HLP11730	HLP11740
Year in Service	1992	2003	1992	2003	2099	2099
Year to be Decommissioned	9999	9999	2098	2098	9999	9999
Load (HP)	150	150	150	150	100	100
Pump Rated Capacity (ML/d)	10	10	8	8	15	15

HLP7C

	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	9.3	11.2	27.9	33.1	42.2	47.0
Installed Station Capacity (ML/d)	36	36	36	36	36	36
Theoretical Firm Capacity (ML/d)	26	26	26	26	26	26
Actual Firm Capacity (ML/d)	21	22	22	23	25	26
	OK	OK	NOT OK	NOT OK	NOT OK	NOT OK

LLP6C

Pump No.	5	6	7	8	9	10
Tag No.	LLP11750	LLP11760	LLP11770	LLP11780	LLP11790	LLP11800
Year in Service	2003	2003	Future	2003	2003	Future
Year to be Decommissioned	9999	9999	9999	9999	9999	9999
Load (HP)	250	250	9999	300	300	9999
Pump Rated Capacity (ML/d)	27	27	9999	36	36	9999

LLP6C

	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	47.1	25.4	26.1	26.8	27.2	27.8
Installed Station Capacity (ML/d)	126	126	126	126	126	126
Theoretical Firm Capacity (ML/d)	90	90	90	90	90	90
Actual Firm Capacity (ML/d)	73	68	68	68	68	68
	OK	OK	OK	OK	OK	OK

EAST BRAMPTON PUMPING STATION

HLP6C

Pump No.	5	6	7	8
Tag No.	HLP11050	HLP11060	HLP11070	HLP11080
Year in Service	1989	1978	1978	1992
Year to be Decommissioned	9999	9999	9999	9999
Load (HP)	400	900	1000	800
Pump Rated Capacity (ML/d)	27	58	65	55

HLP6C

	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	70.7	72.2	74.1	76.0	77.2	78.6
Installed Station Capacity (ML/d)	205	205	205	205	205	205
Theoretical Firm Capacity (ML/d)	140	140	140	140	140	140
Actual Firm Capacity (ML/d)	109	114	112	112	113	114
	OK	OK	OK	OK	OK	OK

LLP5C

Pump No.	1	2	3	4
Tag No.	LLP11010	LLP11020	LLP11030	LLP11040
Year in Service	1989	1978	1978	1978
Year to be Decommissioned	9999	9999	2042	9999
Load (HP)	500	350	200	350
Pump Rated Capacity (ML/d)	60	45	27	45

LLP5C

	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	85.4	98.1	86.7	93.0	99.6	105.5
Installed Station Capacity (ML/d)	177	177	177	177	177	177
Theoretical Firm Capacity (ML/d)	117	117	117	117	117	117
Actual Firm Capacity (ML/d)	100	109	109	109	109	109
	OK	OK	OK	OK	OK	OK

BECKETT SPROULE PUMPING STATION

HLP5C

Pump No.	1	2	3	8	9	10	17	18	19	20
Tag No.	HLP30110	HLP30210	HLP30310	HLP30810	HLP30910	HLP31010	HLP31710	HLP31810	HLP31910	HLP32010
Year in Service	1972	Future	1987	Future	1972	1972	2004	2004	Future	Future
Year to be Decommissioned	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
Load (HP)	350	9999	600	9999	600	350	1000	1000	9999	9999
Pump Rated Capacity (ML/d)	27	9999	45	9999	45	18	60	60	9999	9999

HLP5C

	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	119.5	114.3	123.0	131.3	138.4	146.4
Installed Station Capacity (ML/d)	255	255	255	255	255	255
Theoretical Firm Capacity (ML/d)	195	195	195	195	195	195
Actual Firm Capacity (ML/d)	176	186	184	188	187	189
	OK	OK	OK	OK	OK	OK

LLP4C

Pump No.	4	5	6	7	11	12	13	14	15	16
Tag No.	LLP30410	LLP30510	LLP30610	LLP30710	LLP31110	LLP31210	LLP31310	LLP31410	LLP31510	LLP31610
Year in Service	2001	1978	2004	1987	1995	Future	Future	2004	Future	Future
Year to be Decommissioned	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
Load (HP)	350	350	250	750	750	9999	9999	600	9999	9999
Pump Rated Capacity (ML/d)	45	45	27	90	90	9999	9999	93	9999	9999

LLP4C

	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	184.5	194.8	205.4	215.1	226.0	235.0
Installed Station Capacity (ML/d)	390	390	390	390	390	390
Theoretical Firm Capacity (ML/d)	297	297	297	297	297	297
Actual Firm Capacity (ML/d)	195	273	271	271	271	271
	OK	OK	OK	OK	OK	OK

HANLAN PUMPING STATION

HLP4C

Pump No.	1	2	3	4	1b	2b
Tag No.	HLP11501	HLP11502	HLP11503	HLP11504	HLP11501	HLP11502
Year in Service	1969	1969	2004	1972	2099	2099
Year to be Decommissioned	2098	2098	9999	9999	9999	9999
Load (HP)	350	800	600	900		
Pump Rated Capacity (ML/d)	23	46	34	57	60	60

no mentioning of P1 & P2 Replacement.

HLP4C

	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	87.6	89.5	92.3	94.9	97.4	100.1
Installed Station Capacity (ML/d)	160	160	160	160	160	160
Theoretical Firm Capacity (ML/d)	103	103	103	103	103	103
Actual Firm Capacity (ML/d)	119	127	121	123	124	125
	OK	OK	OK	OK	OK	OK

LLP3C

Pump No.	5	6	7	8	9	10	11	12	13	14	15	16
Tag No.	LLP11505	LLP11506	LLP11507	LLP11508	LLP11509	LLP11510	LLP11010	LLP11020	LLP11030	LLP11040	LLP11050	LLP11060
Year in Service	1972	1989	1972	1992	2004	2004	2011	2011	2011	Future	Future	Future
Year to be Decommissioned	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
Load (HP)	800	1000	800	1000	1050	1050	1250	1250	1250	9999	9999	9999
Pump Rated Capacity (ML/d)	114	136	114	136	145	145	120	120	120	9999	9999	9999

LLP3C

	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	653.9	691.7	801.8	897.1	932.9	969.1
Installed Station Capacity (ML/d)	1150	1150	1150	1150	1150	1150
Theoretical Firm Capacity (ML/d)	1005	1005	1005	1005	1005	1005
Actual Firm Capacity (ML/d)	1024	1029	1029	1032	1032	1033
	OK	OK	OK	OK	OK	OK

PUMPING tables of available vs. required capacity

SILVERTHORN PUMPING STATION

HLP3C	**Pump No.**	**6**	**7**	**8***	**8***	**9**	**10**	
	Tag No.	HLP10600	HLP10700	HLP10800	HLP10800	HLP10900	HLP11000	
	Year in Service	1971	1967	1967	2099	2099	2099	**Refer W-P-174 to P8; no mentioning of P8 Replacement**
	Year to be Decommissioned	9999	9999	2098	9999	9999	9999	
	Load (HP)	550	350	650	?	?	?	
	Pump Rated Capacity (ML/d)	**35**	**23**	**45**	**23**	**35**	**23**	

		2019	2021	2026	2031	2036	2041
HLP3C	**Forecasted Demand (ML/d)**	**39.4**	**40.8**	**44.2**	**46.9**	**48.6**	**50.7**
	Installed Station Capacity (ML/d)	103	103	103	103	103	103
	Theoretical Firm Capacity (ML/d)	58	58	58	58	58	58
	Actual Firm Capacity (ML/d)	**58**	**58**	**58**	**58**	**59**	**59**
		OK	OK	OK	OK	OK	OK

LLP2C	**Pump No.**	**1**	**2**	**3**	**4**	**5**
	Tag No.	LLP10100	LLP10200	LLP10300	LLP10400	LLP10500
	Year in Service	2012	2012	1971	1971	1971
	Year to be Decommissioned	9999	9999	9999	9999	9999
	Load (HP)	1000	1000	750	750	750
	Pump Rated Capacity (ML/d)	**108**	**108**	**83**	**105**	**91**

		2019	2021	2026	2031	2036	2041
LLP2C	**Forecasted Demand (ML/d)**	**73.8**	**78.9**	**116.2**	**134.7**	**152.0**	**167.7**
	Installed Station Capacity (ML/d)	495	495	495	495	495	495
	Theoretical Firm Capacity (ML/d)	387	387	387	387	387	387
	Actual Firm Capacity (ML/d)	**192**	**193**	**204**	**206**	**210**	**213**
		OK	OK	OK	OK	OK	OK

Arthur P. Kennedy PUMPING STATION

HLP2C	**Pump No.**	**2**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
	Tag No.	HLP83220	HLP83520	HLP83620	HLP83720	HLP84220	HLP84320	HLP84420	HLP84520	HLP84120	HLP84620
	Year in Service	2005	2005	2005	2005	2014	2014	2014	2099	2099	2099
	Year to be Decommissioned	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
	Load (HP)	2800	2800	4250	4250	3250	3250	3250	3250	3250	3250
	Pump Rated Capacity (ML/d)	**100**	**100**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**

		2019	2021	2026	2031	2036	2041
HLP2C	**Forecasted Demand (ML/d)**	**608.5**	**635.6**	**703.3**	**777.9**	**805.6**	**835.3**
	Installed Station Capacity (ML/d)	950	950	950	950	950	950
	Theoretical Firm Capacity (ML/d)	800	800	800	800	800	800
	Actual Firm Capacity (ML/d)	**998**	**1005**	**1005**	**1005**	**1005**	**1005**
		OK	OK	OK	OK	OK	OK

HLP1C	**Pump No.**	**1**	**3**	**4**	**14**	**15**
	Tag No.	HLP83120	HLP83320	HLP83420	HLP84720	HLP84820
	Year in Service	1978	1978	1978	2014	2014
	Year to be Decommissioned	9999	9999	9999	9999	9999
	Load (HP)	900	1200	1350	1250	1350
	Pump Rated Capacity (ML/d)	**65**	**90**	**90**	**90**	**90**

		2019	2021	2026	2031	2036	2041
HLP1C	**Forecasted Demand (ML/d)**	**110.4**	**122.5**	**143.5**	**167.6**	**183.2**	**198.0**
	Installed Station Capacity (ML/d)	425	425	425	425	425	425
	Theoretical Firm Capacity (ML/d)	335	335	335	335	335	335
	Actual Firm Capacity (ML/d)	**282**	**281**	**287**	**289**	**295**	**347**
		OK	OK	OK	OK	OK	OK

PUMPING tables of available vs. required capacity

EAST TRANSMISSION SYSTEM

HLP7E	
Pump No.	
Tag No.	
Year in Service	
Year to be Decommissioned	
Load (HP)	
Pump Rated Capacity (ML/d)	

HLP7E						
Forecasted Demand (ML/d)	0.0	0.0	0.0	0.0	0.0	0.0
Installed Station Capacity (ML/d)	0	0	0	0	0	0
Theoretical Firm Capacity (ML/d)	0	0	0	0	0	0
Actual Firm Capacity (ML/d)	0	0	0	0	0	0
	OK	OK	OK	OK	OK	OK

LLP6E	
Pump No.	
Tag No.	
Year in Service	
Year to be Decommissioned	
Load (HP)	
Pump Rated Capacity (ML/d)	

LLP6E						
Forecasted Demand (ML/d)	0.0	0.0	0.0	0.0	0.0	0.0
Installed Station Capacity (ML/d)	0	0	0	0	0	0
Theoretical Firm Capacity (ML/d)	0	0	0	0	0	0
Actual Firm Capacity (ML/d)	0	0	0	0	0	0
	OK	OK	OK	OK	OK	OK

TULLAMORE PUMPING STATION

HLP6E				
Pump No.	1	2	3	4
Tag No.	HLP11910	HLP11920	HLP11930	HLP11940
Year in Service	2013	2013	2013	2013
Year to be Decommissioned	9999	9999	9999	9999
Load (HP)	800	800	800	800
Pump Rated Capacity (ML/d)	40	40	40	40

HLP6E	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	29.9	32.5	43.4	53.9	66.2	85.5
Installed Station Capacity (ML/d)	160	160	160	160	160	160
Theoretical Firm Capacity (ML/d)	120	120	120	120	120	120
Actual Firm Capacity (ML/d)	120	129	128	131	132	135
	OK	OK	OK	OK	OK	OK

LLP5E			
Pump No.	5	6	7
Tag No.	LLP11950	LLP11960	LLP11970
Year in Service	2013	2013	2013
Year to be Decommissioned	9999	9999	9999
Load (HP)	300	300	300
Pump Rated Capacity (ML/d)	30	30	30

LLP5E						
Forecasted Demand (ML/d)	14.8	27.2	37.6	43.6	46.9	48.8
Installed Station Capacity (ML/d)	90	90	90	90	90	90
Theoretical Firm Capacity (ML/d)	60	60	60	60	60	60
Actual Firm Capacity (ML/d)	48	56	57	57	58	58
	OK	OK	OK	OK	OK	OK

AIRPORT ROAD PUMPING STATION

HLP5E				
Pump No.	5E1	5E2	5E3	5E4
Tag No.	HLP30510	HLP30520	HLP30530	HLP30540
Year in Service	2003	2003	2003	2013
Year to be Decommissioned	9999	9999	9999	9999
Load (HP)	900	900	900	900
Pump Rated Capacity (ML/d)	45	45	45	45

HLP5E	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	59.2	50.5	56.4	65.3	70.3	73.3
Installed Station Capacity (ML/d)	180	180	180	180	180	180
Theoretical Firm Capacity (ML/d)	135	135	135	135	135	135
Actual Firm Capacity (ML/d)	131	137	137	139	139	139
	OK	OK	OK	OK	OK	OK

LLP4E					4E3*	4E2*
Pump No.	4E1	4E2	4E3	4E4	4E5	4E6
Tag No.	LLP30410	LLP30420	LLP30430	LLP30440	LLP30450	LLP30460
Year in Service	2003	2003	2003	2013	2099	2099
Year to be Decommissioned	9999	2098	2098	9999	9999	9999
Load (HP)	450	450	450	600	600	600
Pump Rated Capacity (ML/d)	42	42	42	56	56	56

No pump bays available

Modify pumping station to transfer two York pumps to LLP-4E

no mentioning of P4E2 & P4E3 Replacemnet or P4E5 & P4E6 Installation

LLP4E						
Forecasted Demand (ML/d)	86.9	97.0	111.6	122.7	132.7	146.0
Installed Station Capacity (ML/d)	182	182	182	182	182	182
Theoretical Firm Capacity (ML/d)	126	126	126	126	126	126
Actual Firm Capacity (ML/d)	149	151	160	160	160	161
	OK	OK	OK	OK	OK	OK

York										
Pump No.	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	P1	P2
Tag No.	HLP30610	HLP30620	HLP30630	HLP30640	HLP30650	HLP30660	HLP30670	HLP30680	LLP95010	LLP95020
Year in Service	2003	2003	2003	2003	2013	2013	2013	2013	2003	2003
Year to be Decommissioned	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
Load (HP)	1000	1000	1000	1000	1000	1000	1000	1000	125	125
Pump Rated Capacity (ML/d)	56	56	56	56	56	56	56	56	5	5

LLP3Y

York						
Forecasted Demand (ML/d)	210.9	231.8	276.7	331.0	331.0	331.0
Installed Station Capacity (ML/d)	458	458	458	458	458	458
Theoretical Firm Capacity (ML/d)	402	402	402	402	402	402
	OK	OK	OK	OK	OK	OK

BECKETT SPROULE PUMPING STATION

Airport Road Transfer								
Pump No.	21	22	23	24	25	26	27	28
Tag No.	LLP32110	LLP32210	LLP32310	LLP32410	LLP32510	LLP32610	LLP32710	LLP32810
Year in Service	2004	2004	2004	2004	*2023*	*2023*	*2023*	Future
Year to be Decommissioned	9999	9999	9999	9999	9999	9999	9999	9999
Load (HP)	800	800	800	800	800	800	800	800
Pump Rated Capacity (ML/d)	102	102	102	102	102	102	102	102

Refer W-P-064 for P25

LLP3A

Airport Road Transfer	2019	2021	2026	2031	2036	2041
Forecasted Demand (ML/d)	299.6	325.4	407.8	479.2	494.3	510.2
Installed Station Capacity (ML/d)	408	408	714	714	714	714
Theoretical Firm Capacity (ML/d)	306	306	612	612	612	612
Actual Firm Capacity (ML/d)	275	275	513	513	513	513
	NOT OK	NOT OK	OK	OK	OK	OK

3E

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 3E

Strategy Evaluation

System Wide Servicing Concepts Evaluation

Concept Number	Concept Name	Concept Description / Comment	Advantages	Disadvantages	Rating	Carried Forward/Screened Out
1	**Do Nothing**	Do nothing - Existing infrastructure remains as is	- Does not incur any new capital costs - No social / economic / environmental disruptions due to infrastructure construction	- Does not achieve required levels of service to support existing and future growth - Does not comply with Region of Peel Official Plan and Places to Grow growth targets - Does not align with the principles of the Region's Growth Management Strategy - Potential social / economic / environmental disruptions due to lack of servicing	Low	**Screened Out**
2	**Limit Growth**	Limit community growth so as to not trigger new infrastructure or upgrades	- Reduces capital costs incurred from infrastructure construction - Reduces social / economic / environmental disruptions due to infrastructure construction	- Does not comply with Region of Peel Official Plan and Places to Grow growth targets - Does not align with the principles of the Region's Growth Management Strategy	Low	**Screened Out**
3	**Build off Planned 2031 Infrastructure**	- Expand transmission, storage and pumping to support development of upper zones - Increase connectivity within the system	- Meets 2041 servicing requirements - Potential to maximize existing and planned infrastructure - Leverages existing structure for 2041 with considerations for post-2041 growth - Supports the Region of Peel Official Plan and Places to Grow growth targets - Aligns with the principles of the Region's Growth Management Strategy	- Capital cost of construction of infrastructure within existing built-up areas - Potential for social / economic / environmental disruptions to existing built-up areas - Some site capacity limitations at existing Pumping Stations, Reservoirs and Treatment Plants	High	**Carried Forward**
4	**Construct new stream or groundwater based Water Treatment Plant**	- Construct new stream or groundwater based system - Reduce the expansion/ upgrades of transmission, storage and pumping to support development of upper zones - Increase connectivity within the system	- Meets 2041 servicing requirements - Leverages existing structure for 2041 with considerations for post-2041 growth - Northern Water Treatment Plant has potential to minimize need for future transmission system upgrades and energy requirements for pumping - Potential to reduce/eliminate transmission upgrades through built-up areas - Aligns with the principles of the Region's Growth Management Strategy	- Stringent permitting/approval requirements (Conservation authorities, MECP, Approval Agencies, etc.) - Does not maximize existing treatment capacity. Existing Water Treatment Plants have sufficient capacity to meet 2041 demands. - Significant capital cost for a new Water Treatment Plant - Transmission upgrades may still be required to service intensification areas within lower pressure zones	Medium	**Carried Forward**
5	**Construct new Water Treatment Plant in shoreline of Lake Ontario**	- Construct new Lake based Water Treatment Plant - Expand transmission, storage and pumping to support development of upper zones - Increase connectivity within the system	- Meets 2041 servicing requirements with considerations for build-out - Adds system redundancy	- Does not maximize existing treatment capacity. Existing Water Treatment Plants have sufficient capacity to meet 2041 demands. - Significant capital cost for a new Water Treatment Plant in shoreline of Lake Ontario - Site required in developed and valuable land with limited availability	Low	**Screened Out**
6	**Water Conservation Practices**	- Water Conservation - Water Efficiency - Water Reuse - Water Restrictions	- Potential to maximize existing and planned infrastructure - Potential to reduce demands in system, creating savings in pumping, treatment and need for upgraded infrastructure - Leverage ongoing water efficiency strategy - Provide opportunity to introduce new best management practices for water conservation and efficiency - Aligns with the principles of the Region's Growth Management Strategy	- Difficult to predict/quantify levels of conservation trends over the years. Potential not to meet demand reduction targets - Dependent on public and private participation and commitment - Not considered feasible as complete standalone solution. Needs combination with other servicing concepts to ensure 2041 servicing requirements are met - Water rate revenue reduction	Medium	**Carried Forward**

System Wide Servicing Strategies Evaluation

		Strategy 1 Build off Planned 2031 Infrastructure	Strategy 2 New Stream-Based Water Treatment Plant	Strategy 3 New Groundwater-Based Water Treatment Plant
Description of Strategy		•Build off planned 2031 infrastructure by expanding transmission, storage and pumping to support development of upper zones. •Increase connectivity within the transmission and distribution systems. •Continue to implement the Region's water efficiency strategy and conservation program.	•Build off a modified version of the planned 2031 infrastructure with less expansion of transmission, storage and pumping to support development of upper zones. •Increase connectivity within the transmission and distribution systems •Construct a new stream-based water treatment plant in the north/upper pressure zones. •Provide supply to north/upper pressure zones from the new stream-based water treatment plant. •Continue to implement the Region's water efficiency strategy and conservation program.	•Build off a modified version of the planned 2031 infrastructure with less expansion of transmission, storage and pumping to support development of upper zones. •Increase connectivity within the transmission and distribution systems •Construct a new groundwater-based water treatment plant in the north/upper pressure zones. •Provide supply to north/upper pressure zones from the new groundwater-based water treatment plant. •Continue to implement the Region's water efficiency strategy and conservation program.
Technical	Increase spare capacity in existing system Improve/maintain level of service of existing users Avoid/minimize proximity and/or conflicts with existing infrastructure Consider constructability and technical feasibility to build and maintain infrastructure Provide opportunity for operational flexibility and security Integration with road/transportation projects Avoid/minimize construction in areas with limited access Avoid/minimize environmental/roads/utility crossings Ability to maintain existing services during construction/implementation Maximize alignments along road rights of way and/or easements Support intensification growth Support post-2041 growth Incremental extension of infrastructure as growth progresses Ability to provide/maintain desired level of service under climate change conditions	✓✓	×	✓
	Technical Comments	- Maximizes use of existing infrastructure - Does not require new or upgrades to water treatment plants by 2041 - Maintains the lake-based system with no mixing of water from streams or groundwater sources - Provides redundancy in supply/distribution - Water Treatment Plants are located far from upper pressure zones - Increase requirement for transmission system upgrades to service upper zones - Incremental extension of infrastructure as growth progresses	- Does not maximize existing infrastructure - Requires new stream based treatment facility located closer to north service areas and upper pressure zones - Potentially reduce or eliminate future upgrades to existing Water Treatment Plants - Limited / constrained capacity in streams/rivers. Allowable surface water taking may be inadequate to meet demand (i.e. additional transmission may still be required) - Potential for isolated system due to water mixing restrictions - Increased operation and maintenance for new treatment facility. Decreased operation and maintenance and energy for pumping water through several pressure zones	- Does not maximize existing infrastructure - Potentially reduce or eliminate future upgrades to existing Water Treatment Plants - Potential groundwater supply constraints. Allowable groundwater intake may be inadequate to meet demand (i.e. additional transmission may still be required) - May require several well sites - Can supply to localized service areas - Opportunity for phasing multiple well locations as demand increases in separate growth areas - Potential for isolated system due to water mixing restrictions - Increased operation and maintenance for new facilities/wells. Decreased operation and maintenance and energy for pumping water through several pressure zones
Environmental	Minimize impact on nearby agricultural lands Avoid/minimize environmental crossings Avoid/minimize impact on environmental sensitive/protected areas Avoid/minimize impact on local aquatic/terrestrial species at risk and habitats Avoid/minimize potential impact on groundwater quantity and quality during construction Consider resiliency and adaptation to climate change	✓✓	×	×
	Environmental Comments	- Does not require increased water taking - Lake-based supply considered more favorable than stream or groundwater based (less stringent approvals) - Less impact on groundwater sources - More resilient option to potential effects of climate change (e.g. drought)	- Potential for significant environmental/ecosystem impacts with respect to water taking from a watercourse - Potential limitation on volume of water that can be extracted - New treatment plant would potentially be located closer to environmentally sensitive areas (e.g. Greenbelt) - Potential increase for environmental impacts due to plant construction and new required intake structure - Stringent approvals and permitting required - Less resilient option to potential effects of climate change (e.g. drought)	- Potential for significant environmental/ecosystem impacts with respect to taking from groundwater - Potential increase for environmental features due to plant construction - Source water protection measures required - Stringent approvals and permitting required - Less resilient option to potential effects of climate change (e.g. drought)
Socio/Cultural	Minimize short/long term noise & odour Issues Consider visual aesthetics of the proposed infrastructure Consider potential community resistance to alternative/strategy/alignment Avoid/minimize impact on archaeological sites/resources Minimize impact during construction and operation Minimize impact on surrounding properties Minimize construction impact on traffic, local businesses and residents Avoid/minimize impact on heritage sites	✓✓	✓	✓
	Socio/Cultural Comments	- Builds off current plan for water servicing. Less potential for community resistance	'-Significant change away from current water servicing strategy. Potential for public resistance - Potential disruptions to neighboring areas due to construction of new water treatment plant - Potential to reduce impact of transmission main construction in built-up areas - Requires new water treatment plant site away from built-up area - Mixing of stream-based and lake-based supply may be required	- Significant change away from current water servicing strategy. Potential for public resistance - Anticipated impact on groundwater table - Potential disruptions to neighboring areas due to construction of new water treatment plant - Requires new water treatment plant site away from built-up area - Mixing of groundwater and lake-based supply may be required
Legal/Jurisdictional	Maximizes worker safety and operability Does not require land acquisition or easement Minimizes approvals/coordination	✓✓	×	✓
	Legal/ Jurisdictional Comments	- Reduced need for property acquisitions and permits	- New site required for water treatment plant in northern upper pressure zone - Potential for reduced land requirements for transmission mains through built-up core - Stringent approvals and permitting for suite acquisition and water taking	- New site required for water treatment plant in northern upper pressure zone - Potential for reduced land requirements for transmission mains through built-up core - Multiple permits and approvals for site, potential well sites and water taking
Financial	Maximize use of existing infrastructure Avoid/minimize introducing new infrastructure Avoid/minimize upgrading existing infrastructure Minimize long term energy costs Lower capital cost relative to other options Reduce/eliminate operation & maintenance costs Support long-term financial sustainability Integration with SOGR program Support phasing and implementation of capital projects over time	✓	✓	✓
	Financial Comments	- Builds off existing and planned transmission and distribution infrastructure - Requires new infrastructure and upgrades of the transmission system to support upper pressure zones - No new water treatment plant costs within 2041 planning horizon	- Significant capital investment - Increased operation and costs for new water treatment plant, reduced operation and maintenance costs for transmission - Additional costs for studies and permits	- Significant capital investment - Increased operation and costs for new water treatment plant, reduced operation and maintenance costs for transmission - Additional costs for studies and permits
Innovation/ Adaptation	Apply innovation and/or new technologies Use of data for evidence based decision making process Operational flexibility to adapt to climate change Establish a baseline and a process to measure results and desire outcomes Incorporate water conservation and reuse practices Maximize energy efficiency Avoid energy-intensive infrastructure Consider performance of the system under power outage conditions Consider opportunity for renewable energy production and use	✓✓	✓	✓
	Innovation/ Adaptation Comments	- Opportunity for application of innovation to improve efficiency of existing treatment processes - Uses actual historical data to determine current water demands and project future water demands, which results in no need for treatment capacity expansion within the 2041 planning horizon.	- Opportunity for application of innovation in new treatment technologies and construction practices - Requires new treatment facility even though historical data and water demand projection analysis shows that additional treatment capacity is not required within the 2041 planning horizon.	- Opportunity for application of innovation in new treatment technologies and construction practices - Requires new treatment facility even though historical data and water demand projection analysis shows that additional treatment capacity is not required within the 2041 planning horizon.
Preferred Strategy		✓✓	×	✓

Legend

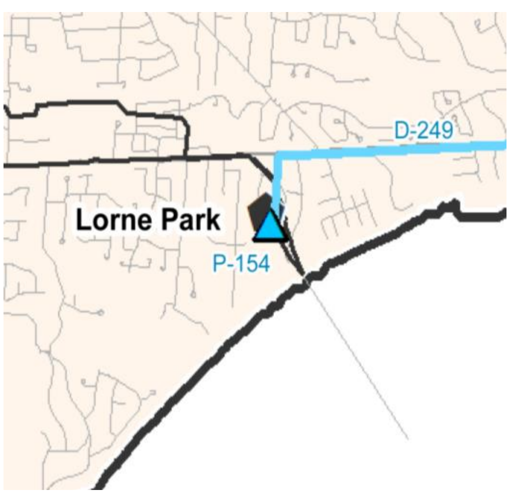
N/A	Not Applicable
×	Adverse impacts
✓	Beneficial Impacts
✓✓	Very Beneficial Impacts

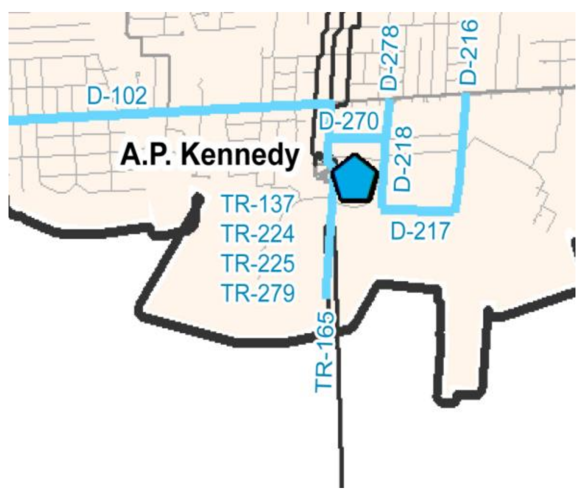
Focus Areas Servicing Solutions

Focus Area	Water Strategy & Key Issues	Servicing Solution Components
Treatment	- The Region of Peel Water Treatment Plants are anticipated to have enough capacity to meet the projected water demands for the Region up to 2041. - Expansion of treatment capacity at the current facilities has not been identified as part of the preferred water servicing strategy. - However, the following components have been incorporated in the servicing strategy: intake, treated water storage, standby power, and waste building	Arthur P. Kennedy WTP - New Intake - Reservoir Expansion - Standby Power - Waste Building Expansion

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	Requirement to service Regoin's planned growth to 2041	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- New proposed intake supports growth to 2041 as well as post-2041 growth	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization			Design Criteria - Water and Wastewater	- Water - 270 L/cap/d, 250 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Existing treatment capacity planned to be used to support growth to 2041	York W WW Needs	- York demands to be supplied by Peel may require MP infrastructure. York Demand and Flow make up part of the long term W WW needs
Alleviate existing capacity constraints	✓	- Storage sizing takes into consideration maximum day demands throughout to provide required level of service	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Minimize pumping, energy, O&M costs			DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alignment with SOGR or other programs	✓	- Region continues to coordinate SOGR program with growth-related upgrades	Existing Studies, Design or Analysis	
Capacity Resiliency / Climate Change				
Source Water Protection				

Area Overview Map





Focus Areas Servicing Solutions

Focus Area	Water Strategy & Key Issues	Servicing Solution Components
Pressure Zone 1	- Pressure zone 1 has projected adequate storage and pumping capacity up to 2041. - Servicing solutions for this area are centered around increasing connectivity of the distribution system to support projected growth within the pressure zone including areas such as Inspiration Lakeview, Port Credit Mobility Hub, West Village and Clarkson GO.	Key distribution projects considered in this pressure zone are the Lakeshore Water Distribution Mains from the Arthur P. Kennedy WTP to the Lorne Park WTP.

