



Water, Wastewater and Stormwater Master Servicing Plan Update – 2051 Amendment

November 2021

Volume III – Water Master Plan



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Key Acronyms and Definitions

ADD (Average Day Demand)

Average Day Demand is the typical daily water consumption within the distribution system.

Boundary Adjustment Lands

The Boundary Adjustment Lands are the lands brought into the City of Brantford Municipal Boundary from the County of Brant as part of the need to secure additional lands for the City's future growth. These adjustment lands were effective as of January 1, 2017.

BPS (Booster Pumping Station)

A Booster Pumping Station allows water, within the distribution system, to be lifted from an area of lower elevation to an area of higher elevation. Within the Brantford water distribution system, a booster pumping station typically refers to smaller pumping stations.

EA (Environmental Assessment)

An Environmental Assessment, or in the context of this document the MEA Municipal Class EA, is an approved planning process for municipal infrastructure that can be used to meet the requirements of the EAA. The Municipal Class EA process was revised and updated in 1993, 2000, 2007, 2011, 2015, and 2020.

ET (Elevated Tank)

An Elevated Tank is a raised water storage facility which stores water for everyday use and for emergencies, discharging to the distribution system by gravity.

Expansion Lands

The Expansion Lands are the lands which were determined through the MCR to be included in the City's new Settlement Area Boundary.

FF (Fire Flow)

Fire Flow is the short-term large water demand needed to fight a fire, typically evaluated under maximum day demand conditions to establish conservative conditions.

FUS (Fire Underwriters Survey)

The Fire Underwriters Survey is national organization which provides data and guidance on public fire protection for fire insurance statistical work and underwriting purposes of subscribing insurance companies. Included within their water supply for public fire protection document is guidance for estimating required fire flows.

HGL (Hydraulic Grade Line)

A Hydraulic Grade Line, within the pressurized water distribution system, refers to the level of a column of water would raise to in a piezometer which is the sum of the pressure head and elevation head.

LOS (Level of Service)

Level(s) of Service is the delivering of a service to customers such that risk, performance, and cost are balanced.

MCR (Municipal Comprehensive Review)

The Municipal Comprehensive Review is a process undergone by municipalities within Ontario to ensure that their official plans conform to policies within A Place to Grow: Growth plan for the Greater Golden Horseshoe. The MCR will complete background review, public consultation, and development of policies necessary for input into a new or amended official plan.

MECP (Ministry of the Environment, Conservation, and Parks)

The Ministry of the Environment, Conservation, and Parks is a department of the Ontario government responsible for protecting and improving the quality of the environment.

MDD (Maximum Day Demand)

Maximum Day Demand is the peak daily water consumption within the distribution system.

ML (Million Litres)

Million Litres is a unit of measure for volume.

MLD (Million Litres per Day)

Million Litres per Day is a unit of measure for flow rate.

MSP (Master Servicing Plan)

The Master Servicing Plan is a comprehensive document that provides a review, evaluation, and development of water, wastewater, and stormwater servicing strategies to support existing needs and projected growth forecasts to 2051.

PD (Pressure District)

A Pressure District is an area bounded specific elevations which allow for acceptable pressures to be maintained within that specific area.

PIC (Public Information Centre)

Public Information Centres are public events which are used to educate and inform the public as well as to elicit feedback from the study. This is a necessary step in the Class EA process and are typically done at study milestones.

PRV (Pressure Reducing Valve)

A Pressure Reducing Valve is a type of valve which allows for the water pressure to be reduced. This is typical in areas with lower elevation than their surroundings such that high water pressures are avoided.

PS (Pumping Station)

A Pumping Station allows water, within the distribution system, to be lifted from an area of lower elevation to an area of higher elevation and help to regulate flows and pressures.

PTTW (Permit to take Water)

Permit to Take Water is a permit issued by the MECP which allows water taking, from either surface water or ground water, to a specific flow rate.

Res (Reservoir)

A Reservoir refers to an inground water storage facility which stores water for everyday use and for emergencies, discharging to the distribution system by pumps.

SCADA (Supervisory Control and Data Acquisition)

Supervisory Control and Data Acquisition is a computer system which gathers, stores, and displays real time data used to monitor and control facilities within the water and wastewater systems.

TDH (Total Dynamic Head)

Total Dynamic Head is the losses a pump must overcome to lift water from a lower elevation to a higher elevation. This can be calculated by the summation of elevation head, friction head loss, and pressure head.

TWL (Top Water Level)

Top Water Level is the maximum height of water within storage facilities (i.e. inground reservoir or elevated tank). Typically, these are presented as either meters above sea level (masl) or as height from the bottom of the storage facility.

Water Treatment Plant (WTP)

A Water Treatment Plant is a facility which contains a treatment process to clean water, passing through many steps to meet water quality requirements, before it enters the water distribution system.

1. Introduction and Background

1.1 City of Brantford Context

The City of Brantford is located in southwest Ontario along the banks of the Grand River and is within proximity of the City of Hamilton and the County of Brant. The City of Brantford is a single tier municipality, which owns and is responsible for the planning, construction, and management of the municipal water, wastewater, and stormwater infrastructure.

The City owns and operates its water system, which includes water treatment, storage facilities, pumping stations, and trunk and distribution watermains. The City's water is supplied by a single surface water treatment plant (WTP) that draws water from the Grand River and distributes treated water to its residents.

The City owns and operates its wastewater system, which includes wastewater treatment, pumping stations, and collection and trunk sewers. The City's wastewater is collected and conveyed to a single wastewater treatment plant (WWTP) that treats the City's wastewater before discharging into the Grand River.

The City owns, maintains, and operates the majority of the stormwater collection and management infrastructure, which includes catch basins, storm sewers, ditches, culverts, stormwater management facilities, and other stormwater facilities and structures. The entirety of the City is located within the Grand River watershed. The majority of the City's existing stormwater sewers and managed ditches drain directly to the Grand River or the following Grand River tributaries: Phelps Creek, Mohawk Lake and D'Aubigny Creek; however, a significant portion of the City's northeast discharges to local creeks along the City's north and east before discharging into Fairchild Creek.

Readily available and accessible public infrastructure is essential to the viability of existing and growing communities. Infrastructure planning, land use planning, and infrastructure investment require close integration to ensure efficient, safe, and economically achievable solutions to provide the required water, wastewater, and stormwater infrastructure.

To balance the needs of growth with the protection and preservation of natural, environmental, and heritage resources, the City of Brantford initiated the preparation of the 2020 Master Servicing Plan Update – 2051 Amendment (2020 MSP Update) for water, wastewater, and stormwater services under the Municipal Engineers Association (MEA) Master Plan Class Environmental Assessment process.

1.2 Municipal Comprehensive Review

The City of Brantford started its Official Plan Review in 2013. Between 2013 and 2016, completed work included the hosting of visioning sessions, the preparation of technical background papers and the creation of a new Draft Official Plan (Version 1, issued in July 2016). The Official Plan Review was put on hold while the Municipal Boundary Adjustment Agreement, between the City of Brantford and the County of Brant, was finalized and approved by the Province, and pending updates to the Growth Plan for the Greater Golden Horseshoe to which the new Official Plan must conform.

In 2016, the municipal boundary, between the City of Brantford and the County of Brant, was adjusted to secure additional lands for the City's future growth, effective January 1, 2017. These lands are referred to as the Boundary Adjustment Lands.

The municipal boundary adjustment brought new lands into Brantford's municipal boundary; however, this did not automatically include the lands in the City's urban area boundary, also referred to as a Settlement Area boundary. To expand the City's Settlement Area boundary, the Province requires municipalities to conduct a Municipal Comprehensive Review (MCR) as input into their new or amended Official Plan. The MCR is necessary as it determines the extent to which the Settlement Area boundary is to be expanded. Following the completion of the MCR, the new or amended Official Plan can designate urban land uses within the expanded Settlement Area boundary.

The City ventured to complete the MCR and revisions to the 2016 Draft Official Plan to include the Boundary Adjustment Lands. The City of Brantford established an eight-stage study process to complete the Municipal Comprehensive Review and finalize the new Official Plan – entitled **Envisioning Our City**, and a new draft Official Plan was released to the public for review and comment in June 2020. To assist the City in completing a new Official Plan, the City retained a team of consultants led by SGL Planning & Design Inc., and includes The Planning Partnership, Cushman Wakefield, Hemson Consulting, AgPlan Limited, ASI (Archaeological Services Inc.), Ecosystem Recovery Inc., GM BluePlan Engineering, Plan B Natural Heritage, and Dillon Consulting. The new Official Plan was adopted by City Council in March 2021 and has been submitted to the Province for approval.

GM BluePlan Engineering was retained to support the MCR Study with respect to the determination of the appropriate water, wastewater, and stormwater servicing plan for the lands to be included within the Settlement Area boundary in the North Brantford and Tutela Heights Boundary Adjustment Lands.

1.3 Master Servicing Plan

In support of the Official Plan Review, and to ensure that infrastructure servicing recommendations to support the new urban land uses are made in a cohesive and integrated manner with the City's long-term servicing needs of the existing system, the City has undertaken an update to its MSP.

The 2020 MSP Update – 2051 Amendment provides a review, evaluation, and development of water, wastewater, and stormwater servicing strategies to support existing needs and projected growth forecasts based to 2051; including the servicing of new urban land uses within the City’s new Official Plan, adopted by Council in March 2021.

The 2020 MSP Update was completed concurrently with the City’s new Official Plan and the Transportation Master Plan Update to enable, where advantageous, alignment of recommended work or capital projects, minimizing potential impacts and disruptions to the public. Following the completion of the 2020 MSP Update to the 2041 growth horizon, updated growth numbers were provided by the Province’s Growth Plan to the 2051 growth horizon.

The 2020 MSP Update – 2051 Amendment is a critical component of the City’s planning for growth and will provide the framework and vision for the management, expansion and funding of the water, wastewater, and stormwater systems for the entire City to 2051 and beyond.

1.4 Master Servicing Plan Objectives

The MSP Update for water, wastewater and stormwater services comprehensively documents the development, evaluation, and selection of the preferred water, wastewater, and stormwater servicing strategies to meet the servicing needs of existing and future development to 2051 and beyond.

The 2020 MSP Update evaluates the ability of existing and planned water, wastewater, and stormwater infrastructure in the City of Brantford to efficiently and effectively service the City’s existing and anticipated growth, including servicing of the new urban land uses within the City’s new Settlement Area boundary in accordance with the draft Official Plan, and to evaluate and develop recommended servicing strategies.

The key objectives of the 2020 MSP Update are as follows:

- Review and integrate the servicing needs to support buildout of the new urban land within the 2017 Boundary Adjustment Lands;
- Review planning forecasts to 2051 and determine the impacts on servicing needs for the City’s water, wastewater, and stormwater infrastructure;
- Consider and incorporate proposed water, wastewater, and stormwater infrastructure needs to support the full buildout lands within the new municipal boundary beyond 2051;
- Undertake a comprehensive review and analysis for the water, wastewater, and stormwater servicing requirements;
- Complete the MSP in accordance with the MEA Class EA process (further described in **Volume II**);

- Address key servicing considerations as part of the development and evaluation of servicing strategies including:
 - Level of service to existing users and approved growth
 - Operational flexibility and security of supply
 - Mitigation of impacts to natural, social, and economic environments
 - Opportunity to meet policy, policy statements, regulations and technical criteria
 - Opportunity to optimize existing infrastructure and servicing strategies
 - Ensuring the strategies are cost effective
- Consider and develop sustainable servicing solutions;
- Utilize updated industry trends and more detailed information from relevant City studies and projects to provide better capital cost estimates;
- Utilize recently completed and on-going projects to update infrastructure status, capacity and cost estimates;
- Utilize the updated water, wastewater, and stormwater hydraulic models for the analysis of servicing alternatives;
- Establish a complete and implementable water, wastewater, and stormwater capital program; and
- Extensive consultation with the public and stakeholders.

1.5 Master Servicing Plan Documentation Layout

The 2020 MSP Update Report, including all supporting volumes, is the documentation placed on public record for the prescribed review period. This documentation, in its entirety, describes all required phases of the planning process and incorporates the procedure considered essential for compliance with the **Environmental Assessment Act**.

The MSP Update Report is organized into six volumes as described below.

Volume I – Executive Summary

Volume I provides a brief overview of the 2020 MSP Update. It summarizes the information contained in **Volume II, III, IV, V** and **VI**, including problem statement, purpose of the study, significant planning, environmental and technical considerations, description of the analysis performed and final solution and recommendations.

Volume II – Plan & Policy

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

The appendices in this volume contain relevant baseline and planning information including:

- Appendix A – Traffic Zone Population and Employment Projections
- Appendix B – Principles, Policies, and Level of Service
- Appendix C – Unit Rates

Volume III – Water Master Plan

Volume III consists of the principal document summarizing the study objectives, approach, methodologies, technical analyses, evaluation and selection of the preferred water servicing strategy. This volume outlines the water policies, design criteria and level of service needed to be achieved by the water network. In addition, **Volume III** identifies the existing water network and describes the hydraulic modelling tool used for the analysis. Further **Volume III** outlines the detailed evaluation and decision-making process as well as the preferred servicing strategy and associated capital program and implementation plan.

A significant amount of technical background information has been compiled, which is critical to the development of the Water Master Servicing Plan. This information is included as appendices in **Volume III**. The technical appendices contain relevant project, implementation, and technical analysis information including:

- Appendix A – Water System Schematic
- Appendix B – Traffic Zone Demand
- Appendix C – Expansion Lands Concepts
- Appendix D – Water Treatment Plant Concepts
- Appendix E – Evaluation Tables
- Appendix F – Capital Program Project Sheets

Volume IV – Wastewater Master Plan

Volume IV consists of the principal document summarizing the study objectives, approach, methodologies, technical analyses, evaluation and selection of the preferred wastewater servicing strategy. This volume outlines the wastewater policies, design criteria and level of service needed to be achieved by the wastewater network. In addition, **Volume IV** identifies the existing wastewater network and describes the hydraulic modelling tool used for the analysis. Further in **Volume IV** is the detailed evaluation and decision-making as well as the preferred servicing strategy and associated capital program and implementation plan.

A significant amount of technical background information has been compiled, which is critical to the development of the Wastewater Master Servicing Plan. This information is included as appendices in **Volume IV**.

The technical appendices contain relevant project, implementation, and technical analysis information including:

- Appendix A – Wastewater System Schematic
- Appendix B – Traffic Zone Flows
- Appendix C – Expansion Lands Concepts
- Appendix D – Wastewater Treatment Plant Concepts
- Appendix E – Evaluation Tables
- Appendix F – Capital Program Project Sheets

Volume V – Stormwater Master Plan

Volume V consists of the principal document summarizing the study objectives, approach, methodologies, technical analyses, evaluation and selection of the preferred stormwater servicing strategy. This volume outlines the stormwater policies, design criteria and level of service needed to be achieved by the stormwater network. In addition, **Volume V** identifies the existing stormwater network and describes the hydraulic modelling tool used for the analysis. Further, **Volume V** outlines the detailed evaluation and decision-making as well as the preferred servicing strategy and associated capital program and implementation plan.

A significant amount of technical background information has been compiled, which is critical to the development of the Stormwater Master Servicing Plan. This information is included as appendices in **Volume V**. The technical appendices contain relevant project, implementation, and technical analysis information including:

- Appendix A – Key Existing Stormwater Infrastructure Facility Details
- Appendix B – Expansion Lands Subwatershed Study
- Appendix C – Evaluation Tables
- Appendix D – Implementation Plan Detailed Study Overview Sheets
- Appendix E – Capital Program Project Sheets

Volume VI – Public and Agency Consultation

Volume VI 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 this process is included. Other presentation material and discussion information from workshops held with relevant agencies, approval bodies and other stakeholders are also included within the appendices:

- Appendix A – Study Stakeholder List
- Appendix B – Study Commencement
- Appendix C – Public Information Centres
- Appendix D – Comments Received
- Appendix E – Study Completion

2. Water System Policy and Criteria

Execution of reasonable Policies and Level of Service (LOS) objectives are essential in ensuring that the proper planning and design principles are followed in the development of detailed servicing strategies, implementation of a system-wide capital program, and operations and maintenance practices.

In the context of the MSP Update, these Policies and LOS objectives 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.

Through the Master Servicing Plan; draft Policies and LOS objectives were established and used to guide future investment in the water, wastewater, and stormwater systems. This section summarizes the key Policy and LOS objectives as they relate to the water system. A fulsome summary of the MSP Policies and LOS objectives review and recommendations is included in **Appendix A of Volume II**.

2.1 Water Servicing Principles and Policies

Specific servicing principles and policies have been developed to guide the development of water servicing strategies. In general:

“The City of Brantford is looking to provide an efficient, sustainable, and safe water system that meets regulatory requirements, minimizes service disruptions, and is capable of accommodating growth”

The servicing policies which impact the water servicing are summarized in **Appendix A of Volume II**.

2.2 Water Design Criteria and Hydraulic Performance Criteria

A guiding principle of design criteria is to ensure that the demand projections are adequately predicted with an appropriate factor of safety and risk management. This overall principle also ensures that infrastructure has sufficient capacity to meet the growing needs of the City and does not impede the approved/planned growth.

The design criteria were reviewed as part of this Master Servicing Plan to ensure water demands are accurate and will support sizing and timing of future infrastructure such as pipes and facilities.

2.2.1 Water Design Criteria and Level of Service Summary

The development of design criteria utilized historical billing data in combination with Ontario Ministry of Environment, Conservation, and Parks (MECP) Design Standards and Guidelines. Level of Service and water policies were discussed and established at the outset of the project. The water demand criteria updated as part of the MSP Update are summarized in **Table 1**.

Table 1: Water Design Criteria and Level of Service

Criteria		Draft Targets
Water Use	Per Capita Rate	270 Liters/capita/day (residential and employment)
	Max Day Peaking Factor	1.8
System Performance	Pressures	40-100 psi
	Fire flow	Land use/FUS-lite approach
	Velocities	Flag velocities >1.5 m/s Maintain peak velocities <2.0 m/s
Facility Capacity	Facility Triggers (supply and pumping)	80% Planning and Design 90% Construction
	Water Storage	Total Storage Needs = Balancing + Fire + Emergency Balancing = 25% MDD Fire = Greater of MECP population-based calculation or the highest landuse based FF needs Emergency = 50% of Balancing + Fire * Each PD to be storage self-sufficient
	Pumping	Firm capacity = largest pump out of service Firm capacity provides MDD if sufficient storage within PD Firm capacity provides largest of MDD+FF or PHD if insufficient storage within PD *FF needs based on highest landuse based FF within the PD

Development of the water demand criteria for the Master Plan Update is detailed further in **Appendix B** in **Volume II**.

2.3 Water Use Design Criteria

2.3.1 Per Capita Demand

An analysis of historic water treatment plant production and water billing records was completed and presented in **Table 2**. Billing data was provided by the City in the form of lot meter readings from 2008-2019. The WTP production describes billed yearly consumption within the City and was used to calculate an average day demand (ADD).

Table 2: Historic Water Use

Year	Billing (MLD)	Average Day Demand (MLD)	Non-Revenue Water (%)	Per Capita Rate (L/c/d)
2008	31.1	34.3	9%	247
2009	29.9	33.3	10%	238
2010	30.1	33.5	10%	239
2011	29.9	34.2	13%	243
2012	30.2	36.3	17%	256
2013 ⁽¹⁾	-	-	-	-
2014	29.7	32.5	8%	225
2015	30.4	32.2	6%	221
2016	30.0	32.1	6%	218
2017	29.4	31.5	6%	227
2018	30.6	32.9	7%	230
2019	29.2	33.1	12%	225
Average Historic Water Use	30.0	33.3	9%	233
Historic Design Criteria (2019)	-	-	-	300

⁽¹⁾ 2013 Water Treatment Plant flows were not available

Growth related per capita rate of 270 L/c/d was recommended for the following reasons:

- This represents a decrease in the existing design criteria per capita rates of 10% and is in line with the recommended wastewater per capita rate decrease.
- The recommended per capita rate remains above the observed historic per capita rate; providing reasonable flexibility in the criteria to accommodate potential changes in future usage rates.
- While there is an observed decreasing trend in per capita rates, a stepped approach to lowering per capita rates is recommended with the next MSP to ensure water conservation measures are maintained.

2.3.2 Peaking Factor

An analysis of historic water treatment plant production, including average and maximum day demands and calculated peaking, was completed and presented in **Table 3**.

Table 3: Peaking Factor

Year	Average Day Demand (MLD)	Max Day Demand (MLD)	Peaking Factor
2008	34.3	53.6	1.62
2009	33.3	48.0	1.49
2010	33.5	50.7	1.57
2011	34.2	57.5	1.78
2012	36.3	56.8	1.68
2013 ⁽¹⁾	-	-	-
2014	32.5	41.8	1.31
2016	32.2	45.2	1.43
2017	31.5	46.6	1.48
2018	32.9	44.7	1.36
2019	33.1	47.6	1.44
Average	33.3	49.0	233

⁽¹⁾ 2013 Water Treatment Plant flows were not available

A peaking factor of 1.8 was recommended for the following reasons:

- Represents a decrease in the existing design criteria maximum day demand peaking factor of 10%.
- The recommended peaking factor remains above the observed historic 10-year maximum day peaking factor, and above the MECP recommended maximum day peaking factor of 1.65 for a population base between 75,001 to 150,000 or 1.5 for a population base greater than 150,000 (2051 Population); providing reasonable flexibility in the criteria to accommodate potential changes in future usage rates.

2.3.3 Starting Point Methodology

The five-year rolling average of average day demands was used to establish baseline system average day demands. Baseline system max day demand was calculated using a peaking factor of 1.8.

2.3.4 Growth Demand Projections

Future system demands were developed using a starting point methodology, the standard approach within Southern Ontario for projecting future growth demands. Expected demand due to growth was added to the starting point demand to establish future demands. An example is provided below.

$$2051 \text{ ADD} = \text{Baseline ADD}^1 + (2051 \text{ total equ.pop.}^2 - 2016 \text{ total equ.pop}) * 270 \text{ L/c/d}$$

2.4 System Hydraulic Performance Criteria

2.4.1.1 Pressures

System pressure objectives consistent with the MECP Criteria are as follows:

- Maintain system pressures between 40-100 psi under average day demand (ADD), maximum day demand (MDD), and peak hour demand (PHD) scenarios
- Maintain system pressures above 20 psi under MDD + fire flow conditions

¹ ADD – Average Day Demand

² Equ. Pop – Total of the combined people and employment population

2.4.1.2 The Fire Flow – Network Capacity

The recommended process of defining fire flow targets is as follows:

- FUS and land use-based approach
- Fire flow at a hydrant is governed by land use with the highest fire flow target
- Due to current uncertainties, within the City of Brantford’s existing water network, on the magnitude of water system upgrades as a result of fire flow targets, a sensitivity analysis was to be performed to ensure reasonable targets can be met.

Table 4 summarizes the system fire flow targets that were used in assessing system capacity.

Table 4: Range of Recommended Fire Flow Targets

Landuse	Typical FUS Range (L/s)	# of Hydrants	Target Fire Flow (L/s)
Dead End Residential	27-100 L/s	-	50 (4.3 MLD)
Single/ Semi Family	27-162 L/s	1	75 (6.5 MLD)
Townhouse/ Row House	82-167 L/s	1-2	125 (10.8 MLD)
Multi Family	117-368 L/s	2	150 (13.0 MLD)
Commercial	111-185 L/s	2-3	175 (15.1 MLD)
Institutional	96-334 L/s	2-3	175 (15.1 MLD)
Industrial	133-299 L/s	3-4	250 (21.6 MLD) ⁽¹⁾
City Center	-	3	225 (19.4 MLD)

⁽¹⁾ Northwest PS was designed to provide a fire flow of 189 L/s (16.3 MLD) to PD4, this facility will continue to support PD4 under its designed conditions, providing a maximum fire flow of 189 L/s (16.3 MLD), until upgrades are completed at the pumping station to allow for an increased fire flow

2.4.1.3 Peak Velocities

The current design criteria requires new watermains to maintain peak velocities, under peak hour conditions, less than 1.5 m/s and any peak velocities which exceed 2.0 m/s should be flagged for review and mitigation.

2.4.2 Water Facilities Capacity Objectives

2.4.2.1 Facility Upgrade Triggers

Industry best practice and recommended methodology for supply and pumping stations facility upgrade triggers are as follows:

- At 80% utilization of a facility's capacity the planning and design process will begin to assess upgrade capacity needs
- At 90% utilization of a facility's capacity the construction process begins through either an upgrade to an existing facility or construction of a new facility

2.4.2.2 Storage Capacity

Potential short-term loss of City raw water supply due to upstream overflow or spill events has been identified and is a significant concern based on the following high-risk factors:

- Single supply source for the entire City of Brantford
- Frequency of intake closures due to upstream contaminant spill
- Limited raw water storage capacity

As such, evaluated through the Water Treatment Plant Emergency Water Supply and Canal Upgrades Study (AECOM, 2019), a raw storage capacity of two (2) days will be achieved through upgrades to the Holmedale Canal and raw/partially treated tank storage at the WTP was recommended. Further, system storage will be supplemental to raw storage in the event of the listed high-risk factors occurring.

System (treated) storage will be evaluated on a pressure district by pressure district basis using the approach of:

Total Storage = Fire Storage (A) + Equalization Storage (B) + Emergency Storage (C)

- Fire storage (A) needs for water reservoirs will be sized to be the greater of:
 - FUS fire storage need based on the highest land use needs as identified within the pressure district; or,
 - Ministry of the Environment, Conservation and Parks (MECP) population-based storage requirement.
- Equalization Storage (B) to be based on the MECP 25% of maximum day demand to meet peak demands
- Emergency Storage (C) to be based on the 50% of Fire Storage (A) + Equalization Storage (B)

To mitigate against the interruption of supply capacity each Pressure District Fire Storage is to be calculated independently. Storage capacity can be supplemented by a second pressure district; however, the City shall maintain adequate storage in the system to support each pressure district as if it was independently supplied while further considering maintaining water quality.