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Pressure Zone has projected adequate storage and pumping capacity up to 2041	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth			Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	- Optimizes connectivity of the distribution system to support projected growth within the Pressure Zone	Design Criteria - Water and Wastewater	- Water - 270 L/cap/d, 250 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Servicing solutions in the area will maximize existing infrastructure by increasing connectivity of existing distribution system to support growth	York W WW Needs	- York demands to be supplied by Peel may require MP infrastructure. York Demand and Flow make up part of the long term W WW needs
Alleviate existing capacity constraints			Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Minimize pumping, energy, O&M costs			Existing Studies, Design or Analysis	- Inspiratoin Lakeview / Port Credit Servicing Studies
Alignment with SOGR or other programs	✓	- Region continues to coordinate SOGR program with growth-related upgrades		
Capacity Resiliency / Climate Change				
Source Water Protection				

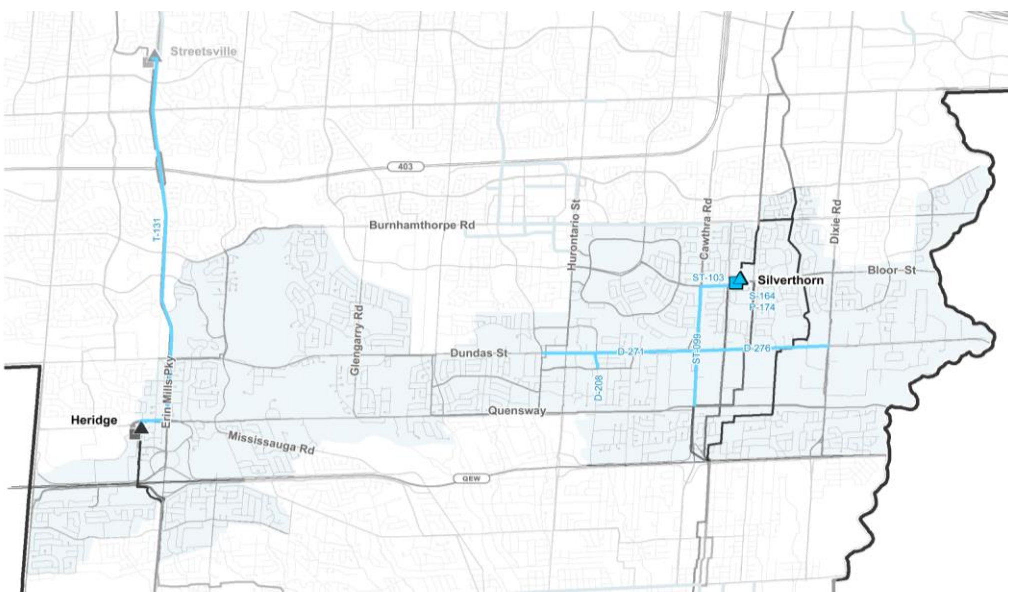
Area Overview Map

Focus Areas Servicing Solutions

Focus Area	Water Strategy & Key Issues	Servicing Solution Components
Pressure Zone 2	Servicing solutions for pressure zone 2 mainly consist of: - Increasing transmission and pumping capacity to move water to the upper pressure zones. - Support growth within intensification areas such as Dundas Connect. - Support the Queensway pressure zone 1 / zone 2 switchover and connection to the Silverthorn Pumping Station.	- Streetsvillle Transmission Main - Queensway Sub-Transmission Main Extension - Lorne Park Pumping Station Capacity Expansion - Key distribution projects considered in this pressure zone include the Distribution Mains along Dundas Street East from Dixie Road to Confederation Parkway

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Projected growth to 2041 within intensification areas (Dundas Connect) - Project(s) support 2041 growth within intensification areas as well as provide additional supply to support growth in upper zones	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Certain projects support post-2041 growth in upper zones	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	- Optimizes flows by constructing new sub-transmission main supporting the connection to the Silverthorn SPS	Design Criteria - Water and Wastewater	- Water - 270 L/cap/d, 250 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximizes existing and future infrastructure to support growth in upper pressure zones	York W WW Needs	- York demands to be supplied by Peel may require MP infrastructure. York Demand and Flow make up part of the long term W WW needs
Alleviate existing capacity constraints	✓	- Additional high lift pumping capacity required to service flows from new development in West Peel	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Minimize pumping, energy, O&M costs			DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alignment with SOGR or other programs			Existing Studies, Design or Analysis	
Capacity Resiliency / Climate Change				
Source Water Protection				

Area Overview Map

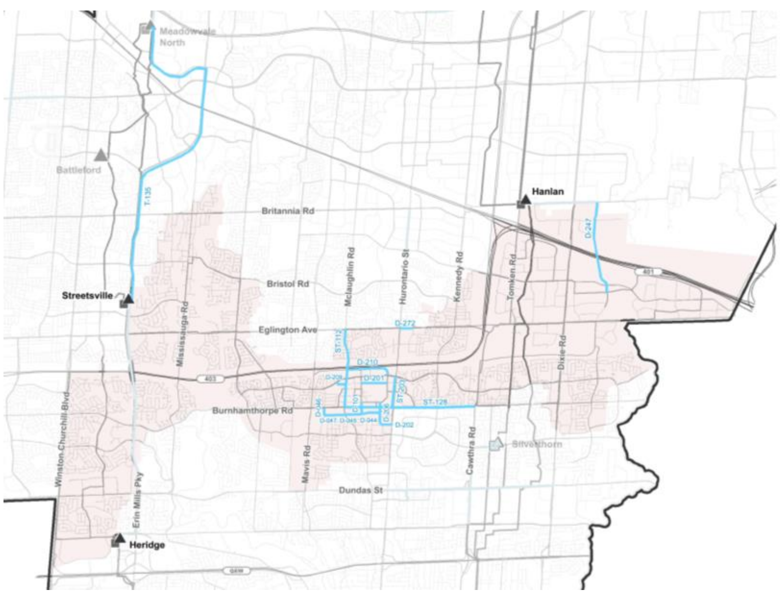


Focus Areas Servicing Solutions

Focus Area	Water Strategy & Key Issues	Servicing Solution Components
Pressure Zone 3	Servicing solutions for pressure zone 3 mainly consist of: - Increasing transmission and pumping capacity to move water to the upper pressure zones - Support growth within intensification areas such as the Mississauga City Centre and the Hurontario Corridor	- Meadowvale North Transmission Main - Burnhamthorpe Road Sub-Transmission Main - Confederation Parkway Sub-Transmission Main - Beckett Sproule Transfer Pumping Station Capacity Expansion - Silverthorn Pumping Station Capacity Expansion - Key distribution projects considered in this pressure zone are distributions mains in the Mississauga City Centre

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Significant growth predicted in intensification areas such as Central Mississauga and Hurontario Corridor - Project(s) support 2041 growth within intensification areas as well as provide additional supply to support growth in upper zones	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Certain projects support post-2041 growth in upper zones	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	- Flexibility needed to move water to the upper pressure to support intensification corridors	Design Criteria - Water and Wastewater	- Water - 270 L/cap/d, 250 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- New transmission, sub-transmission and pumping station capacity constructed to service significant growth areas	York W WW Needs	- York demands to be supplied by Peel may require MP infrastructure. York Demand and Flow make up part of the long term W WW needs
Alleviate existing capacity constraints	✓	- Additional pumping capacity to move more water to intensification areas and limiting constraints	Metrolinx MTO External Ongoing Works - LRT	- 'Transit works may impact planning projections LRT may impact infrastructure along Hurontario corridor
Minimize pumping, energy, O&M costs			Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Alignment with SOGR or other programs			DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Capacity Resiliency / Climate Change			Existing Studies, Design or Analysis	
Source Water Protection				

Area Overview Map

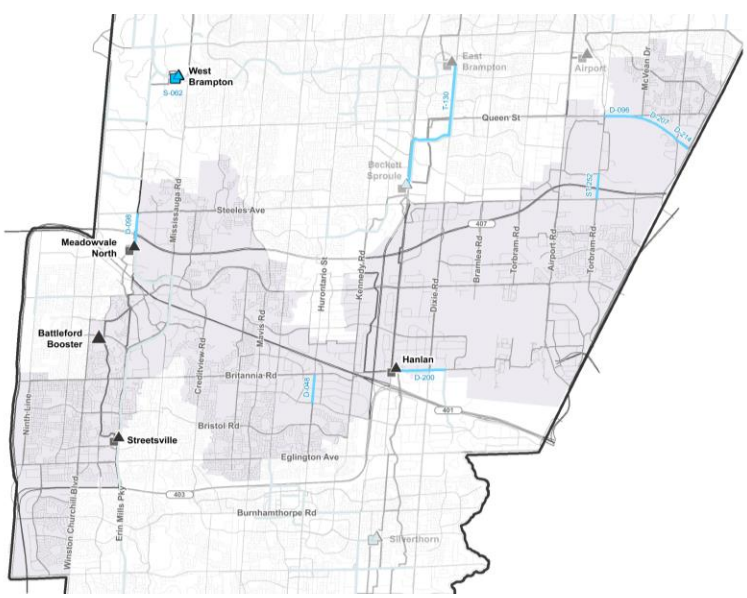


Focus Areas Servicing Solutions

Focus Area	Water Strategy & Key Issues	Servicing Solution Components
Pressure Zone 4	- Pressure zone 4 has projected adequate storage and pumping capacity up to 2041. - The servicing solutions for pressure zone 4 consist mainly of improving the feed to the East Brampton Reservoir.	- East Brampton Transmission Main Twinning - Key distribution projects considered in this pressure zone are distribution mains along Hurontario Street and Queen Street East, among others.

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Pressure Zone has projected adequate pumping capacity to 2041 - Project(s) mainly support 2041 growth in upper zones	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth			Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	- Improve feed to the East Brampton Reservoir to service future development	Design Criteria - Water and Wastewater	- Water - 270 L/cap/d, 250 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximizes the capacity of the East Brampton Transmission Main	York W WW Needs	- York demands to be supplied by Peel may require MP infrastructure. York Demand and Flow make up part of the long term W WW needs
Alleviate existing capacity constraints	✓	- Alleviates storage capacity constraints by expanding the West Brampton reservoir to service future development in the secondary plan areas	Metrolinx MTO External Ongoing Works - LRT	- Transit works may impact planning projections LRT may impact infrastructure along Hurontario corridor
Minimize pumping, energy, O&M costs			Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Alignment with SOGR or other programs			Existing Studies, Design or Analysis	
Capacity Resiliency / Climate Change				
Source Water Protection				

Area Overview Map

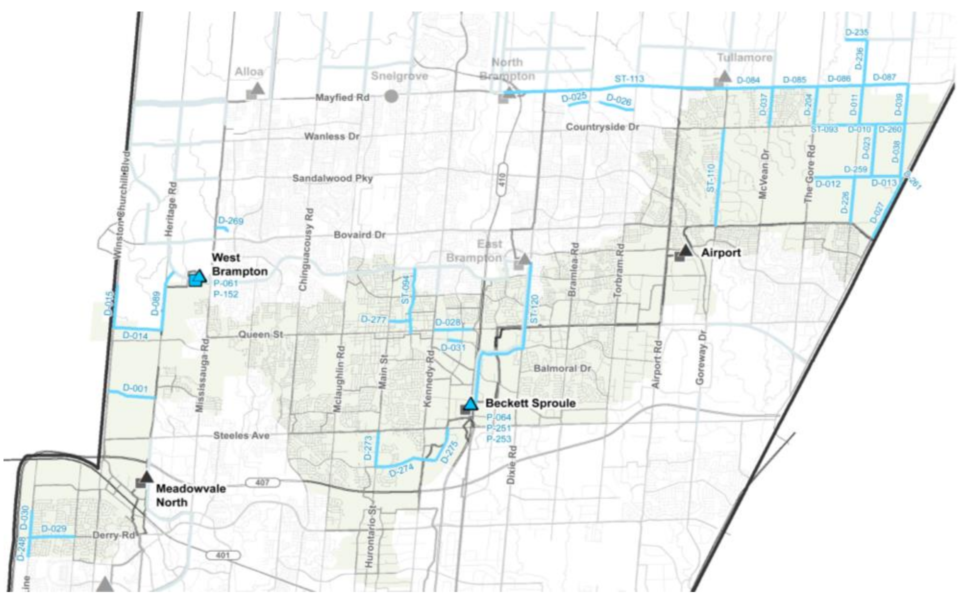


Focus Areas Servicing Solutions

Focus Area	Water Strategy & Key Issues	Servicing Solution Components
Pressure Zone 5	Servicing solutions for pressure zone 5 consist of: - Extending servicing for future greenfield growth and into the Uptown Brampton growth node - Improving connectivity across pressure zone 5 - Supporting intensification in areas such as the Downtown Brampton Core.	- Central Brampton Sub-Transmission Main - Williams Parkway Sub-Transmission Main - Countryside Drive Sub-Transmission Main - Centre Street Sub-Transmission Main - Goreway Drive Sub-Transmission Main - Mayfield Road Sub-Transmission Main - West Brampton Pumping Station - Capacity Expansion - Several distribution projects located in growth areas such as Highway 427 Industrial Secondary Plan, Bram West, Uptown Brampton, Brampton Downtown Core, among others

Project(s) Drivers: *Why do we need the project(s)?*	Project(s) Drivers - Details		Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Projected greenfield and Uptown Brampton growth expected as well as the Downtown Brampton Core - Project(s) support 2041 growth within greenfield areas and intensification areas as well as provide additional supply to support growth in upper zones	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- Certain projects support post-2041 growth in upper zones	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	- Optimizes the connectivity across the entire Pressure Zone by constructing several sub-transmission mains	Design Criteria - Water and Wastewater	- Water - 270 L/cap/d, 250 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximize capacity of planned infrastructure to service future development areas as well as areas with planned intensification	Existing Studies, Design or Analysis	- Queen St Corridor Water / Wastewater Review
Alleviate existing capacity constraints	✓	- Significant reduces capacity of existing sub-transmission mains by constructing several new sub-transmission mains to support servicing in future greenfield and Uptown Brampton nodes	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Minimize pumping, energy, O&M costs	✓	- No storage facility in Pressure Zone 5 east, eliminating costs associated with equalization, fire and emergency storage	GTA West	- Preferred GTA West Corridor alignment crosses through service area
Alignment with SOGR or other programs			Existing Studies, Design or Analysis	
Capacity Resiliency / Climate Change				
Source Water Protection				

Area Overview Map

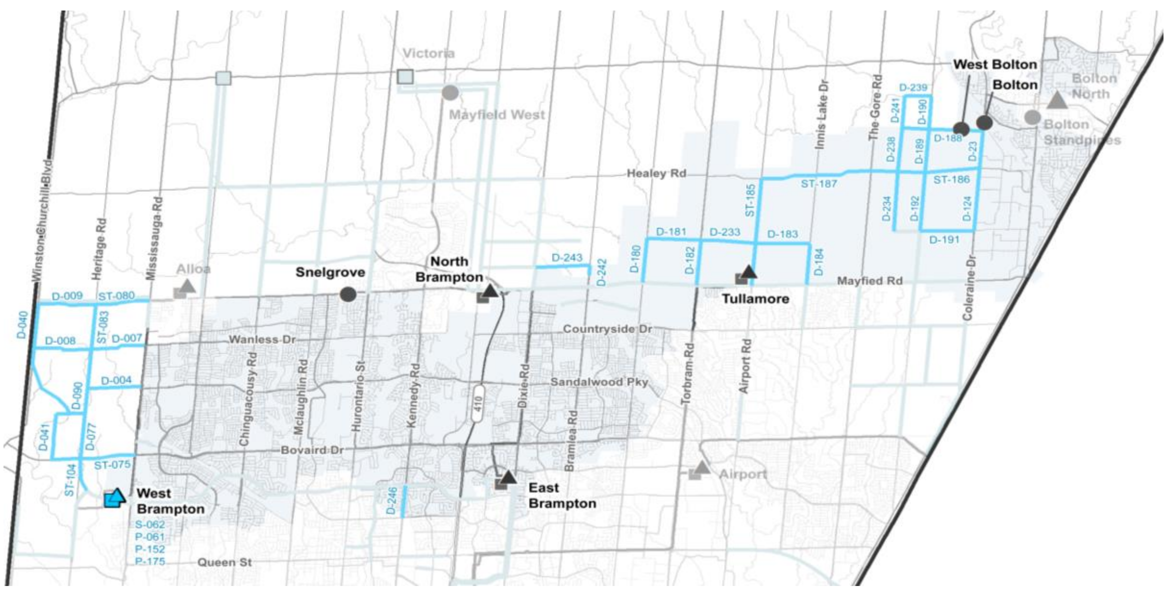


Focus Areas Servicing Solutions

Focus Area	Water Strategy & Key Issues	Servicing Solution Components
Pressure Zone 6	Servicing solutions for pressure zone 6 consist of: - Extending servicing into northwest Brampton - Adding a secondary feed to west Bolton - Providing floating storage from the new zone 6 reservoir	- Victoria Reservoir - Victoria Transmission and Sub-Transmission Mains - West Brampton Pumping Station Capacity Expansion - Bovaird Drive West Sub-Transmission Main - Mayfield Road Sub-Transmission Main - Heritage Road (North) Sub-Transmission Main - Heritage Road Sub-Transmission Main - Several distribution projects are included in the Master Plan to extend servicing to growth areas such as northwest and northeast Brampton, Tullamore Industrial area and West Bolton.

Project(s) Drivers	Project(s) Drivers - Details		Project(s) Influences	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Project(s) mainly support greenfield growth to 2041	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth	✓	- New sub-transmission along Innis Lake Road and Healy Road strategically oversized to support post-2041 growth	Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization	✓	- Optimizes the connectivity across the entire Pressure Zone by constructing several sub-transmission mains	Design Criteria - Water and Wastewater	- Water - 270 L/cap/d, 250 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	Maximizes recently built facilities	DC	- Certain projects provide post 2041 benefit- Out of ByLaw (OBL)
Alleviate existing capacity constraints			Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Minimize pumping, energy, O&M costs			GTA West	- Preferred GTA West Corridor alignment crosses through service area
Alignment with SOGR or other programs			Existing Studies, Design or Analysis	
Capacity Resiliency / Climate Change				
Source Water Protection				

Area Overview Map

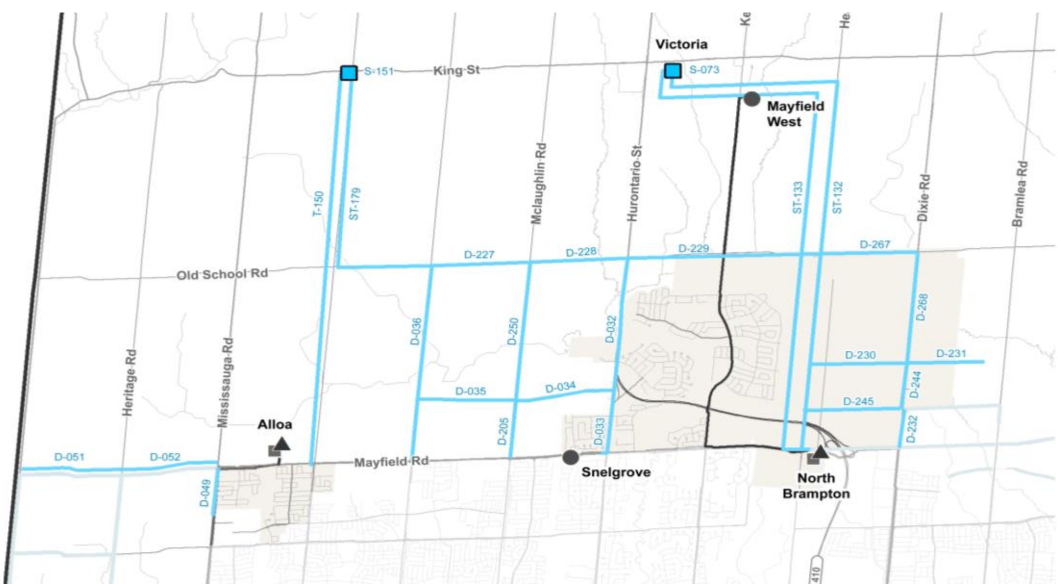


Focus Areas Servicing Solutions

Focus Area	Water Strategy & Key Issues	Servicing Solution Components
Pressure Zone 7	Servicing solutions for pressure zone 7 consist of: - Extending servicing to support growth in areas north of Mayfield Road - Providing pumping storage until the new zone 7 storage is commissioned - Key growth areas in this pressure zone include the Mayfield West Developments and the Tullamore Industrial Area.	Key Components - New Elevated Tank (Option 1 Carried Forward) - Associated transmission and sub-transmission mains - Several distribution projects to support new Greenfield growth north of Mayfield Road

Project(s) Drivers: *Why do we need the project(s)?*		Project(s) Drivers - Details	Project(s) Influences: *What could potentially have an impact on the project(s)?*	Project(s) Influences - Details
Capacity for new growth to 2041	✓	- Project(s) mainly support greenfield growth to 2041	2041 Planning Forecast	- Projected 2041 Population and Employment forecast
Supports post-2041 growth			Post-2041 Forecast	- High level review of potential growth beyond 2041 informs the recommendations
Flexibility / Optimization			Design Criteria - Water and Wastewater	- Water - 270 L/cap/d, 250 L/emp/d
Maximize capacity of existing / planned infrastructure	✓	- Maximizes existing infrastructure to extend servicing to support growth in areas north of Mayfield Road		
Alleviate existing capacity constraints	✓	- Storage capacity constraints alleviated by providing pumped storage until new Zone 7 storage can be commissioned	Climate Change Master Plan	- Climate Change Master Plan will influence future infrastructure policies and projects
Minimize pumping, energy, O&M costs			GTA West	- Preferred GTA West Corridor alignment crosses through service area
Alignment with SOGR or other programs			Existing Studies, Design or Analysis	
Capacity Resiliency / Climate Change	✓			
Source Water Protection	✓	- Elevated tank storage potential lower impact to source water protection than in-ground reservoir		

Area Overview Map



Focus Area - Pressure Zone 6
Secondary Feed to West Bolton Evaluation

Description of Strategy		Zone 6 Sub-Transmission Secondary Feed to West Bolton Option 1: Innis Lake / Healy Road	 Option 2: Mayfield / Humberstation Road
Technical	Increase spare capacity in existing system	✓✓	✓✓
	Improve/maintain level of service of existing users	✓✓	✓✓
	Avoid/minimize proximity and/conflicts with existing infrastructure	✓✓	✗
	Consider constructability and technical feasibility to build and maintain infrastructure	✓✓	✓
	Provide opportunity for operational flexibility and security	✓✓	✓
	Integration with road/transportation projects	✓	✓
	Avoid/minimize construction in areas with limited access	✓	✗
	Avoid/minimize environmental/roads/utility crossings	✓	✓
	Ability to maintain existing services during construction/implementation	✓✓	✓✓
	Maximize alignments along road rights of way and/or easements	✓✓	✓✓
	Support intensification growth	✓✓	✓✓
	Support post-2041 growth	✓✓	✓
	Incremental extension of infrastructure as growth progresses	✓✓	✓✓
	Ability to provide/maintain desired level of service under climate change conditions	✓✓	✓✓
	Technical Comments	- sub-transmission strategically oversized to support post-period/buildout growth within pressure zone 6 - Construction required along existing road, less potential for conflict with existing users and infrastructure	- Construction required along existing road, potential for conflict with existing users and infrastructure - Less opportunity to support post-period/build-out growth due to alignment
Environmental	Minimize impact on nearby agricultural lands	✓	✓✓
	Avoid/minimize environmental crossings	✓	✓
	Avoid/minimize impact on environmental sensitive/protected areas	✓	✓✓
	Avoid/minimize impact on local aquatic/terrestrial species at risk and habitats		
	Avoid/minimize potential impact on groundwater quantity and quality during construction		
	Consider resiliency and adaptation to climate change		
	Environmental Comments	- no major difference in number of environmental crossings between options - crosses wider natural heritage system area	- no major difference in number of environmental crossings between options
Socio/Cultural	Minimize short/long term noise & odour Issues	✓✓	✓
	Consider visual aesthetics of the proposed infrastructure	✓✓	✓✓
	Consider potential community resistance to alternative/strategy/alignment	✓✓	✓
	Avoid/minimize impact on archaeological sites/resources		
	Minimize impact during construction and operation	✓✓	✓
	Minimize impact on surrounding properties	✓✓	✓
	Minimize construction impact on traffic, local businesses and residents	✓✓	✓
	Avoid/minimize impact on heritage sites		
	Socio/Cultural Comments		
Legal / Jurisdictional	Maximizes worker safety and operability	✓✓	✓✓
	Does not require land acquisition or easement	✓✓	✓✓
	Minimizes approvals/coordination	✓✓	✓
	Legal/ Jurisdictional Comments		
Financial	Maximize use of existing infrastructure	✓	✓
	Avoid/minimize introducing new infrastructure	✓✓	✓
	Avoid/minimize upgrading existing infrastructure	✓✓	✓✓
	Minimize long term energy costs		
	Lower capital cost relative to other options		
	Reduce/eliminate operation & maintenance costs		
	Support long-term financial sustainability		
	Integration with SOGR program		
	Support phasing and implementation of capital projects over time	✓✓	✓
	Financial Comments	Sub-transmission main along Innis Lake oversized to support post-period/buildout growth with potential to connect to future zone 7 storage	A new sub-transmission main will be required to extent connection to future Zone 7 storage
Innovation / Adaptation	Apply innovation and/or new technologies		
	Use of data for evidence based decision making process	✓✓	✓
	Operational flexibility to adapt to climate change		
	Establish a baseline and a process to measure results and desire outcomes		
	Incorporate water conservation and reuse practices		
	Maximize energy efficiency		
	Avoid energy-intensive infrastructure		
	Consider performance of the system under power outage conditions		
	Consider opportunity for renewable energy production and use		
	Innovation/ Adaptation Comments	Analysis of potential buildout demonstrate that a future zone 7 storage will be required. This project has oversize provisions to connect to the future zone 7 storage	No provisions for connection to zone 7 storage
Preferred Option		✓✓	✓

Focus Area - Pressure Zone 7
Zone 7 Storage Evaluation

Description of Strategy		Zone 7 Storage: Option 1: Elevated Tank	Zone 7 Storage: Option 2: Inground Reservoir
Technical	Increase spare capacity in existing system	✓✓	✓✓
	Improve/maintain level of service of existing users	✓✓	✓✓
	Avoid/minimize proximity and/conflicts with existing infrastructure	✓✓	✓✓
	Consider constructability and technical feasibility to build and maintain infrastructure	✓✓	✓
	Provide opportunity for operational flexibility and security	✓✓	✓✓
	Integration with road/transportation projects		
	Avoid/minimize construction in areas with limited access		
	Avoid/minimize environmental/roads/utility crossings		
	Ability to maintain existing services during construction/implementation	✓✓	✓✓
	Maximize alignments along road rights of way and/or easements		
	Support intensification growth		
	Support post-2041 growth	✓	✓✓
	Incremental extension of infrastructure as growth progresses	✓	✓✓
	Ability to provide/maintain desired level of service under climate change conditions	✓✓	✓✓
	Technical Comments	- Maximum available storage lower than option 2 - Elevated tanks are not typically expanded and constructing new facilities is required to provide additional storage	- Maximum available storage higher than option 1 - Inground reservoirs can be interconnected for potential expansion if required. - Increased construction required for additional infrastructure; longer feeder main required to reach ground elevations to support pressure zone 7 HGL
Environmental	Minimize impact on nearby agricultural lands	✓✓	✓
	Avoid/minimize environmental crossings		
	Avoid/minimize impact on environmental sensitive/protected areas	✓✓	✓
	Avoid/minimize impact on local aquatic/terrestrial species at risk and habitats	✓✓	✓
	Avoid/minimize potential impact on groundwater quantity and quality during construction	✓	×
	Consider resiliency and adaptation to climate change	✓✓	✓✓
	Environmental Comments	- Construction in greenbelt area, potential to impact environmentally sensitive and protected areas. Less impact than option 2 due to potential location further south. - Lower impact to groundwater and source water protection than option 2 - Lower resiliency to climate change/natural environmental	- Significant construction in greenbelt area, potential to impact environmentally sensitive and protected areas. Higher impact than option 1 due to potential location further north. - Greater potential impact to groundwater and source water protection than option 1 - Potential impact to local aquatic/terrestrial species - Increased natural protection to extreme changes in temperature and harsh weather conditions - Larger areas of surrounding undeveloped or agricultural land, higher potential to impact
Socio / Cultural	Minimize short/long term noise & odour Issues	✓	✓
	Consider visual aesthetics of the proposed infrastructure	✓	✓✓
	Consider potential community resistance to alternative/strategy/alignment	×	✓
	Avoid/minimize impact on archaeological sites/resources		
	Minimize impact during construction and operation	✓✓	✓
	Minimize impact on surrounding properties	✓	✓
	Minimize construction impact on traffic, local businesses and residents	✓✓	✓
	Avoid/minimize impact on heritage sites		
	Socio/Cultural Comments	- Shorter construction period, decreased impact to surrounding residents and businesses - Above ground reservoir has potential to impact aesthetics and visuals to surrounding land users	- Longer construction period, increased impact to surrounding residents and businesses - Location of underground reservoir has higher potential environmental impacts potential due to environmental/greenbelt land designation
Legal / Jurisdictional	Maximizes worker safety and operability	✓	✓
	Does not require land acquisition or easement	×	×
	Minimizes approvals/coordination	✓	×
	Legal/ Jurisdictional Comments	- Greater ease of accessibility, increasing worker safety and operability during routine maintenance	- Lower ease of accessibility - Increased potential for approvals and coordination based on ground/soil suitability for construction
Financial	Maximize use of existing infrastructure	✓	✓
	Avoid/minimize introducing new infrastructure	✓	×
	Avoid/minimize upgrading existing infrastructure	✓✓	✓✓
	Minimize long term energy costs	✓✓	✓
	Lower capital cost relative to other options	✓✓	✓
	Reduce/eliminate operation & maintenance costs	✓	✓
	Support long-term financial sustainability	✓	✓✓
	Integration with SOGR program		
	Support phasing and implementation of capital projects over time	✓	✓✓
	Financial Comments	- Requires new transmission and sub-transmission mains - May require additional storage as pressure zone 7 builds out	- Requires longer transmission and sub-transmission mains than option 1 to reach ground elevations that support pressure zone 7 HGL - Increased pumping required for operation, increased energy requirements and costs - Could potentially be expanded as pressure zone 7 builds out
Innovation / Adaptation	Apply innovation and/or new technologies		
	Use of data for evidence based decision making process	✓✓	✓✓
	Operational flexibility to adapt to climate change	✓	✓✓
	Establish a baseline and a process to measure results and desire outcomes		
	Incorporate water conservation and reuse practices	✓✓	✓✓
	Maximize energy efficiency	✓✓	✓✓
	Avoid energy-intensive infrastructure	✓✓	×
	Consider performance of the system under power outage conditions	✓✓	✓
	Consider opportunity for renewable energy production and use		
	Innovation/ Adaptation Comments		
Preferred Option		✓✓	✓✓

LEGEND

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

The proposed storage options, and associated transmission and sub-transmission mains will require the completion of a Schedule C Class Environmental Assessment prior to proceeding with design and implementation. As such, both options for new storage in Zone 7 are considered to be viable and are carried forward at this time. For the purposes of the Mater Plan Capital Program, a cost for the Option 1 – New Elevated Tank was carried. Both options will be reviewed through the EA process.

3F

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 3F

Standby Power Report

AECOM Imagine it. Delivered.

AECOM Canada Ltd.
105 Commerce Valley Drive West
7th Floor
Markham, ON L3T 7W3
Canada

T: 905.886.7022
F: 905.886.9494
aecom.com

Project name:
Region of Peel - Standby Power Study Update

Project ref:
60270348

From:
Benny Wan (P.Eng.)

Date:
June 19, 2020

To:
Ms. Sogol Bandehali, M.Sc., P.Eng.
Project Manager,
Infrastructure Planning & Asset Management,
Growth and Water Resources
Region of Peel
10 Peel Centre Drive, Suite A
4th Floor
Brampton, ON L6T 4B9

CC:
Laura Boroweic, Region of Peell
Miriam Polga, Region of Peel

Memo

Subject: Standby Power Study Update 2019

1. Introduction

The Region of Peel retained AECOM to review the standby power requirements in 2018. The scope of the study was updated to address the Region's comments regarding additional considerations in calculating the available standby power capacity for pumping as well as the growth/demands updates. The analysis results presented herein are based on the updated water hydraulic model analysis and the latest planning information. For the hydraulic modelling, AECOM used the hydraulic model that included the water infrastructure information as per the 2018 capital program. The model also included the population and demands as per Scenario 15 (SGU October, 2017) and subsequently validated the information with the latest projected population as per Scenario 16.

The purpose of the study is to assess the water supply ability to meet the anticipated water demands (including York Region) and acceptable criteria during a blackout or other emergency conditions based on existing standby power capacity as well as identifying additional standby power requirements to provide sustainable water service to the customers. The hydraulic analysis was completed for the existing and future demand (2031 and 2041) scenarios and the following tasks were completed in the hydraulic analysis:

- Compiled available background information to establish and document the existing standby power capacity at each station;
- Reviewed the best industry practices to provide water service under emergency conditions;
- Reviewed the standby power capacity required based on the latest planning forecasts (SGU Scenario 16) for existing (2020), 2031 and 2041 planning years.;
- Updated the water model analysis for extended emergency condition (72 hours);
- Reviewed the tank and reservoirs levels based on the recent SCADA available and identified the typical starting water level;

- Created scenarios based on the maximum residential and average ICI demand condition to represent the blackout or emergency condition demand for existing (2020), 2031 and 2041 scenarios;
- Selected the appropriate pumps based on the operation description mentioned in PCN and O&Ms and available horsepower in each station; and
- Optimized the pump selection based on the available and allowable horsepower usage.

2. Data Collection and Review

A comprehensive review of the following information provided by the Region was undertaken and data for standby power requirement assessment was obtained:

- Process Control Narrative (PCN);
  - Obtained the available standby power capacity (standby generators capacity)
- Operational Manual (O&M);
  - Pump operation under emergency conditions
- Recent Station's Schematic;
  - Existing pump capacity (horsepower)
- Design Reports
  - Pump capacity, generator capacity, modeling criteria

Table 1 below provides a summary of the information utilized in this study.

Table 1: Data Summary

Facility	Data Type				
	PCN	Schematic	Design Report	O&M Manual	Drawings
Lakeview	✓	✓	✓	✗	✓
Silverthorn	✓	✓	✗	✗	✓
Hanlan	✓	✓	✓	✗	✓
Beckett Sproule	✓	✓	✗	✗	✓
East Brampton	✓	✓	✗	✗	✓
North Brampton	✓	✓	✗	✗	✗
Airport	✓	✓	✗	✗	✗
Tullamore	✓	✓	✗	✗	✗
Lorne Park	✓	✓	✗	✗	✗
Herridge	✓	✓	✗	✓	✓
Streetsville	✓	✓	✗	✗	✓
Meadowvale	✓	✓	✗	✗	✗
West Brampton	✓	✓	✗	✗	✗
Alloa	✓	✓	✓	✗	✓

The above information was used to calculate the standby power requirements presented in the following sections.

3. Industry Best Practices

In reviewing the required standby power capacity in South Peel Water System, several materials were reviewed for validating the evaluation approach applied in this study. The following materials were utilized in the industry best practices review.

- AWWA Emergency Power Source Planning for Water and Wastewater, 2004
- AWWA Manual of Water Supply Practices – M19, Fifth Edition, Emergency Planning for Water and Wastewater Utilities, 2018
- EPA Power Resilience presentation, Guide for Water and Wastewater Utilities, 2019
- MOE Design Guidelines for Drinking Water Systems, 2019

The above noted documents provided similar considerations in determining the method for providing sustainable water and wastewater services under power outage conditions. The design considerations that were applicable for water supply system were summarized as follow:

- Water Demand
- Emergency Duration
- Design of standby power
  - Existing system configurations (with or without water storage)
  - Equipment technology
  - Selection fuel supply
  - On site fuel storage capacity
  - Operation and Maintenance
- Other considerations:
  - Economic
  - Code, regulation and standard
  - Communication planning
  - Coordination with commercial electric power company

The key information that obtained from these documents were the durage of outage and water demand considerations under emergency condition. Accodring to the AWWA Eermgency Power Source Planning for Water and Wastewater, 2004, the duration for long term outages for large-scale natural diasters such as huurrians and flooding was not articulated; however, it was suggested that the design of the standby power could be based on the prescedant of the similar long term outage event. For Region of Peel, the most recent long term outage event was 2003 Blackout which the extended power outage duration was about 72 hours. As a result, this study included the evaluation of standby power requirement for 72 hours in order to determine the system upgrade implications.

For system demand consideration, MOE Design Guidelines for Drinking Water Systems, 2019, suggested that the standby power should be designed to meet the average day demand conditions. In 2007 Peel Standby Power Study, the water demand conditions under 2003 Blackout was approximately equal to maximum day demand for residential use plus average day demand for employment use; which was higher than the typical average day demand conditions for the Region. As a result, it was considered acceptable for the demand criteria identified in 2007 Peel Standy Power Study to be used for evaluating the standby power requirements.

The following sections details the industry best practices for water system.

3.1 AWWA Emergency Power Source Planning

The following summarizes the relevant information obtained from the AWWA document that applied to the study:

- The minimum requirement for water demand under emergency condition should be average day demand;
- Outage Duration:
    - For the short term (local power outage)
        - Normally last less than 2 hours
        - Some events could last 16 hours of longer
    - For the long term (catastrophic events)
        - No articulation of emergency duration
        - Castrophic events as such earthquakes, hurricane could last from a few hours to a month
        - The manual suggested that the duration should consider the previous event(s) and fuel tank size.

3.2 AWWA Manual of Water Supply Practices – M19 Emergency Planning for Water and Wastewater Utilities

The following summarizes the relevant information obtained from the AWWA M19 document that was related to the study

- No articulation of emergency duration
- No articulation of water demands required under emergency conditions
- The document mentioned that standby power would be required for protecting critical infrastructures.

3.3 EPA Power Resilience presentation, Guide for Water and Wastewater Utilities

The following summarizes the relevant information obtained from the EPA document that was related to the study

- Emergency standby power was designed for short-term use; typically rated to operate for no more than 200 hours per year
- The selection of standby power equipment must comply with local and federal regulations on generators, fuel storage, and use and maximum permissible testing.
- An extended emergency condition was referred to as the "Black Sky" incident that will last for at least 30 days.

3.4 MOE Design Guidelines for Drinking Water Systems

The following summarizes the relevant information obtained from the MOE document that was related to the study

- Standby power should be identified to ensure that average day demand can be met during a power outage
- Availability of storage capacity in the distribution should be taking into account when identifying the standby power requirements
- The following considerations were suggested by identifying the standby power requirements:
    - Frequency and length of power outages;
    - Reliability of primary power source;
    - Available treated water storage within the system;
    - Type of water storage (underground or elevated);
    - Requirements for fire protection;
    - Type of standby power; and
    - Lower level of emissions provided by alternative fuel technology

4. Model Update

As part of this study, AECOM used the hydraulic model that included the water infrastructure information as per the 2018 capital program. The model also included the population and demands as per Scenario 15 (SGU October, 2017) and subsequently validated the information with the latest projected population as per Scenario 16. The following sections provide a review of the proposed infrastructures, the estimation of the anticipated water demand (including York Region demand) and the design criteria definition.

- Update demand based on the latest planning forecasts (SGU Scenario 16) for planning years of 2017(existing), 2031 and 2041;
- Update the water model according to the latest master plan capital program to have the most recent infrastructures incorporated into the model;

In validating the applicability and the validity of the hydraulic model, the water demands for Scenario 15 and Scenario 16 were compared. Table 2 summarizes the comparison results.

Table 2: Water Demand Comparison

	Scenario 15 (applied in hydraulic analysis)			Scenario 16		
Year	**Region of Peel Under Emergency (ML/d)**	**York Demand (ML/d)**	**Total (ML/d)**	**Region of Peel Under Emergency (ML/d)**	**York Demand (ML/d)**	**Total (ML/d)**
Existing	868	100	968	751	100	851
2031	1,061	100	1,161	899	100	999
2041	1,179	100	1,279	1,019	100	1,119

As noted in Table 2, the water demands included in the hydraulic model were higher than those for Scenario 16. After reviewing this comparison result with the Region, it was concluded that the analysis results based on the current hydraulic model used for this study would provide relatively conservative results and it was considered acceptable.

4.1 Water Demand

The modeling water demand was established based on the latest Region's planning forecasts (SGU Scenario 16) and Master Plan's design criteria. Table 3 summarizes the residential and employment population-based on updated information from Scenario 16. The design criteria are presented in Table 4.

Table 3: Region of Peel Population as per Scenario 16

Year	Residential Population	Employment-Population	Total Equivalent Population
2020	1,489,743	748,556	2,238,299
2031	1,735,231	863,628	2,598,858
2041	1,931,654	963,439	2,895,093

Table 4: Design Criteria

Design Criteria	Residential Consumption	Employment Consumption
Average Day Demand (ADD) (L/cap/day)	270	250
Maximum Day Factor (MDF)	1.8	1.4

The model demand was calculated based on Maximum Day Demand for Residential plus Average Day Demand for Employment as per the 2007 South Peel Standby Power Study. Table 5 summarizes the water demands used for this study.

Table 5: Model Demand

Year	Region of Peel Under Emergency (ML/d)	York Demand (ML/d)*	Total (ML/d)
2020	751.0	100.0	851.0
2031	899.0	100.0	999.0
2041	1,019.0	100.0	1,119.0

**As a part of this study, the York Region demand is considered and agreed as 100ML/d as per the previous study for standby power (2007) and there is a provision for one reservoir turnover.*

4.2 Watermain Infrastructure

As part of this study, the latest Capital Work Plans were reviewed. Please refer to the Region's Water and Wastewater Master Plan Update 2019 for further details of the recommended water infrastructure upgrades.

5. Basis of the Analysis

5.1 Assumptions

The following assumptions were applied in evaluating the standby power requirements

- Victoria reservoir was expected to be commissioned in 2022 and Snelgrove Elevated Tank was expected to be decommissioned in 2022
- Emergency supply for York Region was 100ML/d for analysis scenarios

5.2 Analysis Criteria

The Region's water distribution system was analyzed for the system pressure and flow velocity based on the following criteria from the Ministry of the Environment Design Guidelines for Drinking-Water Systems:

- Minimum acceptable pressure - 275 kPa (40 psi)
- Maximum acceptable pressure - 700 kPa (100 psi)
- Maximum acceptable velocity – 2 m/s

5.3 Modeling Approach

The analysis was conducted in the Extended Period Simulation. The modeling scenarios were analyzed based on the following boundary conditions:

- The scenario began at 4 pm to simulate the start of the emergency condition; which was considered as peak hour demand period.
- The initial water storage level was 60% full. This value was validated based on historical SCADA / EMS.
- The simulation was performed for 72 hours and the duration of the emergency was analyzed for 3 hours, 12 hours, 24 hours, 48 hours and 72 hours. For each emergency duration scenario, the objective was to identify the minimum pumping requirements at each pumping station for maintaining the low water level at the reservoirs at the end of the emergency period. The following shows the low water level at each reservoir.

Reservoir Name	Zone	Min %	Status
Silverthorn Reservoir	1C	40	Existing
Herridge Reservoir	1W	37	Existing
Hanlan Reservoir	2C	37	Existing
Streetsville Reservoir	2W	37	Existing
Beckett Sproule Reservoir	3C	37	Existing
Airport Road Reservoir	3E	37	Existing
Meadowvale Reservoir	3W	37	Existing
East Brampton Reservoir	4C	37	Existing
Tullamore	4E	40	Existing
West Brampton Reservoir	4W	37	Existing
North Brampton Reservoir	5C	37	Existing
Bolton Elevated Tank	6B	5	Existing
Snelgrove Elevated Tank	6C	45	To be decommissioned by 2022
Mayfield Elevated Tank	7C	37	Existing
Victoria Reservoir	6C	37	To be commissioned by 2022
Alloa Reservoir	5W	37	Existing
West Caledon Elevated Tank	7W	37	To be commissioned by 2027

5.4 Standby Power Evaluation Methodology

The following summarizes the evaluation approach for identifying the standby power requirements at the pumping facilities.

- Utilized hydraulic modeling results to identify minimum pump operation for maintaining minimum water service
- Identified the horsepower requirements at each station based on simulated pump ON/OFF status.
  - Based on design pump horsepower at per OCWA pump station schematic
- Compared horsepower requirements with the available standby power. Required standby power was calculated based on the following considerations:
  - Reduce the total installed standby power to address Base Load for each station;
  - Increase the required standby power to address the energy usage for pump startup;
    - Additional 50% of horsepower requirement for a single largest pump in operation
  - Reduce the total installed standby power by 25 % to consider the energy efficiency of the unit that was operated beyond 3 hours.

6. Hydraulic Analysis Methodology

6.1 Available Power for Pumping

After reviewing the data provided by the Region (PCNs, O&Ms, etc.), the total capacity at each station was obtained and the following table is summarizing the total installed and total available capacity at each station. The available power for operating the pump(s) presented in Table 6 was used to analyze the required standby power for each pumping station under emergency conditions. As noted in Section 5.4, the available standby power was calculated based on the following considerations:

- Base Load:
  - Base loads for Arthur P. Kennedy Water Treatment Plant and Lorne Park Water Treatment Plant were provided by the Region
  - Base load for East Brampton Pumping Station was calculated by comparing the Historical pump ON/OFF Status as per SCADA and energy consumption records
    - The different pump ON/OFF status was compared to the energy consumption records to identify the energy consumption for each pump;
    - Historical energy consumption was subtracted by the total energy usage for the number of pumps in operation for the same period to determine the base load
    - The calculated base load for East Brampton was about 56kW
  - Base loads for other pumping stations were assumed to be the ratio between the base load and installed standby power at East Brampton (about 4%)
  - Available standby power capacity was reduced by 25% after 3 hours of continuous operation

Table 6: Available Horsepower Capacity at Existing Pump Stations

Pumping Stations	Zones	Total Installed Standby Power (kW)	Auxiliary Load (kW) – Base Load	Available Power for Pumping for first 3 hours (kW)	Available Power for Pumping after 3 hours (kW)
Arthur P. Kennedy (APK)	Zone 1 Zone 2	12,000	1,058	10,942	8,207
Lorne Park (LP)	Zone 1 Zone 2	9,300	1,200	8,100	6,075
Silverthorn (SN)	Zone 2 Zone 3	3,000	113	2,887	2,165
Herridge (HG)	Zone 2 Zone 3	3,000	113	2,887	2,165
Hanlan (HN)	Zone 3 Zone 4 Zone 3 (Transfer)	5,500	207	5,293	3,970
Streetsville (SV)	Zone 3 Zone 4	3,000	113	2,887	2,165
Meadowvale (MV)	Zone 4 Zone 5	3,500	66	3,434	2,576
Becket Sproule (BS)	Zone 4 Zone 5 Zone 4 (Transfer)	4,500	169	4,331	3,248
Airport (AP)	Zone 4 Zone 5 York Region	4,000	151	3,849	2,887
West Brampton (WB)	Zone 5 Zone 6	1,360	51	1,309	982
East Brampton (EB)	Zone 5 Zone 6	1,500	56	1,444	1,083
Tullamore (TM)	Zone 5 Zone 6	1,500	56	1,444	1,083
North Brampton (NB)	Zone 6 Zone 7	750	28	722	542
Alloa (AA)	Zone 6 Zone 7	1,250	47	1,203	902

6.2 Pump Selection

Pumps selection for each scenario was determined using the following priorities:

1. Designated pumps mentioned in PCN or O&M
2. Variable Frequency Drive Pumps (VFD)
3. Large size pumps
4. Medium Size pumps
5. Small size pumps

Using the above list and the total available power at each station, the combinations of pumps were selected to provide water service under emergency or blackout conditions.

7. Modeling Results

The hydraulic analysis was conducted for the modeling scenarios to evaluate and confirm the serviceability under emergency conditions. The modeling results were utilized to confirm the pump selection for maintaining adequate water service in the system and the results were used for evaluating the standby power requirements under various modeling scenarios; including different emergency durations. Table 7 summarizes the additional standby power requirements at each pumping station.

The analysis results as presented in Table 7 led to the following key findings.

- Sufficient stand power capacity was installed at the water facilities to meet the 3 hours emergency duration until 2031.
- Standby power capacity upgrades at North Brampton and Tullamore Pumping Stations would be required by 2041.
- Additional standby power capacity requirement at North Brampton Pumping Station was dropped in 2031 for the 12 hours to 72 hours emergency durations due to the commissioning of Victoria Reservoir.
- In comparison of the additional standby power capacity for the 12 hours to 72 hours emergency duration for 2041, the required additional capacity in these scenarios were nearly identical.