2.4.2.3 Pumping Firm Capacity

The evaluation of pumping firm capacities, at both pumping stations and water treatment plant high lift pumps, considered historic and future pumping needs, current firm capacity definition, and storage within a pressure district. The recommended approach in determination of pumping firm capacities is as follows:

- Firm capacity is defined as the largest pump out of service
- The pump capacity shall be sized to provide
 - Max day demands where sufficient elevated storage is available
 - The greater of peak hour demand or max day demand + fire flow where no/insufficient elevated storage is available; further, fire flow needs are based on the highest land use-based fire flow target within the Pressure District

2.5 Capital Cost Projections

A capital cost is provided for all projects proposed as part of this Master Servicing Plan. For the majority of the water system projects, a base construction cost was obtained using either a unit rate construction cost, based on pipe diameter, or unique project analysis. The base construction cost considers several factors specific to each project such as creek crossings, railway and highway crossings, tunneling requirements, and location of construction (Greenfield, urban, suburban). Design, administration, contingency, and non-recoverable HST costs were added to arrive at a final project cost. Detailed costing sheets were developed to support the financial evaluation for each capital project.

3. Planning & Growth Projections

A Place to Grow: Growth plan for the Greater Golden Horseshoe is a 25-year plan, released in 2006, that includes the following aims:

- Promote economic growth;
- Prioritize intensification in strategic growth areas;
- Increase housing supply;
- Improve integration of land use planning with planning and investment in infrastructure and public service facilities;
- Protect and enhance natural heritage, hydrologic and landform systems, features and functions;
- Create jobs; and,
- Build communities that make life easier, healthier and more affordable for people of all ages

Amendment 2 to the Province’s Growth Plan came into effect on June 17, 2013. This amendment updated Schedule 3 population and employment forecasts to 2031 and extended forecasts to a 2041 horizon and subsequently a 2051 horizon. The basis of the Master Servicing Plan is to identify the long-term servicing requirements to support the City’s growth needs in line with the Amendment 1 to the Province’s A Place to Grow: Growth Plan for the Greater Golden Horseshoe to 2051, with appropriate strategic servicing decisions to support post 2051 growth.

3.1 Growth Lands

In 2016, the municipal boundary between the City of Brantford and the County of Brant was adjusted in order to secure additional lands in the City for future growth, effective January 1, 2017. These lands are referred to as the Boundary Adjustment Lands.

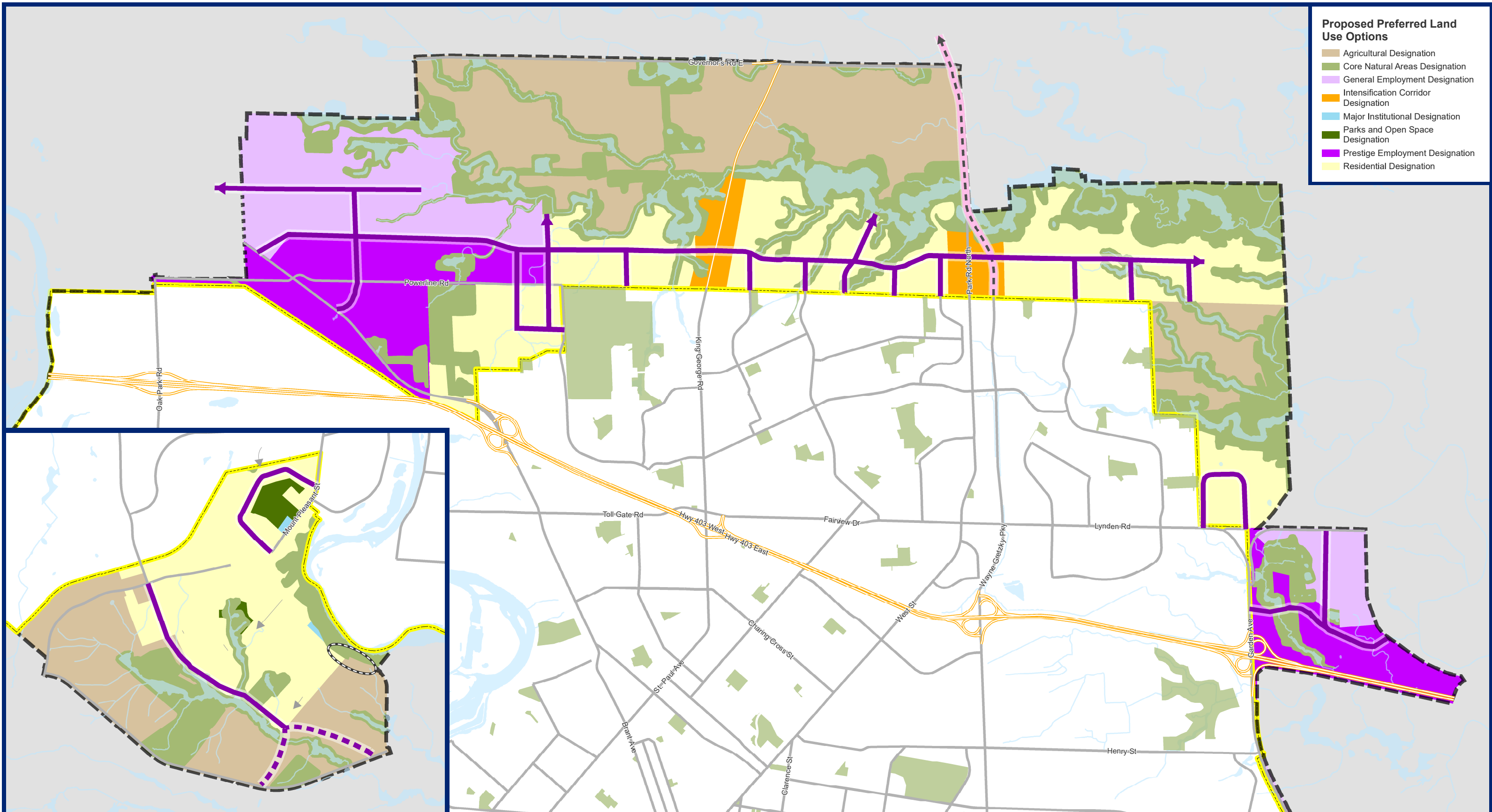
The municipal boundary adjustment brought new lands into Brantford’s municipal boundary; however, this did not automatically include the lands in the City’s urban area boundary, also referred to as the Settlement Area boundary. To expand the City’s Settlement Area boundary, the Province requires municipalities to conduct an MCR as input into their new or amended Official Plan. The MCR is necessary as it determines the extent to which the Settlement Area boundary is to be expanded. Following the completion of the MCR the new or amended Official Plan can designate urban land uses within the expanded Settlement Area boundary.

The MCR identified both growth and intensification targets as well as Settlement Area boundary expansion needs. **Figure 1** presents the Settlement Area Boundary Expansion Lands which are further subdivided into the following sub-areas:

- North Expansion Lands;
- East Expansion Lands; and,
- Tutela Heights

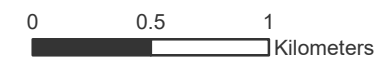
Both the East Expansion Lands and Tutela Heights include lands previously within the Settlement Area boundary of the County of Brant and through the boundary adjustment became part of the City's Settlement Area. However, as these areas require municipal servicing infrastructure, they are included as part of the three expansion sub-areas listed above.

The proposed land use designations for the Settlement Area boundary expansion areas are presented in Schedule 3 of the Official Plan and include a variation of residential, intensification, and employment areas. Portions of the Settlement Area Boundary Expansion are within the GRCA floodplain and Natural Heritage System; as such, urban development is not permitted in these areas of the new urban land uses due to their environmental sensitivity and the importance of maintaining the existing land uses. Additionally, beyond the Settlement Area Boundary Expansion are Trigger Lands, which are lands held for future Settlement Area expansion following substantial development of the current proposed Settlement Area Boundary Expansion areas.



Water, Wastewater and Stormwater
Master Servicing Plan Update

Figure 1
Preferred Land Uses



The population projections for the Expansion Lands within the Settlement Area Boundary are provided in **Table 5**.

Table 5: Expansion Lands Population Projections

Settlement Area Boundary Expansion Lands	Area (ha)	Population		
		Residential ⁽¹⁾	Employment ⁽²⁾	Total
North Expansion Lands	1,883	21,789	12,383	34,172
East Expansion Lands	240	2,772	2,666	5,438
Tutela Heights	581	7,386	278	7,664

⁽¹⁾ Inclusion of 3% undercount and secondary suite residential population growth distributed within the expansion lands.

⁽²⁾ Inclusion of employment no fixed place of work and work from home employment growth distributed within the expansion land

3.1.1 Settlement Area Boundary Expansion Water Servicing

The water servicing concepts and strategies presented in the following sections consider upgrades within the City’s existing infrastructure system, as well as new infrastructure and upgrades needed to service the expansion areas.

3.1.2 Tutela Heights Water System

Existing residents within the Tutela Heights area are serviced by the County of Brant’s Mount Pleasant water system. To allow for the servicing of the anticipated intensification and growth in the area, the existing Tutela Heights area’s water system will be separated from the County’s system and integrated into the City of Brantford’s existing water system.

3.2 Population and Employment Growth Analysis

Growth projections for the City of Brantford were provided by SGL based on the City’s Official Plan. SGL has refined the population and employment forecasts set out in the Official Plan and allocated the projections based on Traffic Survey Zone distribution, factoring projected detailed planning information within Greenfield growth areas, intensification corridors and the Settlement Area Boundary Expansion Lands. **Table 6** and **Table 7** present the population and employment breakdowns. **Appendix A** of **Volume II** provides a detailed breakdown of existing and 2051 population and employment projections by Traffic Survey Zone. The City’s total growth estimate by Traffic Zone data is 113,833 people and jobs.

Table 6: Growth Population Estimates

Land Use Type	2051 Population
In existing 2016 units	84,598
In new units in built up and intensification areas	26,151
In new greenfield units in existing urban area	16,503
In new greenfield units in expansion area ⁽¹⁾	30,541
In secondary suites	2,000
Total population	159,794
Existing 2016 population	97,110
Total population +3% undercount	164,736
Growth population	67,626

⁽¹⁾ Exclusion of secondary suite residential population distributed within the expansion lands

Table 7: Growth Employment Estimates

Land Use Type	2051 Employment
Existing 2016 employment ⁽¹⁾	37,158
Vacant employment lands in existing urban area	8,738
Additional employment in intensification areas	10,534
Vacant employment lands in existing greenfield areas	603
Employment in expansion area ⁽¹⁾	12,311
No fixed place of work	10,067
Work from home	3,954
Existing 2016 employment⁽²⁾	37,158
Total employment	83,365
Growth employment	46,207

⁽¹⁾ Exclusion of no fixed place of work and work from home employment growth distributed within the expansion lands

⁽²⁾ Existing employment undercounted due to StatCan employment suppression

3.2.1 Growth by Water Pressure District

Table 8 summarizes growth needs by water pressure district from Traffic Zone data.

Table 8: Pressure District Population and Employment Growth

Pressure District	Population		Employment	
	2016	2051	2016	2051
Pressure District 1	42,640	75,154	9,346	21,129
Pressure District 2/3	44,255	75,276	23,967	39,776
Pressure District 4	10,215	14,306	3,845	22,460
Total	97,110	164,736	37,158	83,365

3.3 County Agreements

Cainsville, in the County of Brant, is currently serviced via a single 300 mm watermain on Colborne Street. As part of the 2016 Boundary Adjustment Agreement, the City committed to allowing the County to connect to the City’s service water infrastructure and provide adequate capacity on the City’s design criteria for the Cainsville Lands. **Table 9** summarizes forecasted growth needs within Cainsville including existing not serviced lands.

Table 9: Cainsville Population Growth

Growth Area	Population & Employment	
	2016	2051
Cainsville	4,106	10,738

3.3.1 Post Period Considerations

The servicing analysis focuses on servicing the buildout of the internal growth and Settlement Area Boundary Expansion Areas to 2051; however, in the development of the recommended servicing strategy and infrastructure sizing, consideration for the full buildout of the City’s municipal boundary, which includes the Trigger Lands, was considered assuming similar population and employment densities. Where applicable, identification of future facility expansion needs and/or strategic upsizing of linear infrastructure was identified and incorporated into the final recommended servicing plan.

The growth projection for the remainder of the urban boundary area was estimated by applying a density to these remaining areas, not including Natural Heritage Areas. These densities include:

- 25 jobs per hectare for North and East Expansion Employment Lands
- 60 residents and jobs combined per hectare for North and East Expansion Residential Lands
- 55 residents and jobs combined per hectare for Tutela Heights

This approach typically aligns with the residential densities for proposed growth to 2051.

Table 10 summarizes the area and population for the trigger lands.

Table 10: Trigger Lands Population & Employment

Trigger Lands	Area (ha)	Population & Employment
North Expansion Lands	319	19,162
Tutela Heights	170	9,361
Total Trigger Lands	490	28,522

4. Existing Water Distribution System

4.1 Existing Water Infrastructure

The Brantford water system consists of one (1) water treatment plant, five (5) pumping stations, four (4) storage reservoirs, and two (2) elevated tanks (ET) with one ET in operation and one ET currently under construction. A water system schematic is provided in **Appendix A**. Further, the City of Brantford’s water system is organized into three pressure districts: Pressure District 1 (PD1), Pressure District 2/3 (PD2/3), and Pressure District 4 (PD4).

Water supply originates from the Grand River and is treated at the Holmedale Water Treatment Plant (WTP). The WTP High Lift Pump (HLP) Station delivers water directly to PD1 including the new Shellard Elevated Tank (ET) and reservoirs in PD2/3 and PD4, while secondary pump stations deliver water within PD2/3 and PD4. The boundaries along the pressure districts consist of a series of closed valves and pipes, and pressure reducing valves (PRV) to decrease the pressure to the acceptance range of level of service. The hydraulic grade lines (HGL) for the three pressure districts and Tutela Heights, which is currently serviced by Mount Pleasant, are included in **Table 11**.

Table 11: Pressure District HGL

Pressure District	HGL (m)
Pressure District 1	271
Pressure District 2/3	281
Pressure District 4	304
Mount Pleasant	286







Pressure District 1 generally consists of the low elevations within south Brantford, along the Grand River and is fed directly from the Holmedale WTP HLP station via trunk watermains. Storage for PD1 is provided at the WTP Reservoir (Res) and new Shellard ET. PD1 is a large pressure district that includes the residential Greenfield growth area in southwest Brantford along Shellard Lane as well as the downtown Brantford Urban Growth Centre.

Water is pumped into Pressure District 2/3 from the Holmedale WTP via several pumping stations. Storage and pumping for PD2/3 is provided by the Tollgate Road Reservoir (Res) and Pumping Station (PS), Wayne Gretzky Parkway Res and PS, Albion Street Booster Pumping Station (BPS) and King George ET. PD2/3 is a large, combined pressure district that comprises the residential and commercial areas in north Brantford, industrial areas in east Brantford and small Greenfield growth area in east Brantford.




Pressure District 4 is fed by a 900 mm watermain from the WTP HLP and is serviced by the Northwest PS and Res. PD4 is a smaller pressure district consisting mainly of industrial areas in Northwest Brantford.

An overview of the existing water distribution system is provided in **Figure 2**.

Water Network

-  Water Treatment Plant
-  Pumping Station
-  Elevated Tank / Reservoir
-  Pressure Reducing Valve
-  Watermains (< 250 mm)
-  Transmission (>= 250 mm)

Water Pressure Districts

-  Pressure District 1
-  Pressure District 2/3
-  Pressure District 4

General Features

-  Expressway / Highway
-  Arterial and Collectors
-  2016 Municipal Boundary
-  New Municipal Boundary
-  Six Nations of the Grand River Territory
-  Outside Municipalities
-  Parks
-  Waterbody

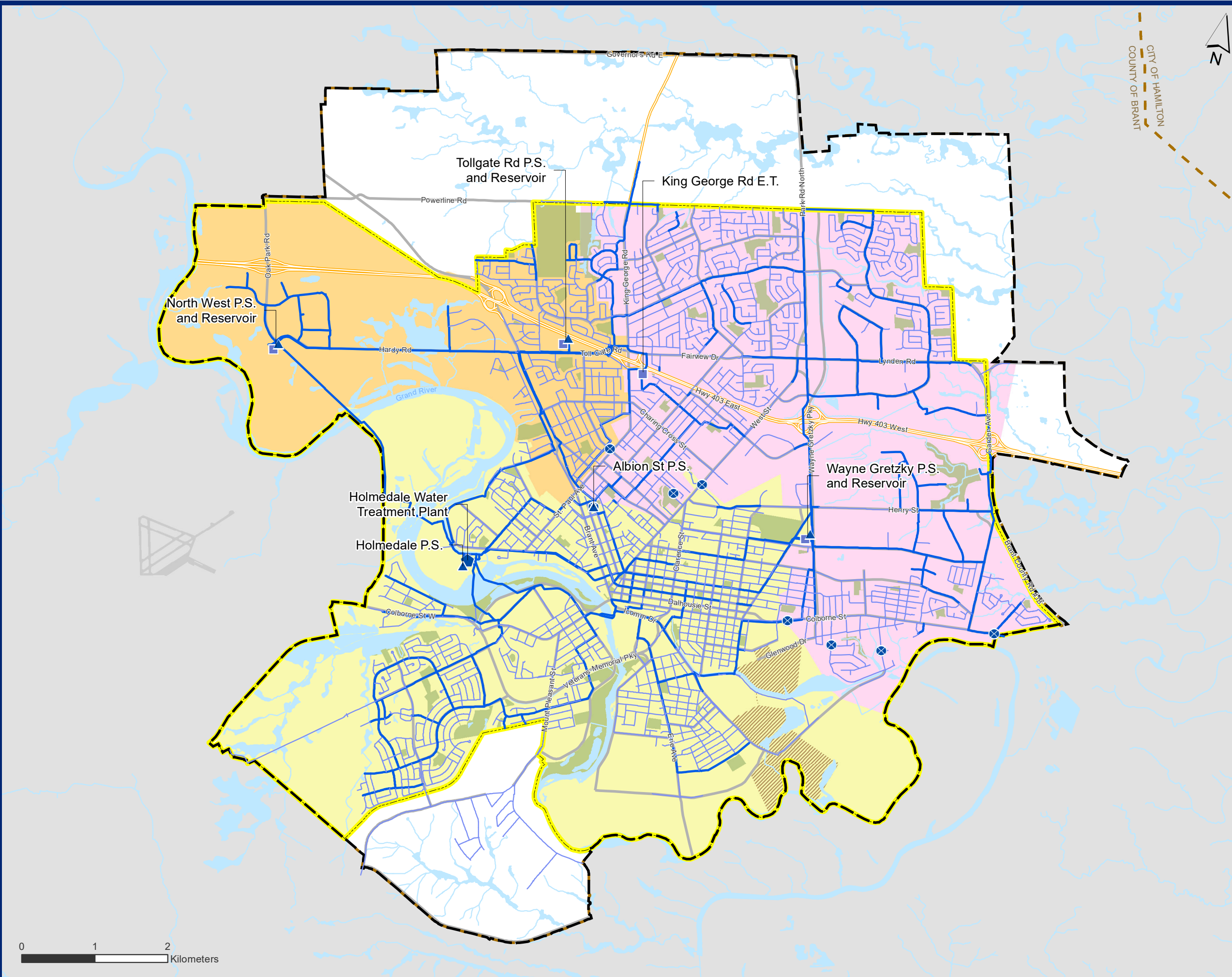


Figure 2
Existing Water System

4.1.1 Tutela Heights Water System

Tutela Heights' existing water system is supplied from the County of Brant Mount Pleasant water system; however, it is expected to be fully integrated into the City's network (and disconnected from the County's system) before 2026. The Tutela Heights system currently operates at a higher HGL than the adjacent City's PD1 which will result in decreased pressures to the existing serviced areas.

4.1.2 Cainsville Water System Connection

Cainsville, in the County of Brant, is currently serviced via a single 300 mm watermain on Colborne Street connecting to the City's PD2/3 which is primarily fed by Tollgate PS, Albion BPS and Wayne Gretzky PS. The City has a continued servicing agreement with the County of Brant to supply Cainsville with required water including existing and proposed future growth.

4.2 Water Treatment Plant

The Holmedale WTP is located at 324 Grand River Avenue, drawing water from the Holmedale Canal; the intake of which is located in the Grand River, 1.5 km upstream of the WTP. The water facility has a current rated treatment capacity of 100 MLD (Million Liters per Day) based on the Drinking Water Works Permit. A review of the individual process capacities was conducted based on background reports and workshops with City staff. **Table 12** includes the WTP processes and corresponding capacities and an overview of the processes is provided in **Figure 3**.

Table 12: Water Treatment Plant Capacity Process Overview

Process	Elements	Installed Capacity (MLD) ⁽¹⁾	Operating/Rated Capacity (m ³ /day) ⁽²⁾
Permit To Take Water (PTTW)	-	260	260
Intake Channel	Storage volume	40.4	40.4
Raw Water Storage	-	260	260
Low Lift Pumping Station	(4) pumps rated @ 45.2 MLD	180	100 – 125
Header	(1) 900 mm diameter pipe	110	110
Polymer Feed System	-	50	50
Actiflo Trains	(2) trains rated @ 70 MLD	140	100
Ozonation	(2) generators and contact chambers @ 50 MLD	100	100
Hydrogen Peroxide (future)	(3) units rated @ 50 MLD	150	100
Filtration	(8) filtration beds	157	105
UV Reactors	(3) units rated @ 50 MLD	150	100
Chlorine Contact Chambers	(2) chambers @ 119 MLD based on 30 min CT	238	119
Residual Management Facility	-	125	100

⁽¹⁾ The installed capacity is the total installed capacity of all units in the process as based on facility specifications

⁽²⁾ The observed/rated capacity is the actual operating capacity of the station based on current facility operations

Water Treatment Plant
Infrastructure

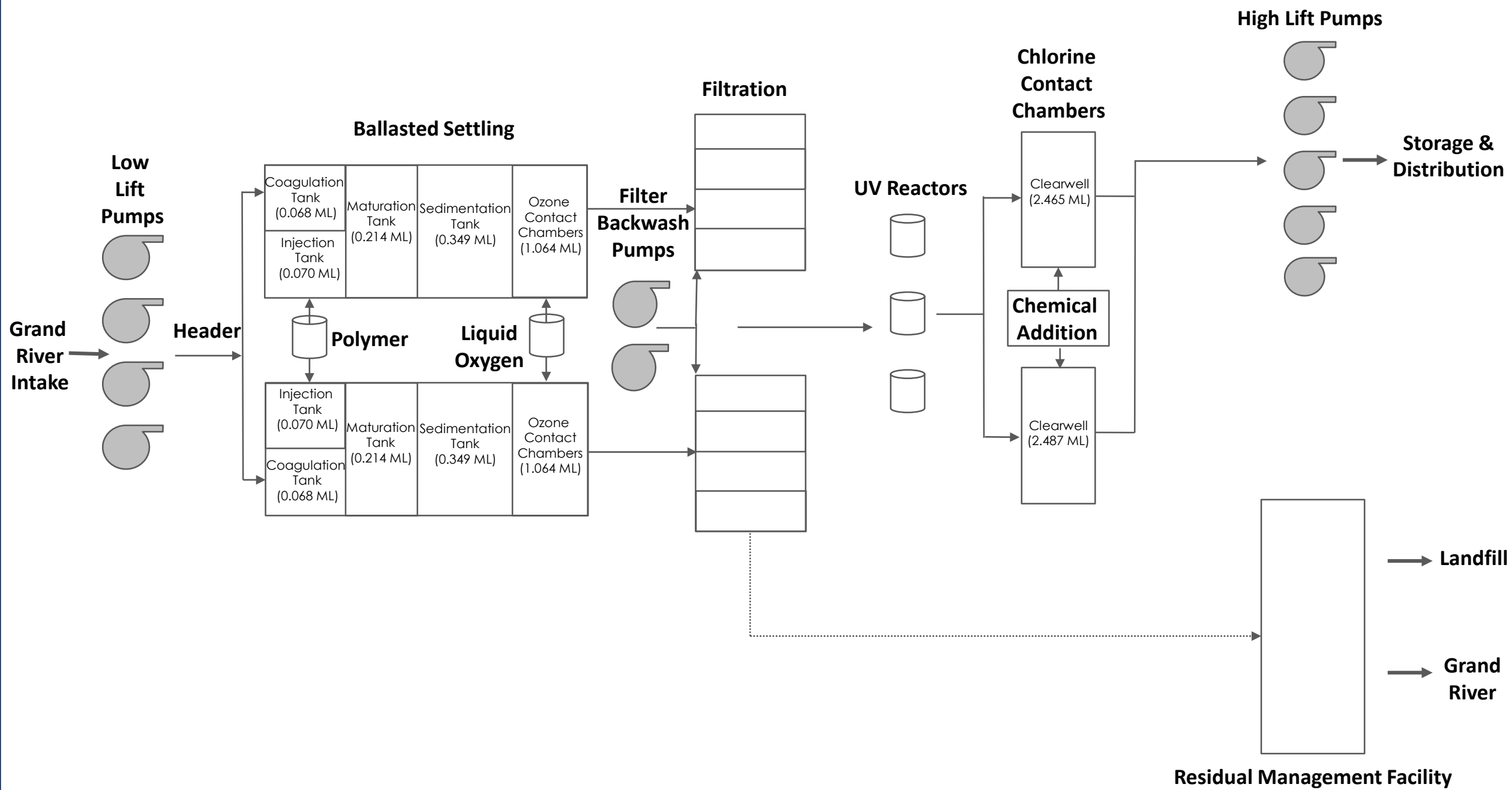


Figure 3
Water Treatment Plant Process
Diagram

4.3 Water Pumping Stations and Storage Facilities

In the City of Brantford water distribution system, there are currently four (4) stand-alone pumping stations throughout the City and one (1) high lift pumping station (HLP) at the WTP. **Table 13** summarizes the pumping facilities capacities.