Table 7: Standby Power Evaluation Results

		Additional Standby Power for 3 hours Duration (kW)			Additional Standby Power for 12 hours Duration (kW)			Additional Standby Power for 24 hours Duration (kW)			Additional Standby Power for 48 hours Duration (kW)			Additional Standby Power for 72 hours Duration (kW)		
System	Station	2020	2031	2041	2020	2031	2041	2020	2031	2041	2020	2031	2041	2020	2031	2041
Central	APK[1]	-	-	-	-	4,426	5,321	-	4,426	5,321	-	4,426	5,321	-	4,426	5,321
Central	SN	-	-	-	-	109	668	-	668	668	370	668	668	370	668	668
Central	HN	-	-	-	-	-	560	-	262	560	-	262	560	-	262	560
Central	BS	-	-	-	368	368	368	368	368	368	368	368	368	368	368	368
Central	EB	-	-	-	-	185	483	185	185	185	185	185	483	185	185	483
Central	NB	-	-	173	130	-	-	241	18	130	241	18	130	241	18	130
West	LP	-	-	-	-	319	991	-	319	991	170	991	991	170	991	991
West	HG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West	SV	-	-	-	-	463	1,545	-	463	1,545	240	985	1,545	240	985	1,545
West	MV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West	WB	-	-	-	-	174	361	-	174	361	361	361	361	361	361	361
West	AA	-	-	-	-	-	421	-	-	421	-	-	645	-	-	645
East	AP	-	-	-	96	432	432	96	432	432	96	432	432	96	432	432
East	TM	-	-	271	36	408	408	36	408	408	36	408	408	36	408	408

[1] Included future capacity upgrade to a total capacity of 18000kW as per Region capital plan

8. CONCLUSIONS AND RECOMMENDATIONS

The completion of this analysis for the Region of Peel leads to the following conclusions:

- In reviewing of the industry best practices for providing water services under emergency conditions, the following materials were studied:
    - AWWA Emergency Power Source Planning for Water and Wastewater, 2004
    - AWWA Manual of Water Supply Practices – M19, Fifth Edition, Emergency Planning for Water and Wastewater Utilities, 2018
    - EPA Power Resilience presentation, Guide for Water and Wastewater Utilities, 2019
    - MOE Design Guidelines for Drinking Water Systems, 2019
- The key information that was obtained from these documents was:
    - The level of service under extended emergency conditions should be 72hours based on the latest Blackout event in 2003.
    - The standby power requirements should be designed to meet average day demand conditions
        - Region of Peel used maximum day demand for residential use plus average day demand for employment use; which was considered appropriate
- To confirm the system upgrade requirements for extended emergency conditions, this study included an assessment of the additional standby power capacity needs for 72 hours.
- The standby power analysis was completed based on the same criteria as those in the Peel Standby Power Study, 2007.
    - Water demand under emergency condition = MDD for Residential plus ADD for Employment
    - The following additional considerations were applied in evaluating the required standby power capacity:
        - Base load
        - 25% reduction in available standby power capacity after 3 hours of operation
        - 50% increase in power requirement for pump start-up
- The hydraulic modeling results show that the Region of Peel would provide sustainable water service under 3 hours emergency duration until 2041; Upgrades in North Brampton and Tullamore Pumping Stations were identified in 2041.
- Since additional standby power capacity for the 12 hours to 72 hours emergency duration for 2041 were marginal, it is recommended the Region to further review the level of service requirements under emergency conditions in the next master plan study. The following summarizes the recommended investigation for identifying the suitable level of service on a station by station basis:
    - Review fuell storage capacity for emergency duration.
    - Review land availability
    - Review pump station expandability to accommodate additional standby power unit(s)

- Revview life cycle for standby power equipment and replacement option(s):
  - Fuel type (e.g. diesel, natural gas)
  - Continuous backup power to maximum the efficiency under long term outage condition
- Detailed cost analysis for the above noted considerations
- Review the standby power requirements for wastewater system (sanitary sewer lift station)

Appendix A:

Detailed Hydraulic Modelling Results

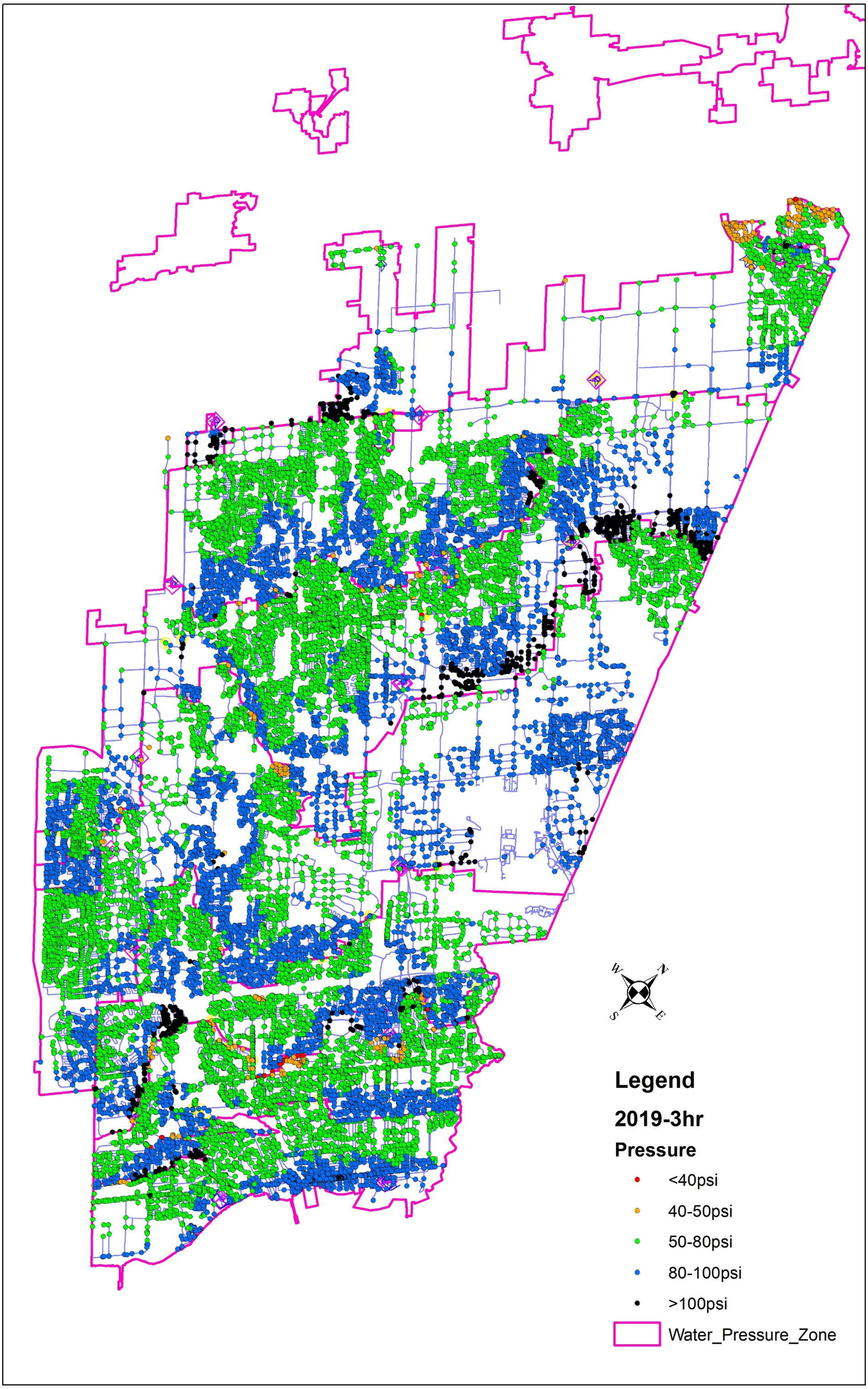


Figure A.1 System Pressures for 3 hours Emergency Duration under Existing Demand Conditions

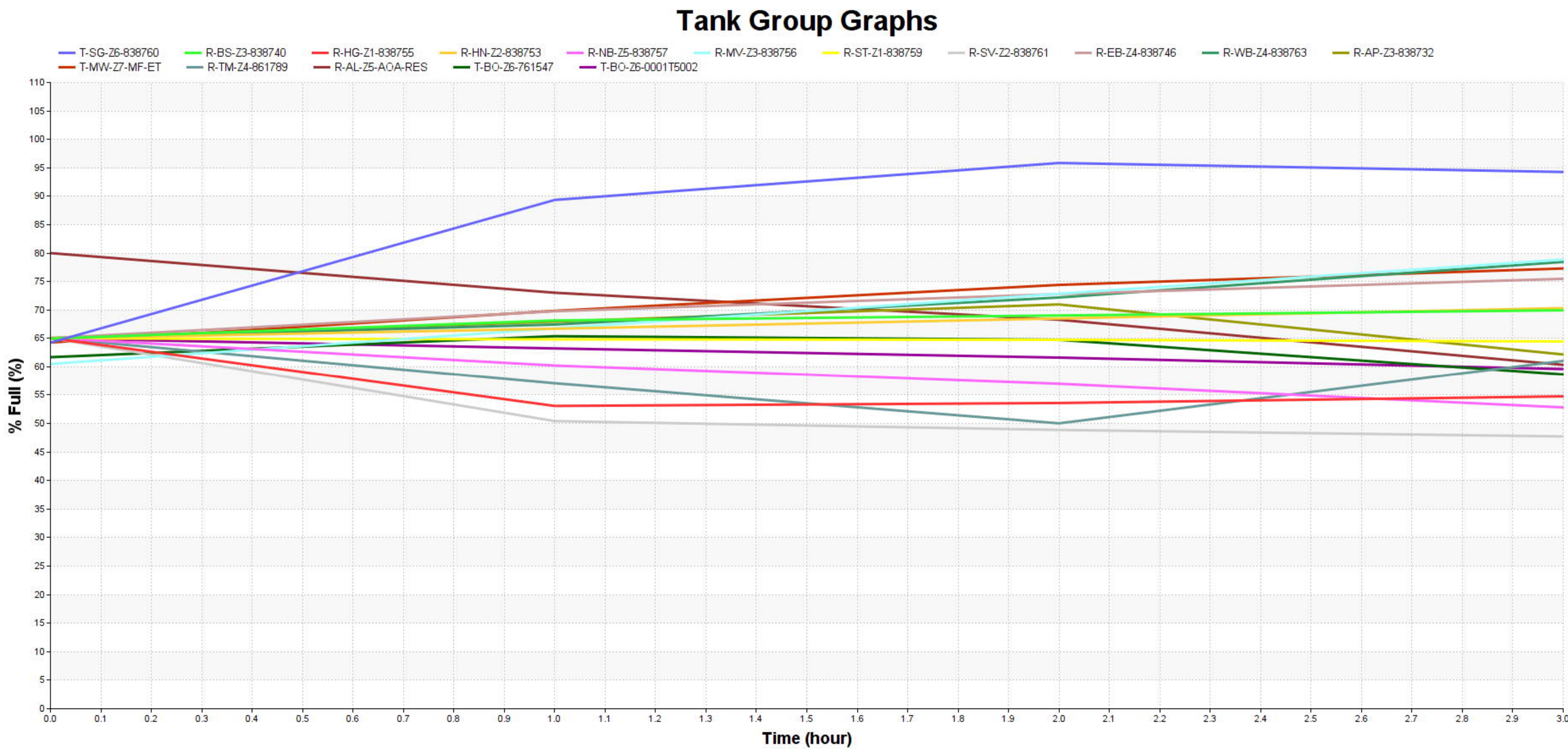


Figure A.2: Tank Levels for 3 hours Emergency Duration under Existing Demand Conditions

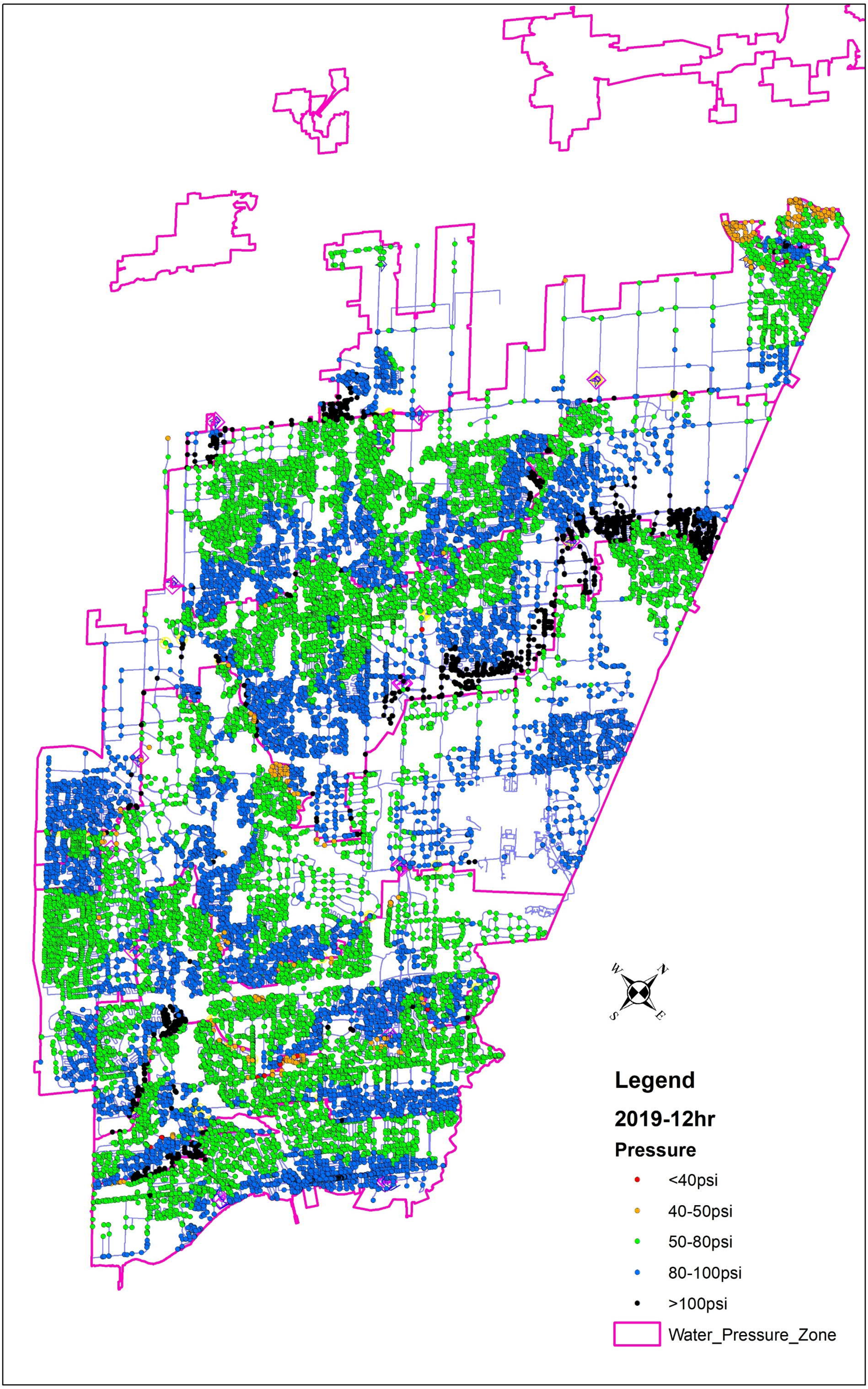


Figure A.3 System Pressures for 12 hours Emergency Duration under Existing Demand Conditions

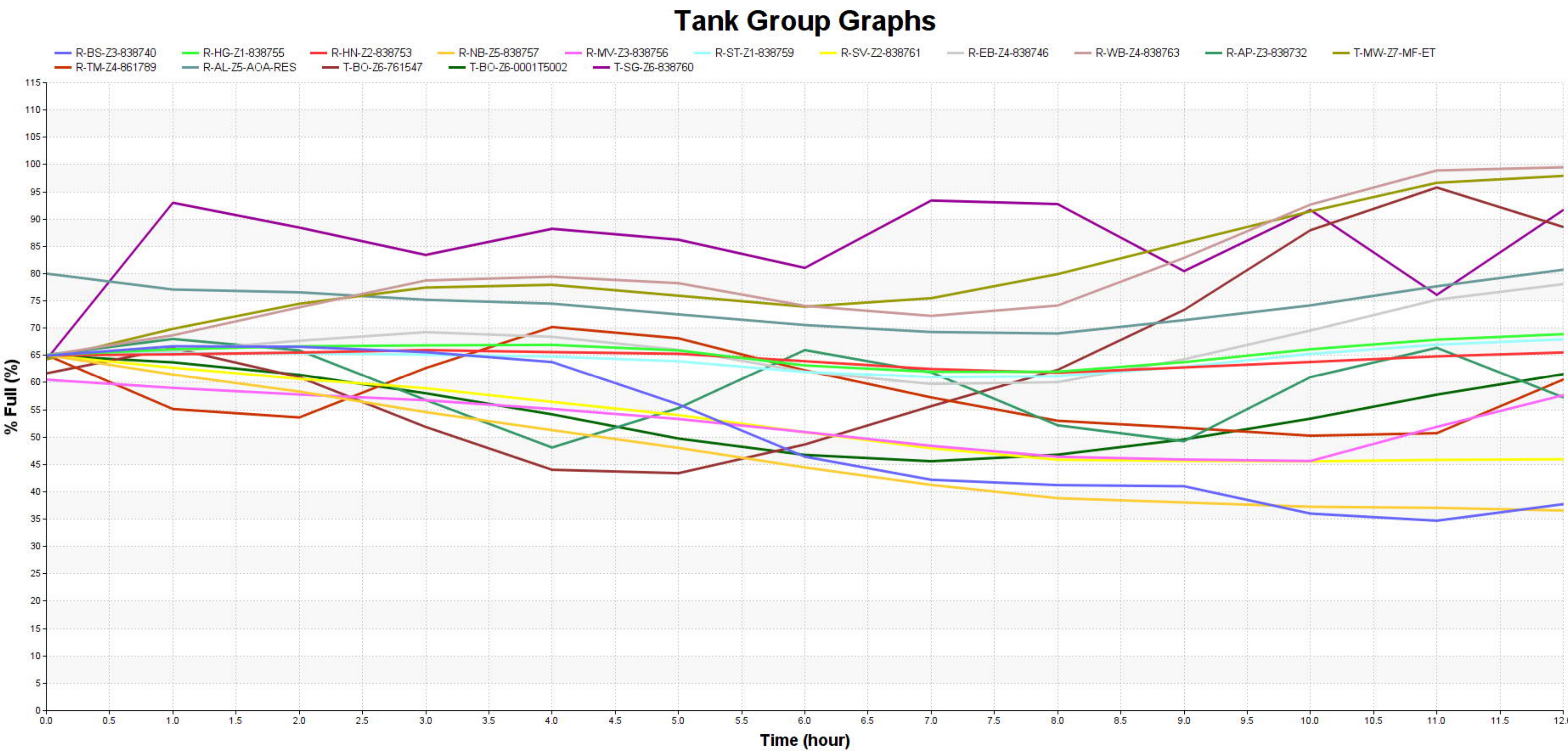


Figure A.4: Tank Levels for 12 hours Emergency Duration under Existing Demand Conditions

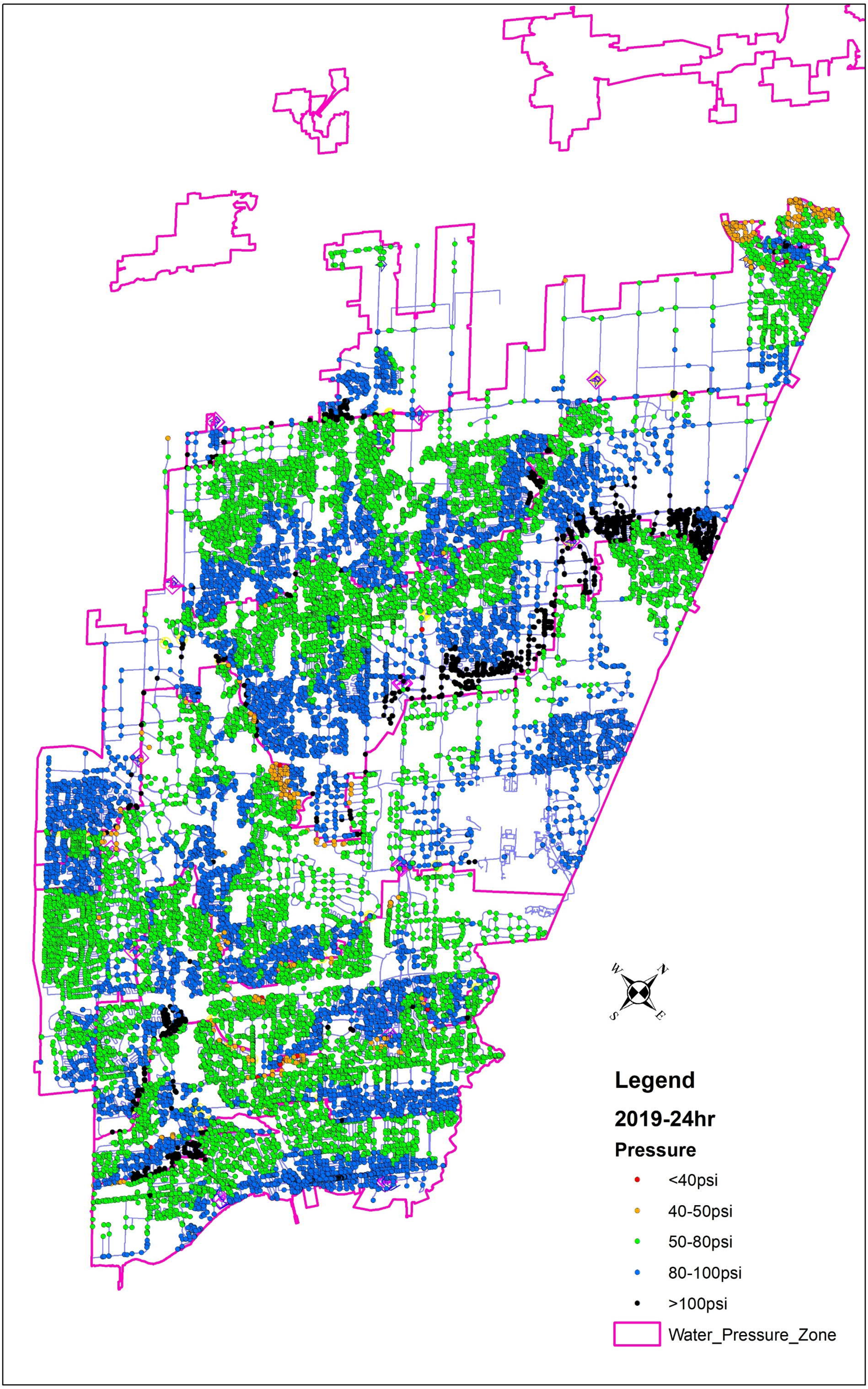


Figure A.5 System Pressures for 24 hours Emergency Duration under Existing Demand Conditions

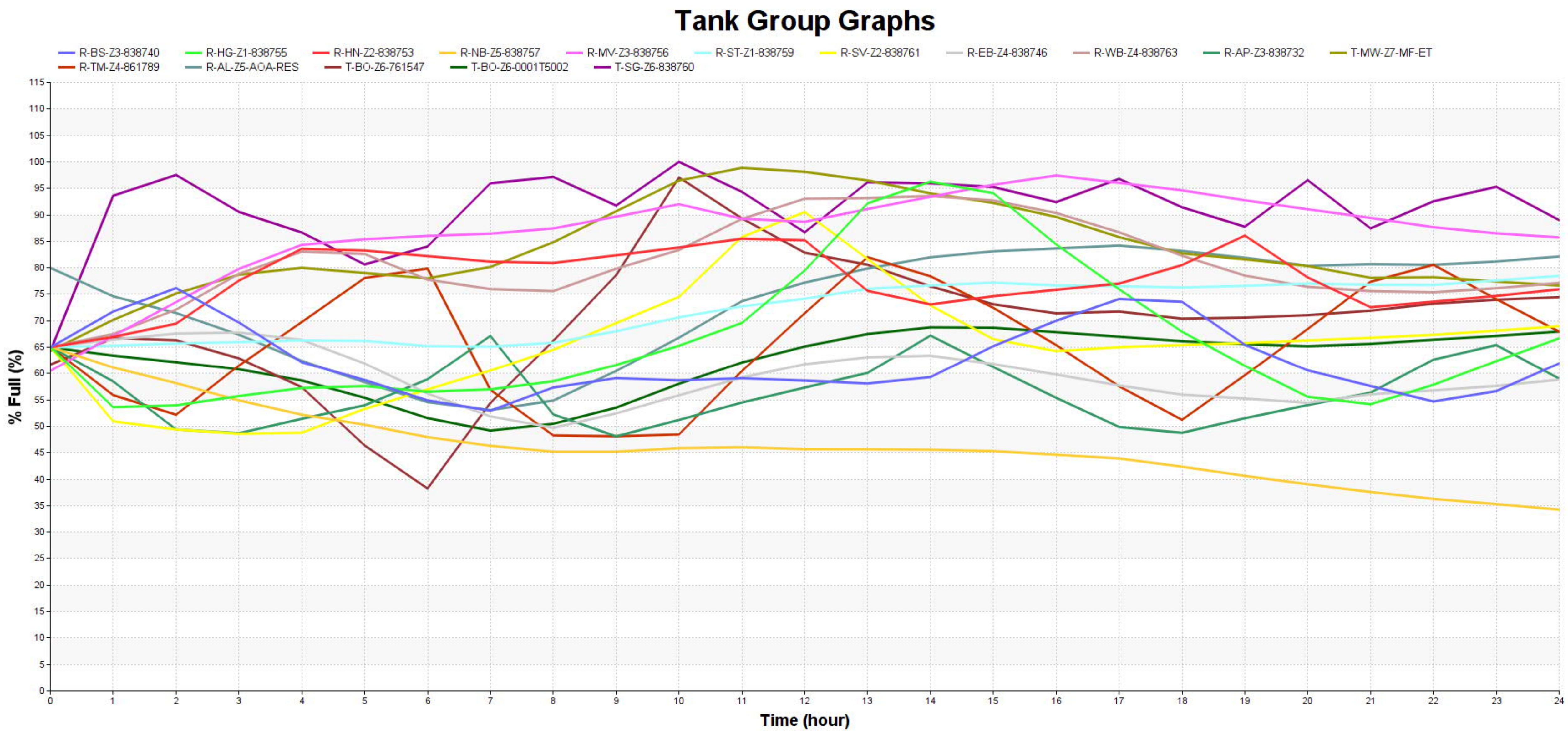


Figure A.6: Tank Levels for 24 hours Emergency Duration under Existing Demand Conditions

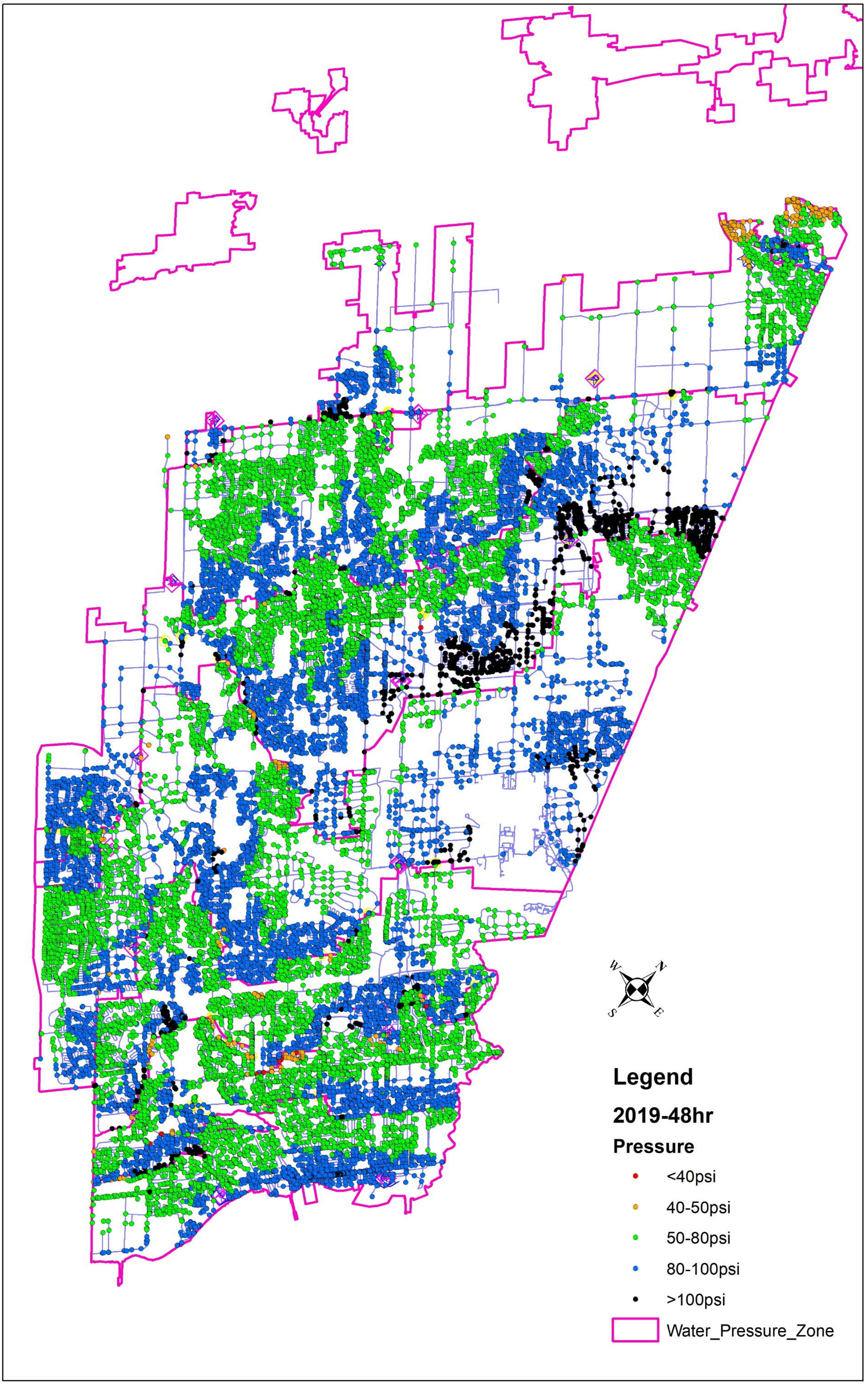


Figure A.7 System Pressures for 48 hours Emergency Duration under Existing Demand Conditions

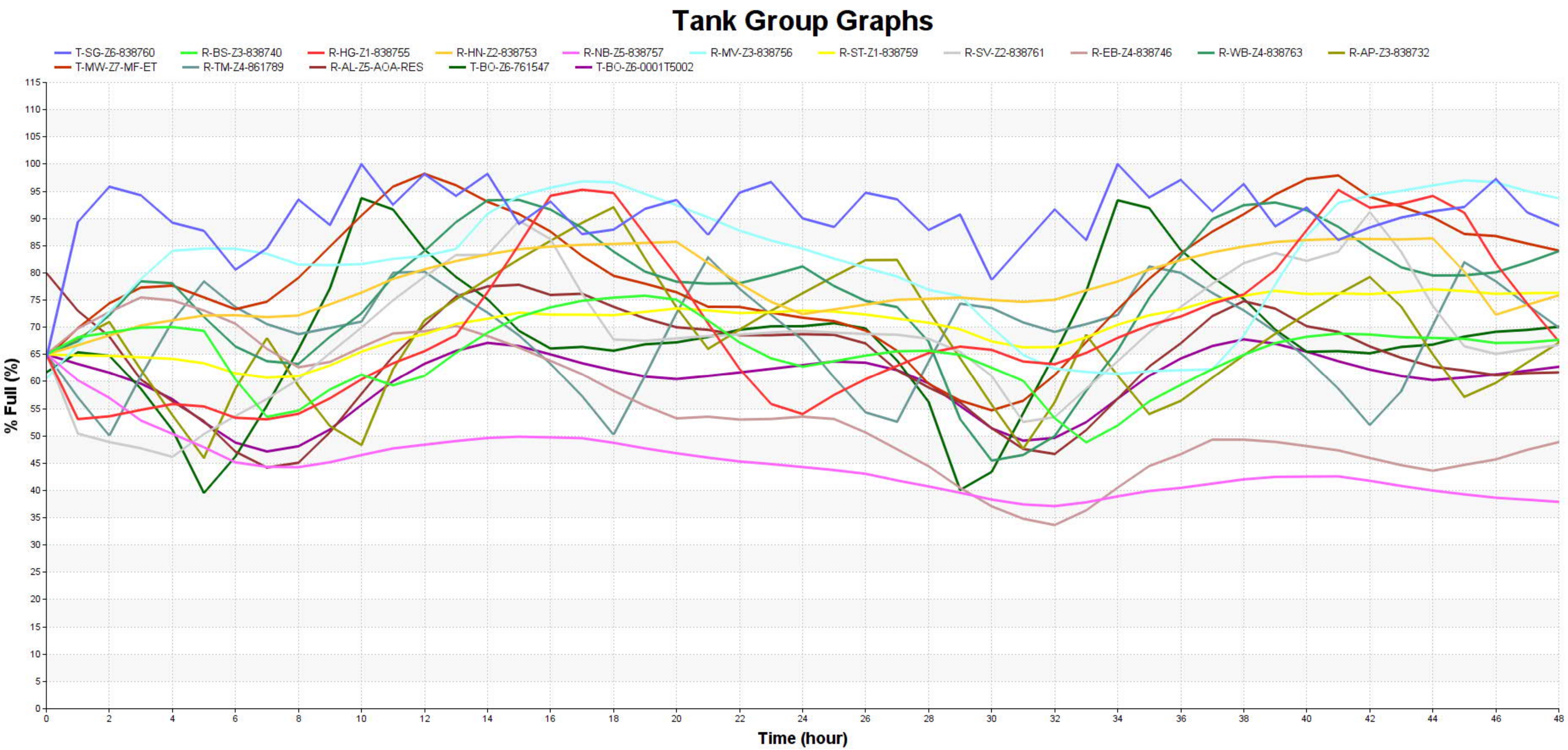


Figure A.8: Tank Levels for 48 hours Emergency Duration under Existing Demand Conditions

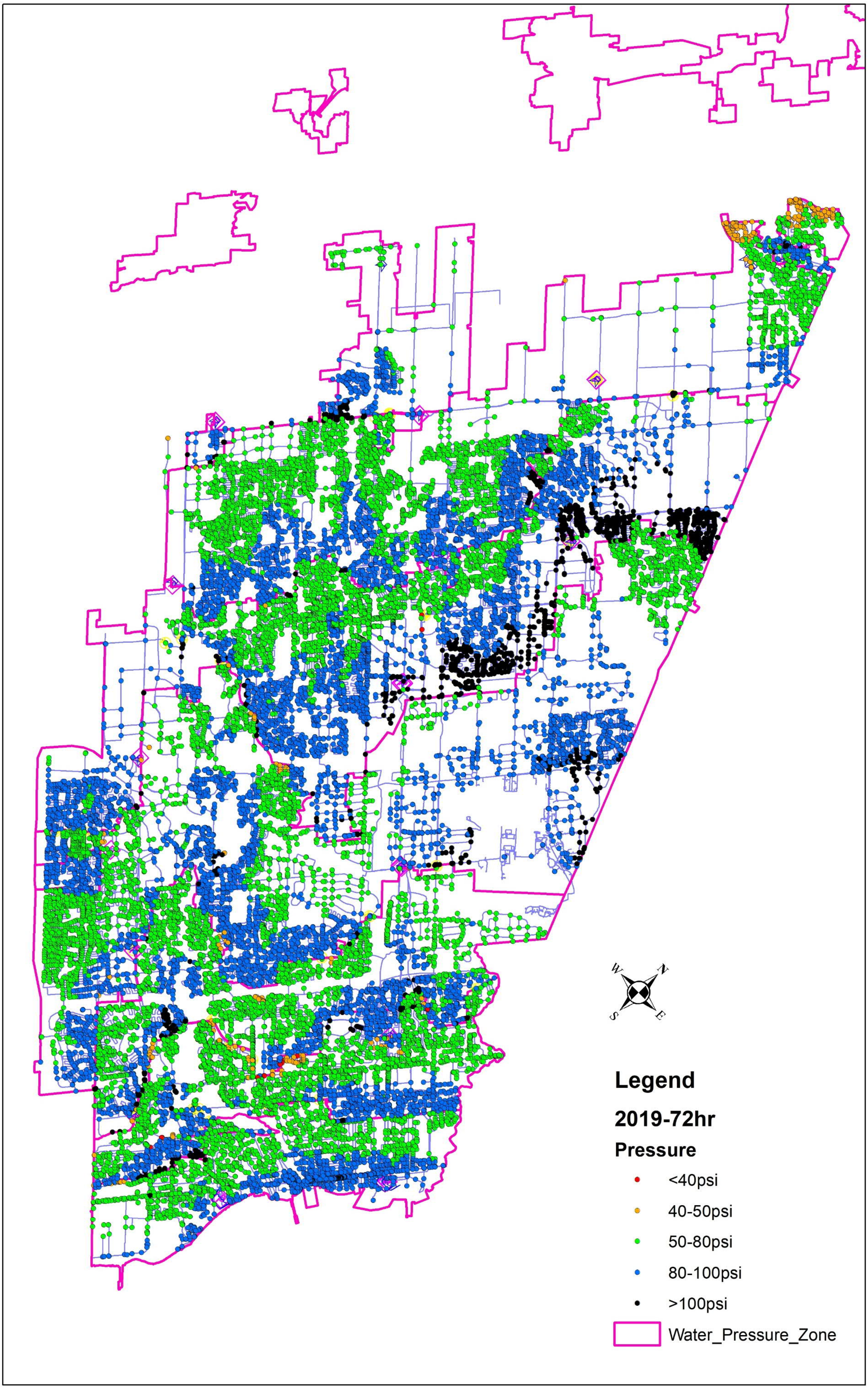


Figure A.9 System Pressures for 72 hours Emergency Duration under Existing Demand Conditions

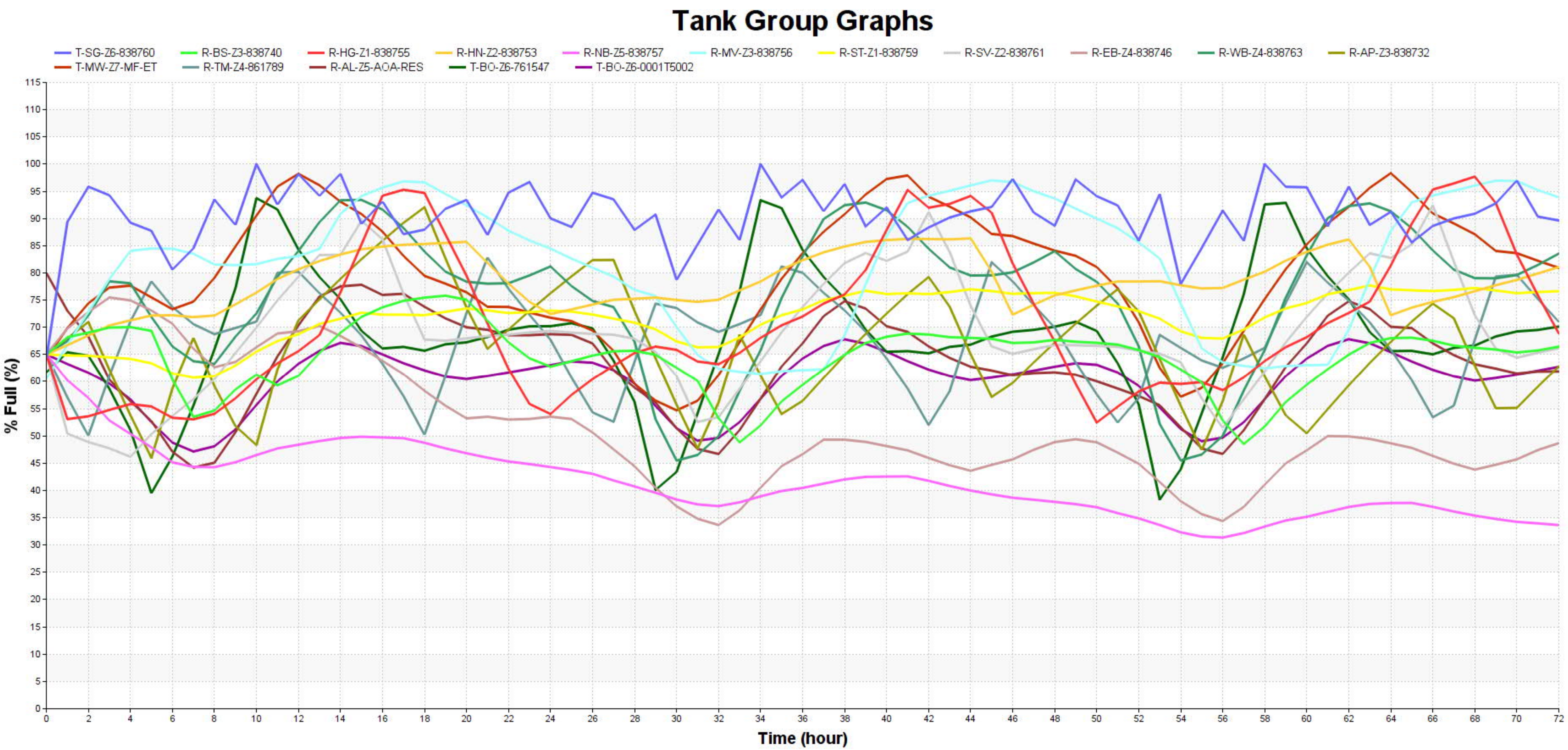


Figure A.10: Tank Levels for 72 hours Emergency Duration under Existing Demand Conditions

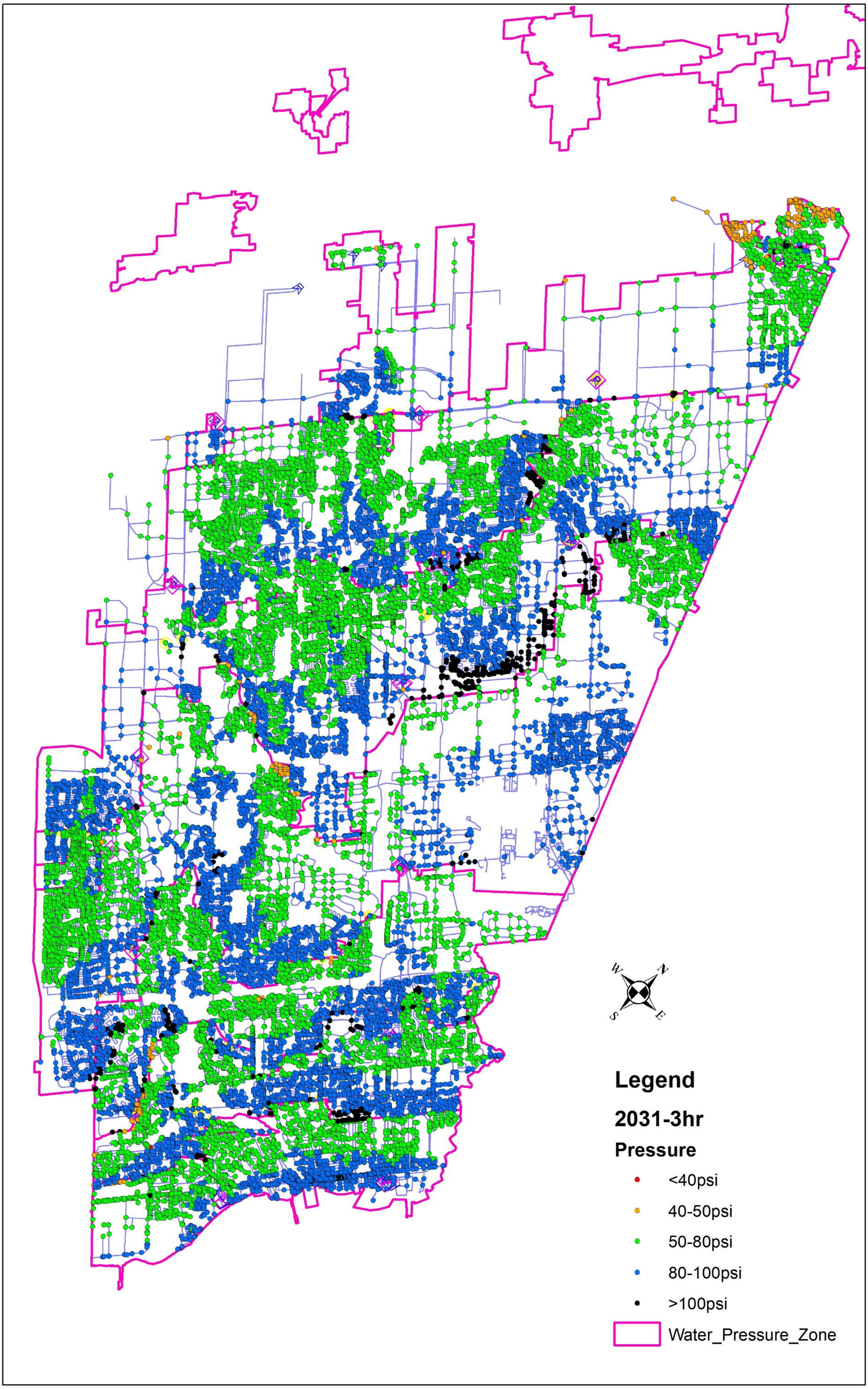


Figure A.11 System Pressures for 3 hours Emergency Duration under 2031 Demand Conditions

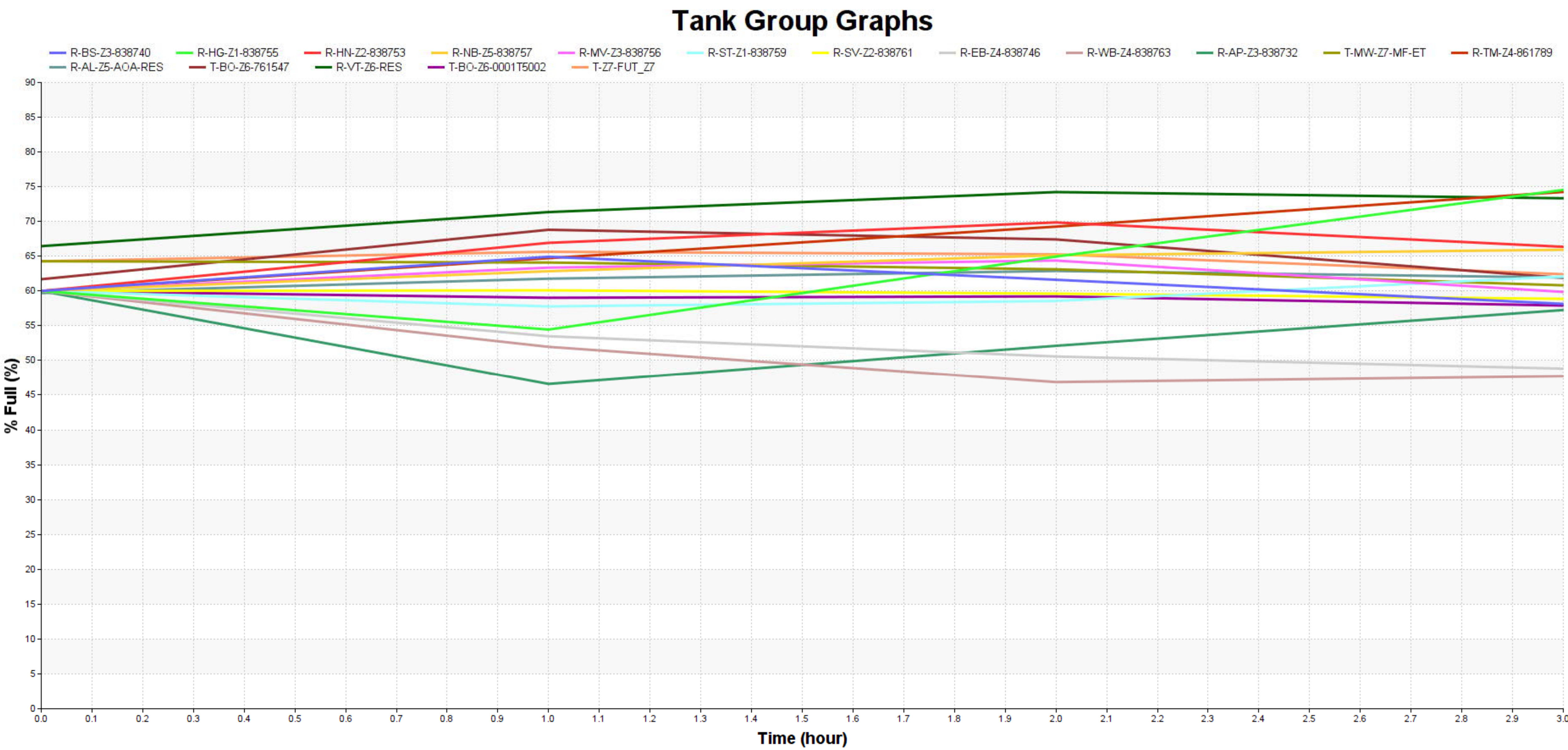


Figure A.12: Tank Levels for 3 hours Emergency Duration under 2031 Demand Conditions

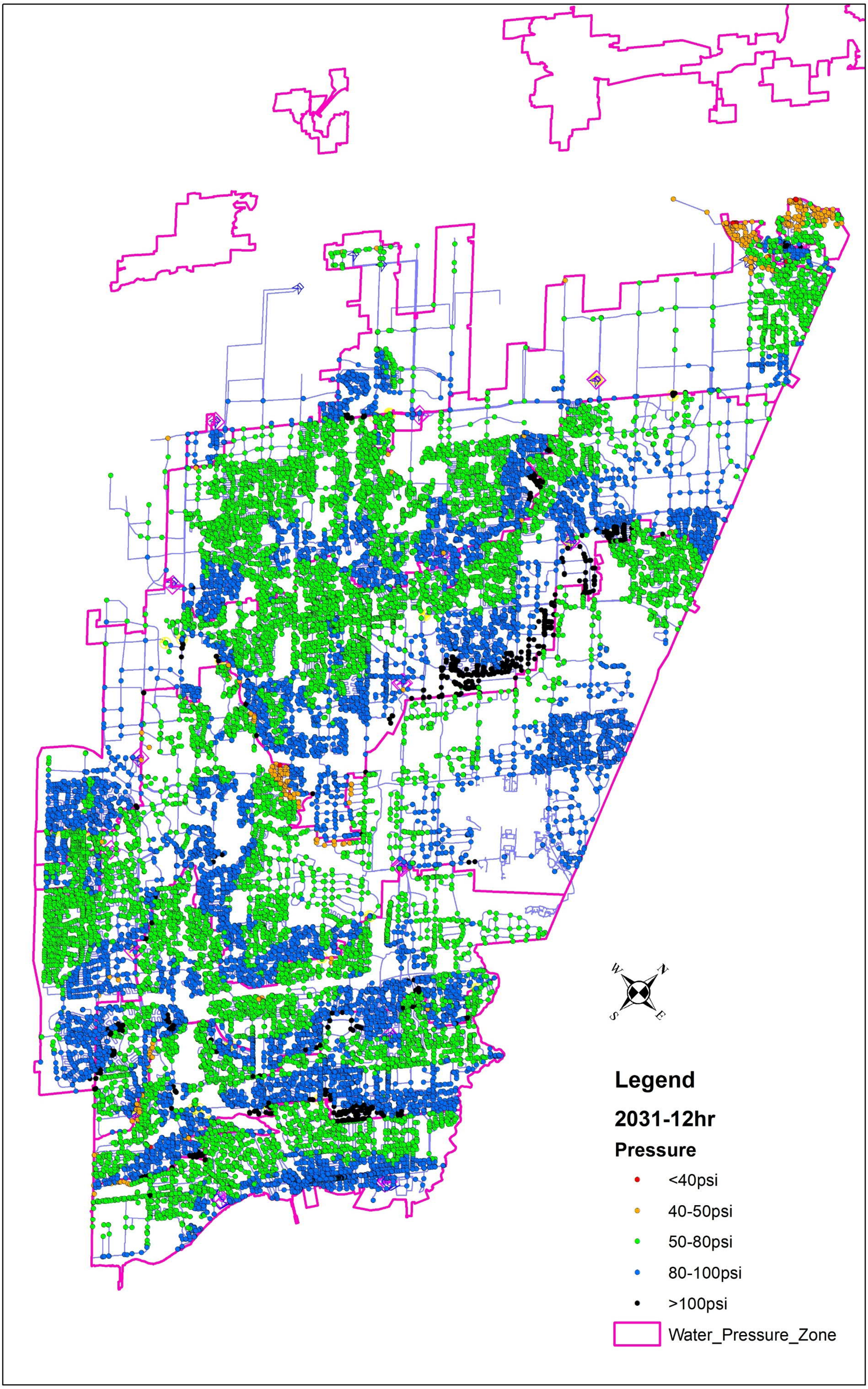


Figure A.13 System Pressures for 12 hours Emergency Duration under 2031 Demand Conditions

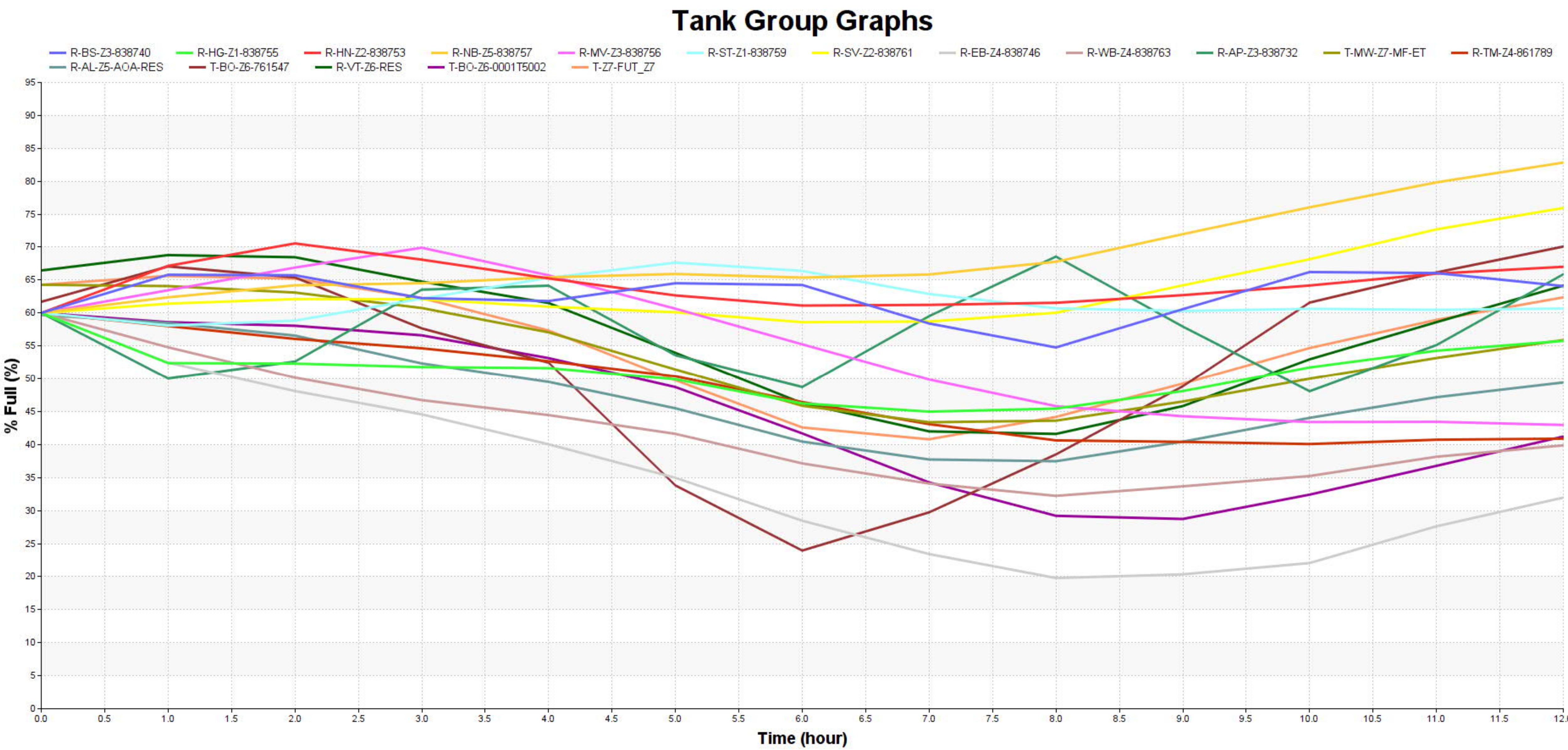


Figure A.14: Tank Levels for 12 hours Emergency Duration under 2031 Demand Conditions

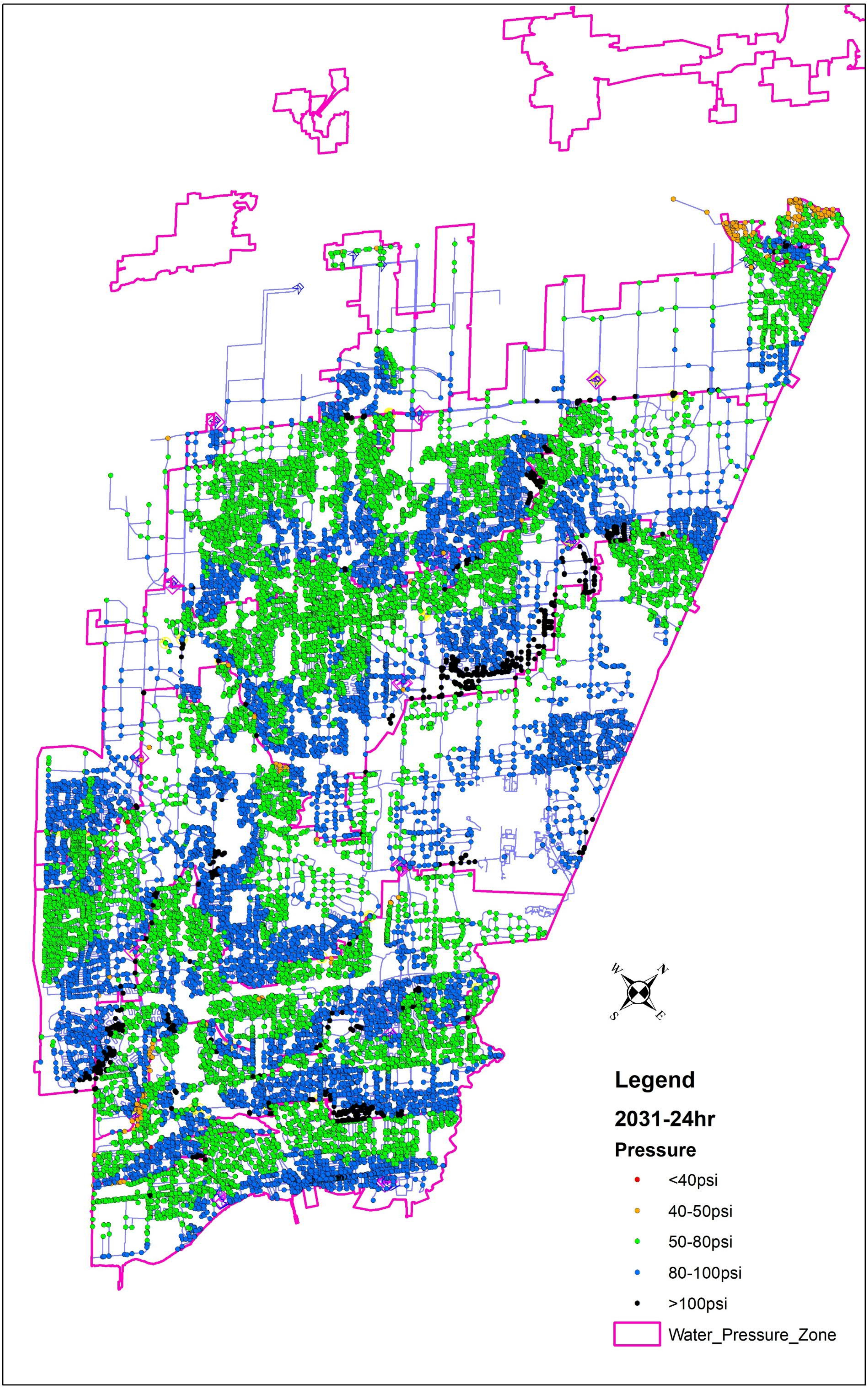


Figure A.15 System Pressures for 24 hours Emergency Duration under 2031 Demand Conditions