Table 13: Pumping Facilities

Pressure District	Facility	Pumps	Installed Capacity (MLD) ⁽¹⁾	Firm Capacity (MLD) ⁽²⁾	Observed Firm Capacity (MLD) ⁽³⁾
PD1	Holmedale HLP	5	130.0	100	100
	Total PD1 Firm Capacity				103.7
PD2/3	Albion Street BPS	2	45.8	22.9	22.9
	Tollgate PS	4	93.3	70.0	48.0
	Wayne Gretzky PS	5	90.3	67.7 ⁽⁴⁾	67.7
	Total PD2/3 Firm Capacity				138.5
PD4	Northwest PS	6	47.5	36.3	36.3
	Total PD4 Firm Capacity				36.3

⁽¹⁾ The installed capacity is the total installed capacity of all pumps at the facility based on pump specifications

⁽²⁾ The firm capacity is the capacity with the largest pump out of service based on pump specifications

⁽³⁾ Observed firm capacity is the estimated operating capacity of the station based on pump station pump curves and calculated system curves

⁽⁴⁾ Firm capacity for Wayne Gretzky PS includes two smallest pumps out of service as the pump station operates with two smallest pumps on in conjunction or three largest pumps on in conjunction

There are existing hydraulic and operational limitations that restrict the operational capacity of the Tollgate PS and Wayne Gretzky PS. For the purposes of the MSP analysis, the station’s operational capacity was used.

Under current system operations, the Albion BPS does not operate on a regular basis and is typically only needed during emergency conditions; however, it is manually operated at regular intervals to support maintenance activities.

4.4 Water Storage Facilities

There are currently four (4) reservoirs and two (2) elevated tanks in the City of Brantford water distribution system. **Table 14** summarizes the storage facilities and their installed capacity.

Table 14: Storage Facilities

Pressure District	HGL (m)	Facility	Installed Capacity	Type	Top Water Level (m)
PD 1	271	Holmedale WTP Res	18.3 ML	Pumped	204
		Shellard ET	6.0 ML	Floating	271
PD 2/3	281	Tollgate Res	11.8 ML	Pumped	246
		Wayne Gretzky Res	13.6 ML	Pumped	230
		King George ET	2.7 ML	Floating	282
PD 4	304	North West Res	12.0 ML	Pumped	250

4.5 System Demands

The population and employment projections presented in **Table 8** and Level of Service criteria presented in **Table 1** were utilized to calculate the average day demand (ADD) and the maximum day demand (MDD). Future system demands were developed using the starting point methodology previously discussed. The total projected ADD and MDD are shown in **Table 15** and further detailed in **Appendix B**.

Table 15: System Demands

Pressure District	ADD (MLD)		MDD (MLD)	
	2016	2051	2016	2051
Pressure District 1	14.1	22.8	24.5	40.1
Pressure District 2/3	14.4	32.0	25.2	56.8
Pressure District 4	3.8	8.4	6.6	14.9
Total	32.2	63.2	56.3	111.9

4.5.1.1 County Agreements

The City currently supplies potable water to Cainsville, in the County of Brant, through a 300 mm watermain on Colborne Street. In the 2016 Boundary Adjustment Agreement, signed by the City and the County, the City committed to entering into a Servicing Agreement based on various principles including that the water system capacity will be provided based on the City’s design criteria. The existing and projected ADD and MDD demands for Cainsville are shown in **Table 16**.

Table 16: Cainsville Demands

County of Brant Servicing	Growth Scenario	ADD (MLD)	MDD (MLD)
Cainsville Buildout	2016	0.70	1.40
	Buildout	1.87	3.97
	Growth	1.17	2.57

4.5.1.2 Post Period Considerations

The servicing analysis focuses on servicing the buildout of the internal growth and Settlement Area Boundary Expansion Areas to 2051; however, in the development of the recommended servicing strategy and infrastructure sizing, consideration for the full buildout of the City’s municipal boundary including the Trigger Lands was considered, assuming similar population and employment densities. Where applicable, identification of future facility expansion needs and/or strategic upsizing of linear infrastructure was identified and incorporated into the final servicing plan.

The growth projection for the remainder of the urban boundary area was estimated by applying a density to these remaining areas, not including Natural Heritage Areas. These densities include:

- 25 jobs per hectare for North and East Expansion Employment Lands
- 60 residents and jobs combined per hectare for North and East Expansion Residential Lands
- 55 residents and jobs combined per hectare for Tutela Heights

This approach typically aligns with the residential densities for proposed growth to 2051. The projected ADD and MDD for the buildout of the municipal boundary are shown in **Table 17**.

Table 17: Municipal Boundary Full Buildout Population and Demands

Pressure District	Area (ha)	Population & Employment	ADD (MLD)	MDD (MLD)
Pressure District 1	170	9,361	2.5	4.5
Pressure District 2/3	319	19,162	5.2	9.3
Pressure District 4	63	3,139	0.9	1.6
Total	490	28,522	7.7	13.9

4.6 Hydraulic Water Model

The City’s existing hydraulic model was updated using InfoWater, a water distribution system modelling and management software package by Innovyze.

The model was updated through the following procedure:

- System review through facilities drawings, SCADA and GIS data.
- Direct GIS to model link for pipes, valves, and hydrants.
- Demand analysis and allocation based on billing and plant production records.
- EPS validation through SCADA.
- Establish model scenarios (ADD, MDD, MDD+FF)

4.6.1 Network Development

Updates to the system and watermain were imported directly into the City’s existing GIS water system infrastructure data. Before importing the network information into the model, GIS and existing model pipes were analyzed for any discrepancies with respect to watermain diameter and material. A small number of discrepancies were found, and the correct source of information was identified for each case (GIS or existing model).

System network elevations for each model junction were based on the City’s ground surface contours.

4.6.2 Facility Development

Each system facility was manually reviewed and updated in the model based on available facility site plan drawings, and process flow diagrams, pump curves, and other available information. The scope of the facility development included:

- Reviewing and updating the network configuration around each facility
- Updating the system pumps and pump curves
- Reviewing system storage elements and defining the storage geometry

4.6.3 System Demand Analysis

The system's WTP production demands, detailed in **Table 3**, were evaluated based on SCADA and billing information provided. This process supports determination of:

- Average system demands, including determination of system non-revenue water usage;
- Spatial allocation of system demands; and
- Temporal variation of system demands and peaking factors.

4.6.3.1 Demand Allocation

Using the billing data, average day demand (ADD) were allocated to nodes in the model using a method of spatial allocation. This method takes the average demand of each water meter's parcel and assigns it to the node in the closest proximity.

Further, the average non-revenue water (NRW) from 2014-2016 billing data was distributed equally at each meter and allocated to nodes in the model using the same method of special allocation for the billed demands. The NRW remains constant for all scenarios.

4.6.3.2 Diurnal Demand

System demands were calculated based on the SCADA data provided from 2016-2018 for each of the pressure districts and the point-of-entry. A diurnal curve was created to reflect system average day consumption in 1-hour intervals over a 24-hour period for each of the pressure districts. The demands vary for each pressure district which can be correlated to land use type. The diurnal curves were applied to each pressure district in the model.

4.7 Facility Details, System Control Narrative, and SCADA Validation

SCADA was also used to understand the system control narrative and validate model controls. The model was validated, SCADA versus Model EPS, over seven days during an average day in 2018 based on operations and pump curves following the Pressure District 2/3 and 4 adjustment. This comparison ensured that the model was accurately predicting WTP flow rates, ET levels and cycles, pump controls, and other general system performance.

Calibration is mandatory prior to the use of the model for any capital works decision-making analysis, as well as further applications of the model such as water quality, operations or energy management modelling. The benefits of calibration include discovering and correcting discrepancies in the model data and, occasionally, identification of problems in the field.

5. Assessment of Existing Water Infrastructure

A critical step in the master planning process is the assessment of the existing infrastructure to establish the water system baseline conditions. These baseline conditions will become the basis of the future recommendations of the MSP Update; therefore it was important to ensure that they were determined through a comprehensive detailed analysis of the system. Once the existing system conditions were established, the potential impacts of the future growth demand on the water distribution system were analyzed to develop and recommend future servicing strategies.

The following sections describe the current infrastructure constraints, as well as opportunities for developing and expanding the water system to meet growing demands to the 2051 planning horizon and beyond.

5.1 Opportunities and Constraints

Existing and future water opportunities and constraints were identified through discussions with City staff, as well as through hydraulic analyses and review of infrastructure data (e.g. GIS, design reports, as-built information, etc.). The InfoWater hydraulic model was used to analyze the performance of the existing and future system under different demand conditions such as ADD, MDD, PHD and MDD+FF.

In general, the water distribution system has sufficient capacity to deliver water at acceptable service levels, though there are some areas at the higher or lower end of the acceptable pressure range. **Figure 4** highlights some of the key opportunities and constraints within the City's existing distribution system.

The key opportunities and constraints identified by the City and through the modelling exercise include:

Storage

- Constraints due to storage deficiencies are realized in all three pressure districts by 2051 with limited balancing storage within the existing system
- Opportunity to increase elevated storage to decrease pumping needs
- Opportunity to replace aging King George Elevated Tank with a new, larger elevated tank

Pumping

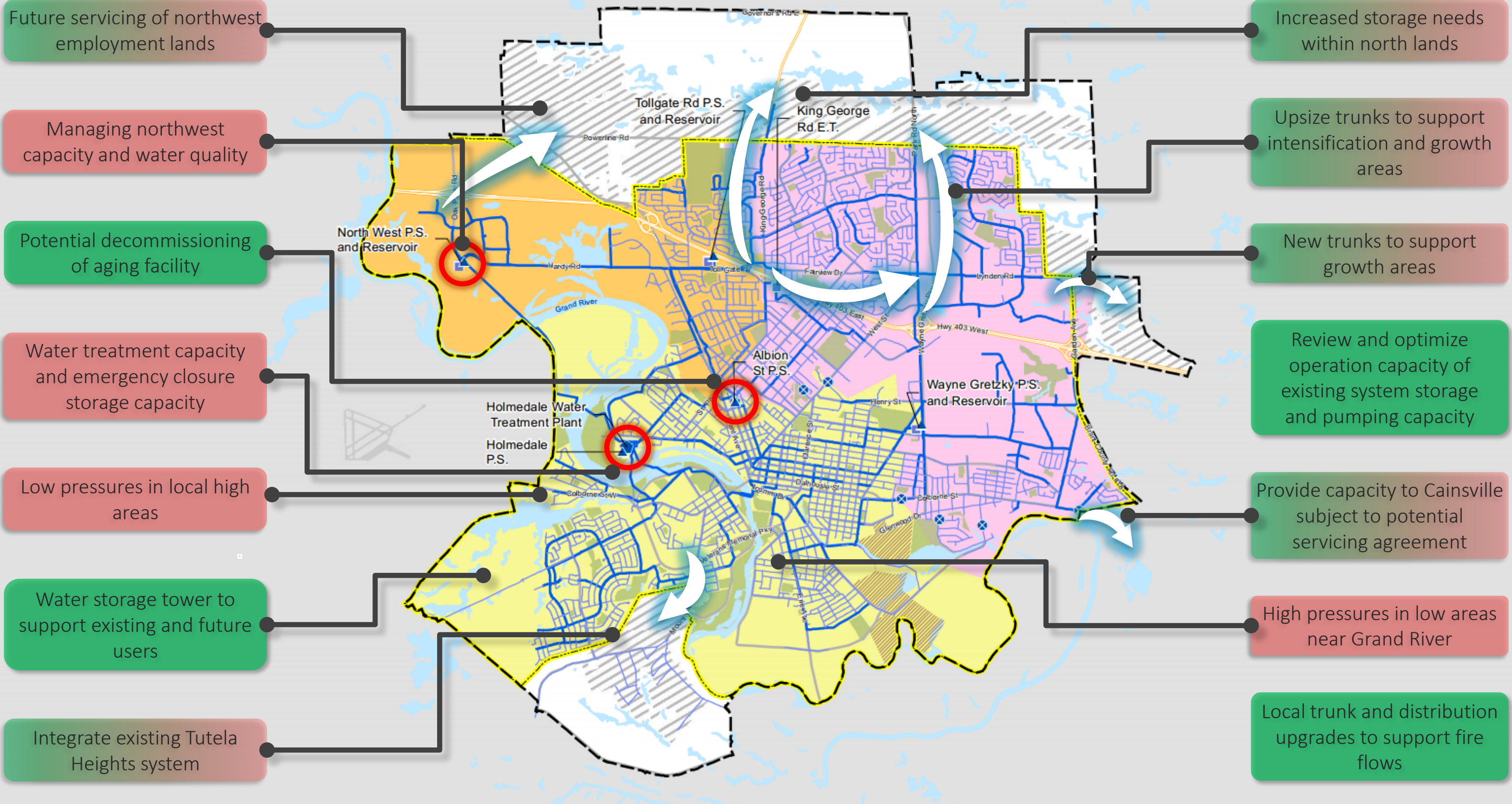
- Limited pumping upgrades needed in PD1 or PD2/3 to accommodate 2051 growth
- PD4 may need pumping upgrades; dependent on storage strategy
- Opportunity to decommission aging Albion BPS

Transmission

- Aging watermains will need to be replaced to improve local conveyance
- Trunk watermain upgrades needed to support intensification areas and to service expansion lands
- Existing system fire flow deficiencies are located primarily downtown, in areas of older cast iron watermains, and in areas with limited trunk conveyance

Pressure

- High and low pressures exist due to variation in elevations



5.2 Facility Capacity

Future facility capacity utilization for storage, pumping and storage are presented in the following section.

5.2.1 Holmedale Water Treatment Plant

The 2020 MSP analyzed the projected growth demand within the Holmedale WTP service area to ensure that the facility has adequate capacity within the 2051 growth horizon.

The starting point methodology identified in **Appendix B** of **Volume II** was used to calculate the projected demands for the Holmedale WTP. **Figure 5** presents the Holmedale WTP’s existing supply capacity versus the long-term supply need. With the full buildout to 2051, the forecasted demand on the WTP will be above its current treatment capacity.

Although the WTP has a rated capacity of 100 MLD, based on discussions with City staff, not all processes within the treatment plant are limited by this capacity and thus the WTP processes were further reviewed to determine limiting capacities and potential opportunities at the existing facility.

Table 18 presents the limitations and opportunities of the processes at the WTP to expand treatment capacity to meet 2051 demand needs. These opportunities were further evaluated to determine alternative solutions for system upgrades.

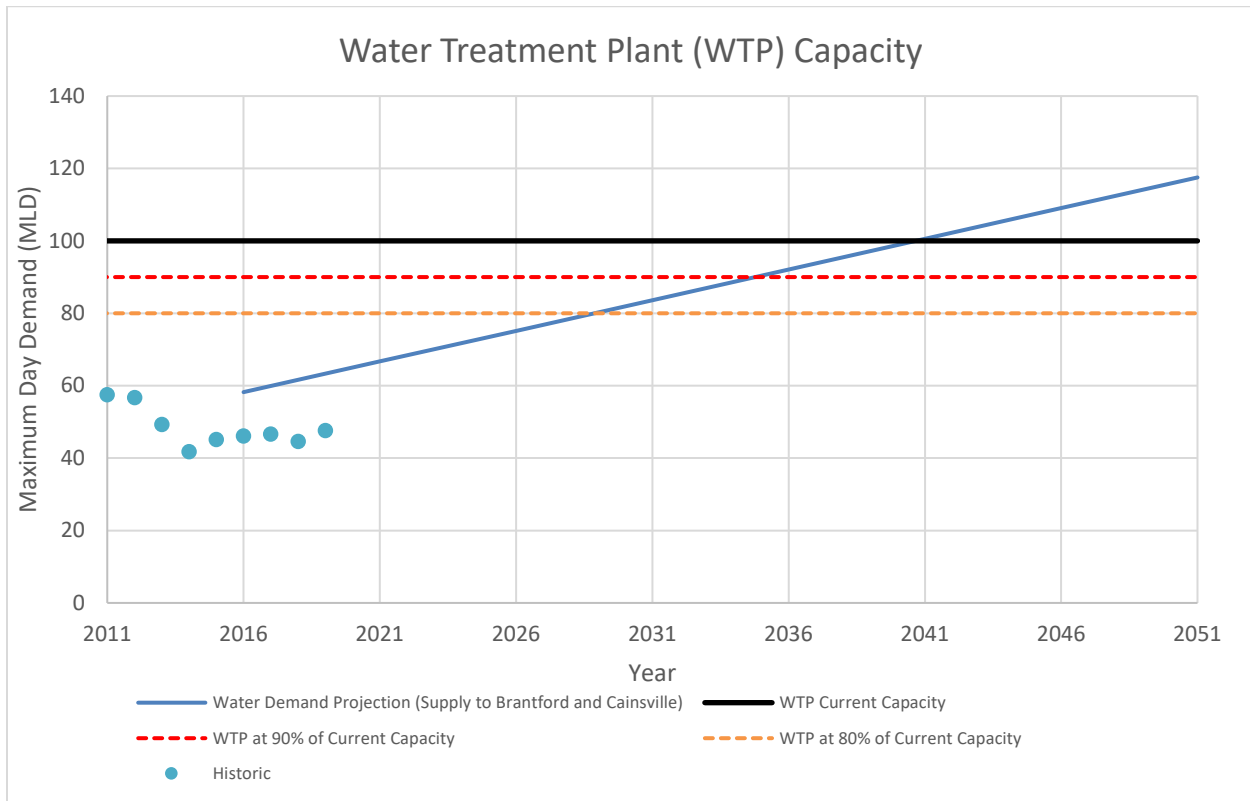


Figure 5: Holmedale WTP Capacity

Table 18: Holmedale WTP Process Limitations & Opportunities

Process	Operating/Rated Capacity (MLD)	Limitations	Opportunities
PTTW	260	<ul style="list-style-type: none"> Existing capacity is sufficient 	<ul style="list-style-type: none"> Existing capacity is sufficient
Low Lift Pumping Station	100 – 125	<ul style="list-style-type: none"> Standby power is limited to a maximum of 3 pumps Hydraulic restriction due to common 900 mm header if all 3 pumps running Pump station is limited in its ability to operate at low flow rates without throttling a valve to raise the system curve so that it intersects the pump curve 	<ul style="list-style-type: none"> To increase operating capacity, Twin existing header (single) to reduce hydraulic restriction during discharge Increase existing pumps capacity Construct additional low lift station with intake structure Provide additional security of supply Increase number of pumps to allow for better low flow controls and add additional capacity Facilitate increased standby power capacity
Header	110	<ul style="list-style-type: none"> Limited opportunity to take header offline to complete condition assessment and existing condition is unknown Security of supply concern with one pipe from low lift pumping station to preliminary treatment 	<ul style="list-style-type: none"> Twin existing header with a new header with equal size 900 mm diameter pipe or smaller diameter pipe to provide excess capacity and security of supply
Polymer Feed System	50	<ul style="list-style-type: none"> Existing polymer pumps are undersized 	<ul style="list-style-type: none"> Only minor upgrades required to expand polymer pump capacity beyond 100 MLD Increase pumping capacity to meet capacity needs Complete process piping upgrades to support pump capacity upgrades
Actiflo Trains	100	<ul style="list-style-type: none"> Actiflo trains do not have enough settling time if exceeding 68 MLD per train No redundancy provided with only two trains Cannot bypass process if Actiflo goes down causing entire WTP to run at half capacity 	<ul style="list-style-type: none"> Increase flow rate to maximize available capacity Construct additional Actiflo train of equal or smaller capacity. There is existing space on site beside existing second Actiflo train. Would require a new building for the train Additional upgrades to other preliminary treatment processes and associated piping.
Ozonation	100	<ul style="list-style-type: none"> Existing ozone equipment is difficult to service as it is obsolete Generator and contact chamber size are limiting factors. Limited space to add third ozone generator to increase capacity to 150,000 m³/day Regular maintenance is required to keep system operational Alternative treatment process to be recommended if ozone is to be eliminated 	<ul style="list-style-type: none"> Increase operating capacity Additional contact chamber cannot be accommodated within the existing building Eliminate ozone process Currently only used for taste and odour
Filtration	105	<ul style="list-style-type: none"> Backwash wells are the limiting factor in the filtration process as it takes too long to re-fill backwash well using existing gravity fed system. Currently limited to wash one filter every 3-4 hours 	<ul style="list-style-type: none"> Add additional filter bed. There is existing space on site to expand. Increase backwash well pump capacity to increase flowrate. Upsize or twin backwash wastewater piping to eliminate process pipe restrictions.

Process	Operating/Rated Capacity (MLD)	Limitations	Opportunities
UV Reactors	100	<ul style="list-style-type: none"> Existing hydraulic limitations with flow splitting between three units 	<ul style="list-style-type: none"> The existing hydraulic limitations can be resolved by adding a fourth unit to provide improved flow balancing.
Chlorine Contact Chambers	119	<ul style="list-style-type: none"> Three existing chlorinators that provide chemical addition are 20 years old and require upgrades 	<ul style="list-style-type: none"> Upgrade or replace existing chlorinators for chemical addition Utilize existing treated water reservoir for contact time
Residual Management Facility	100	<ul style="list-style-type: none"> Flows through the facility are dependent on filter loading; designed for a typical waste stream when plant is running at 100 MLD. Filter loading could cause decrease in facility capacity. Filter backwash tank is limiting process as it is only able to hold one backwash cycle 	<ul style="list-style-type: none"> Upsize or construct additional filter backwash tank to increase backwash cycle time Space to accommodate increase in capacity

5.2.2 Pump Station Capacity

Assessment of pumping capacity was based on the ability of the pumping stations to provide observed firm capacity to meet the required demands in the system on a pressure district by pressure district basis. **Table 19** and **Table 20** presents the pumping requirements within the City to 2051.

Table 19: Water Pumping Requirements

Pressure District	Observed Firm Capacity ⁽¹⁾ (MLD) ¹	Design Condition	2016 Demand (MLD)	2016 Surplus / Deficit (MLD)
Pressure District 1 (including transfer to upper pressure districts)	103.7	MDD+FF	77.9	25.8
Pressure District 2/3 Albion BS Tollgate Rd PS Wayne Gretzky PS	138.6	MDD+FF	46.8	91.7
Pressure District 4 North West PS	36.3	MDD+FF	28.2	8.1

⁽¹⁾ Observed firm capacity is the estimated operating capacity of the station based on pump station pump curves and calculated system curves

Table 20: Growth Water Pumping Requirements

Pressure District	Design Condition	Growth Demand (MLD)	Surplus / Deficit (MLD)
Pressure District 1 (including transfer to upper pressure districts)	MDD+FF	133.5	-29.8
Pressure District 2/3 Albion BS Tollgate Rd PS Wayne Gretzky PS	PHD	85.3	53.3
Pressure District 4 North West PS	MDD+FF	36.5	-0.2

It is noted that Pressure District 1 and Pressure District 2/3 have existing elevated storage facilities; however, in both Pressure Districts there is insufficient floating storage to independently provide balancing storage or fire storage and are dependent on pumped storage to support peak flow needs. As such, pumping capacity for Pressure District 1 and Pressure District 2/3 are required to provide the greater of peak hour demand or max day + fire flow demand.

Pressure District 4 has no floating storage and is entirely dependent on the pump station to provide flow under all conditions. Pumping capacity requirements for Pressure District 4 is to provide the greater of peak hour demand or max day + fire flow demand.

Based on the pumping capacity review:

- Pressure District 1 has insufficient capacity to service 2051 growth. Pumping upgrades are needed to support the combined growth, external servicing agreement, and operational reserve capacity.
- Pressure District 2/3 currently has sufficient pumping capacity to meet peak flow conditions in 2051
- Pressure District 4 is just over capacity under 2051 demand conditions, and capacity needs will need to be monitored and re-assessed as the pressure district buildout occurs.

In addition to the pumping capacity review, opportunities to optimize the operation of the existing Pressure District 2/3 pump stations were identified:

- The existing Albion BPS is not utilized under typical conditions; however, it requires ongoing maintenance needs. With the projected 2051 growth needs, there remains sufficient pumping capacity within Pressure District 2/3 such that the Albion BPS is not needed under typical operating conditions. There is an opportunity to decommission the Albion BPS following the construction of additional storage within PD2/3.
- The existing Tollgate PS and Wayne Gretzky PS operational capacity is well below the total installed capacity. There is an opportunity to address the existing constraints at both PS to increase the available operational capacity at each station.

Servicing strategies and concepts related to pumping needs are further described in **Section 7**.

5.2.3 Storage Capacity

Water storage is provided at several facilities throughout the City as previously identified in **Table 14**. **Table 21** and **Table 22** summarize existing storage volumes by pressure district, growth maximum day demands and projected growth storage requirements.

Table 21: Existing Storage Requirements

Pressure District	Storage Capacity (ML)	2016 Capacity Required (ML)				2016 Surplus / Deficit (ML)
		Equalization	Fire	Emergency	Total	
Pressure District 1 Holmedale WTP Res Shellard ET	24.30	6.12	8.16	7.14	21.43	2.87
Pressure District 2/3 Tollgate Res Wayne Gretzky Res King George ET	28.10	6.31	8.16	7.24	21.71	6.39
Pressure District 4 North West Res	12.00	1.64	2.37	2.01	6.02	5.98

Table 22: 2051 Storage Requirements

Pressure District	Storage Capacity (ML)	2051 Capacity Required (ML)				2041 Surplus / Deficit (ML)
		Equalization	Fire	Emergency	Total	
Pressure District 1 Holmedale WTP Res Shellard ET	24.30	10.02	8.16	9.09	27.28	-2.98
Pressure District 2/3 Tollgate Res Wayne Gretzky Res	25.40	14.21	8.16	11.19	33.56	-5.46
Pressure District 4 North West Res	12.00	3.73	6.00	4.87	14.60	-2.60

Based on the storage review, 2051 growth needs are anticipated to trigger storage deficits in all pressure districts

Based on discussions with the City, the King George ET will need major rehabilitation or replacement in the next 10 years, presenting an opportunity to replace and relocate PD2/3 storages. The above table includes the PD2/3 deficit including the available capacity at King George ET. Without the King George ET, the 2051 deficit is 8.16 MLD. With the trigger lands and without the King George ET, the PD2/3 deficit is 11.65 MLD.

It is also noted that the existing King George ET elevation limits the available pressure within Pressure District 2/3 resulting in marginal pressure with the high elevation areas of PD2/3. The replacement of the King George ET provides an opportunity to optimize the operating levels of Pressure District 2/3 and improves system pressures. This is only feasible when combined with pumping improvements at the Tollgate PS and Wayne Gretzky PS.