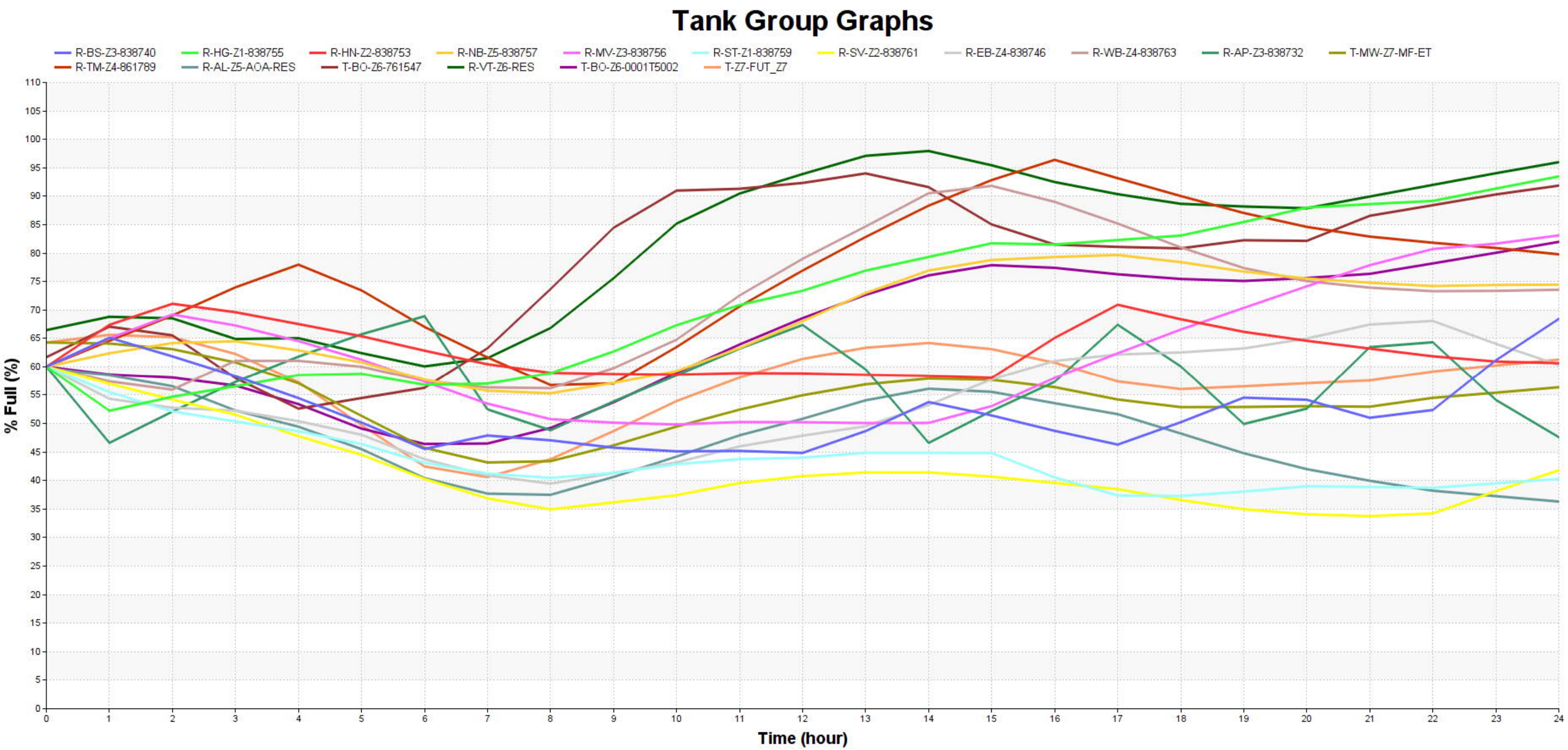


Figure A.16: Tank Levels for 24 hours Emergency Duration under 2031 Demand Conditions

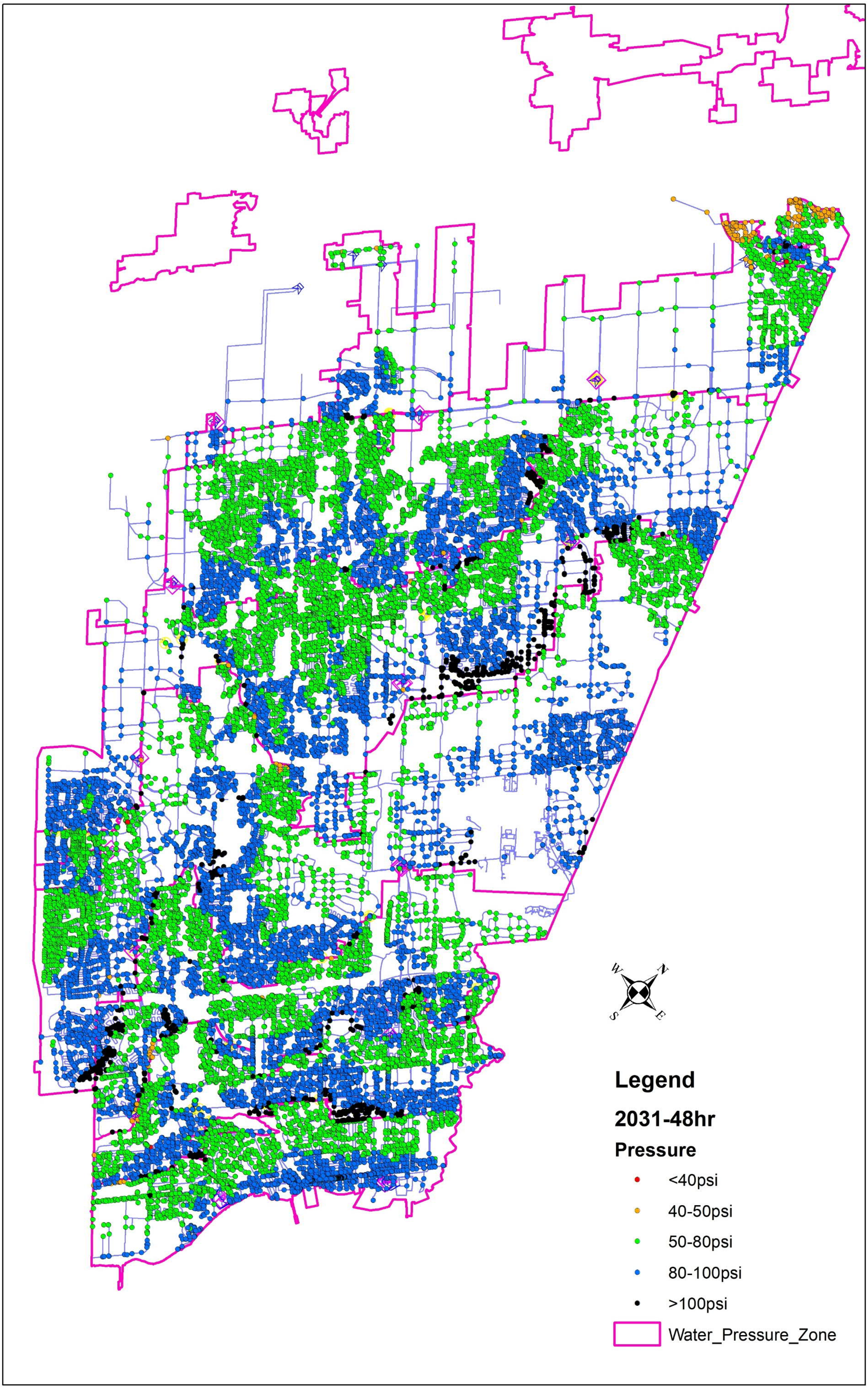


Figure A.17 System Pressures for 48 hours Emergency Duration under 2031 Demand Conditions

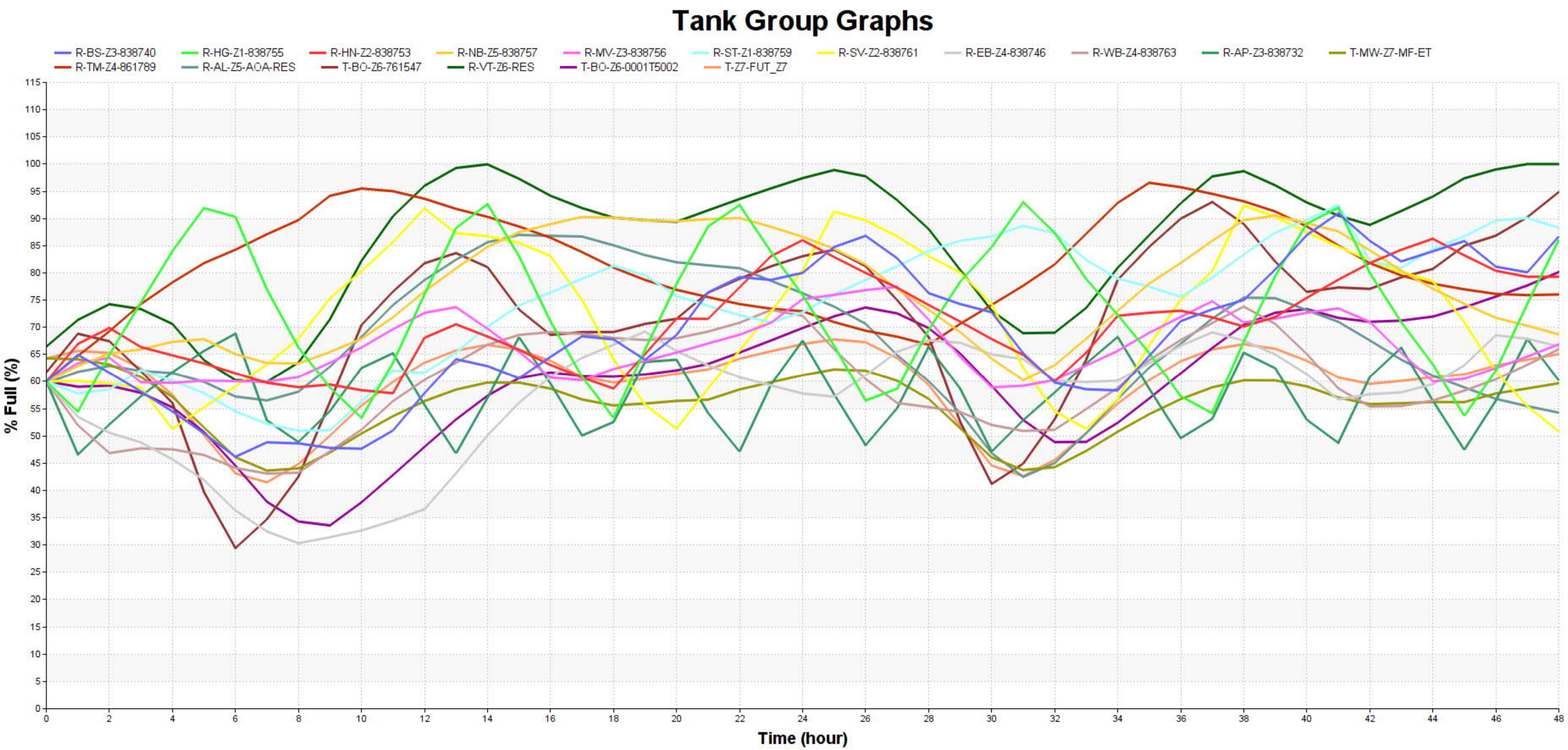


Figure A.18: Tank Levels for 48 hours Emergency Duration under 2031 Demand Conditions

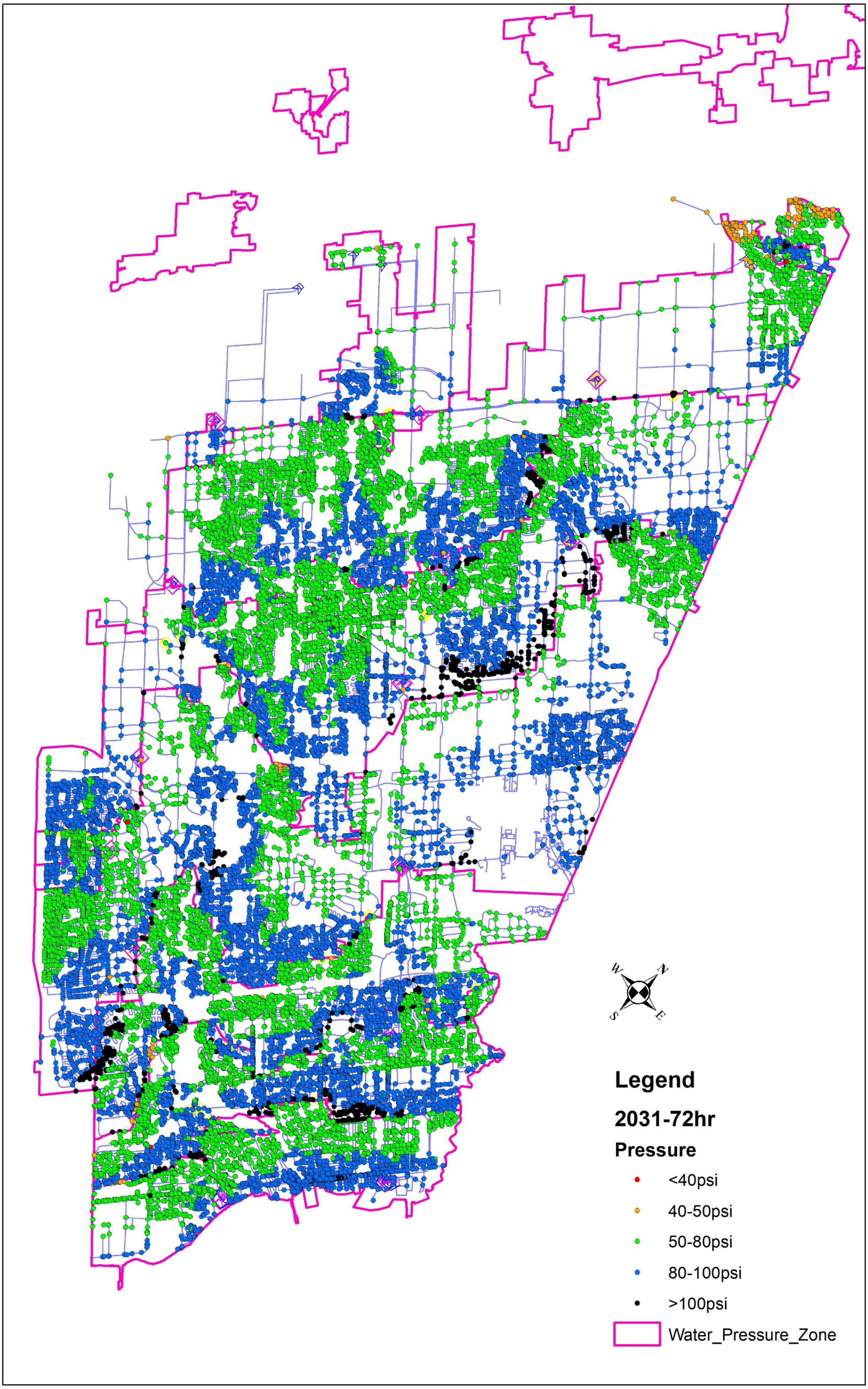


Figure A.19 System Pressures for 72 hours Emergency Duration under 2031 Demand Conditions

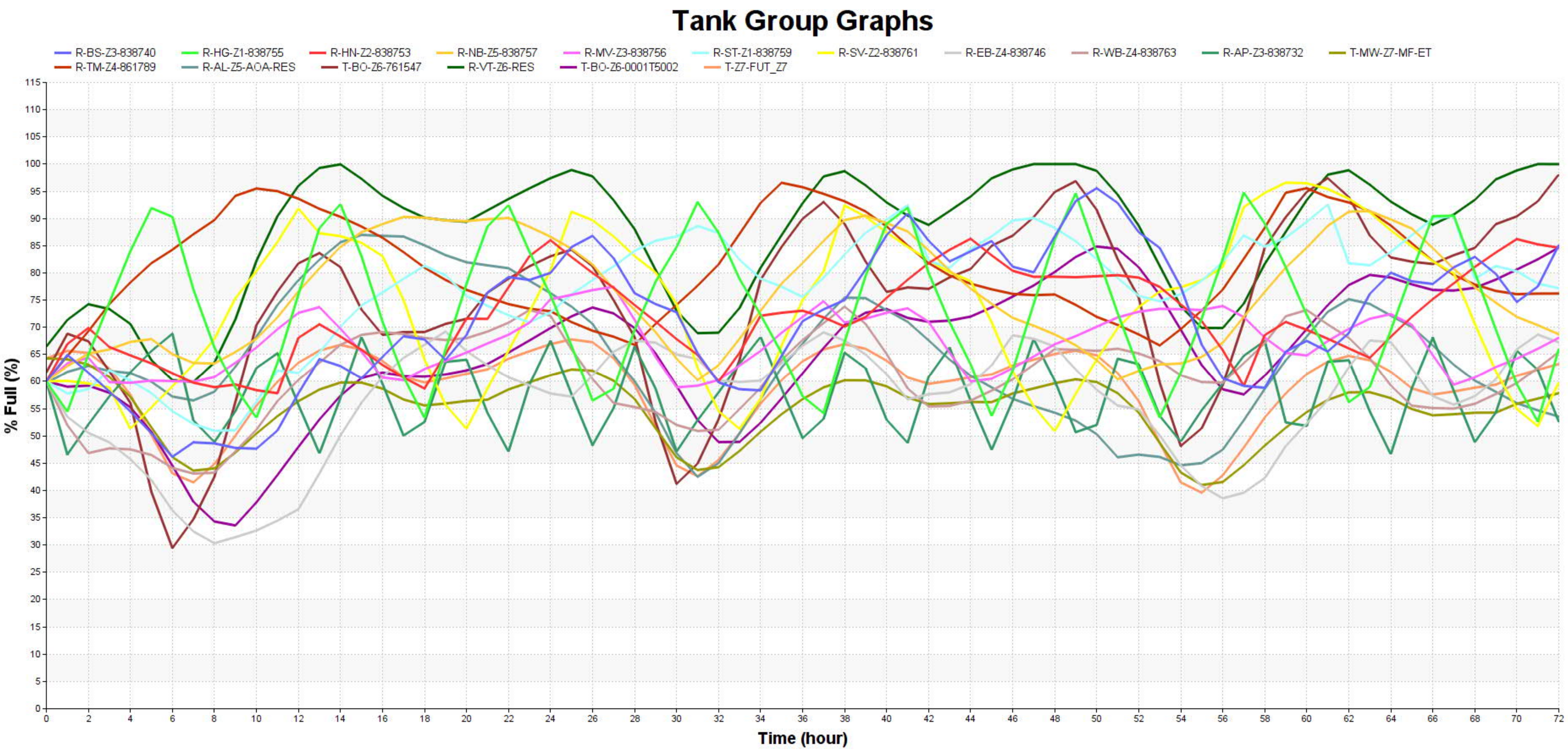


Figure A.20: Tank Levels for 72 hours Emergency Duration under 2031 Demand Conditions

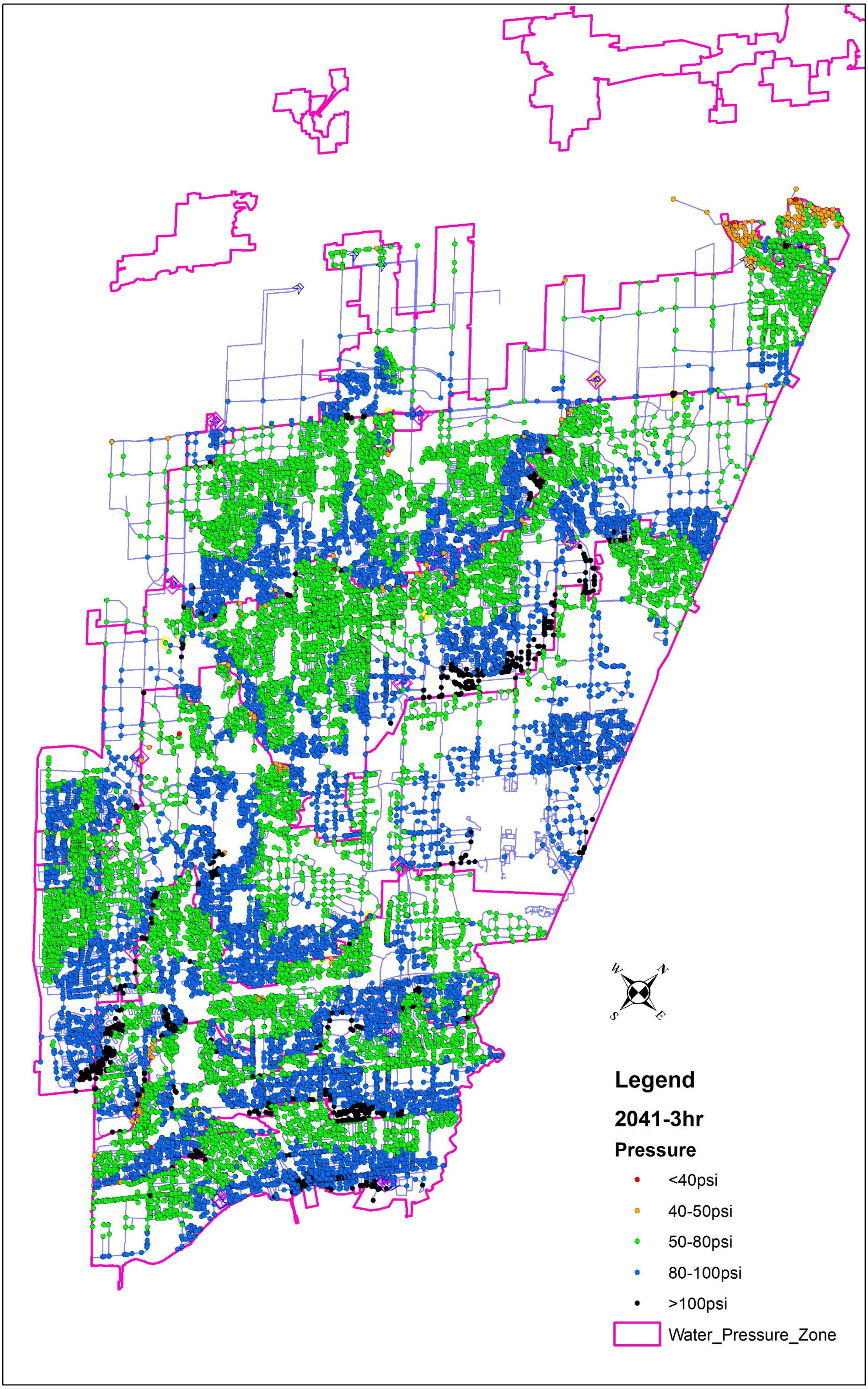


Figure A.21 System Pressures for 3 hours Emergency Duration under 2041 Demand Conditions

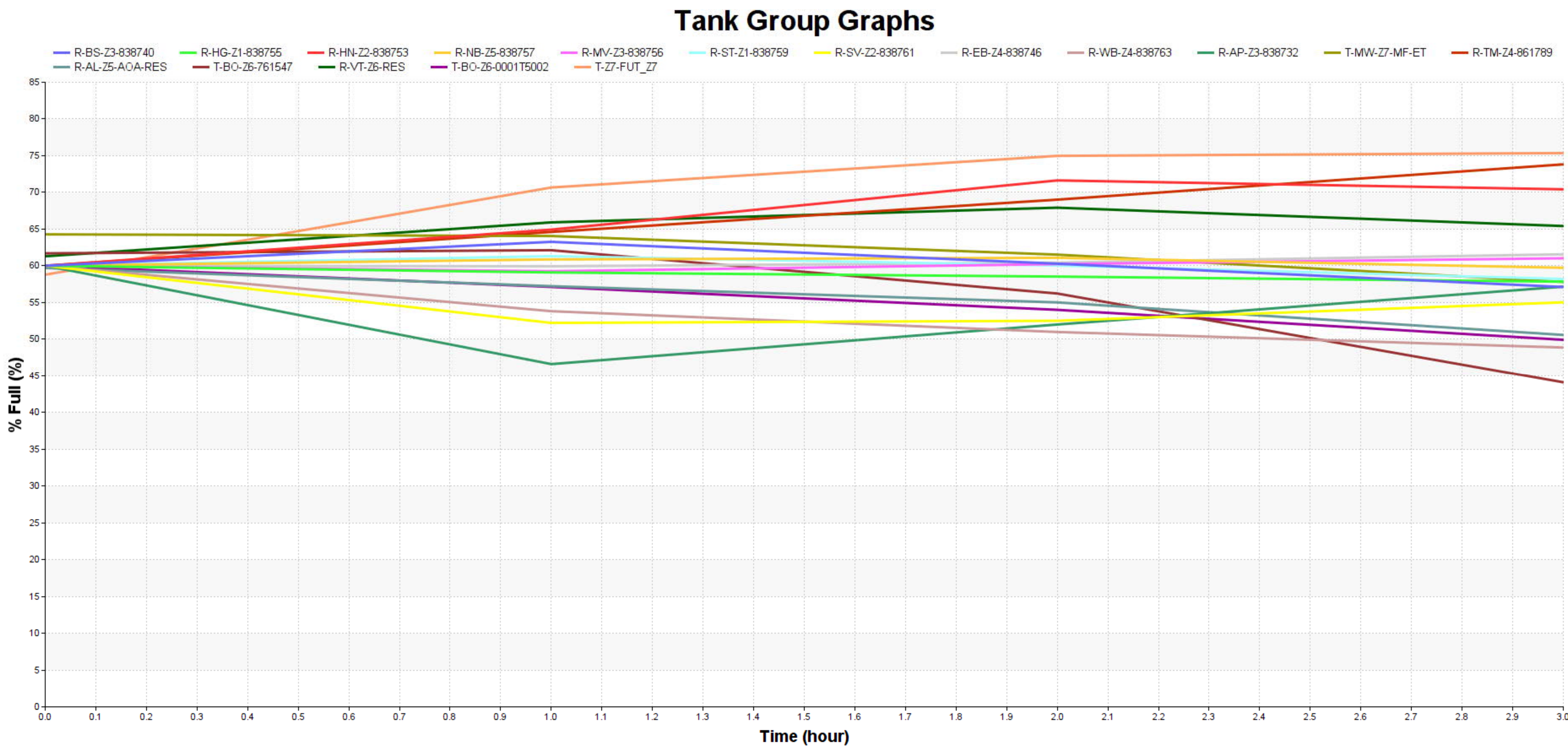


Figure A.22: Tank Levels for 3 hours Emergency Duration under 2041 Demand Conditions

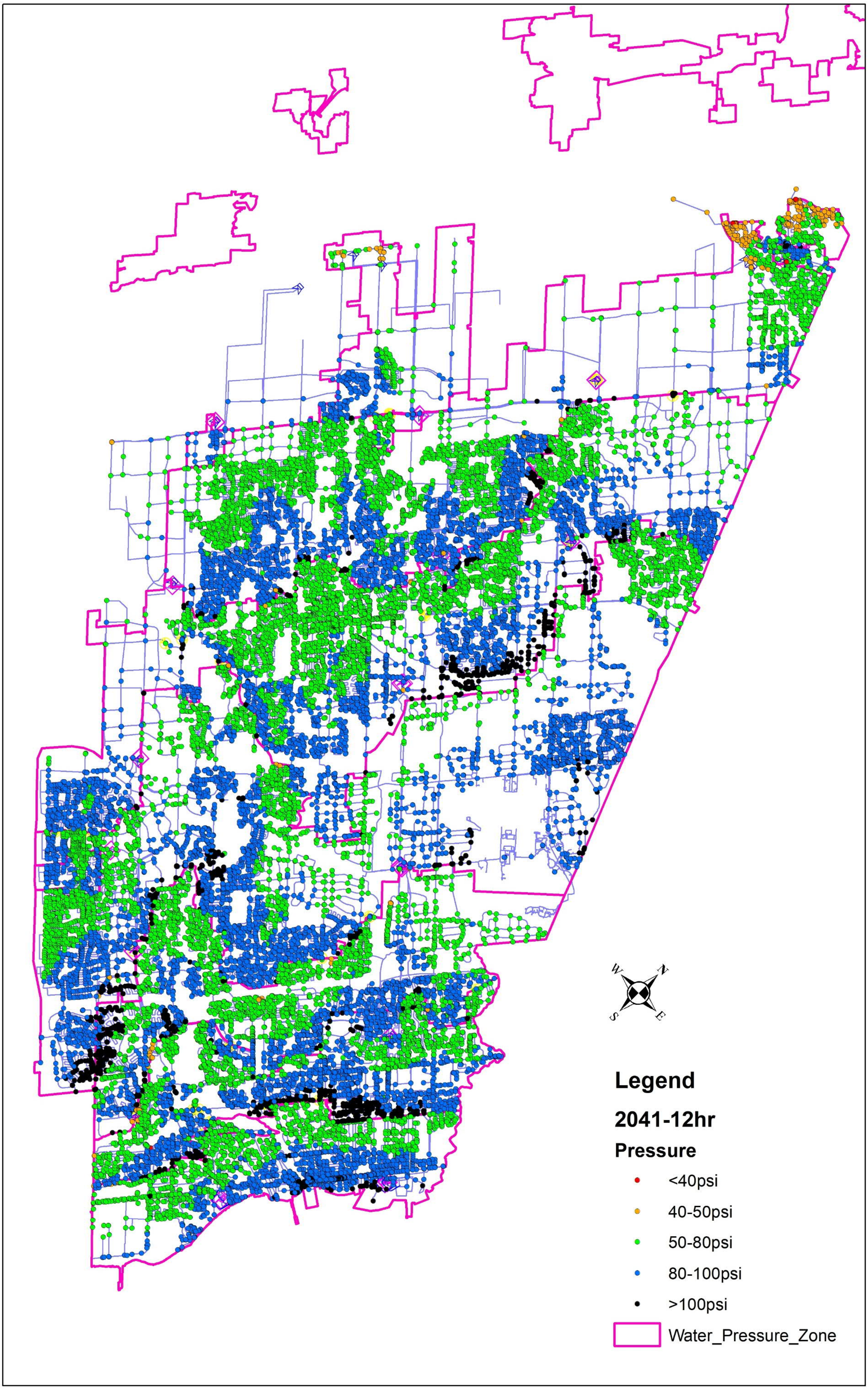


Figure A.23 System Pressures for 12 hours Emergency Duration under 2041 Demand Conditions

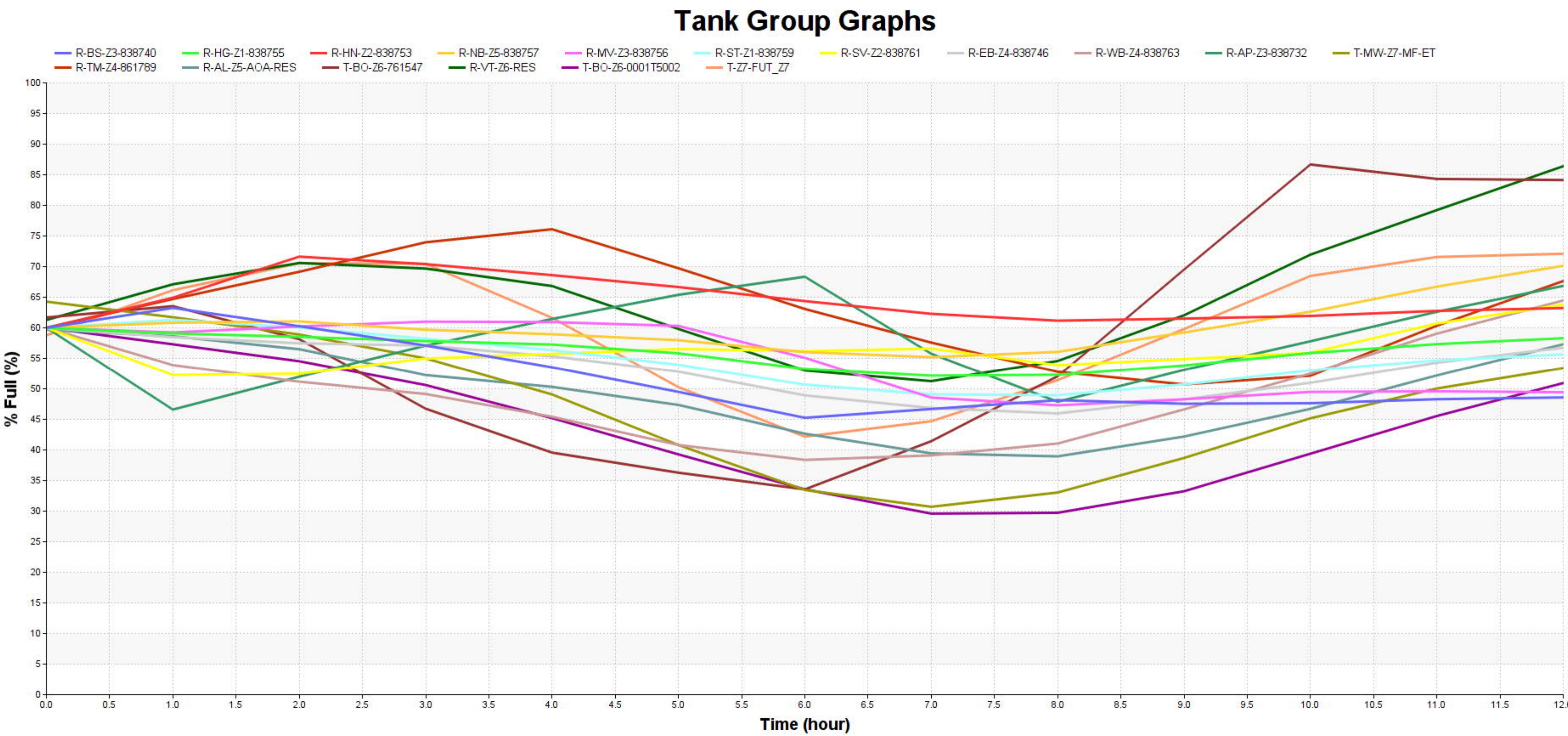


Figure A.24: Tank Levels for 12 hours Emergency Duration under 2041 Demand Conditions

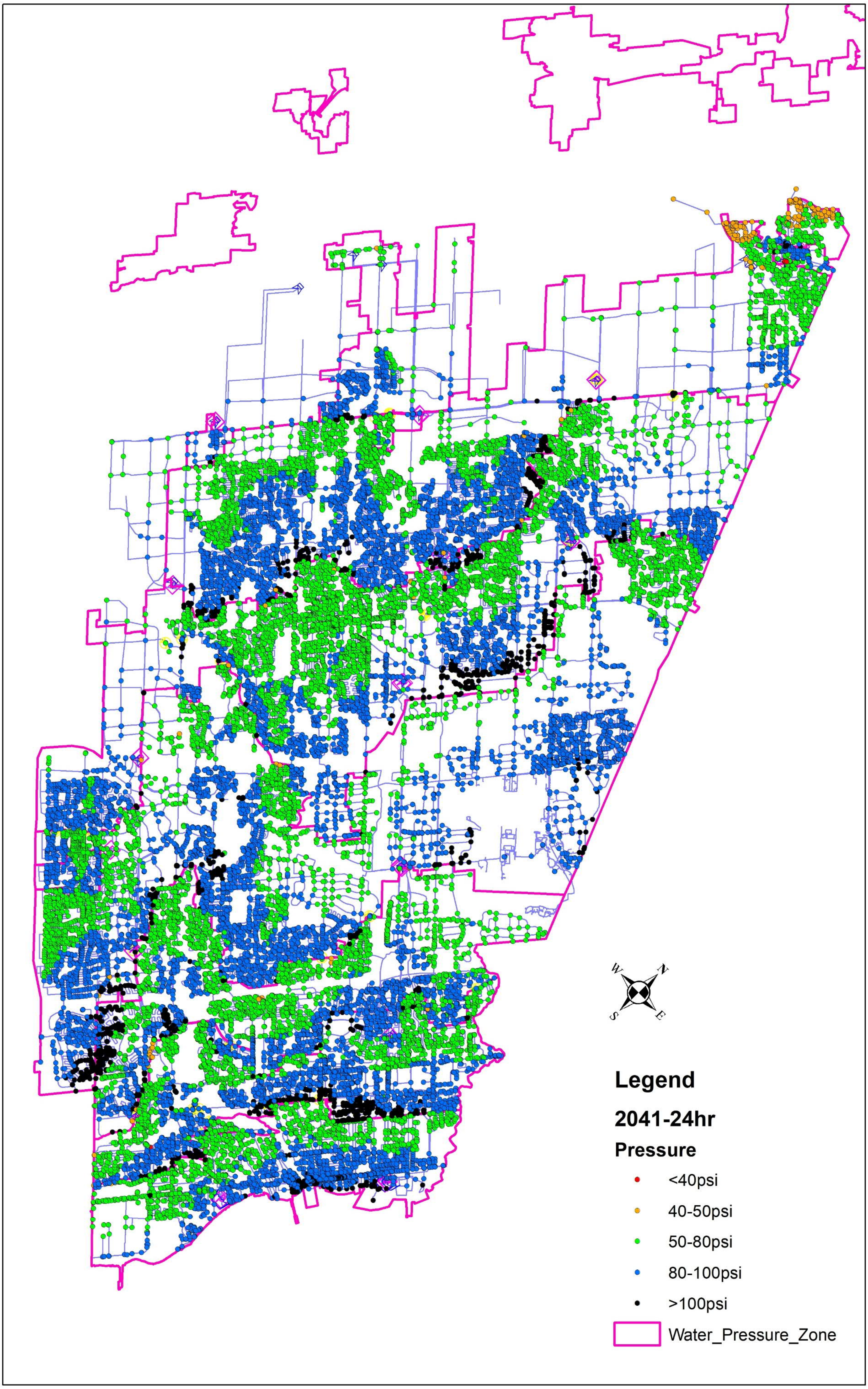


Figure A.25: System Pressures for 24 hours Emergency Duration under 2041 Demand Conditions

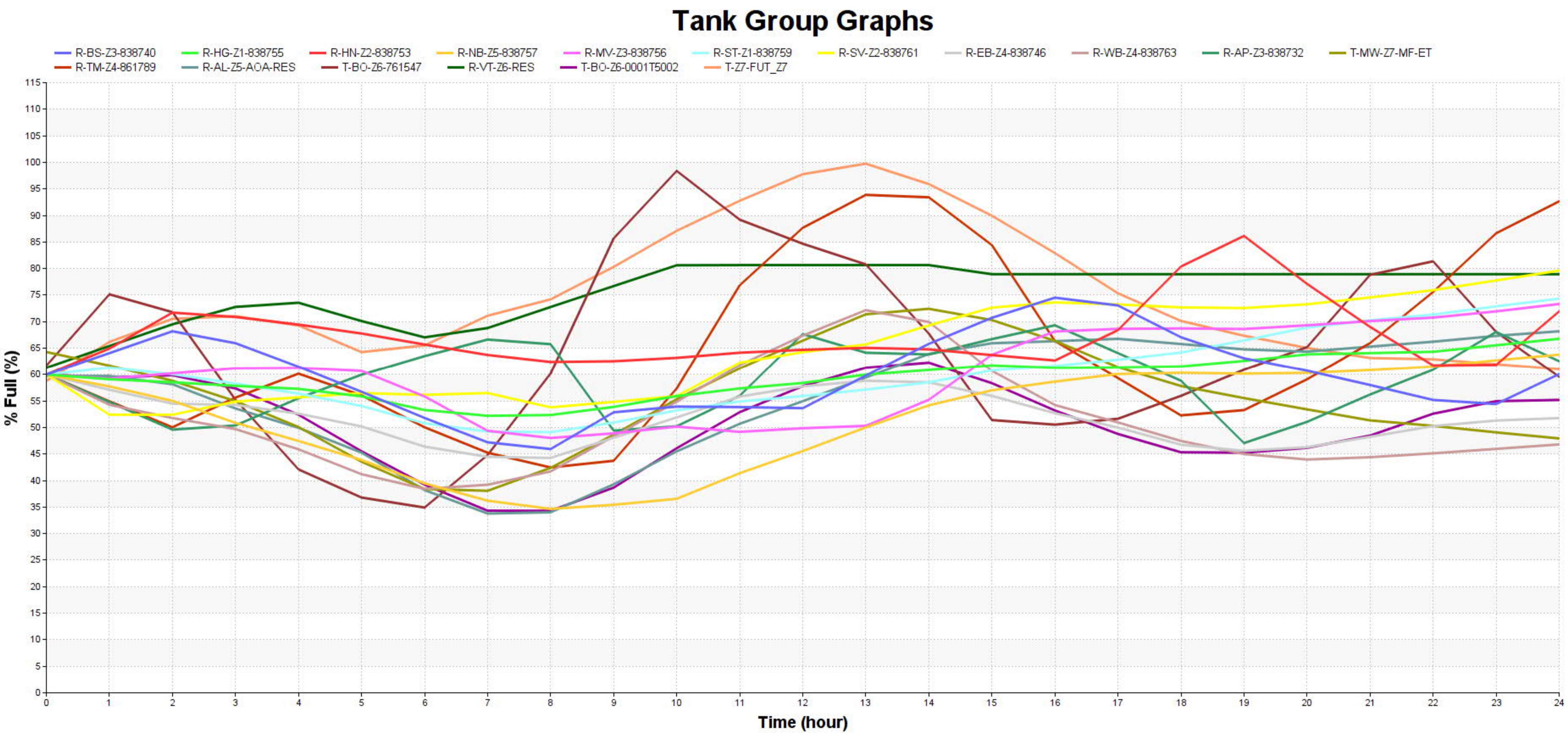


Figure A.26: Tank Levels for 24 hours Emergency Duration under 2041 Demand Conditions

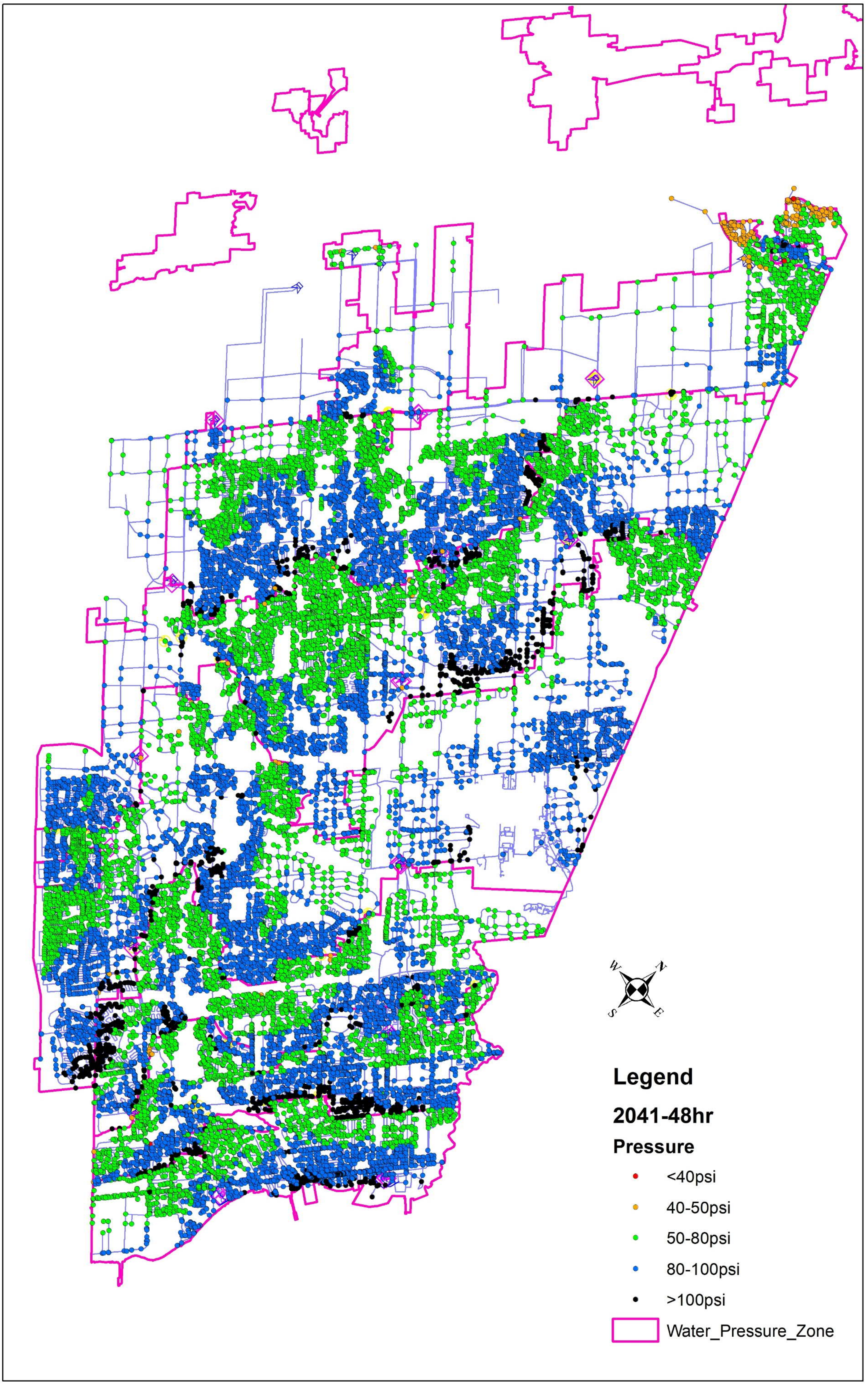


Figure A.27 System Pressures for 48 hours Emergency Duration under 2041 Demand Conditions

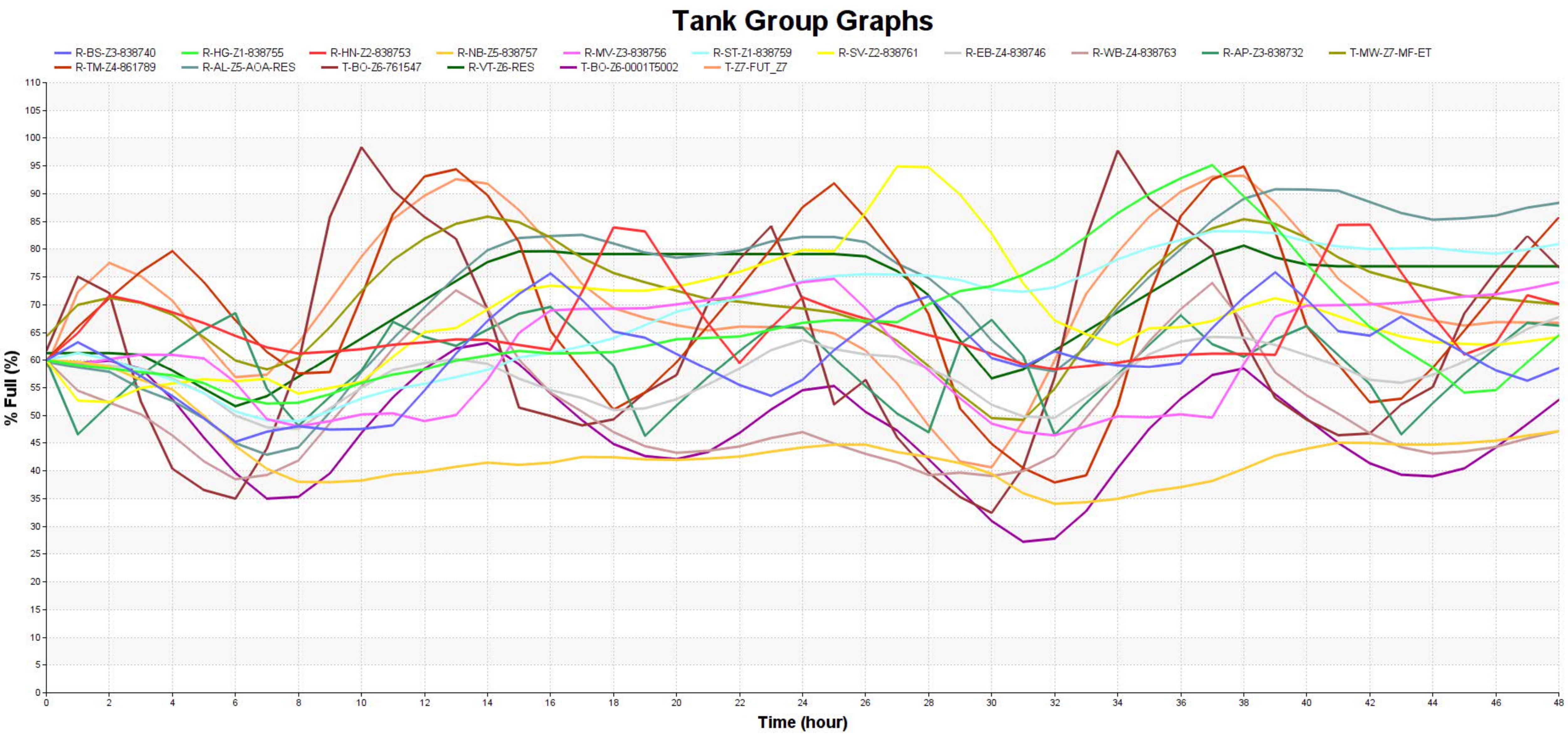


Figure A.28: Tank Levels for 48 hours Emergency Duration under 2041 Demand Conditions

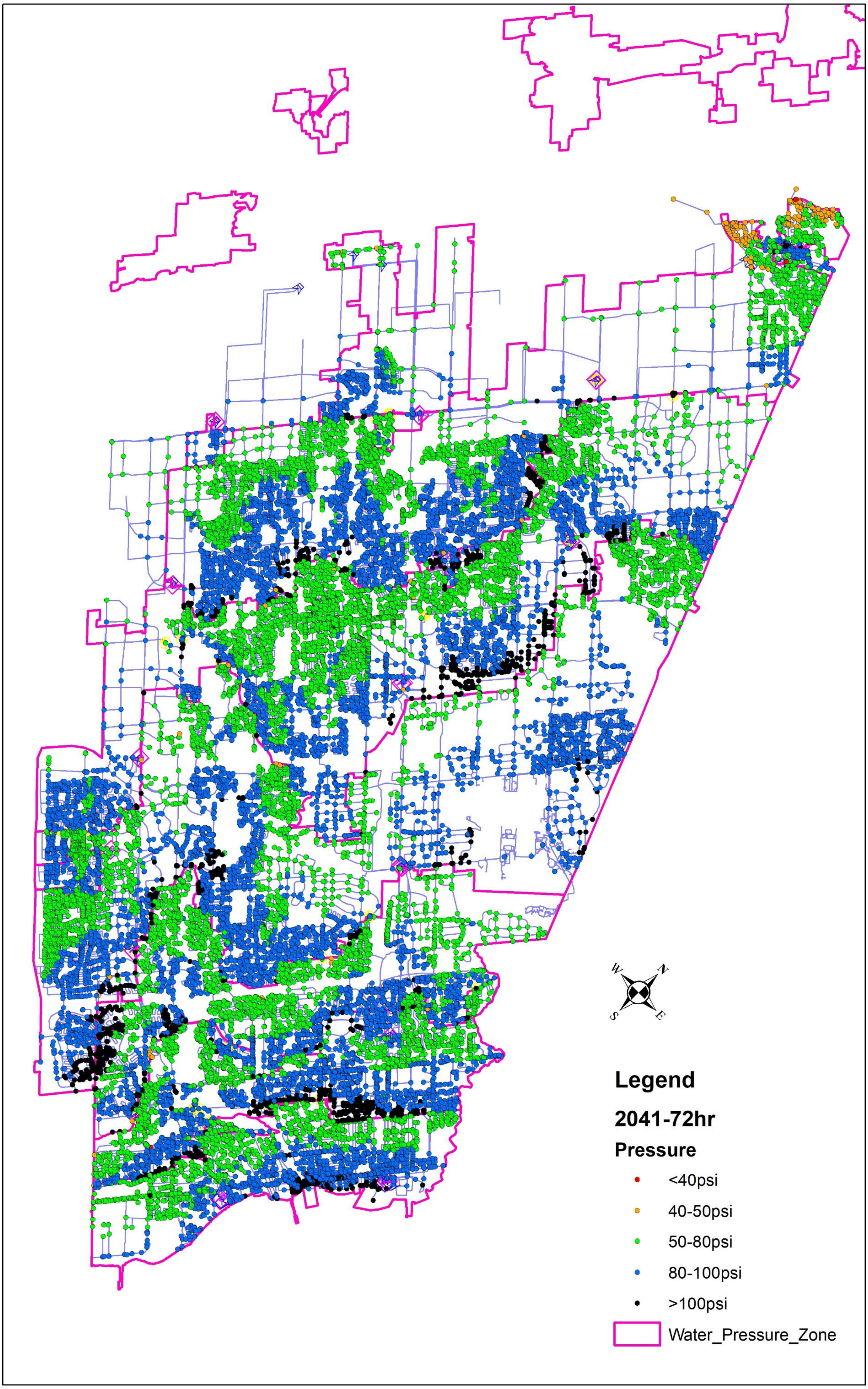


Figure A.29 System Pressures for 72 hours Emergency Duration under 2041 Demand Conditions