Servicing strategies and concepts related to storage needs are further described in **Section 7**.

5.3 System Performance

The City's hydraulic water model was used to support the assessment of the water system's watermain capacity.

5.3.1 Transmission (Trunk Watermains)

Based on the hydraulic modelling results, the existing trunk watermains generally have sufficient capacity to move water under maximum day conditions as presented in **Figure 6**; however, the following trunk watermain needs were identified:

- New trunk watermain to convey flows to expansion areas (North Expansion Lands, East Expansion Lands and Tutela Heights)
- New trunk watermain to convey flows east-west within Pressure District 2/3
- New trunk watermain to convey flows in Pressure District 1 east and south within intensification areas

Servicing strategies are further described in **Section 7**.

5.3.2 Distribution (Local Watermains)







Fire flow deficiencies were identified using a land-use based approach, where the governing land-use, at the closest fire hydrant, determined the fire flow target identified in **Section 2.4.2**. **Figure 7** presents the fire flow deficiencies under existing conditions.

Deficiencies are typically along intensification corridors, pressure district boundaries and along older or smaller watermains.





Peak Velocity

- <0.5 m/s
- 1.5-2.0 m/s
- 0.5-1.0 m/s
- >2.0 m/s
- 1.0-1.5 m/s

Water Network

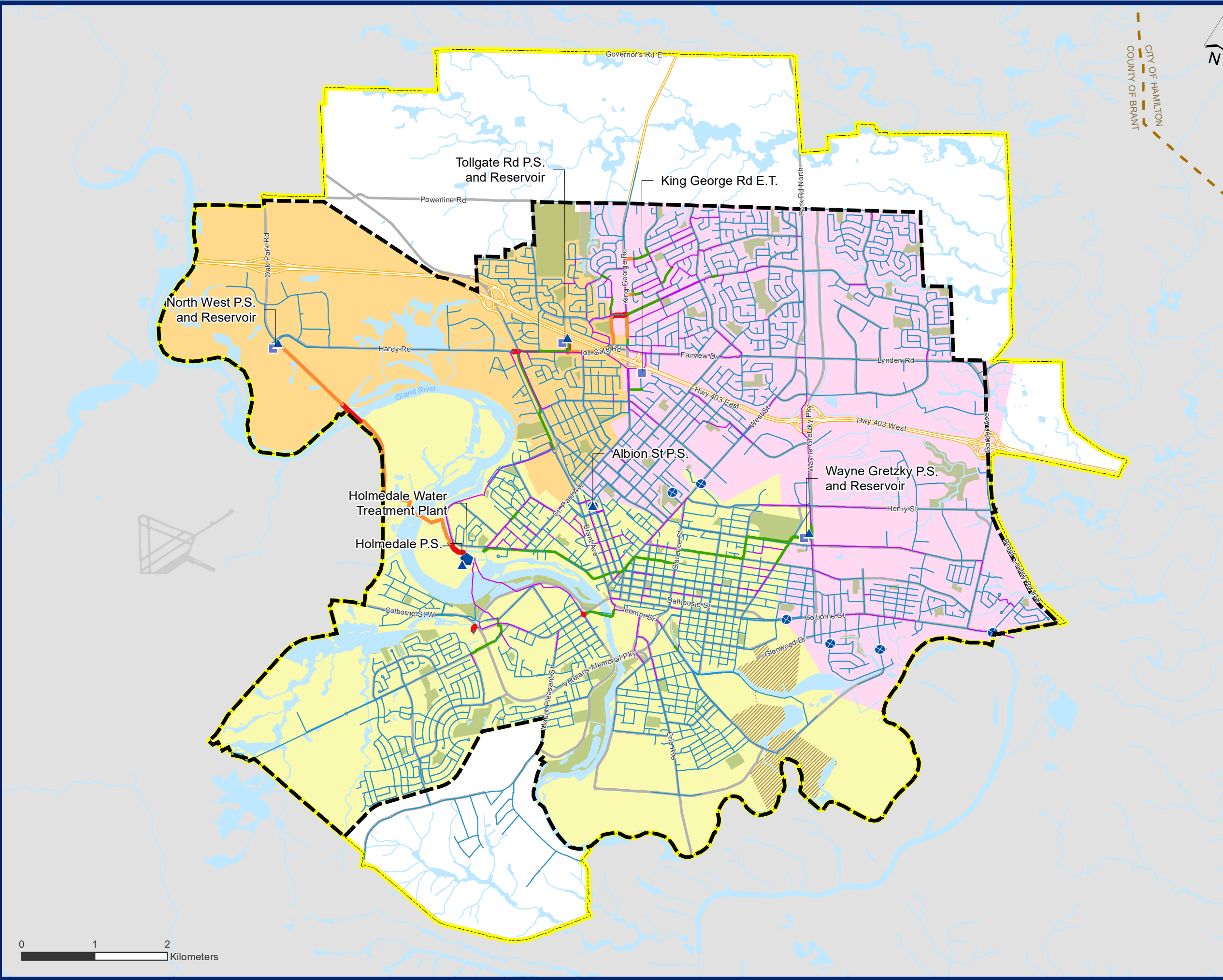
-  Water Treatment Plant
-  Pumping Station
-  Elevated Tank / Reservoir
-  Pressure Reducing Valve
-  Watermain (< 400 mm)
-  Water Transmission (>= 400 mm)

Water Pressure Districts

-  Pressure District 1
-  Pressure District 2/3
-  Pressure District 4
-  Pressure District 4 Expansion

General Features

-  Expressway / Highway
-  Arterial and Collectors
-  2016 Municipal Boundary
-  New Municipal Boundary
-  Six Nations of the Grand River Territory
-  Outside Municipalities
-  Parks
-  Waterbody



CITY OF HAMILTON
COUNTY OF BRANT

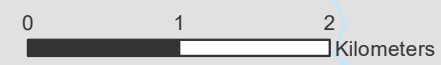


Figure 6
Existing Max Day Demand (MDD) Peak Velocity

Fire Flow Deficiencies

- <80% FF Criteria
- 80-100% FF Criteria

Water Network

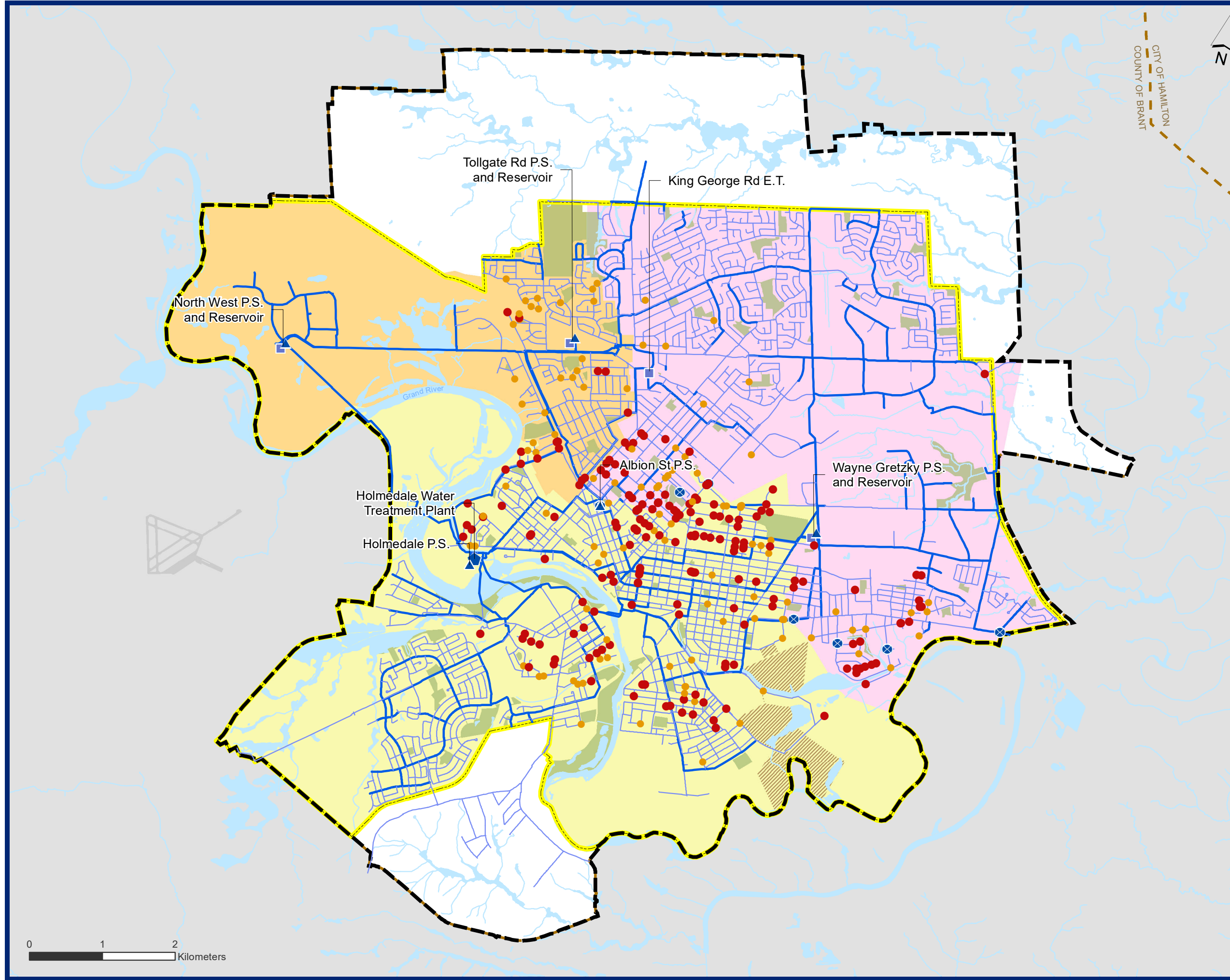
- Water Treatment Plant
- Pumping Station
- Elevated Tank / Reservoir
- Pressure Reducing Valve
- Watermains (< 400 mm)
- Water Transmission (>= 400 mm)

Water Pressure Districts

- Pressure District 1
- Pressure District 2/3
- Pressure District 4

General Features

- Expressway / Highway
- Arterial and Collectors
- 2016 Municipal Boundary
- New Municipal Boundary
- Six Nations of the Grand River Territory
- Outside Municipalities
- Parks
- Waterbody



**Figure 7
Existing Fire Flow
Deficiencies**

5.3.3 Pressures

Low pressure areas in the system were identified as presented in **Figure 8** and include:

- **Colborne Street West:** There is a proposed development and 6 existing properties on Colborne Street West extending west to the municipal boundary in Pressure District 1 with low pressures (<40 psi) due to increased elevations.
- **Strawberry Hill:** There are existing low pressures from Shellard Lane to Mount Pleasant Street.

5.4 Servicing of Expansion Lands

The Settlement Area Boundary Expansion Lands will require municipal water servicing via an extension of the City's existing water system.

Minimum Pressure (psi)

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

Water Network

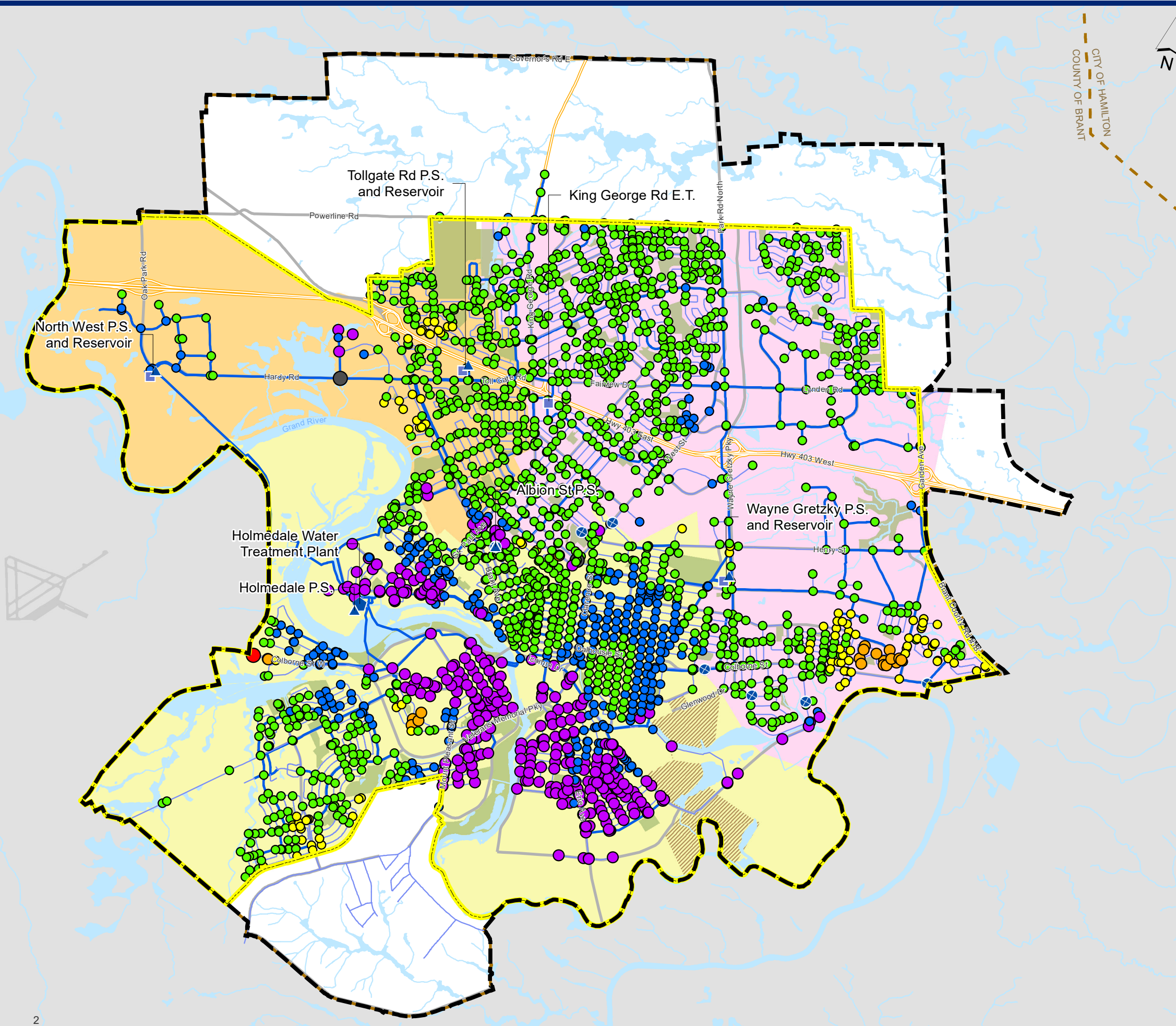
- Water Treatment Plant
- ▲ Pumping Station
- Elevated Tank / Reservoir
- ⊗ Pressure Reducing Valve
- Watermains (< 400 mm)
- Water Transmission (>= 400 mm)

Water Pressure Districts

- Pressure District 1
- Pressure District 2/3
- Pressure District 4
- ▨ Pressure District 4 Expansion

General Features

- Expressway / Highway
- Arterial and Collectors
- 2016 Municipal Boundary
- New Municipal Boundary
- ▨ Six Nations of the Grand River Territory
- Outside Municipalities
- Parks
- Waterbody



**Figure 8
Existing Max Day Demand
(MDD) Minimum Pressure**

5.5 County Servicing

The City currently supplies potable water to Cainsville, in the County of Brant, through a 300 mm watermain on Colborne Street. In the 2016 Boundary Adjustment Agreement, signed by the City and the County, the City committed to entering into a Servicing Agreement based on various principles including that the water system capacity will be provided based on the City’s design criteria.

A future storage deficit within the Cainsville system requires upgrades which will be provided in one of the two proposed ways, shown in **Figure 9**:

- New Elevated Tank in Cainsville
- Second supply connection to the City

The future servicing method for the Cainsville system will impact the flow required from the City. If a new ET is constructed (Option 1), the City’s system will only need to meet MDD, as the new storage will provide peak flow balancing within the Cainsville system. If a new ET is not constructed and a second supply connection from the City is required (Option 2), the new connection will need to have sufficient capacity to support full peak hour demands in Cainsville.

The City’s strategy for servicing Cainsville includes accounting for a new ET in Cainsville and ensuring there is water infrastructure to support the new ET. The City will continue to provide MDD flows including buildout in Cainsville.

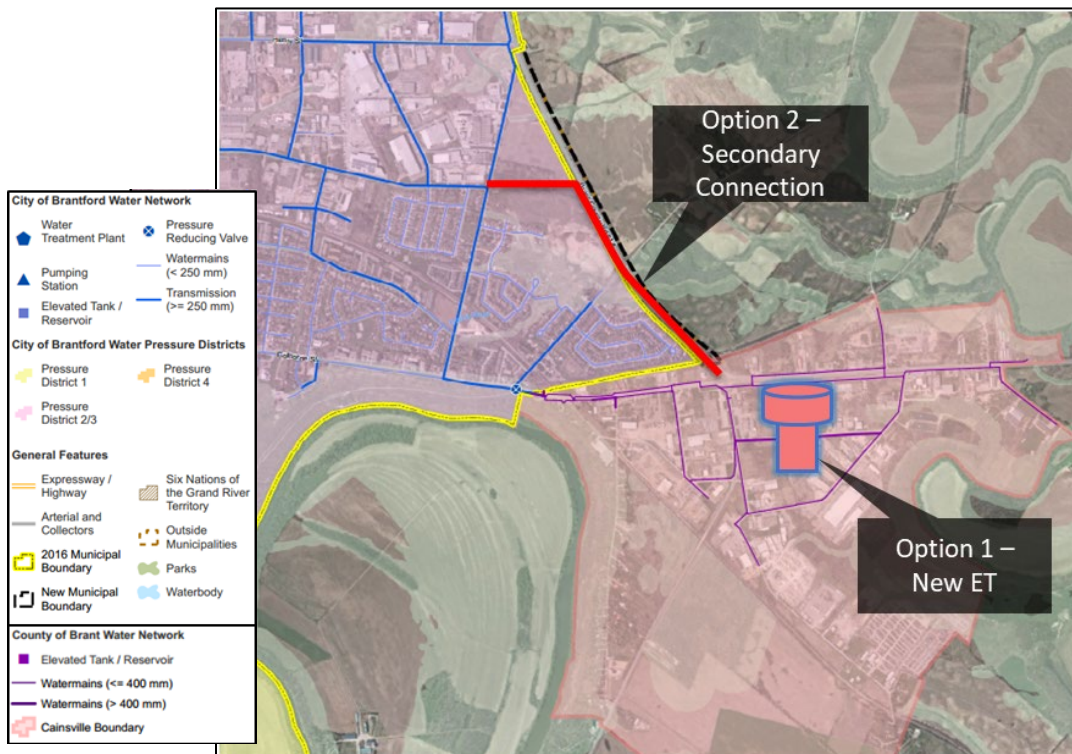


Figure 9: Cainsville Servicing

6. Concepts to Servicing of Expansion Lands

The Settlement Area Boundary Expansion Lands will require municipal water servicing via an extension of the City's existing water system. A broad range of water servicing concepts were established based on high level feasibility to meet the servicing requirements for the North and East Expansion Lands and Tutela Heights. The concepts are based on the City's existing water system configuration and capacity, existing ground elevations within the expansion lands, and the identified natural heritage system.

All opportunities are dependent on the overall servicing concept and ultimate strategy as outlined in **Sections 7** and **8**. Figures for the servicing concepts for the expansion lands are included in **Appendix C**.

6.1 North Expansion Lands

The North Expansion Lands will be serviced via connections to the existing system's trunk watermain along the northern boundary including connections at Oak Park Road, King George Road, Park Road North and Brantwood Park Road.

Servicing opportunities were considered and are outlined below including:

- King George and Oak Park Supply
- Park Road North and Oak Park Supply
- Pressure District 2/3 Supply Only
- Pressure District 4 Supply Only

6.1.1 King George and Oak Park Supply Concept

Under this concept, the residential lands will be serviced as an extension of the City's existing PD2/3, with supply provided predominantly via a new trunk watermain generally along the King George Road and Toll Gate Road right-of-way from Tollgate PS to the North Expansion Lands, with Tollgate PS acting as the primary supply source. Water servicing within the residential North Expansion Lands will consist of a looped watermain network with the trunk watermain generally following the east-west collector road system making a secondary connection to the Park Road North trunk watermain. Under this strategy, upgrades to the existing water system that are needed to support the North Expansion Lands are concentrated within the King George Road alignment. The Park Road North watermain connection is intended to provide a secondary supply source within the limits of the trunk watermain's existing capacity.

The employment lands will be predominately serviced as an extension of the City's PD4, with supply provided via an extension of the existing Oak Park Road trunk watermain, with the North West PS acting as the supply source. Water servicing within the employment North Expansion Lands will consist of a looped watermain network with the trunk watermain generally following the east-west collector road system making a secondary connection to Paris Road.

To support increased pumping and storage needs resulting from the North Expansion Lands, two new ETs, generally located along King George Road in PD2/3 and the north-south collector road, north of Highway 403 in PD4 will be needed. The new PD2/3 ET will replace the City's existing King George ET; as such, the ET and support watermain infrastructure will need to be sized to support both the residential North Expansion Lands and existing PD2/3 needs. The new PD4 ET and support watermain infrastructure will be sized to support the employment North Expansion Lands and existing PD4 needs.

6.1.2 Park Road North and Oak Park Supply Concept

Under this concept, the residential lands will be serviced as an extension of the City's existing PD2/3, with supply provided predominantly via a new trunk watermain generally along the Park Road North right of way, with Wayne Gretzky PS acting as the primary supply source. Water servicing within the residential Settlement Area Boundary Expansion Lands will consist of a looped watermain network with the trunk watermain generally following the east-west collector road system making a secondary connection to the King George trunk watermain. Under this strategy, upgrades to the existing water system needed to support the North Expansion Lands are needed along the Park Road North alignment for north-south conveyance. The King George watermain connection is intended to provide a secondary supply source within the limits of the trunk watermain's existing capacity.

The employment lands will be predominantly serviced as an extension of the City's PD4, with supply provided via an extension of the existing Oak Park Road trunk watermain, with the North West PS acting as the supply source. Water servicing within the employment North Expansion Lands will consist of a looped watermain network with the trunk watermain generally following the east-west collector road system making a secondary connection to Paris Road.

To support increased pumping and storage needs resulting from the North Expansion Lands, two new ETs, generally located along King George Road in PD2/3 and the north-south collector road, north of Highway 403 in PD4 will be needed. The new PD2/3 ET will replace the City's existing King George ET; as such, the ET and support watermain infrastructure will need to be sized to support both the residential North Expansion Lands and existing PD2/3 needs. The new PD4 ET and support watermain infrastructure will be sized to support the employment North Expansion Lands and existing PD4 needs.

6.1.3 Pressure District 2/3 Supply Only Concept

Under this concept, the residential lands will be serviced as an extension of the City's existing PD2/3, with supply provided via new trunk watermains along the King George Road and Park Road North right of ways, with Tollgate PS and Wayne Gretzky PS as supply sources. Water servicing will extend east-west along the collector road to the Employment Expansion Lands which will be serviced by a new Booster Pumping Station (BPS) as the employment lands are located at a higher elevation than the residential lands. Under this strategy, the extent of the employment lands serviced by the BPS will be the smallest area based on limiting elevations. Upgrades to the existing water system needed to support the expansion lands are required along both the King George Road and Park Road North alignments to provide security of supply. Under this strategy, a Highway 403 crossing will not be required as the North West PS will not be used as a supply source.

To support increased pumping and storage needs resulting from the North Expansion Lands, a new ET, generally located along King George Road will be needed. The new ET will replace the City's existing King George Road ET; and as such, the ET and supporting watermain infrastructure will need to be sized to support both the North Expansion Lands and existing PD2/3 needs.

6.1.4 Pressure District 4 Supply Only Concept

Under this concept, the North Expansion lands will be serviced as an extension of the City's existing PD4, with supply provided predominantly via a new trunk watermain along the Oak Park Road right of way, with North West PS acting as the primary supply source. Water servicing will consist of a trunk watermain generally following the east-west collector road. Residential Expansion Lands will be serviced by the east-west trunk watermain system, which requires a PRV from the high elevations in the western employment lands to the eastern residential lands. Secondary connections will be made in the residential lands at King George Road and Park Road North. Under this strategy, upgrades to the existing water system needed to support the expansion lands are concentrated within the Oak Park Road alignment and second trunk watermain along Paris Road, with pumping capacity upgrades required at the North West PS. The King George Road and Park Road North watermain connections are intended to provide secondary supply sources within the limits of the trunk watermains existing capacity.

To support increased pumping and storage needs resulting from the North Expansion Lands, a new ET, generally located within the new employment lands will be needed. Under this configuration the City's existing King George Road ET will be maintained and will require major rehabilitation.

6.2 East Expansion Lands Servicing Concepts

Water servicing for the East Expansion Lands along the eastern boundary are characterized by a general downward slope southwest to the northeast. As elevations are decreasing, only a portion of the East Expansion Lands can be serviced by the existing PD2/3. The East Expansion Lands will be serviced by connections to the existing system at Lynden Road and Sinclair Boulevard.

Servicing opportunities were considered and are outlined below including:

- New Pressure District
- Private PRVs
- Pressure District 4 Expansion

6.2.1.1 New Pressure District Concept

Under this concept, the residential lands will be serviced by an extension of the City's existing PD2/3, with supply provided predominantly via a new trunk watermain along Lynden Road. Water servicing within the residential lands will consist of a looped watermain network following the collector road system.

The employment lands south of Lynden Road will be serviced via a watermain extension along the Lynden Road right of way and a watermain extension along Sinclair Boulevard, including two new PRV's to create a new pressure district. Trunk watermains will extend between Lynden Road and Sinclair Road along the collector road system, creating a looped watermain system. The Sinclair Road watermain connection is intended to provide a secondary supply source within the limits of the watermain's existing capacity.

6.2.1.2 Private PRVs Concept

Under this concept, the residential lands will be serviced by an extension of the City's existing PD2/3, with supply provided predominantly via a new trunk watermain along Lynden Road. Water servicing within the residential lands will consist of a looped watermain network following the collector road system.

The employment lands south of Lynden Road will be serviced via a watermain extension along the Lynden Road right of way and a watermain extension along Sinclair Boulevard. Private PRV's will be installed at identified local high points in the employment lands to ensure pressures are within an acceptable range. Trunk watermains will extend between Lynden Road and Sinclair Road along the collector road system, creating a looped watermain system. The Sinclair Road watermain connection is intended to provide a secondary supply source within the limits of the watermain's existing capacity.

6.2.1.3 Pressure District 4 Expansion Concept

Under this concept, the existing PD4 boundary will be expanded east to Wayne Gretzky Parkway and PD3 will extend west to Wayne Gretzky Parkway. The new PD3 will operate at a lower HGL than the existing PD2/3.

The east expansion lands will be serviced by an extension of the City's PD3, with supply provided predominantly via a new trunk watermain along Wayne Gretzky Parkway. The residential lands north of Lynden Road will be serviced via a new trunk watermain along Lynden Road. Water servicing within the East Residential Lands will consist of a looped watermain network following the collector road system.

The employment lands south of Lynden Road will be serviced via a watermain extension along the Lynden Road right of way and a watermain extension along Sinclair Boulevard. Trunk watermains will extend between Lynden Road and Sinclair Road along the collector road system, creating a looped watermain system. Direct connections will be made to the new PD3, with no additional PRV's needed. The Sinclair Road watermain connection is intended to provide a secondary supply source within the limits of the watermain's existing capacity.

6.3 Tutela Heights Concepts

Tutela Heights' existing water system is supplied from the County of Brant Mount Pleasant water system; however, it is expected to be fully integrated into the City's network (and disconnected from the County's system) before 2026. The Tutela Heights system currently operates at a higher HGL than the adjacent City PD1 which will result in decreased pressures to the existing serviced areas after the integration.

Servicing opportunities were considered and are outlined below including:

- Connect Only
- Connect and Upgrade Local Network
- Connect, Upgrade and Loop
- Connect, Upgrade, Loop and Booster Pumping Station

6.3.1.1 Connect Only Concept

Under this concept, the existing system and expansion lands will be serviced by an extension of the City's existing PD1, with supply provided via trunk watermains along the Mount Pleasant Road and Conklin Road right of ways, with Holmedale WTP acting as the primary supply source. The trunk watermains along Mount Pleasant Road and Conklin Road will extend from the City's PD1 to the existing County system, with no upsizing completed in Tutela Heights's existing system. The distribution network from the County of Brant will be disconnected, resulting in lower pressures connected to the City's water system than the County's water system, and automatic flushing devices will be installed at dead ends.

Water servicing within the existing lands will be provided by the existing infrastructure, with no additional upgrades completed. The residential lands will be serviced by a new trunk watermain along the collector road system, extending from the Mount Pleasant Road and Tutela Heights Road to create a looped watermain network.

6.3.1.2 Connect and Upgrade Local Network Concept

Under this concept, the existing system and expansion lands will be serviced by an extension of the City's existing PD1, with supply provided via trunk watermains along the Mount Pleasant Road and Conklin Road right of ways, with Holmedale WTP acting as the primary supply source. The trunk watermain along Mount Pleasant Road and Conklin Road will be upsized in Tutela's existing system to provide a better trunk loop. The distribution network from the County of Brant will be disconnected, resulting in lower pressures connected to the City's water system than the County's water system, and automatic flushing devices will be installed at dead ends.

Local watermains within the existing system will be upsized to meet the City's existing level of service. The residential lands will be serviced by a new trunk watermain along the collector road system, extending from the upsized trunk watermains along Mount Pleasant Road and Conklin Road to create a looped watermain network.

6.3.1.3 Connect, Upgrade and Loop Concept

Under this concept, the existing system and expansion lands will be serviced by an extension of the City's existing PD1, with supply provided via trunk watermains along the Mount Pleasant Road and Conklin Road right of ways, with Holmedale WTP acting as the primary supply source. The trunk watermain along Mount Pleasant Road and Conklin Road will be upsized in Tutela's existing system to provide a better trunk loop. The distribution network from the County of Brant will be disconnected, resulting in lower pressures connected to the City's water system than the County's water system.

Local watermains within the existing system will be upsized to maintain or increase the existing level of service. The residential lands will be serviced by a new trunk watermain along the collector road system, extending from the upsized trunk watermains along Mount Pleasant Road and Conklin Road to create a looped watermain network. To support water quality in the Tutela Heights system, a new watermain will be extended through an unopened road allowance from Mount Pleasant Road to Tutela Heights Road along Phelps Road. The remaining existing watermains, along Mount Pleasant from Phelps Road to the municipal boundary and along the Tutela Heights from Davern Road to the municipal boundary, which are servicing existing local properties will need automatic flushers as they are dead ends.

6.3.1.4 Connect, Upgrade, Loop and Booster Pumping Station Concept

Under this concept, the existing system and expansion lands will be serviced by an extension of the City's existing PD1, with supply provided via trunk watermains along the Mount Pleasant Road and Conklin Road right of ways, with Holmedale WTP acting as the primary supply source. The trunk watermain along Mount Pleasant Road and Conklin Road will be upsized in Tutela's existing system to provide a better trunk loop. The distribution network from the County of Brant will be disconnected.

Local watermains within the existing system will be upsized to maintain or increase the existing level of service. The residential lands will be serviced by a new trunk watermain along the collector road system, extending from the upsized trunk watermains along Mount Pleasant Road and Conklin Road to create a looped watermain network. To support water quality in the Tutela Heights system, a new watermain will be extended through an un-opened road allowance from Phelps Road to Tutela Heights Road, eliminating the need for additional automatic flushing devices.

In addition to the local system upgrades, a new BPS and Res will be installed to improve system pressures. The BPS will provide pressures similar to the current pressures, experienced in the County system, which would otherwise decrease as a result of a connection to the City's PD1.

7. Water Servicing Concepts

Water servicing concepts were developed under the context of identifying high level servicing solutions or concepts to address both system wide and local opportunities and constraints. These concepts focus on the existing water system while still accommodating growth within the North Expansion Lands, East Expansion Lands, and Tutela Heights. This long list of servicing concepts was developed first to evaluate the feasibility to either be carried forward for further analysis and consideration or being screened out completely.

The following sections summarize all water servicing concepts, with their advantages and disadvantages, such that only desired concepts are carried forward as servicing strategies for further evaluation and costing.

7.1 Servicing Concept Development

As part of this Master Servicing Plan, water concepts were reviewed for existing and future growth areas in order to select the servicing concepts that:

- Make best use of existing infrastructure to avoid new infrastructure where possible;
- Minimize cost of new infrastructure;
- Consider operation and maintenance costs to ensure financial sustainability;
- Ensure long term reliability and security of the water system;
- Increase system resilience to climate change;
- Avoid/minimize environmental crossings and other disruptions to the environment where possible;
- Avoid disruptions to cultural heritage resources;
- Plan for future infrastructure within the existing road right-of-way where possible;
- Avoid/reduce production of Greenhouse Gas Emissions; and,
- Avoid/minimizes impact to areas where a disturbance could represent a significant drinking water threat.

Water servicing concepts were identified and reviewed for existing and future growth areas within the City of Brantford in order to select the best servicing strategies for the system.

7.2 Holmedale Water Treatment Plant

The capacity of the existing treatment plant is not sufficient to accommodate all projected growth. As such, upgrades are required to facilitate development. The following concepts, detailed in **Table 23**, were presented to address the additional growth demand and figures are included in **Appendix D**.

Table 23: Holmedale WTP Concepts

Holmedale WTP Upgrades	
The following concepts to upgrade the capacity at the Holmedale WTP were reviewed.	
Concept 1: Minimal process upgrades – 100 MLD	
Under this concept, the WTP will remain as 100 MLD. Although the existing rated capacity is 100 MLD, minor upgrades will be required to ensure all processes can supply this capacity. The polymer pumps will require upgrades to the pumping capacity and process piping.	
Advantages	Disadvantages
<ul style="list-style-type: none"> Minimal upgrades required 	<ul style="list-style-type: none"> Only services existing system and City growth to 2031 No focus on security of supply
Carried Forward	
Concept 2A: Moderate process upgrades – 125 MLD	
Under this concept, the WTP capacity will be re-rated to 125 MLD. For all processes to meet this capacity, moderate upgrades are required including twinning the header with the same size or smaller diameter pipe, pumping capacity and process piping upgrades to the polymer pumps, capacity increases to the ozonation through an additional generator and contact chamber or re-rating the process to reduce contact time, and a larger future hydrogen peroxide system.	
Advantages	Disadvantages
<ul style="list-style-type: none"> Moderate process upgrades required Interim solution that can support phased expansion of the plant 	<ul style="list-style-type: none"> Interim solution to service City growth and Cainsville lands to 2051 No flexibility to service additional growth beyond 2051
Carried Forward	
Concept 2B: Moderate process upgrades – 130 MLD	
Under this concept, the WTP capacity will be re-rated to 130 MLD. For all processes to meet this capacity, moderate upgrades are required including twinning the header with the same size or smaller diameter pipe, increasing the capacity of the low lift pumping station by upsizing the pumps or constructing a second station, pumping capacity and process piping upgrades to the polymer pumps, capacity increases to the ozonation through an additional generator and contact chamber or re-rating the process to reduce contact time, upgrading the filtration backwash pumps, a larger future hydrogen peroxide system, and residual management capacity upgrades through upsizing the existing facility or modifying other system processes to reduce loading on filters.	
Advantages	Disadvantages
<ul style="list-style-type: none"> Moderate process upgrades required Supports further expansion of plant 	<ul style="list-style-type: none"> Services all growth in the City including flexibility to service Cainsville to 2051 Minimal capacity beyond 2051
Carried Forward	
Concept 3: Major capacity upgrades – 180 MLD	
Under this concept, the WTP capacity will be re-rated to 180 MLD. For all processes to meet this capacity, major upgrades are required including twinning the header with the same size or smaller diameter pipe, increasing the capacity of the low lift pumping station by upsizing the pumps or constructing a second station, constructing an additional Actiflo train for preliminary treatment, pumping capacity and process piping upgrades to the polymer pumps, capacity increases to the ozonation through an additional generator and contact chamber or re-rating the process to reduce contact time, adding four additional filtration cells including upgrading the filtration backwash pumps, a larger future hydrogen peroxide system, adding a fourth UV reactor and residual management capacity upgrades through upsizing the existing facility or modifying other system processes to reduce loading on filters.	
Advantages	Disadvantages
<ul style="list-style-type: none"> Provides redundancy for major system processes Streamlines upgrades Supports growth post 2051 	<ul style="list-style-type: none"> Requires major process upgrades System would be oversized for existing and growth flows Additional O&M costs Allows processes to be offline for maintenance
Carried Forward	

7.3 System Wide Concepts

Water servicing concepts were developed first to address system wide opportunities and constraints to the existing water system while also servicing the expansion lands. This high-level analysis was done to review and evaluate system pressures, storage needs, and pumping capacities such that a pressure district realignment has the potential to optimize both pressure bands and storage and pumping capacity needs. This process was done by first evaluating and realigning pressure district boundaries and subsequently calculating the storage and pumping capacity needs. Where the pressure district boundaries were realigned from existing, a range of potential boundaries was established such that pumping, and storage needs could be optimized further if the concept was carried forward. To determine the best overall operation of the system while incorporating the increased demands, a variety of pressure district splits were reviewed prior to determining four optimized system concepts.

Four system wide pressure district concepts are presented in the following section. Additional sub-concepts were also developed to present storage and pumping upgrade concepts which would be unique to each pressure district concept. The four pressure district concepts are as follows:

- **Water Servicing Concept 1: Status Quo**
 - Maintains the current pressure district boundaries, PD1, PD2/3 and PD4 with servicing from the existing facilities within each pressure district
 - Storage and pumping capacities at the existing facilities are similarly provided to their current pressure district; additional facilities, where necessary, are presented in the sub-concepts detailed in the sections below
- **Water Servicing Concept 2: Split PD2/3 into PD2 and PD3**
 - Splits the PD2/3 into two pressure districts, PD2 and PD3, where the boundary of the realignment is flexible generally between Wayne Gretzky Parkway and Highway 403; PD1 and PD3 boundary is flexible generally between Brant Avenue and Greenwich Street; PD4 boundary is maintained at existing
 - Storage and pumping facilities within PD1 and PD4 will continue to service their existing pressure districts while facilities within PD2/3 would be split up between PD2 and PD3 geographically; additional facilities, where necessary, are presented in the sub-concepts detailed in the sections below

- **Water Servicing Concept 3: Maximize PD4**
 - Expand PD4 boundary east and splitting PD2/3 at Wayne Gretzky Parkway into PD3 and PD2 integrated into PD4 (i.e. PD2 and PD4 are a single pressure district noted as PD4); PD1 boundary is maintained at existing
 - Storage and pumping facilities within PD1 will continue to service their existing pressure districts while facilities within PD3 and PD4 will be serviced to their respective pressure districts based on geography; additional facilities, where necessary, are presented in the sub-concepts detailed in the sections below
- **Water Servicing Concept 4: Split PD1**
 - Splits PD1 into PD1, PD1A, and PD1B generally split along Veterans Memorial Parkway and along Colborne Street West; splits PD2/3 into PD2 and PD3 where the boundary of the realignment is flexible generally between Wayne Gretzky Parkway and Highway 403; PD1 and PD3 boundary is flexible generally between Brant Avenue and Greenwich Street; PD4 boundary is maintained at existing location
 - Storage and pumping facilities within PD1 will be addressed through the sub-option alternatives; facilities within PD2/3 would be split up between PD2 and PD3 geographically; additional facilities; facilities within PD4 will continue to service their existing pressure district; where necessary, are presented in the sub-concepts detailed in the sections below

Based on these four system wide concepts, outlining pressure district boundaries, sub-concepts for the individual pressure districts addressed storage and pumping deficiencies. These pressure district sub-concepts are provided following the subsequent system wide pressure district concepts.

The water servicing concepts for the Settlement Area Boundary Expansion Lands, previously discussed in **Section 6**, were carried forward and incorporated into the four system wide concepts with the following strategies:

- The North Expansion Lands will be serviced via connections to the existing system's trunk watermain along the northern boundary including connections at King George Road, Oak Park Road, Park Road North and Brantwood Park Road.
- The East Expansion Lands will be serviced by connections to the existing system at Lynden Road and Sinclair Boulevard
- Tutela Heights will be serviced via connections to the existing system at Mount Pleasant Road and Conklin Road

7.3.1 Water Servicing Concept 1: Status Quo

Servicing Concept 1: Status Quo maintains the existing pressure district boundaries within the existing water system, as further described in **Table 24**. This system configuration requires upgrades to both storage, in PD1, PD2/3, and PD4, and pumping, in PD4; as such, the following sub-concepts were presented in **Table 25** to **Table 27**, detailing the servicing sub-concepts.

- Within PD1, the following storage sub-concepts were presented to address the storage deficiency
 - PD1 Sub-Concept 1: Pumped storage at Holmedale WTP
 - PD1 Sub-Concept 2: New, second ET within PD1
 - PD1 Sub-Concept 3: Oversize the ET in PD2/3 providing storage via a PRV to PD1
- Within PD2/3, the following storage sub-concepts were presented to address the storage deficiency
 - PD2/3 Sub-Concept 1: Pumped storage at Tollgate PS or Wayne Gretzky PS
 - PD2/3 Sub-Concept 2: New PD2/3 ET
 - PD2/3 Sub-Concept 3: Decommission Albion BPS with pumped storage or new ET
- Within PD4, the following pumping and storage sub-concepts were presented to address both the pumping and storage deficiencies
 - PD4 Sub-Concept 1: Pumped storage at Northwest PS
 - PD4 Sub-Concept 2: New PD4 ET with existing pumps at Northwest PS

Table 24: Water Servicing System Wide Concept 1

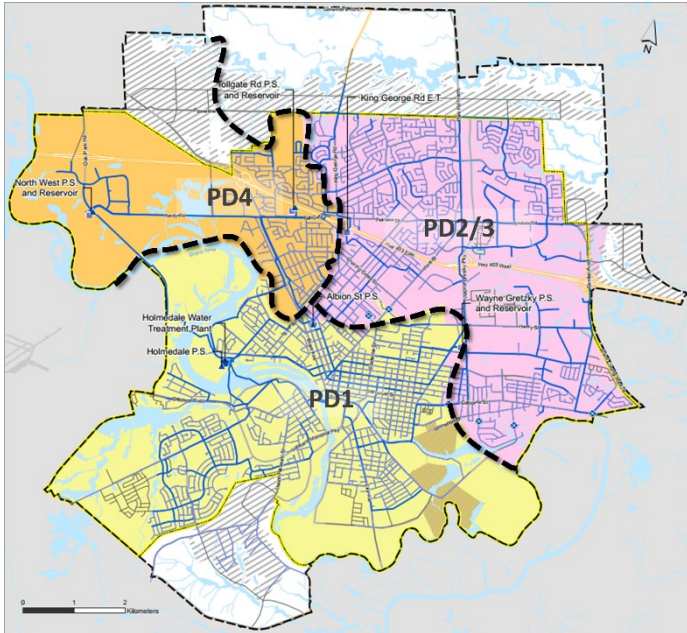
Water Servicing Concept 1: Status Quo	
Overview	
Storage	<ul style="list-style-type: none"> Water storage, as either elevated or pumped water storage, is needed in PD1, PD2/3, and PD4
Pumping	<ul style="list-style-type: none"> No pumping upgrades needed in PD1 or PD2/3 PD4 pumping strategy may require pumping upgrades; dependent on storage strategy
Transmission (Watermains)	<ul style="list-style-type: none"> Trunk watermain upgrades needed to support intensification areas and to service expansion lands
Pressure	<ul style="list-style-type: none"> Current pressures are maintained
Expansion Lands	<ul style="list-style-type: none"> Pressure district boundary for PD4 within expansion lands to be optimized further based on local elevations and demands Allows extension of PD2/3 to service north residential lands east of Balmoral Drive and PD4 extension to service north employment lands west of Balmoral Drive Requires sub-zoning of PD2/3 to service east expansion lands Allows connection of Tutela Heights in PD1 along Mount Pleasant Road and Conklin Road
<p>This system wide concept was carried forward and is further reviewed in Section 8.3.</p>	

Table 25: Water Servicing Concept 1 – PD1 Sub-Concepts

Water Servicing Concept 1: PD1 Storage Sub-Concepts		
The following sub-concepts accommodate the PD1 storage deficiency.		
PD1 Sub-Concept 1: More pumped storage at Holmedale WTP		
Storage within PD1 is provided through reservoir upgrades at the WTP. The existing pumps at the WTP have sufficient capacity to accommodate the increased pump needs to satisfy storage needs.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> No new facilities required 	<ul style="list-style-type: none"> Upgrades required at WTP More extensive infrastructure upgrades to utilize existing WTP 	
Carried Forward		
PD1 Sub-Concept 2: New, Second Elevated Tank		
Storage within PD1 is provided by a new, second ET, in addition to the existing Shellard ET. The location of the new ET would be subject to a separate EA.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> ET location can be optimized to reduce infrastructure requirement Potential to locate new ET next to the Shellard ET, within lands already owned by the City 	<ul style="list-style-type: none"> Shellard ET currently under construction Second ET required in PD1 may be operationally difficult 	
Screened Out		
PD1 Sub-Concept 3: Oversized PD2/3 ET with PRV		
Storage within PD1 is provided via PD2/3. A new ET within PD2/3 would be oversized to accommodate storage needs within both PD1 and PD2/3 with a PRV to convey the storage, as needed, from PD2/3 into PD1.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> No new facilities required in PD1 PRV from PD2/3 into PD1 will provide additional security of supply to southeast PD1 	<ul style="list-style-type: none"> Additional infrastructure upgrades required in PD2/3 Oversized ET may create water quality impacts before buildout 	
Carried Forward		

Table 26: Water Servicing Concept 1 – PD2/3 Sub-Concepts

Water Servicing Concept 1: PD2/3 Storage Sub-Concepts		
The following sub-concepts to accommodate the PD2/3 storage deficiency.		
PD2/3 Sub-Concept 1: Pumped Storage at Tollgate PS or Wayne Gretzky PS		
Storage within PD2/3 will be provided by pumping reservoir storage from either Tollgate PS or Wayne Gretzky PS. Either facility will require upgrades to both the existing reservoir and the pumps. Albion PS is maintained to convey additional flows from PD1 into PD2/3.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> No new facilities required Albion BPS provides additional transfers to PD2/3 	<ul style="list-style-type: none"> Requires pumping upgrades at either Wayne Gretzky PS or Tollgate PS Does not provide the benefits of floating storage and decreases operational flexibility 	
Screened Out		
PD2/3 Sub-Concept 2: New PD2/3 ET		
Storage within PD2/3 will be provided by constructing a new ET within the expansion lands and decommissioning the existing King George ET.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> ET location can be optimized to reduce infrastructure requirements Floating storage within PD2/3 presents operational flexibility within a PD with large increase in demands Allows for the decommissioning of King George ET 	<ul style="list-style-type: none"> New ET required 	
Carried Forward		
PD2/3 Sub-Concept 3: Decommission Albion BPS with Pumped Storage or New ET		
Albion BPS can be decommissioned in combination with PD2/3 Sub-Concept 1 (pumped storage) or Sub-Concept 2 (new ET).		
Advantages	Disadvantages	
<ul style="list-style-type: none"> Albion BPS can be decommissioned 	<ul style="list-style-type: none"> Decreased operational flexibility Without a new ET, high risk during a fire or emergency Greater importance placed on watermain upgrades 	
Carried Forward		

Table 27: Water Servicing Concept 1 – PD4 Sub-Concepts

Water Servicing Concept 1: Status Quo – PD4 Storage and Pumping Sub-Concepts

The following sub-concepts to accommodate the PD4 storage and pumping deficiency.

PD4 Sub-Concept 1: Pumped Storage at Northwest Reservoir

Storage and pumping within PD4 will be provided by upgrading the existing Northwest PS pumps and reservoir. The pumps will be sized to convey max day demand plus fire flow.

Advantages	Disadvantages	
<ul style="list-style-type: none"> No new facilities and minimizes new infrastructure requirements Increased operational flexibility at Northwest PS Space is available within Northwest PS lands Can optimize with expansion lands serviced via PD4 	<ul style="list-style-type: none"> Additional pumping and inground reservoir cells needed to accommodate fire flows within PD4 	
<p>Carried Forward</p>		

PD4 Sub-Concept 2: New ET with Existing Pumping at Northwest PS

Storage within PD4 will be provided by a new ET within the expansion lands. As the new ET will provide emergency and fire storage, upgrades at Northwest PS are not necessary as it can convey 2051 max day demand with existing pumps.

Advantages	Disadvantages	
<ul style="list-style-type: none"> ET location can be optimized to reduce infrastructure requirements Easier to gain approval/support for an ET within employment lands No upgrades required at Northwest PS 	<ul style="list-style-type: none"> Potential negative public perception with two new ETs in north expansion lands 	
<p>Carried Forward</p>		

7.3.2 Water Servicing Concept 2: Split Pressure District 2/3

Servicing Concept 2: Split PD2/3, described in **Table 27**, separates PD2/3 into PD2 and PD3 with a flexible alignment between Wayne Gretzky Parkway and Highway 403. Within both new pressure districts, the HGL is optimized by ground elevations, increasing HGL within PD2 and decreasing the HGL within PD3. Further to the boundary realignment between PD2 and PD3, the PD1 and PD3 boundary is flexible between Brant Avenue and Greenwich Street, due to an opportunity to decrease the HGL within PD3. The PD4 boundary is unchanged.

The system configuration results in Tollgate PS, Albion BPS, and King George ET servicing PD2 and Wayne Gretzky PS servicing PD3 with PD1 and PD4 being serviced by their existing facilities. This results in PD1, PD2, PD3 (dependent on the boundary realignment) and PD4 requiring storage upgrades while PD4 requires pumping upgrades. The decrease in HGL within PD2 and PD3 may require minor upgrades at the respective pumping station to accommodate for a change in Total Dynamic Head (TDH). As PD1 and PD4 are serviced by their existing facilities, additional sub-concepts were not developed as they are the same as Servicing Concept 1: Status Quo – PD1 Sub-Concepts and PD4 Sub-Concepts. The sub-concepts developed for PD2 storage needs are presented in **Table 28**.