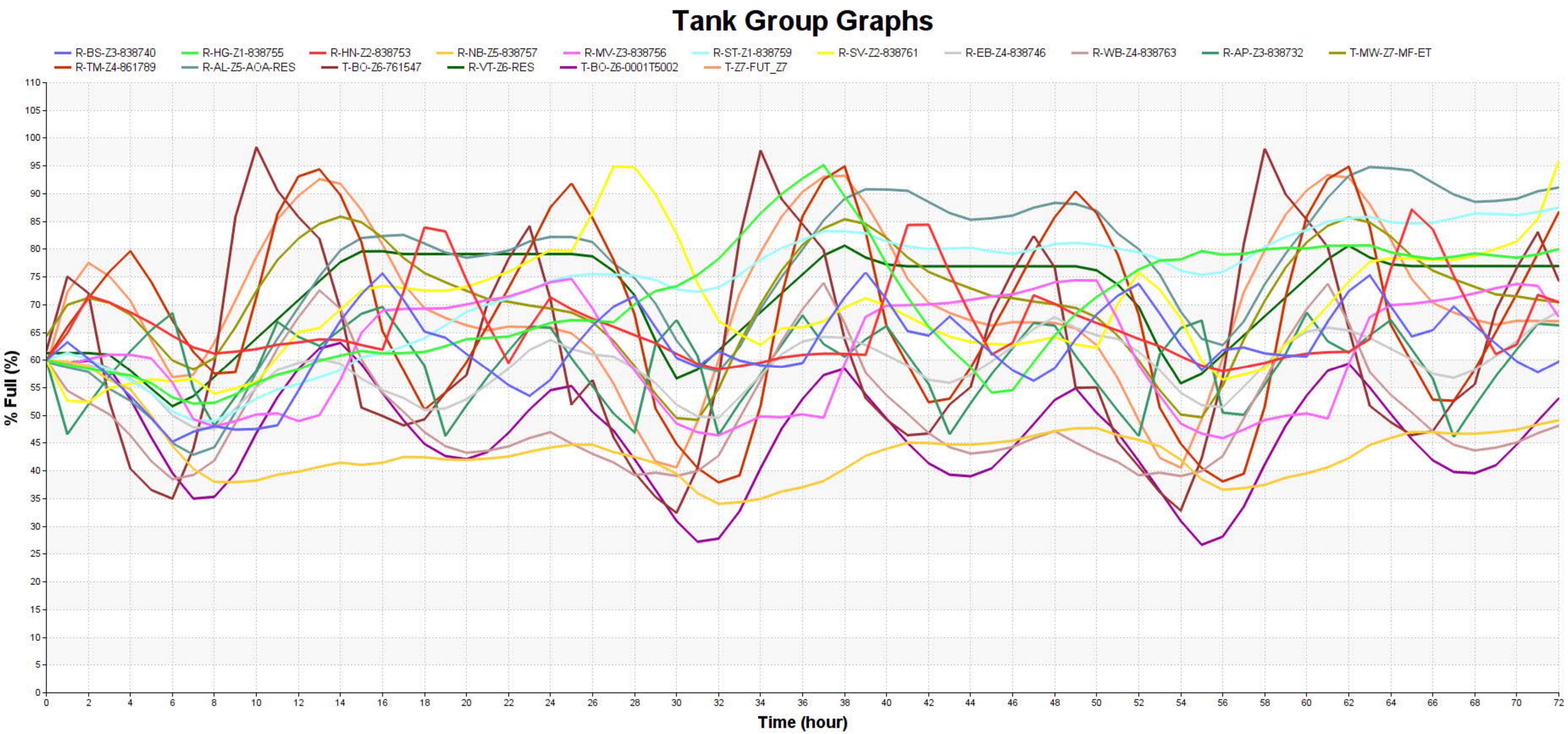


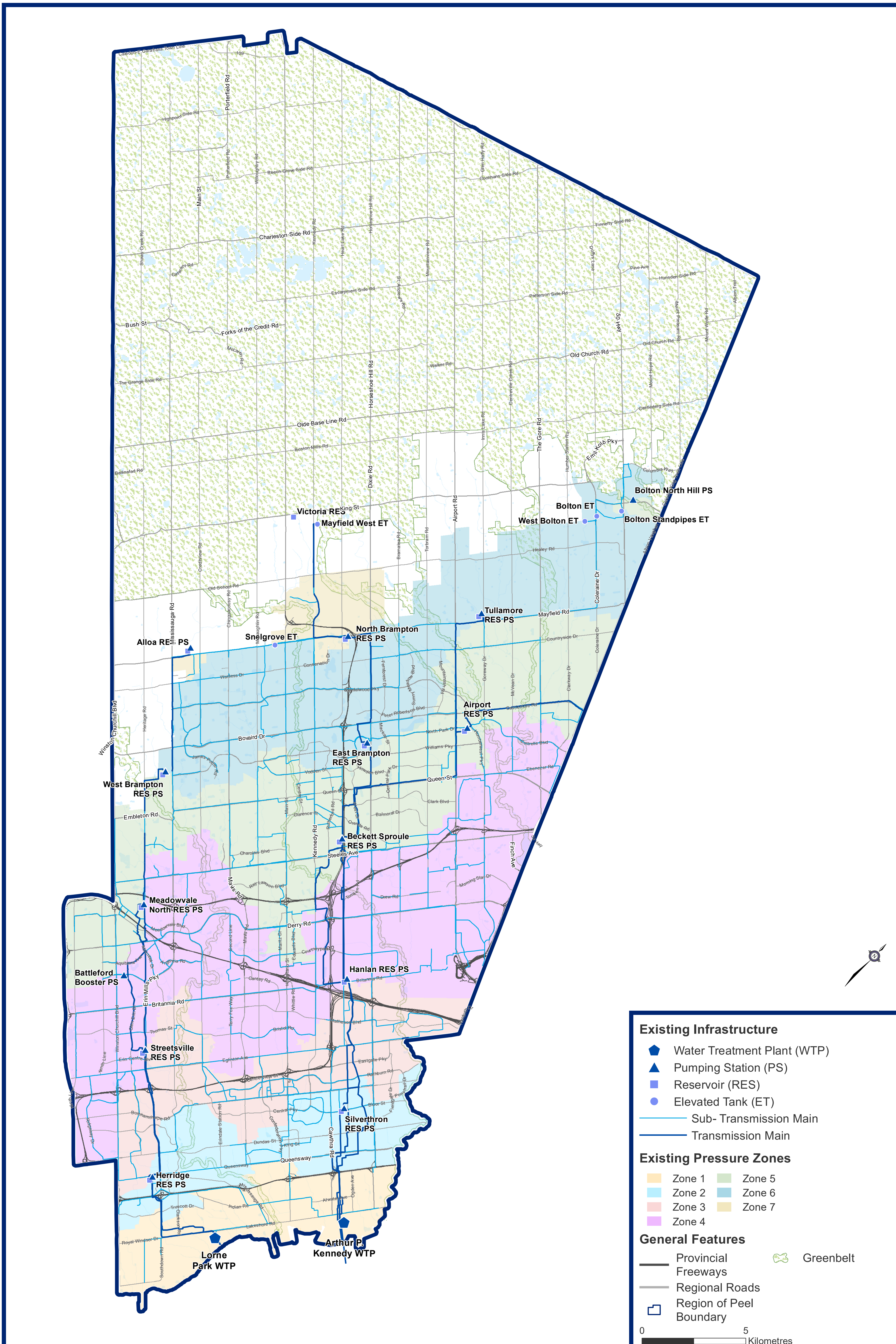
Figure A.30: Tank Levels for 72 hours Emergency Duration under 2041 Demand Conditions

3G

REGIONAL MUNICIPALITY OF PEEL

APPENDIX 3G

Maps



Region of Peel
working with you

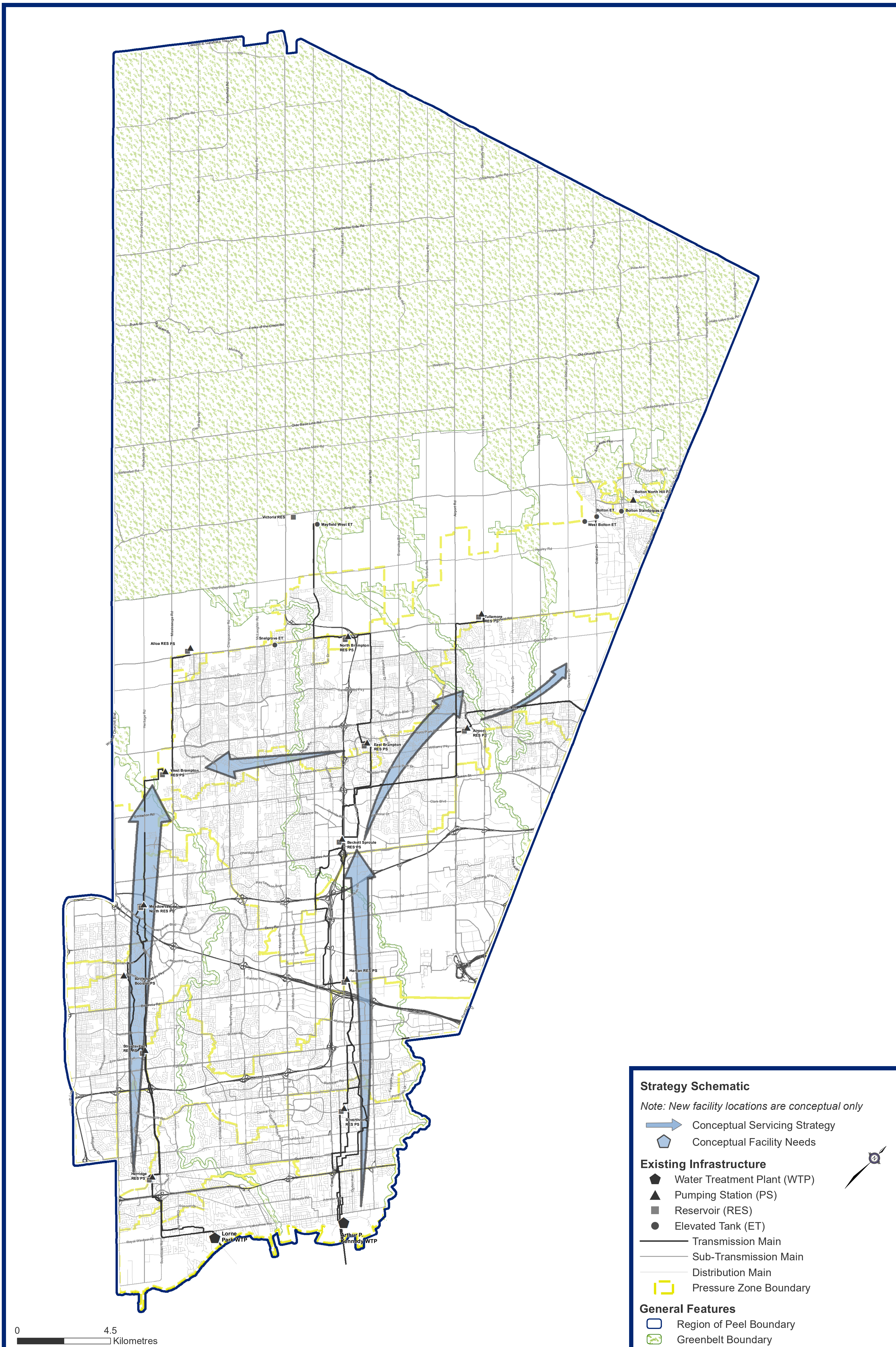
2020 WATER AND WASTEWATER MASTER PLAN

Existing Water System

BluePlan ENGINEERING

June 2020
715022-139-W-PIC 2
NAD 1983 UTM Zone 17N

Document Path: W:\GTA\715000\715022 - Region of Peel W WW MP\3_WIP\3_GIS\715022-139-W-Existing Water System (MSP).mxd



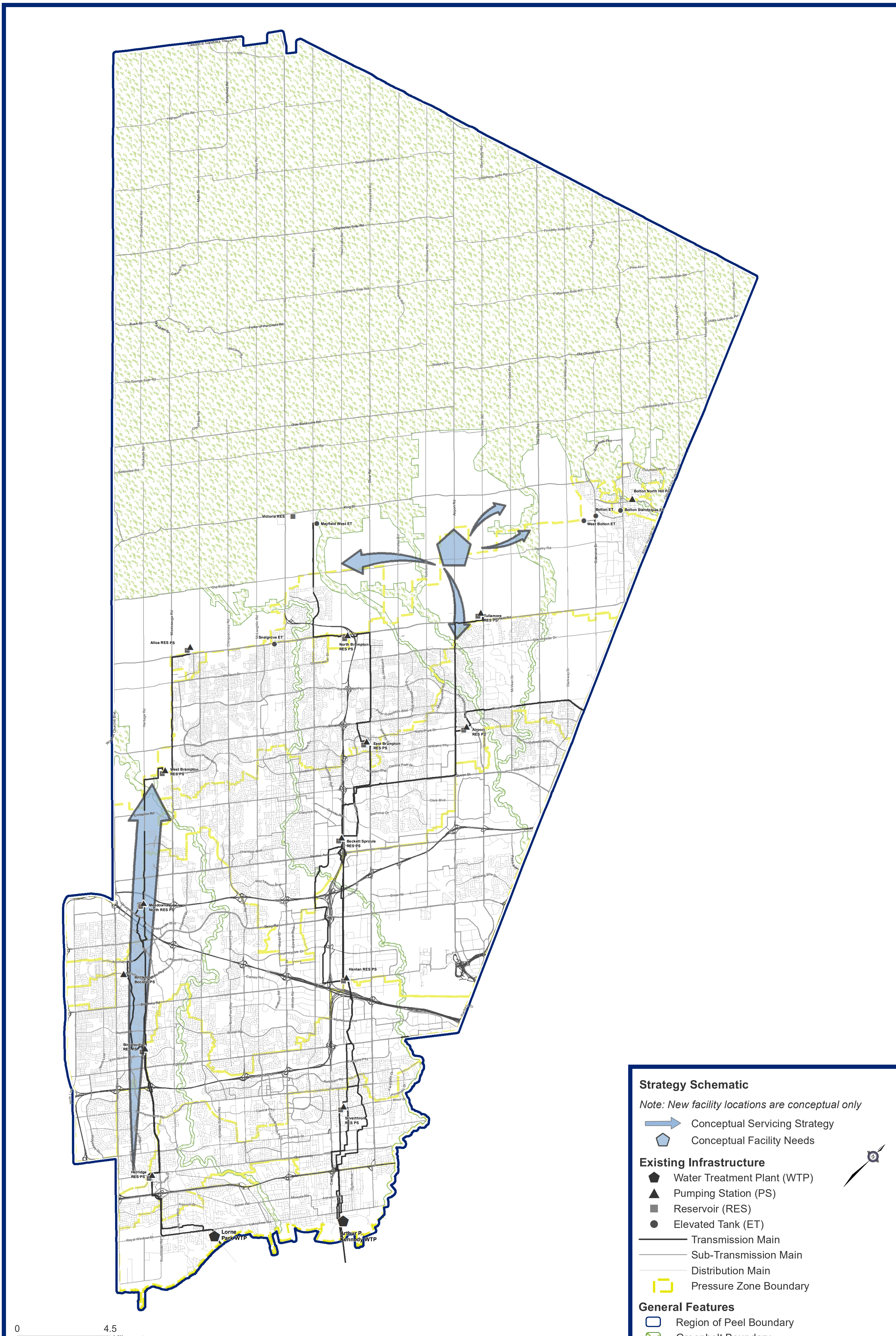
Region of Peel
working with you

2020 WATER AND WASTEWATER MASTER PLAN
Alternative System Wide Servicing Strategy 1

BluePlan ENGINEERING

June 2020
715022-174-W
NAD 1983 UTM Zone 17N

Document Path: W:\GTA\715000\715022 - Region of Peel W WW MP3_WIP\3_GIS\715022-174-W-Water Servicing Strategy 1.mxd



Region of Peel
working with you

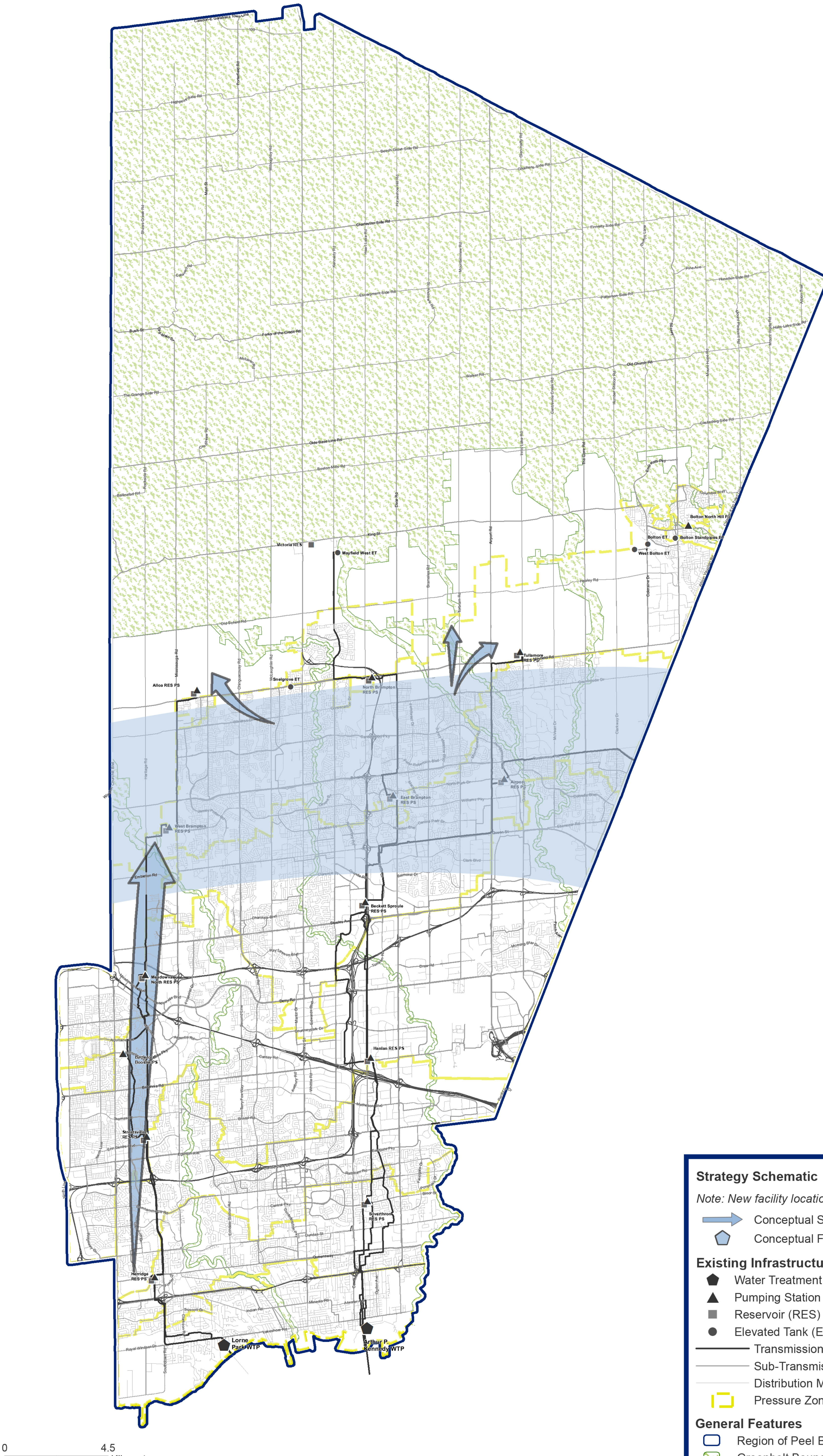
2020 WATER AND WASTEWATER MASTER PLAN

Alternative System Wide Servicing Strategy 2

BluePlan ENGINEERING

June 2020
715022-174-W
NAD 1983 UTM Zone 17N

Document Path: W:\GTA\715000\715022 - Region of Peel W WW MP3_WIP\3_GIS\715022-174-W-Water Servicing Strategy 2.mxd



Strategy Schematic

Note: New facility locations are conceptual only

- Conceptual Servicing Strategy
- Conceptual Facility Needs

Existing Infrastructure

- Water Treatment Plant (WTP)
- Pumping Station (PS)
- Reservoir (RES)
- Elevated Tank (ET)
- Transmission Main
- Sub-Transmission Main
- Distribution Main
- Pressure Zone Boundary

General Features

- Region of Peel Boundary
- Greenbelt Boundary

Region of Peel
working with you

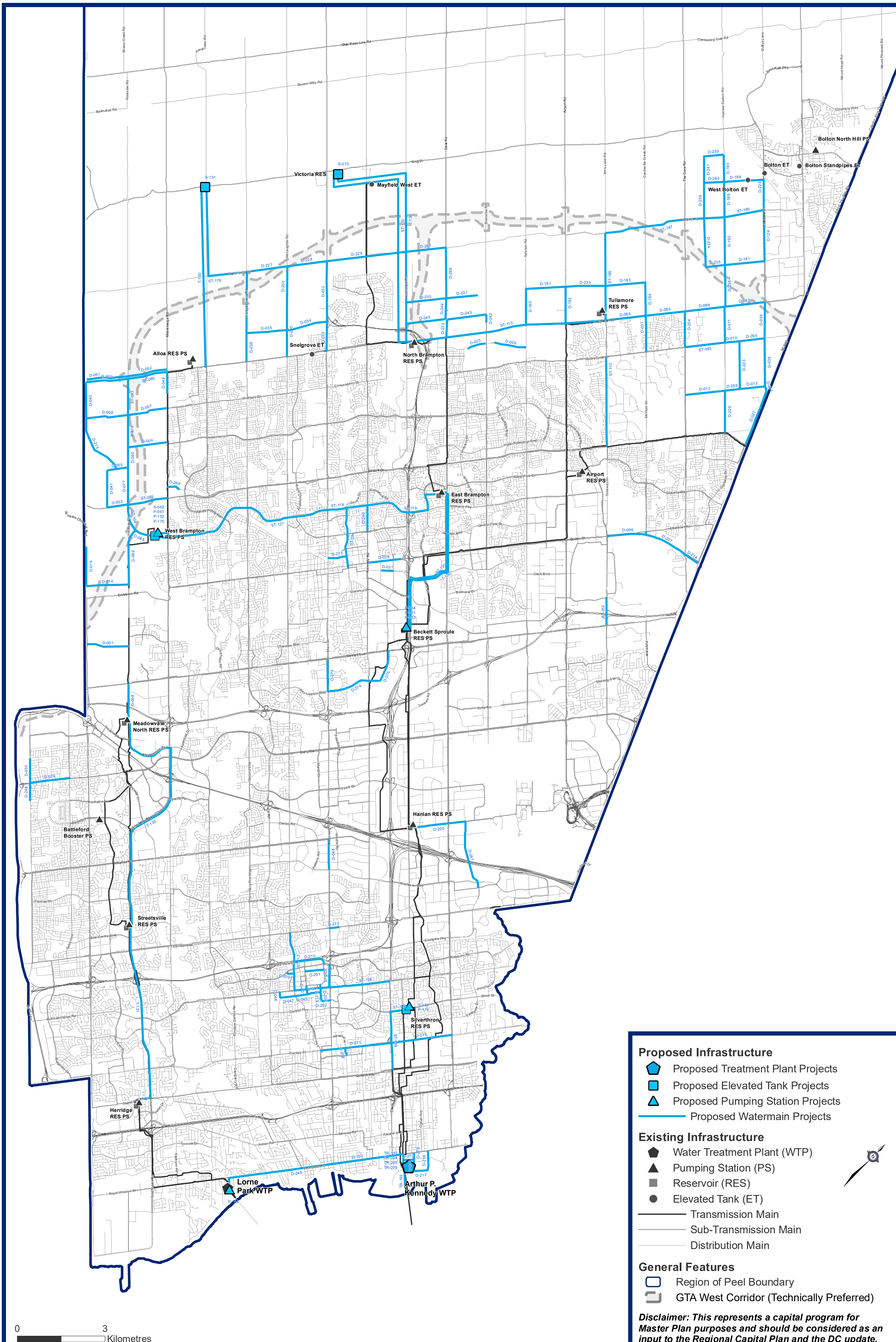
2020 WATER AND WASTEWATER MASTER PLAN

Alternative System Wide Servicing Strategy 3

BluePlan ENGINEERING

June 2020
715022-174-W
NAD 1983 UTM Zone 17N

Document Path: W:\GTA\715000\715022 - Region of Peel W WW MP\3_WIP\3_GIS\715022-174-W-Water Servicing Strategy 3.mxd



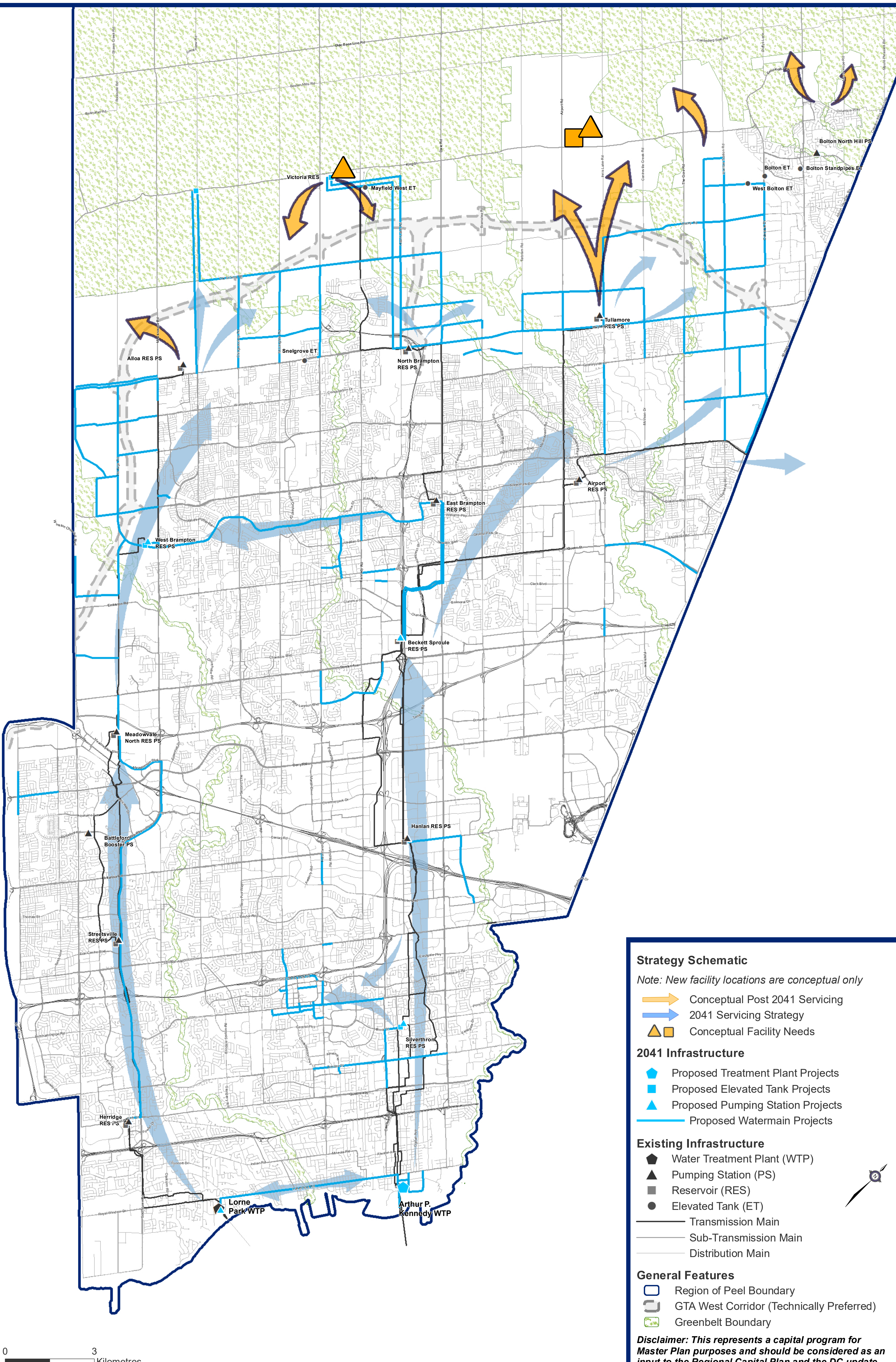
Region of Peel
working with you

2020 WATER AND WASTEWATER MASTER PLAN

2041 Water Capital Program

BluePlan ENGINEERING

June 2020
715022-148-W
NAD 1983 UTM Zone 17N



Region of Peel
working with you

2020 WATER AND WASTEWATER MASTER PLAN

Post-2041 Water Servicing Strategy

BluePlan ENGINEERING

June 2020
715022-160-W
NAD 1983 UTM Zone 17N