- Within PD2, the following storage sub-concepts were presented to address the storage deficiencies in both pressure districts
 - PD2 Sub-Concept 1: Reservoir upgrades at Tollgate PS
 - PD2 Sub-Concept 2: New PD2 ET
 - PD2 Sub-Concept 3: New PD2 ET with PRV support to PD3 (passive feed to consolidate volume)

Table 28: Water Servicing System Wide Concept 2

Water Servicing Concept 2: Split PD2/3 into PD2 and PD3	
Overview	
<ul style="list-style-type: none"> Split PD2/3 into PD2 and PD3 to optimize pressures and facility needs Pressure district boundary realignment is flexible due to ground elevations 	
Storage	<ul style="list-style-type: none"> Water storage, as either elevated or pumped water storage, is needed in PD1, PD2, and PD4 Storage needs in PD3 are dependent on the boundary realignment
Pumping	<ul style="list-style-type: none"> No pumping upgrades needed in PD1 Minor upgrades to PD2 and PD3 may be needed to support new pressure districts Potential PD4 upgrades needed; dependent on storage strategy and boundary realignment
Transmission (Watermains)	<ul style="list-style-type: none"> Trunk watermain upgrades needed to support intensification areas and to service expansion lands
Pressure	<ul style="list-style-type: none"> Improved pressures to PD2 and PD3
Expansion Lands	<ul style="list-style-type: none"> Potential for North Expansion Lands to be service by PD2, PD3 and/or PD4 with possible decreased pressures in North Lands Does not require sub-zoning of East Expansion Lands; allows natural extension of PD2 or PD3 to service East Expansion Lands along Lynden Road Allows connection of Tutela Heights in PD1 along Mount Pleasant Road and Conklin Road
<p>This system wide concept was screened out and is not discussed further.</p>	

Table 29: Water Servicing Concept 2 – PD2 Sub-Concepts

Water Servicing Concept 2 – PD2 Storage Concepts		
The following sub-concepts to accommodate the PD2 storage deficiency.		
PD2 Sub-Concept 1: Reservoir Upgrades at Tollgate PS		
Storage within PD2 will be provided by pumped storage at the Tollgate PS requiring upgrades to the existing Tollgate Reservoir.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> Optimizes PD4 facilities as PD2 will service the expansion lands 	<ul style="list-style-type: none"> Insufficient floating storage, MDD+FF to be provided by pumping Storage upgrades needed at Tollgate PS Reduced operational flexibility Low pressures in new employment lands 	
Screened Out		
PD2 Sub-Concept 2: New PD2 ET		
Storage within PD2 will be provided by constructing a new PD2 ET within the expansion lands and decommissioning the existing King George ET and Alton BPS.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> ET location can be optimized to reduce infrastructure needs Can optimize system pressures (HGL change) Increased operational flexibility in PD2 	<ul style="list-style-type: none"> No floating storage in PD3, reduced operational flexibility New ET required Potential storage upgrades at Wayne Gretzky PS 	
Screened Out		
PD2 Sub-Concept 3: New PD2 ET with PRV support to PD3 (passive feed – consolidate volume)		
Storage within PD2 will be provided by constructing a new PD2 ET within the expansion lands and decommissioning the existing King George ET and Alton BPS. Additional storage is provided to PD3 via PRVs.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> Can be combined with either Sub-Concept 1 or 2 Operational flexibility in PD3 in event of a fire or emergency 	<ul style="list-style-type: none"> PD3 reliance on conveyance from PD2 during fire or emergency 	
Screened Out		

7.3.3 Water Servicing Concept 3: Maximize Pressure District 4

Servicing Concepts 3: Maximize PD4, described in **Table 30**, extends PD4 east to Wayne Gretzky Parkway, incorporating PD2, separating PD4 and PD3. Within both realigned pressure districts, the HGL is optimized by ground elevations, decreasing the HGL in PD3 and maintaining the HGL in PD4. The PD1 boundary is unchanged.

The system configuration results in Tollgate PS, Albion BPS, and Northwest PS servicing PD4, Wayne Gretzky PS servicing PD3, and PD1 being serviced by their existing facilities. This results in PD1, PD3, and PD4 requiring storage upgrades. Due to the change in HGL at Tollgate PS and Wayne Gretzky PS minor upgrades may be required to accommodate the change in TDH. As PD1 is serviced by its existing facilities, additional sub-concepts were not developed as they are the same as Servicing Concept 1: Status Quo – PD1 Sub-Concepts. The sub-concepts developed for PD3 and PD4 storage needs are presented in **Table 31** to **Table 32**.

- Within PD3, the following storage sub-concepts were presented to address the storage deficiencies in both pressure districts
 - PD3 Sub-Concept 1: New ET in PD3 and PD4
 - PD3 Sub-Concept 2: Oversize ET in PD4 with PRV to PD3
- Within PD4, the following storage sub-concepts were presented to address the storage deficiencies in both pressure districts
 - PD4 Sub-Concept 1: Existing pump station storage expansion
 - PD4 Sub-Concept 2: New ET in PD3 and PD4
 - PD4 Sub-Concept 3: PRV support from PD4 to PD3

Table 30: Water Servicing System Wide Concept 3

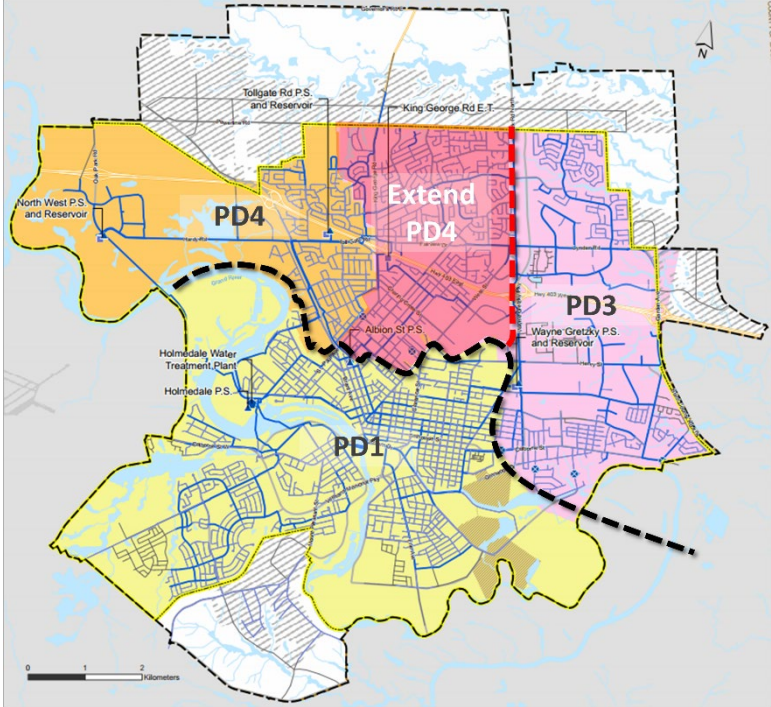
Water Servicing Concept 3: Maximize Pressure District 4	
Overview	
<ul style="list-style-type: none"> • Expansion of PD4 eastwards to eliminate PD2 with the PD3 boundary realigned to Wayne Gretzky Parkway • Pressure district boundary realignment to optimize pressures and facility needs 	
Storage	<ul style="list-style-type: none"> • Water storage, as either elevated or pumped water storage, is needed in PD1, PD3, and PD4
Pumping	<ul style="list-style-type: none"> • Pumping upgrades needed in PD3 and PD4 to accommodate new pressure districts and change in HGL
Transmission (Watermains)	<ul style="list-style-type: none"> • Trunk watermain upgrades needed to support intensification areas and to service expansion lands
Pressure	<ul style="list-style-type: none"> • Improved pressures in PD3 and PD4
Expansion Lands	<ul style="list-style-type: none"> • Allows natural extension of PD4 to service north employment lands and part of residential lands and PD3 to service remaining North residential lands • Does not require sub-zoning of east expansion lands; allows natural extension of PD3 to service east expansion lands along Lynden Road • Allows connection of Tutela Heights in PD1 along Mount Pleasant Road and Conklin Road
This system wide concept was carried forward and is further reviewed in Section 8.3.	

Table 31: Water Servicing Concept 3 - PD3 Sub-Concepts

Water Servicing Concept 3 – PD3 Storage Sub-Concepts

The following sub-concepts to accommodate the PD3 storage deficiency.

PD3 Sub-Concept 1: New ET in PD3 and PD4

Storage within PD3 will be provided by constructing a new PD3 ET within the expansion lands.

Advantages	Disadvantages	
<ul style="list-style-type: none"> ET location can be optimized to reduce infrastructure requirements Increases operational flexibility in each PD 	<ul style="list-style-type: none"> Requires two new ETs which may result in negative public perception Extensive watermain construction required to strengthen north/ south trunks 	
<p>Carried Forward</p>		

PD3 Sub-Concept 2: Oversize ET in PD4 with PRV into PD3

Storage within PD4 will be provided by constructing a new PD4 ET within the expansion lands with a PRV to provide storage to PD3. Reservoir upgrades are needed at the Wayne Gretzky PS.

Advantages	Disadvantages	
<ul style="list-style-type: none"> Allows for only ET in PD4 that is easier to locate in employment lands Pumping at Wayne Gretzky PS is sufficient to accommodate MDD+FF PRV provides security of supply to PD3 	<ul style="list-style-type: none"> Increased storage required at Wayne Gretzky Extensive watermain construction required to strengthen north/south trunks 	
<p>Carried Forward</p>		

Table 32: Water Servicing Concept 3 – PD4 Sub-Concepts

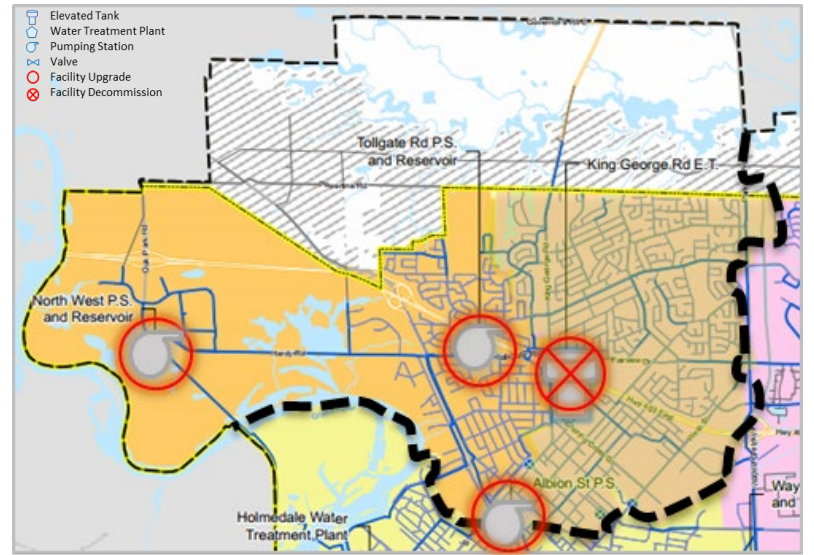
Water Servicing Concept 3 – PD4 Storage Concepts

The following sub-concepts to accommodate the PD4 storage deficiency.

PD4 Sub-Concept 1: Existing PS Storage Expansion

Storage within PD4 will be provided by pumped storage by upgrading the reservoirs at either Northwest PS or Tollgate PS and decommissioning the existing King George ET.

Advantages	Disadvantages
<ul style="list-style-type: none"> No new facilities required Optimize system pressures 	<ul style="list-style-type: none"> Storage upgrades required at either Northwest PS or Tollgate PS Decreased operational flexibility

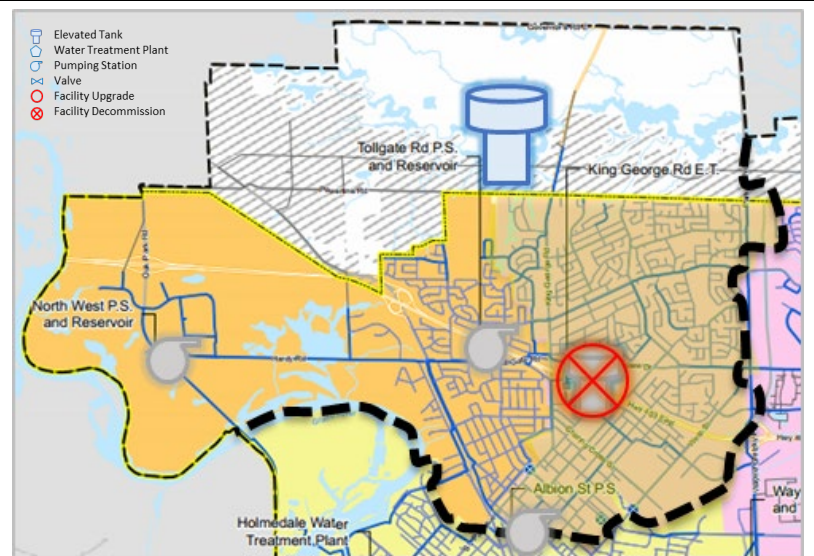


Carried Forward

PD4 Sub-Concept 2: New ET in PD4 and PD3

Storage within PD4 will be provided by constructing a new PD4 ET within the expansion lands and decommissioning the existing King George ET and Albion BPS.

Advantages	Disadvantages
<ul style="list-style-type: none"> ET location can be optimized to reduced infrastructure requirements Increased operational flexibility Optimize system pressures 	<ul style="list-style-type: none"> Two new ET's required

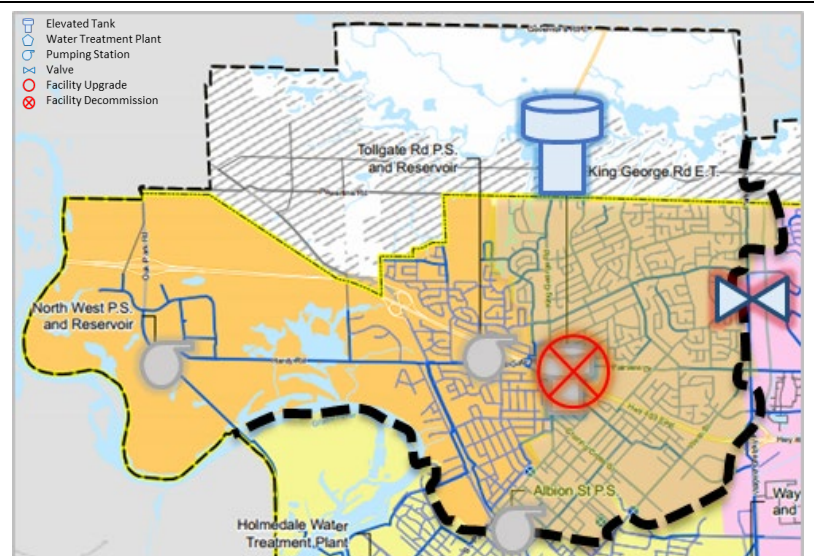


Carried Forward

PD4 Sub-Concept 3: PRV support from PD4 to PD3

Storage within PD4 will be provided by constructing a new PD4 ET within the expansion lands with a PRV to provide storage to PD3. The King George ET will be decommissioned.

Advantages	Disadvantages
<ul style="list-style-type: none"> Only one ET required Optimize system pressures 	<ul style="list-style-type: none"> More extensive watermain construction (PD3 support)



Carried Forward

7.3.4 Water Servicing Concept 4: Split Pressure District 1

Servicing Concepts 4: Split PD1, described in **Table 33**, splits PD1 into three pressure districts. PD1 extends from Veterans Memorial Parkway and Greenwich Street, PD1A extends west from Veterans Memorial Parkway, and PD1B extends east along Colborne Street West. The PD2 and PD3 are split into separate pressure districts with a flexible alignment between Wayne Gretzky Parkway and Highway 403. Within both new pressure districts, the HGL is optimized by ground elevations, increasing HGL within PD2 and decreasing the HGL within PD3. The PD4 boundary is unchanged.

The system configuration results in Tollgate PS, Albion BPS, and King George ET servicing PD2 and Wayne Gretzky PS servicing PD3 with PD1 and PD4 being serviced by their existing facilities. This results in PD1A, PD1B, PD2, PD3 (dependent on the boundary realignment) and PD4 requiring storage upgrades while PD1A, PD1B, and PD4 requires pumping upgrades. The decrease in HGL within PD2 and PD3 may require minor upgrades at the respective pumping station to accommodate for a change in Total Dynamic Head (TDH). The sub-concepts developed for PD2 and PD3 were similar to Servicing Concept 2: Split PD2/3 – PD2 Sub-Concepts and PD3 Sub-Concepts and are not presented again. As PD4 is serviced by its existing facilities, additional sub-concepts were not developed as they are the same as Servicing Concept 1: Status Quo – PD4 Sub-Concepts. The sub-concepts developed for PD1 storage needs are presented in **Table 34**.

- Within PD1 and PD1A, the following storage sub-concepts were presented to address the storage deficiencies in both pressure districts
 - Sub-Concept 1: Elevated tank in PD1 with dedicated watermain and new pumping station to PD1A and PD1B
 - Sub-Concept 2: Elevated tank raised with new pumping station
 - Sub-Concept 3: Holmedale HLP raised with dedicated watermain to raised elevated tank and PRV to old PD1
 - Sub-Concept 4: Two sets of pumps at Holmedale HLP to each Pressure District 1

Table 33: Water Servicing System Wide Concept 4

Water Servicing Concept 4: Split Pressure District 1	
Overview	
<ul style="list-style-type: none"> Split PD1 into three pressure districts to optimize PD1 pressures Split PD2/3 into two pressure districts to optimize pressures and facility needs Pressure district boundary realignment is flexible due to ground elevations 	
Storage	<ul style="list-style-type: none"> Water storage, as either elevated or pumped water storage, is needed in all pressure districts
Pumping	<ul style="list-style-type: none"> New pumping facilities are needed to accommodate PD1A and PD1B Minor upgrades to PD2 and PD3 may be needed to support new pressure districts
Transmission (Watermains)	<ul style="list-style-type: none"> Trunk watermain upgrades needed to support intensification areas and to service expansion lands
Pressure	<ul style="list-style-type: none"> Improved pressures in PD1, PD1A, PD1B, PD2, and PD3
Expansion Lands	<ul style="list-style-type: none"> Potential for North Expansion Lands to be service by PD2, PD3 and/or PD4 with possible decreased pressures Does not require sub-zoning of East Expansion Lands; allows natural extension of PD2 or PD3 to service East Expansion Lands along Lynden Road Allows connection of Tutela Heights with optimized pressures in PD1B along Mount Pleasant Road and Conklin Road
<p>This system wide concept was screened out and is not discussed further.</p>	

Table 34: Water Servicing Concept 4 - PD1 Sub-Concepts

Water Servicing Concept 4: PD1 Storage Concepts		
The following sub-concepts to accommodate the PD1 storage deficiency.		
PD1 Sub-Concept 1: ET in PD1 with dedicated watermain and new PS to PD1A and PD1B		
Storage within PD1 will be provided by a dedicated feed from the Shellard ET into PD1 with two new PS into PD1A and PD1B.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> No modification to new PD1 ET Increased pressures to Mount Pleasant 	<ul style="list-style-type: none"> Requires new PS and watermain High pressures in PD1 are still high 	
Screened Out		
PD1 Sub-Concept 2: ET raised with new PS		
Storage within PD1 will be provided by pumped storage from the WTP and storage within PD1A will be provided by raising the existing Shellard ET to a higher HGL.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> Reduces watermain upgrades PD1 pressures <100 psi with lowered HGL 	<ul style="list-style-type: none"> Requires modifications at new PD1 ET Requires new PS for raised ET New PD1 ET not large enough to support PD1B 	
Screened Out		
PD1 Sub-Concept 3: Holmedale HLP raised with dedicated watermain to raised ET and PRV to old PD1		
Storage to PD1A will be provided by increasing the TDH from the WTP and increasing the height of the Shellard ET to a higher HGL and storage within PD1 will be provided by a PRV from PD1A into PD1.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> Reduces new infrastructure required Increases operational flexibility PD1 pressures <100 psi with lowered HGL 	<ul style="list-style-type: none"> Requires modifications at newly constructed PD1 ET New PD1 ET not large enough to support PD1B 	
Screened Out		
Concept 4: Two sets of pumps at High Lift Pump Station to each Pressure District		
Storage to PD1 and PD1A will be provided by pumped storage from the Holmedale WTP via two separate headers with two separate HGLs.		
Advantages	Disadvantages	
<ul style="list-style-type: none"> Reduces new infrastructure required PD1 pressures <100 psi with lowered HGL 	<ul style="list-style-type: none"> Requires modifications to Holmedale HLP and new conveyance watermains PD1B storage through pumping (MDD+FF) or a new ET in Mount Pleasant 	
Screened Out		

7.3.5 System Wide Short Listed Servicing Concepts

These concepts were presented to City staff at an opportunities and constraints workshop and to the public at a Public Information Centre (PIC) in February 2020, and a consensus was reached on the two most viable options. These two options are listed below as being carried forward and are discussed in **Section 8.3**.

- **Concept 1: Status Quo**
 - Maintains current servicing strategy, including current pressure district boundaries
 - This concept was **carried forward** as a servicing strategy as it is the easiest to implement while minimizing facility upgrade needs
- **Concept 2: Split Pressure District 2/3 into Pressure District 2 and Pressure District 3**
 - Split PD2/3 to optimize pressures and facility needs
 - Pressure district boundary realignment is flexible due to ground elevations
 - This concept was **screened out** as it would be difficult to implement with complex long term operation
- **Concept 3: Maximize Pressure District 4**
 - Expansion of PD4 eastwards to eliminate PD2 with the PD3 boundary realigned to Wayne Gretzky Parkway
 - Pressure district boundary realignment to optimize pressures and facility needs
 - This concept was **carried forward** as a servicing strategy as it best optimizes system pressures
- **Concept 4: Split Pressure District 1**
 - Split PD1 into three pressure district to optimize pressures
 - Pressure district boundary realignment is flexible due to ground elevations
 - This concept was **screened out** as it would be the hardest to implement requiring the most new facilities and watermains

8. Water Servicing Alternatives and Evaluation

8.1 Objectives

Water servicing strategies were carried forward based on the servicing concepts and sub-concepts presented in **Section 7** and reviewed for existing and future growth in the City in order to select the best servicing solutions. The carried forward concepts and sub-concepts are presented as follows:

- **Concept 1: Status Quo**
 - Maintains current servicing strategy, including current pressure district boundaries
 - Sub-Concepts to address storage and pumping deficiencies are as follows:
 - PD1 Sub-Concept 1: More pumped storage at Holmedale WTP
 - PD1 Sub-Concept 3: Oversize the ET in PD2/3 providing storage via a PRV to PD1
 - PD2/3 Sub-Concept 2: New PD2/3 ET
 - PD2/3 Sub-Concept 3: Decommission Albion BPS with pumped storage or new ET
 - PD4 Sub-Concept 1: Pumped storage at Northwest PS
 - PD4 Sub-Concept 2: New PD4 ET with existing pumps at Northwest PS
- **Concept 3: Maximize Pressure District 4**
 - Expansion of PD4 eastwards to eliminate PD2 with the PD3 boundary realigned to Wayne Gretzky Parkway
 - Sub-Concepts to address storage and pumping deficiencies are as follows:
 - PD3 Sub-Concept 1 and PD4 Sub-Concept 2: New ET in PD3 and PD4
 - PD3 Sub-Concept 2 and PD4 Sub-Concept 4: Oversize ET in PD4 with PRV to PD3
 - PD4 Sub-Concept 1: Existing pump station storage expansion

The following sections summarize the alternative servicing strategies and evaluation of the strategies. The evaluation process is outlined in **Appendix C** in **Volume II**.

8.2 Facilities

8.2.1 Holmedale Water Treatment Plant

An overview of the water treatment plant alternatives is provided in **Section 7.2**. The evaluation process is summarized in **Table 35**. Alternative 2B provides a greater plant benefit as compared to Alternative 1 and 2A; while maintaining a lower capital cost as compared to Alternative 3. On a balance of system benefit vs. cost, Alternative 2B was selected as the preferred servicing alternative.

Table 35: Holmedale WTP Alternatives & Evaluation

Holmedale WTP Upgrade Alternatives																
	Alternative 1				Alternative 2A				Alternative 2B				Alternative 3			
Overview	<ul style="list-style-type: none"> Minimal process upgrades – 100 MLD 				<ul style="list-style-type: none"> Moderate process upgrades – 125 MLD 				<ul style="list-style-type: none"> Moderate process upgrades – 130 MLD 				<ul style="list-style-type: none"> Major capacity upgrades – 200 MLD 			
Advantages	<ul style="list-style-type: none"> Minimal upgrades required Minimal impacts during construction 				<ul style="list-style-type: none"> Moderate process upgrades required Interim solution that can support phased expansion of the plant 				<ul style="list-style-type: none"> Moderate process upgrades required. Supports further expansion of plant 				<ul style="list-style-type: none"> Provides redundancy for major system processes Streamlines upgrades Supports growth post 2051 			
Disadvantages	<ul style="list-style-type: none"> Only services existing system and City growth to 2031 No focus on security of supply 				<ul style="list-style-type: none"> Moderate impacts during construction Interim solution to service City growth and Cainsville lands, no flexibility to service additional growth beyond 2051 				<ul style="list-style-type: none"> Moderate impacts during construction Services all growth in the City including flexibility to service Cainsville Minimal capacity to service additional County lands and growth beyond 2051 				<ul style="list-style-type: none"> Major impacts during construction Requires major process upgrades. System would be oversized for existing & growth flows. Additional O&M costs Allows processes to be taken offline for maintenance 			
Upgrades, Costs and Timing	0 – 2 years ~\$1 M				2 – 10 years ~\$7 M				10 – 15 years ~\$15 M				15+ years ~\$200 M			
Four-Point Criteria Evaluation	Technical	Environmental	Social & Cultural	Financial	Technical	Environmental	Social & Cultural	Financial	Technical	Environmental	Social & Cultural	Financial	Technical	Environmental	Social & Cultural	Financial
Recommended Alternative	<ul style="list-style-type: none"> Not Recommended: Cannot effectively service growth in Brantford. 				<ul style="list-style-type: none"> Not Recommended: Lacking security of supply for major processes including the low lift pumping station and intake. 				<ul style="list-style-type: none"> Recommended: It services all City growth to 2051 including flexibility to service Cainsville lands by providing sufficient capacity within all processes. 				<ul style="list-style-type: none"> Not Recommended: High costs and oversized equipment based on current and growth flows. 			

Evaluation Scoring Legend: High Medium Low

8.3 System Wide & Pressure District Servicing Strategies

8.3.1 System Wide Alternatives

Four pressure district boundary concepts were reviewed in **Section 7.3** and two concepts were carried forward as servicing alternatives to determine the preferred pressure district configuration including:

- **Alternative 1** – Maintain Existing Pressure District Boundaries
- **Alternative 3** – Expand and Maximize Pressure District 4 Boundary

8.3.1.1 Alternative 1 – Maintain Existing Pressure District Boundaries

Under Alternative 1, the existing pressure district boundaries will be maintained. Water will be supplied to the North residential lands in PD2/3 through a primary trunk connection at King George Road with additional watermain connections to the existing system in PD2/3 recommended at Park Road North and Brantwood Park Road. The north employment lands will be serviced by PD4 through a watermain extension at Oak Park Road.

To service the East residential lands north of Lynden Road, a direct connection to the existing PD2/3 system on Lynden Road can be made. To service the employment lands east of Garden Avenue, a new sub-pressure district is required with a connection to PD2/3 through a new PRV at either Lynden Road or at Sinclair Boulevard.

To integrate Tutela Heights into PD1 within the City's system, connections at both Mount Pleasant Road and Conklin Road are required. Sub-pressure districts will be created at the west end of Colborne Street and within the east employment lands.

The key projects required to service Alternative 1 include:

- New PD2/3 Elevated Tank to address storage in largest growth Pressure District with potential to supplement storage in PD1
- Storage upgrades needed in PD4, potentially on existing site
- King George Elevated Tank to be decommissioned
- Pump upgrades at existing facilities including Holmedale HLP, Tollgate PS and Wayne Gretzky PS
- Albion PS to be decommissioned
- Downtown trunk watermain loop, Conklin Road and Tutela Heights trunk watermain loop, King George trunk watermain, Fairview Drive/Lynden Road trunk watermain, Oak Park trunk watermain and Paris Road trunk watermain

The overview, advantages, disadvantages and evaluation are summarized in **Table 36**.

8.3.1.2 Alternative 2 – Expand and Maximize Pressure District 4 Boundary

Under Alternative 2, the Pressure District 4 boundary will be extended east to Wayne Gretzky Parkway to optimize pressures in Pressure District 3 and Pressure District 4. Water will be supplied to the North employment lands and residential lands west of Wayne Gretzky Parkway through primary trunk connections at King George Road and Oak Park Road. The remaining North residential lands will be supplied by a connection at Wayne Gretzky Parkway.

To service the East residential lands north of Lynden Road, a direct connection to the existing PD3 system on Lynden can be made. To service the employment lands east of Garden Avenue, a direct connection to PD3 can be made at either Lynden Road, or at Sinclair Boulevard.

To integrate Tutela Heights into PD1 within the City's system, connections at both Mount Pleasant Road and Conklin Road are required. Sub-pressure districts will be created at the west end of Colborne Street and within the east employment lands.

The key projects required to service Alternative 2 include:

- New PD4 Elevated Tank to address storage in largest growth Pressure District with potential to supplement storage in PD1 and PD3
- King George Elevated Tank to be decommissioned
- Pump upgrades at existing facilities including Holmedale HLP, Tollgate PS, Wayne Gretzky PS and Northwest PS to accommodate change in HGL
- Albion PS to be decommissioned
- Downtown trunk watermain loop, Conklin Road and Tutela Heights trunk watermain loop, King George trunk watermain, Wayne Gretzky Parkway trunk watermain, Oak Park trunk watermain and Paris Road trunk watermain
- Additional valving needed for boundary delineation

The overview, advantages, disadvantages and evaluation are summarized in **Table 36**.

Table 36: Pressure District Boundary Alternatives & Evaluation

Pressure District Boundary Alternatives								
	Alternative 1: Existing Pressure District Boundary		Alternative 3: Maximize Pressure District 4					
Overview	<ul style="list-style-type: none"> Existing pressure district boundaries will be maintained North employment lands will be serviced by PD4 Sub-pressure districts created at west end of Colborne Street and within employment lands 		<ul style="list-style-type: none"> Pressure District 4 is expanded east to Wayne Gretzky Parkway and incorporates Pressure District 2 Valving is needed for boundary delineation 					
Storage	<ul style="list-style-type: none"> Storage deficit in Pressure District 1, 2/3, and 4 New water tower is needed in Pressure District 2/3 as King George water tower will be decommissioned (location of a new water tower subject to a separate EA) 		<ul style="list-style-type: none"> Storage deficit in Pressure Districts 1, 2/4 and 3 New water tower is needed in Pressure District 2/4 as King George water tower will be decommissioned (location of a new water tower subject to a separate EA) 					
Pumping	<ul style="list-style-type: none"> Pumping deficit in Pressure District 2/3 and potentially PD4 Pumping upgrade needs at both Wayne Gretzky and Tollgate Pumping Stations will be at existing facilities Albion Pumping Station decommissioned Upgrades may be needed to Northwest Pumping Station Pumping deficit at WTP for both PD1 needs and system supply 		<ul style="list-style-type: none"> Pumping deficit in Pressure District 2/4 and 3 Pumping upgrade needs at Wayne Gretzky, Tollgate, and Northwest Pumping station will be at existing facilities Albion Pumping Station decommissioned Pumping deficit at WTP for both PD1 needs and system supply 					
Transmission (Watermains)	<ul style="list-style-type: none"> Upgraded trunk watermains will be needed to accommodate growth demands 		<ul style="list-style-type: none"> New trunk watermains needed to accommodate growth demands and pressure district change 					
Pressure	<ul style="list-style-type: none"> Pressures remain at status quo with no HGL adjustments 		<ul style="list-style-type: none"> Pressures will be increased within existing Pressure District 2/3 now in Pressure District 2/4 and decreased within new Pressure District 3 					
Costing	<ul style="list-style-type: none"> Facility Upgrades: \$26 - \$27 M Watermain Upgrades: \$60 M 		<ul style="list-style-type: none"> Facility Upgrades: \$31 - \$33 M Watermain Upgrades: \$58 M Implementation: \$6 M 					
Advantages	<ul style="list-style-type: none"> Minimal changes in existing operation of pressure districts Easy implementation of upgrades 		<ul style="list-style-type: none"> New water tower can be sited in employment lands Pressures can be optimized 					
Disadvantages	<ul style="list-style-type: none"> Land acquisition needs and potential delays for new water tower 		<ul style="list-style-type: none"> Land acquisition needs and potential delays for the new water tower Complex implementation of upgrades which have quick timing and funding needs Major watermain construction within existing water system 					
Four-Point Criteria Evaluation	Technical	Environmental	Social & Cultural	Financial	Technical	Environmental	Social & Cultural	Financial
Recommended Alternative	<ul style="list-style-type: none"> Recommended: The implementation and construction process is simpler 		<ul style="list-style-type: none"> Not Recommended: Complex implementation with quick timing and funding needs 					

Evaluation Scoring Legend: High Medium Low

The full evaluation is included in **Appendix E**. Alternative 1 (Existing Pressure District Boundary) provides a greater system benefit with a simpler implementation and construction process as compared to Alternative 2. On the balance of system benefit vs. cost Alternative 1 was selected as the preferred servicing option. Moving forward with Alternative 1, individual pressure districts were evaluated to determine the best servicing alternative for each pressure district, based on the concepts carried forward in the previous section.

8.3.2 Pressure District 1 and Pressure District 2/3 Storage Alternatives

The PD1 and PD2/3 Storage alternatives address the storage deficiencies in both PD1 and PD2/3.

Under Alternative 1, the storage deficiencies in PD1 and PD2/3 are addressed separately through the construction of a new reservoir cell at the Holmedale WTP, providing pumped storage to PD1 and the construction of a new ET within the north expansion lands to provide storage to PD2/3.

Under Alternative 2, the storage deficiencies in PD1 and PD2/3 are addressed together through the construction of an oversized new ET within the PD2/3 north expansion lands with a PRV at Tollgate PS and Wayne Gretzky PS to convey storage from PD2/3 into PD1.

The overview, advantages, disadvantages and evaluation are summarized in **Table 37**.

Table 37: Pressure District 1 Storage Alternatives

Pressure District 1 Storage Alternatives								
	Alternative 1: Pressure District 1 Storage provided by pumps at the Holmedale Water Treatment Plant Reservoir				Alternative 2: Pressure District 1 storage is provided from large water tower by valves from Pressure District 2/3			
Advantages	<ul style="list-style-type: none"> No substantial changes to current operations No significant construction challenges; impacts localized to facility sites Reduces conveyance watermain upgrades required 				<ul style="list-style-type: none"> Optimized location for valves provides better conveyance to more vulnerable areas Allows for phased usage of ET storage; now for PD1 deficit, future for north trigger lands Provides greater hydraulic benefit and system resiliency 			
Disadvantages	<ul style="list-style-type: none"> Dependence on pumps has higher energy usage and reduced system resiliency 				<ul style="list-style-type: none"> ET will be oversized until all expansion lands are constructed Greater reliance on watermains May be more complex to operate the water system 			
Four-Point Criteria Evaluation	Technical	Environmental	Social & Cultural	Financial	Technical	Environmental	Social & Cultural	Financial
Recommended Alternative	<ul style="list-style-type: none"> Not Recommended: Less energy efficient and does not improve system resiliency 				<ul style="list-style-type: none"> Recommended: Hydraulically, more beneficial and alternative allows for future accommodation of growth trigger lands 			

Evaluation Scoring Legend: High Medium Low

The full evaluation is included in **Appendix E**. Alternative 2 (Pressure District 1 storage is provided from large water tower by valves from Pressure District 2/3) is hydraulically more beneficial to the existing system and accommodates future growth within the trigger lands by constructing an oversized ET.

8.3.3 Pressure District 4 Storage Alternatives

The PD4 Storage alternatives address the storage deficiencies in PD4.

Under Alternative 1, the storage deficiency in PD4 is resolved by upgrading the existing reservoir and pumps at the Northwest PS. This includes the construction of a new cell at the existing facility and installation of new or upsizing of existing pumps.

Under Alternative 2, the storage PD4 deficiencies are addressed through the construction of a new PD4 ET within the expansion lands.

The overview, advantages, disadvantages and evaluation are summarized in **Table 38**.

Table 38: Pressure District 4 Storage Alternatives

Pressure District 4 Storage Alternatives								
	Alternative 1: Upgrade storage at Northwest Reservoir				Alternative 2: New Pressure District 4 Elevated Tank			
Advantages	<ul style="list-style-type: none"> Maximizes use of existing pumping and storage capacity at facility No substantial change to current operations on facility site 				<ul style="list-style-type: none"> Location of the water tower can be optimized in employment lands Provides greater hydraulic benefit and system resiliency Pump upgrades at the Northwest pumping station are not necessary 			
Disadvantages	<ul style="list-style-type: none"> Dependence on pumps has higher energy usage and reduced system resiliency Pump upgrades at the Northwest pumping station may be necessary to accommodate peak demands 				<ul style="list-style-type: none"> City will have two water towers in the north lands 			
Four-Point Criteria Evaluation	Technical	Environmental	Social & Cultural	Financial	Technical	Environmental	Social & Cultural	Financial
Recommended Alternative	<ul style="list-style-type: none"> Not Recommended: Less energy efficient and does not improve system resiliency 				<ul style="list-style-type: none"> Recommended: Hydraulically, more beneficial and alternative allows for future accommodation of growth trigger lands 			

Evaluation Scoring Legend: High Medium Low

The full evaluation is included in **Appendix E**. Alternative 2 (New Pressure District 4 Elevated Tank) is hydraulically more beneficial to the existing system and accommodates future growth within the trigger lands by constructing an oversized ET

8.4 Tutela Height Water Servicing

The Tutela Heights water system will be fully integrated into the City’s network (and disconnected from the County’s system) before 2026. To service both the existing system and growth to 2051, four servicing concepts, presented in **Section 6.3**, were evaluated and presented in **Table 39**.

Table 39: Tutela Heights Servicing Alternatives

Tutela Heights Alternatives				
	Alternative 1: Connect Only	Alternative 2: Connect and Upgrade Local Network	Alternative 3: Connect, Upgrade, and Loop	Alternative 4: Connect, Upgrade, Loop, and Booster Pumping Station
Advantages	<ul style="list-style-type: none"> Can be implemented immediately 	<ul style="list-style-type: none"> Increases or maintains existing fire flows Implementation can be staged 	<ul style="list-style-type: none"> Increases or maintains existing fire flows Can be designed appropriately to accommodate future growth 	<ul style="list-style-type: none"> Maintains existing system pressures New booster pumping station can be designed to provide appropriate fire flows based on land use
Disadvantages	<ul style="list-style-type: none"> Reduction in pressures from existing level of service; however, pressure is maintained above 40 psi Localized reduction in fire flow below level of service target Will not service growth needs Increased operational requirements related to automatic flushers 	<ul style="list-style-type: none"> Reduction in pressures from existing level of service; however, pressure is maintained above 40 psi Longer implementation May or may not service growth, dependent on block plan Increased operational requirements related to automatic flushers 	<ul style="list-style-type: none"> Reduction in pressures from existing level of service; however, pressure is maintained above 40 psi May trigger an EA as the loop would be adjacent to Phelps Creek, which is part of the recommended NHS and along an unopened road allowance. Need for automatic flushers at municipal boundary on Mount Pleasant Road and Tutela Heights Road to for existing properties 	<ul style="list-style-type: none"> High financial cost Will require land acquisition to site a new booster pumping station An EA will be required
Four-Point Criteria Evaluation	Technical: Medium (Yellow) Environmental: High (Green) Social & Cultural: Medium (Yellow) Financial: High (Green)	Technical: Medium (Yellow) Environmental: High (Green) Social & Cultural: Medium (Yellow) Financial: Medium (Yellow)	Technical: High (Green) Environmental: High (Green) Social & Cultural: Medium (Yellow) Financial: Medium (Yellow)	Technical: High (Green) Environmental: High (Green) Social & Cultural: Medium (Yellow) Financial: Low (Red)
Recommended Alternative	<ul style="list-style-type: none"> Not Recommended: Does not improve system performance and does not service growth needs 	<ul style="list-style-type: none"> Not Recommended: Minimally improves system performance and may or may not service growth needs 	<ul style="list-style-type: none"> Recommended: Improves level of service and can service growth needs 	<ul style="list-style-type: none"> Not Recommended: High cost to implement

Evaluation Scoring Legend: ● High ● Medium ● Low

8.5 Local Servicing Needs

In addition to the system wide servicing upgrades, the following local servicing needs were identified.

8.5.1 Colborne Street West

There is a proposed development and six (6) existing properties on Colborne Street West extending west to the municipal boundary in Pressure District 1 with low pressures (<40 psi) due to elevations outside the service range of the existing Pressure District 1. Previous servicing reviews have identified the need for a new pump station to service the proposed development and to extend servicing to the existing low-pressure properties, shown in **Table 40**.

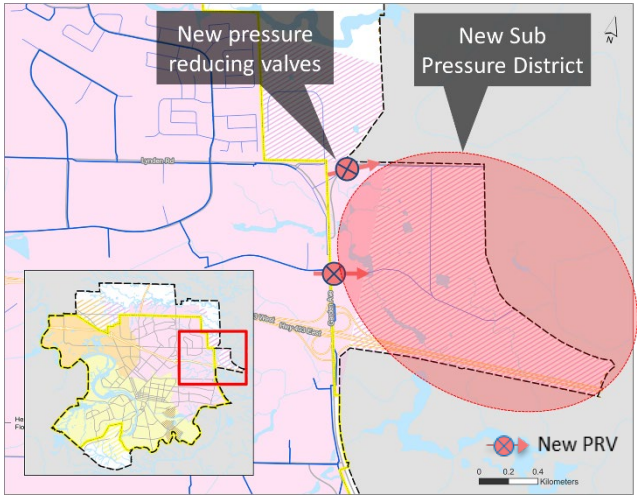
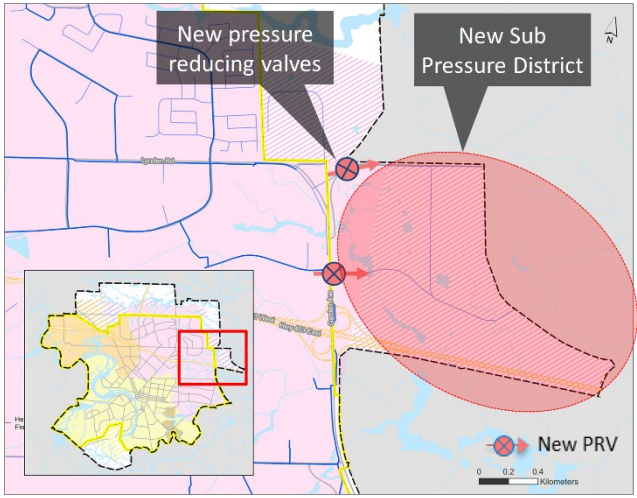
Table 40: Sub Pressure District Concepts

Colborne Street West Pumping Station	
Overview	
<ul style="list-style-type: none"> Area along Colborne Street West, at the Municipal boundary has low pressures due to high ground level elevations Development proposed further west will need to be serviced by a pumping station 	
Planned Upgrades	
<ul style="list-style-type: none"> New sub-pressure district to include existing properties on Colborne Street West and development extending west to the municipal boundary Developer led pumping station to be sized to provide peak demands and fire flows to the development and existing properties 	

8.5.2 East Sub-Pressure District 2/3

Due to low elevations within the east expansion lands, east of Garden Avenue, the area will be serviced via PD2/3 by two PRVs located at Lynden Road and Sinclair Boulevard, as shown in Table 41.

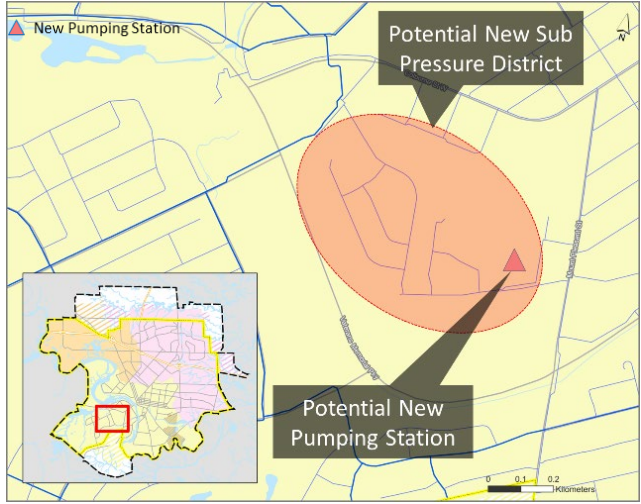
Table 41: East Sub-Pressure District 2/3

East Sub-Pressure District 2/3	
Overview	
<ul style="list-style-type: none"> East expansion lands, east of Garden Avenue, will have high pressures due to low ground level elevations Growth occurring in the expansion lands will need to be serviced by pressure reducing valves 	
Planned Upgrades	
<ul style="list-style-type: none"> New sub-pressure district to include east expansion lands, generally east of Garden Avenue to the municipal boundary Two municipal owned pressure reducing valves will be sized to provide peak demands and fire flows New watermain along Garden Avenue will be needed to complete watermain loop 	

8.5.3 Strawberry Hill Pumping Station

Further development within the Strawberry Hill area, generally following Hillcrest Avenue and Bell Lane, will require the construction of a new booster pumping station as the existing area currently experiences low pressures marginally exceeding 40 psi, as shown in **Table 42**.

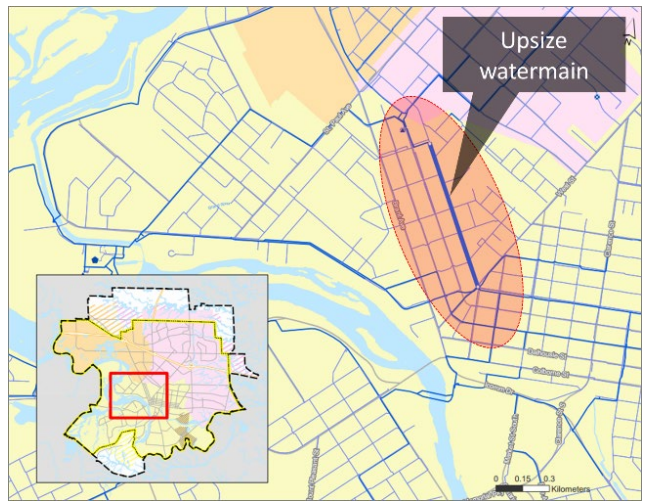
Table 42: Strawberry Hill Pumping Station

Strawberry Hill Pumping Station	
Overview	
<ul style="list-style-type: none"> Strawberry Hill area, a local high point, has low pressures due to high ground level elevations Development potential within this area and its servicing would require a new pumping station 	
Proposed Upgrades	
<ul style="list-style-type: none"> New sub-pressure district to include proposed development and existing properties Pumping station to be triggered by development and sized to provide peak demands to the development and/or existing properties 	

8.5.4 Downtown Trunk Watermain

Future intensification within the downtown core requires accommodating growth while maintaining the current level of service. Upgrading the existing watermain along Pearl Street will create a loop in the system’s downtown core, as shown in **Table 43**.

Table 43: Downtown Trunk Watermain

Downtown Trunk Watermain	
Overview	
<ul style="list-style-type: none"> • Downtown watermain upgrades needed to support intensification areas • Upsize existing watermains to create a trunk loop in the downtown core 	
Proposed Upgrades	
<ul style="list-style-type: none"> • Upsize the existing watermain along Pearl Street from St. James Street to West Street to 400 mm 	

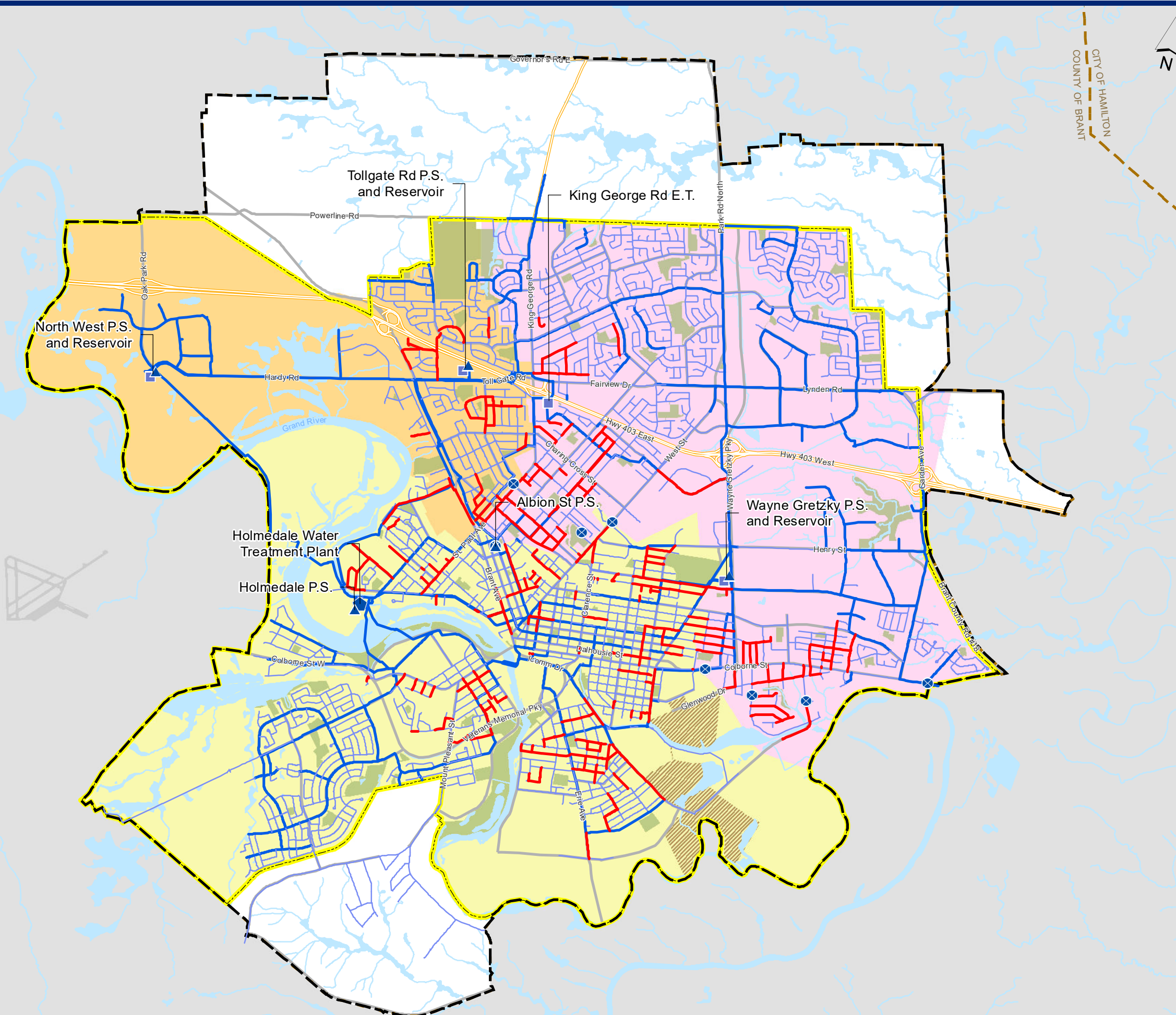
8.6 Distribution System Upgrades

Fire flow deficiencies were identified using a land-use based approach, where the governing land-use, at the closest fire hydrant, determined the fire flow target identified in **Section 2.4.2**. **Figure 10** presents the watermain upgrades to address fire flow deficiencies under existing conditions. A strategic approach was followed such that a prioritized capital program was developed using the following triggers:








- Existing deficiencies typically along previously broken and/or cast iron watermains. These areas can be addressed by the City’s infrastructure renewal program; and
- Growth development deficiencies within areas of infill/intensification. These areas can be addressed as growth occurs and can be funded by development charges.

Prioritization of capital projects, to address fire flow deficiencies, has been completed using the following methodology:

1. Replacement of watermains with a diameter less than 150 mm
2. Replacement of cast iron watermains with a historic break record
3. Replacement of cast iron watermains
4. Replacement of ductile iron watermains



Water Network

-  Water Treatment Plant
-  Pumping Station
-  Elevated Tank / Reservoir
-  Pressure Reducing Valve
-  Watermain Upgrades to Address Fire Flow Deficiencies
-  Watermains (< 250 mm)
-  Transmission (>= 250 mm)

Water Pressure Districts

-  Pressure District 1
-  Pressure District 2/3
-  Pressure District 4

General Features









-  Expressway / Highway
-  Arterial and Collectors
-  2016 Municipal Boundary
-  New Municipal Boundary
-  Six Nations of the Grand River Territory
-  Outside Municipalities
-  Parks
-  Waterbody

Figure 10
Watermain Upgrades to Address Fire Flow

8.7 Post Period Servicing

The servicing analysis presented focuses on servicing the buildout of the internal growth and Settlement Area Boundary Expansion Areas to 2051; however, the City's municipal boundary including the Trigger Lands was considered and will be serviced by the following extensions:

North Expansion Trigger Lands

- Trigger Lands in the North Expansion Lands will be serviced by an extension of the North-South Collector Road trunk watermain, King George Road trunk watermain and Park Road North trunk watermain, creating a loop.
- Trigger lands west of Balmoral Drive will be serviced by PD4 and lands east of Balmoral Drive will be serviced by PD2/3.
- Pumping for the trigger lands in PD4 will be provided by the Northwest PS which may require upgrades at the time the trigger lands enter the Settlement Area Boundary and storage will be serviced by the proposed PD4 ET which has been oversized to include the trigger lands growth.
- Pumping for the PD2/3 trigger lands will be provided by Tollgate PS and Wayne Gretzky PS. Storage will be provided by the proposed PD2/3 ET which has been oversized to include the trigger lands. Upon inclusion of the trigger lands in the Settlement Area Boundary, additional storage will be required in PD1 as storage is being provided, in the interim to 2051, by the excess capacity from the PD2/3 ET through use of PRVs at the existing Tollgate PS and Wayne Gretzky PS.

Tutela Heights Trigger Lands

- Trigger lands in Tutela Heights will be serviced by an extension of the watermains along Mount Pleasant Road, Tutela Heights Road and the Collector Road.
- Pumping will be provided by the Holmedale HLP and storage will be provided by the Holmedale Res and the PD1 ET. Additional storage and pumping may be required based on the timing of the North Expansion Lands.

9. Preferred Water Servicing Strategy

The recommended water servicing strategy can be broken down into various components that have different aims but each contribute to the overall improvement of the existing system and service the projected buildout growth.

The preferred servicing strategy was developed to ensure that extension of the water distribution system to the expansion lands is supportive of the existing servicing strategy and follows an integrated approach with the City's development plans.

9.1 Preferred Water Servicing Strategy Overview

In general, the preferred water servicing strategy consists of maintaining the existing pressure district split with new elevated tanks in PD2/3 and PD4.

Water will be supplied to the North Expansion residential lands in PD2/3 through a primary trunk connection at King George Road. Additional watermain connections to the existing system in PD2/3 are recommended at Park Road North and Brantwood Park Road. The north employment lands located in PD4 will be supplied through a trunk extension at Oak Park Road.

To service the East Expansion residential lands north of Lynden Road, a direct connection to PD2/3 on Lynden Road can be made. To service the employment lands east of Garden Avenue, a direct connection to PD2/3 at either Lynden Road or Sinclair Boulevard can be made.

To integrate Tutela Heights into PD1 within the City's system, connections at both Mount Pleasant Road and Conklin Road are required.

Each water project is further depicted in **Section 9.1.1 to 9.2.4**.

9.1.1 Holmedale WTP

Upgrades at the Holmedale Water Treatment Plant will increase the rated capacity of the water treatment plant to 130 MLD with completion over the next 10-15 years. Proposed works will be at the existing water treatment plant with minimal disruption to operations and include the following upgrades:

- **Low Lift Pumping Station & Header:** Second low lift pump station which includes new intake and twin header
- **Polymer Pumps:** Increase pumping capacity
- **Ozonation:** Additional generator and new contact chamber
- **Filtration:** Upsize filtration well and backwash pumps
- **Residual Management:** Expand capacity at existing facility
- **Hydrogen Peroxide:** Future addition to the preliminary treatment process

9.1.2 Pumping Stations

The following details the recommended upgrades at existing pumping stations:

- **Holmedale Water Treatment Plant High Lift Pump Upgrades:** Install additional pump to supply elevated tank and reservoirs from reservoirs in PD1
- **Wayne Gretzky Pump Upgrades:** Replace existing pumps with three (3) new pumps at Wayne Gretzky PS to improve operational capacity and support new Pressure District HGL. Install new PRV to allow PD2/3 to backfeed to PD1
- **Tollgate Pump Upgrades:** Replace existing pumps with three (3) new pumps at Tollgate PS to improve operational capacity and support new Pressure District HGL. Install new PRV to allow PD2/3 to backfeed to PD1
- **Decommissioning Albion Booster Pumping Station:** Decommissioning of Albion Booster Pumping Station

9.1.2.1 Sub-Pressure District Pumping Stations

The following details the recommended projects for proposed sub-pressure district pumping stations:

- **Colborne Street West Booster Pumping Station:** Install new 11.1 MLD booster pumping station to be serviced off of PD1 to service existing properties on Colborne Street and development extending west to the municipal boundary.
- **Strawberry Hill Booster Pumping Station:** Install new booster pumping station to boost flows from PD1 to a new sub-pressure district extending from Shellard Lane to Mount Pleasant Street. This booster pumping station is required to service future development.

9.1.3 Storage

The following details the recommended storage projects:

- **Pressure District 2/3 Elevated Tank:** New 11.7 ML ET in PD2/3, sized to service both PD2/3 and PD1 storage deficiency including North Expansion Lands until 2051. Post 2051, the PD2/3 ET will service PD2/3 and the Trigger Lands with additional storage needed in PD1 post 2051.
- **Pressure District 4 Elevated Tank:** New 2.7 ML ET in PD4 to service the PD4 storage deficiency including North Expansion Lands and Trigger Lands.
- **Pressure District 1 Elevated Tank:** New 6.0 ML ET in PD1 along Shellard Lane, construction of this ET was completed in 2021.
- **Decommissioning of King George Elevated Tank:** Decommissioning of the King George ET as it will be replaced by the new PD2/3 ET.

9.2 System Wide

9.2.1 Existing System Upgrades

Projects to service the existing water system include the following:

- **Upsize Fairview Drive/Lynden Road Trunk Watermain:** Watermain upgrades on Fairview Drive/Lynden Road from King George Road to Brantwood Park Road to 600 mm to support growth in PD2/3.
- **Downtown Trunk Watermain:** Upsize existing watermain along Pearl Street from St. James Street to West Street to 400 mm.
- **Garden Avenue Watermain Upgrade:** Upsize existing watermain along Garden Avenue from Lynden Road to Sinclair Boulevard to 300 mm to create loop within PD2/3.
- **Fire Flow Watermain Upgrades:** Fire flow program to include replacing watermains less than or equal to 100mm, replacing Cast Iron watermains, replacing Asbestos Cement/Ductile Iron watermains (installed before 1990) and upsizing and looping to strengthen local trunk network. All watermain replacements will be PVC.

9.2.2 North Expansion Lands

Projects to service the North Expansion Lands include the following:

- **King George Road Watermain:** Upsize existing watermain from 400 mm to 750 mm on King George Road from Tollgate PS to the proposed east-west collector road in the North Expansion Lands or the new PD2/3 ET.
- **Oak Park Road Trunk Watermain:** New 600 mm trunk watermain extending from Oak Park Road watermain limit to Powerline Road in PD4.
- **Powerline Road Trunk Watermain:** New 600 mm trunk watermain in PD4 along Powerline Road from new Oak Park Road watermain to the proposed east-west collector road.
- **North-South Collector Road Trunk Watermain:** New 600 mm trunk watermain in PD4 along proposed north-south collector road from Powerline Road to proposed east-west Collector Road
- **North-South Collector Road Local Watermain:** New 300 mm local watermain in PD4 along proposed north-south collector road from proposed east-west collector road to North expansion limit.
- **Paris Road Trunk Watermain:** New 600 mm watermain in PD4 along Paris Road from Tollgate Road to proposed north-south collector road at Powerline Road.
- **Powerline Road Distribution Watermain:** New 300 mm distribution watermain in PD4 along Powerline Road from proposed north-south collector road to Balmoral Drive extension.

- **Pressure District 4 East-West Collector Road Trunk Watermain:** New 400 mm trunk watermain in PD4 along east-west collector road from north-south collector road to PD4 boundary at Balmoral Drive Road extension.
- **Pressure District 2/3 East-West Collector Road Trunk Watermain:** New 600 mm trunk watermain in PD2/3 along east-west collector road from PD4 boundary trunk watermain to Park Road North.
- **Pressure District 2/3 East-West Collector Road Trunk Watermain:** New 400 mm trunk watermain in PD2/3 along east-west collector road from Park Road North to Brantwood Park Road.
- **Brantwood Park Road Trunk Watermain:** New 400 mm trunk watermain in PD2/3 along Brantwood Park Road from Powerline Road to east-west collector road.
- **Park Road North Trunk Watermain:** New 600 mm trunk watermain in PD2/3 along Park Road North from Powerline Road to east-west collector road.
- **Powerline Road Local Watermain:** New 300 mm local watermain in PD2/3 along Powerline Road from Brantwood Park Road to east-west collector road eastern limit.
- **East-West Collector Road Local Watermain:** New 300 mm local watermain in PD2/3 along east-west collector road from Powerline Road eastern limit to Brantwood Park Road.

9.2.3 East Expansion Lands

Projects required to service the East Expansion Lands include the following:

- **Lynden Road Trunk Watermain:** Upgrade existing watermain to 400 mm on Lynden Road from Brantwood Park Road to eastern limit for East Expansion Lands.
- **Lynden Road Distribution Watermain Extension:** New 300 mm local watermain in PD2/3 along Lynden Road from Lynden Road trunk watermain to East Expansion Lands limit.
- **East Expansion Lands Residential Loop:** New 300 mm local watermain in East Expansion Lands along proposed collector road north of Lynden Road.
- **East Expansion Lands Employment Loop:** New 300 mm local watermain in East Expansion Lands along employment lands collector road from Lynden Road watermain extension to Sinclair Road connection including two (2) new PRVs from PD2/3 to the East Expansion Lands at Lynden Road and Sinclair Road.

9.2.4 Tutela Heights

Watermain upgrades that will be required to accommodate growth include the following:

- **Mount Pleasant Road Watermain Upgrades:** Upsize existing 200 mm watermain on Mount Pleasant Road in Tutela Heights to 300 mm, including automatic flushers at the dead ends.
- **Conklin Road Watermain Upgrades:** Upsize existing 200 mm watermain on Conklin Road from Blackburn Drive to Mount Pleasant Road to 300 mm.
- **Tutela Heights Road Upgrades:** Upsize existing 200 mm watermain on Tutela Heights from Mount Pleasant Road to Davern Road to 300 mm.
- **Tutela Heights Collector Road Distribution Watermain:** New 300 mm distribution watermain along collector road from Mount Pleasant Road to Phelps Road in Tutela Heights, including automatic flushers at the dead ends.
- **Davern Road Distribution Watermain:** New 300 mm distribution watermain along Davern Road from Mount Pleasant Road southern limit to collector road.

9.3 Capital Program & Implementation Plan

The preferred water servicing strategy has been developed to support the servicing needs of the existing and future growth areas within the City of Brantford to 2051 and beyond. The capital costs for each project of the Preferred Strategy were estimated according to the costing methodology within **Volume II**. These projects are listed according to their project number. Detailed project sheets are included in **Appendix F**.

9.3.1 Project Costing

The water Capital Program project costs were developed using a unit cost approach. A breakdown of the unit cost methodology is included in **Volume II**.

9.3.2 Development Charge Contributions

For each identified water project, the project’s estimated growth/benefit to existing related contributions were identified. **Table 44** summarizes the Development Charges (DC) benefit to existing classifications

Table 44: Development Charges Benefit to Existing Classifications

Development Charges Benefit to Existing Class	Description
A	Solely supporting new development area
B	Triggered by growth but also services existing users
C	Triggered by growth but also provides some operational improvement
D	Supports both growth and existing users equally
E	Primarily to address existing operational issues but also supports growth
F	Sole benefit to existing users

9.3.3 Project Timing and Triggers

To support the City’s long-term budgeting and water rates, a preliminary project timeline for each water Capital Program project has been identified. Project timing has been identified in the following increments.

- 0-5 Years
- 5-10 Years
- 10-20 Years

The estimated project timeline was based on individual capacity triggers for each project. These capacity triggers are based on the growth within the system which can be accommodated before the identified project is required.

9.4 Operational and Maintenance Impacts

The proposed water system upgrades represent a 40% increase in value of the City’s trunk watermain network and includes a 30% increase in treatment plant capacity upgrades, and an increase in one (1) storage facility; while eliminating one (1) existing pumping station.

It is anticipated that the above system expansions will increase the network operational and maintenance costs by an equivalent amount. As such, these additional operational costs, and supporting staff increases, will need to be factored into the City’s long-term water system financial planning and operational needs

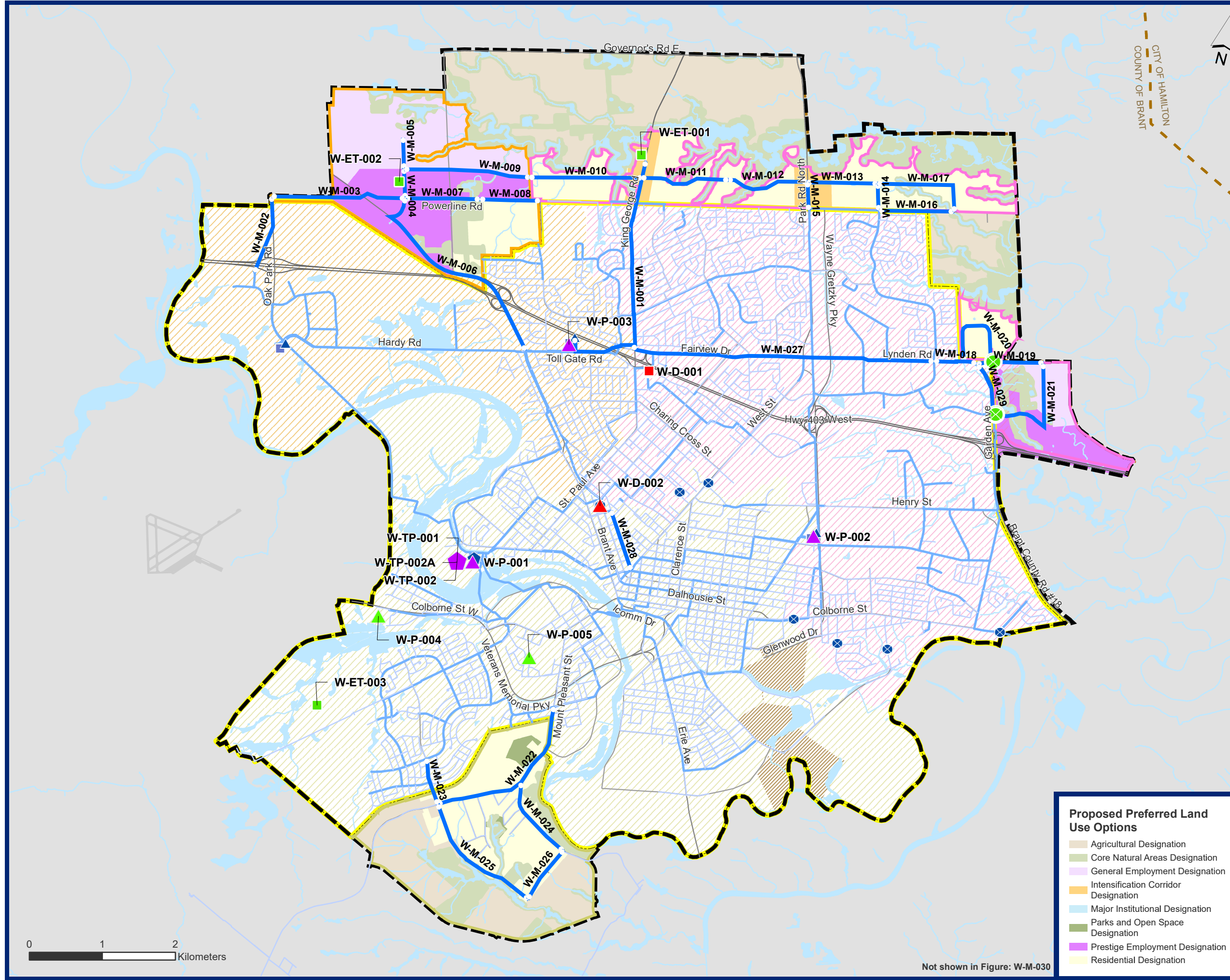
9.4.1 Capital Program Summary

The capital program table, shown in **Table 45** and **Figure 11**, contains project descriptions, dimensions, proposed timing, and estimate total project cost.

Table 45: Capital Program Summary

Capital Program ID	Name	Required Studies	Class EA Schedule	Size/ Capacity	Total Estimated Cost (2020\$)	Timeline	DC Benefit to Existing Class
W-M-001	King George Road Watermain	-	A+	750 mm	\$ 17,421,000	0-5 Years	C
W-M-002	Oak Park Road Trunk Watermain	Municipal Class EA	B	600 mm	\$ 14,407,000	0-5 Years	A
W-M-003	Powerline Road Trunk Watermain	Municipal Class EA	B	600 mm	\$ 7,682,000	0-5 Years	A
W-M-004	North-South Collector Road Trunk Watermain	-	A	600 mm	\$ 1,088,000	10-20 Years	A
W-M-005	North-South Collector Road Local Watermain	-	A	300 mm	\$ 524,000	10-20 Years	A
W-M-006	Paris Road Trunk Watermain	-	B	600 mm	\$ 11,184,000	5-10 Years	C
W-M-007	Powerline Road Distribution Watermain	-	A+	300 mm	\$ 1,357,000	5-10 Years	A
W-M-008	Powerline Road Distribution Watermain	-	A+	300 mm	\$ 1,457,000	5-10 Years	A
W-M-009	Pressure District 4 East-West Collector Road Trunk Watermain	-	A	400 mm	\$ 3,329,000	10-20 Years	A
W-M-010	Pressure District 2/3 East-West Collector Road Trunk Watermain	-	A	400 mm	\$ 2,712,000	10-20 Years	A
W-M-011	Pressure District 2/3 East-West Collector Road Trunk Watermain	-	A	600 mm	\$ 3,389,000	10-20 Years	A
W-M-012	Pressure District 2/3 East-West Collector Road Trunk Watermain	-	A	600 mm	\$ 3,208,000	10-20 Years	A
W-M-013	East-West Collector Road Trunk Watermain	-	A	400 mm	\$ 1,070,000	0-5 Years	A
W-M-014	Brantwood Park Road Trunk Watermain	-	A	400 mm	\$ 651,000	0-5 Years	A
W-M-015	Park Road North Trunk Watermain	-	A+	600 mm	\$ 1,125,000	0-5 Years	A
W-M-016	Powerline Road Local Watermain	-	A+	300 mm	\$ 1,431,000	0-5 Years	A
W-M-017	East-West Collector Road Local Watermain	-	A	300 mm	\$ 1,679,000	0-5 Years	A
W-M-018	Lynden Road Trunk Watermain Upgrades	-	A+	400 mm	\$ 1,184,000	5-10 Years	C
W-M-019	Lynden Road Distribution Main Extension	-	A+	300 mm	\$ 2,998,000	0-5 Years	A
W-M-020	East Expansion Lands Residential Loop	-	A	300 mm	\$ 1,535,000	0-5 Years	A
W-M-021	East Expansion Lands Employment Loop	-	A	300 mm	\$ 2,502,000	5-10 Years	A
W-M-022	Mount Pleasant Road Watermain Upgrades	-	A+	300 mm	\$ 3,417,000	0-5 Years	D
W-M-023	Conklin Road Watermain Upgrades	-	A+	300 mm	\$ 870,000	0-5 Years	D
W-M-024	Tutela Heights Road Upgrades	-	A+	300 mm	\$ 1,709,000	5-10 Years	B
W-M-025	Tutela Heights Collector Road Distribution Watermain	-	A	300 mm	\$ 2,316,000	10-20 Years	A
W-M-026	Davern Road Distribution Watermain	-	A+	300 mm	\$ 1,108,000	10-20 Years	A
W-M-027	Upsize Fairview Drive/Lynden Road Trunk Watermain	-	A+	600 mm	\$ 11,949,000	5-10 Years	C

Capital Program ID	Name	Required Studies	Class EA Schedule	Size/ Capacity	Total Estimated Cost (2020\$)	Timeline	DC Benefit to Existing Class
W-M-028	Downtown Trunk Watermain	-	A+	400 mm	\$ 1,782,000	5-10 Years	C
W-M-029	Garden Avenue Watermain Upgrade	-	A+	300 mm	\$ 1,574,000	5-10 Years	B
W-M-030	Fire Flow Watermain Upgrades	-	A+	300 mm	\$ 3,818,000	0-5 Years	D
W-ET-001	Pressure District 2/3 Elevated Tank	Municipal Class EA	B	11.7 ML	\$ 22,002,000	0-5 Years	C
W-ET-002	Pressure District 4 Elevated Tank	Municipal Class EA	B	2.7 ML	\$ 6,252,000	10-20 Years	C
W-ET-003	Pressure District 1 Elevated Tank	Municipal Class EA	B	6.0 ML	\$ 10,828,000	Completed in 2021	C
W-D-001	Decommissioning of King George Elevated Tank	-	A+	-	\$ 929,000	5-10 Years	C
W-D-002	Decommissioning of Albion Booster Pumping Station	-	A+	-	\$ 463,000	5-10 Years	C
W-P-001	Holmedale Water Treatment Plant High Lift Pump Upgrades	-	A+	-	\$ 2,320,000	0-5 Years	C
W-P-002	Wayne Gretzky Pump Upgrades	-	A+	-	\$ 6,497,000	5-10 Years	C
W-P-003	Tollgate Pump Upgrades	-	A+	-	\$ 7,425,000	5-10 Years	C
W-P-004	Colborne Street West Booster Pumping Station	Municipal Class EA	B	11.1 MLD	\$ 5,564,000	0-5 Years	B
W-P-005	Strawberry Hill Booster Pumping Station	Municipal Class EA	B	-	\$ 2,056,000	10-20 Years	B
W-TP-001	Water Treatment Plant Upgrades - 0-5 Years	-	A+	-	\$ 929,000	0-5 Years	B
W-TP-002	Water Treatment Plant Upgrades - 5-10 Years	-	A+	-	\$ 12,993,000	5-10 Years	A
TOTAL					\$ 188,734,000		



- Capital Program Projects**
- Watermains
 - Decommission Elevated Tank
 - Decommission Pumping Station
 - New Pressure Reducing Valve
 - New Elevated Tank
 - New Pumping Station
 - Existing Pumping Station Upgrade
 - Water Treatment Plant Upgrade

- Water Network**
- Water Treatment Plant
 - Pumping Station
 - Elevated Tank / Reservoir
 - Pressure Reducing Valve
 - Watermains (< 400 mm)
 - Water Transmission (>= 400 mm)

- Water Pressure Districts**
- Pressure Zone 1
 - Pressure Zone 2/3
 - Pressure Zone 4

- Proposed Pressure District Expansions**
- To be serviced by PD 1
 - To be serviced by PD 2/3
 - To be serviced by PD 4

- General Features**
- New Municipal Boundary
 - 2016 Municipal Boundary
 - Six Nations of the Grand River Territory
 - Waterbody

- Proposed Preferred Land Use Options**
- Agricultural Designation
 - Core Natural Areas Designation
 - General Employment Designation
 - Intensification Corridor Designation
 - Major Institutional Designation
 - Parks and Open Space Designation
 - Prestige Employment Designation
 - Residential Designation

0 1 2 Kilometers

Not shown in Figure: W-M-030

Figure 11
Water - Capital Program

10. Implementation Plan

As outlined in **Section 2** of **Volume II**, the 2020 MSP sets out to satisfy the Class EA Master Plan Approach 1 requirements according to the MEA Class EA document. The Preferred Wastewater Servicing Strategy will support the servicing needs of the City of Brantford’s future growth to 2051 and beyond. This strategy will be implemented in accordance with each project Class EA schedule.

The Preferred Water Servicing Strategy will support the servicing needs of the City of Brantford’s future growth to 2051 and beyond.

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. Schedule B or equivalent projects that have been identified within the Preferred Water Servicing Strategy will be part of a developer-led local servicing plan and approved through the Planning Act Municipal development review process or will be satisfied through separate Class EA studies prior to design and construction. The Preferred Water Strategy did not identify any Schedule C projects.

All necessary studies (environmental impact, cultural heritage resource, and archeological resource, etc.) should be undertaken by an appropriate professional as early as possible during the planning process for all Schedule B projects identified within the Preferred Servicing Strategy.

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

- Finalization of property requirements;
- Refinement of infrastructure alignment;
- Identification of preferred construction methodologies;
- Completion of additional supporting investigations as required (e.g. geotechnical, hydrogeological, etc.);
- Review and mitigation of potential construction related impacts; and,
- Satisfying all provincial, municipal and conservation authority approval requirements.

With respect to the City’s planning and budgeting, this program will be used as a high-level baseline estimate for the City’s capital budget. These costs will be further developed and refined during the implementation 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 City. The water program’s projected scheduling has also been cross-referenced with the wastewater and stormwater programs to ensure project coordination along common alignments.

Given the growth-related nature of the servicing strategies, the water capital program forms the foundation for the water component of the City of Brantford’s Development Charges By-Law.

The following subsections outline the proposed implementation for water infrastructure.

10.1 Holmedale Water Treatment Plant

Upgrade triggers at the Holmedale WTP are outlined in **Table 46** and shown in **Figure 12**. Based on the existing MDD supply firm capacity of 100 MLD and existing MDD of 58.2 MLD, there is approximately 41.8 MLD of available treatment capacity to support growth; corresponding to an equivalent population of approximately 85,000 people and jobs. The following criteria should be referenced as facility upgrade triggers, as outlined in **Section 2.4.2.1**:

- Planning and design process will begin at 80% utilization of the facility’s capacity. There is approximately 21.8 MLD of available treatment capacity to reach 80% utilization; corresponding to an equivalent population of approximately 45,000 people and jobs due to an expediated schedule discussed and preferred by the City
- Construction process will begin at 90% utilization of the facility’s capacity. There is approximately 31.8 MLD of available treatment capacity to reach 90% utilization; corresponding to an equivalent population of approximately 65,000 people and jobs due to an expediated schedule discussed and preferred by the City

Table 46: Holmedale WTP Upgrade Triggers

	MDD Rated Capacity (MLD)	Existing MDD (MLD)	Upgrade Trigger	
			Additional Capacity before Trigger (MLD)	People & Jobs
80% Capacity	80.0	58.2	21.8	45,000
90% Capacity	90.0		31.8	65,000
100% Capacity	100.0		41.8	85,000

Upgrades are classified into two sets of upgrades, based on expedited timeline and are as follows:

- **0-5 Years:**
 - Increase polymer pumping capacity
- **5-10 Years:**
 - Second low lift pump station including new intake and twinning header
 - Install additional generator and new contact chamber
 - Upsize filtration well and backwash pumps
 - Upsize residual management facility

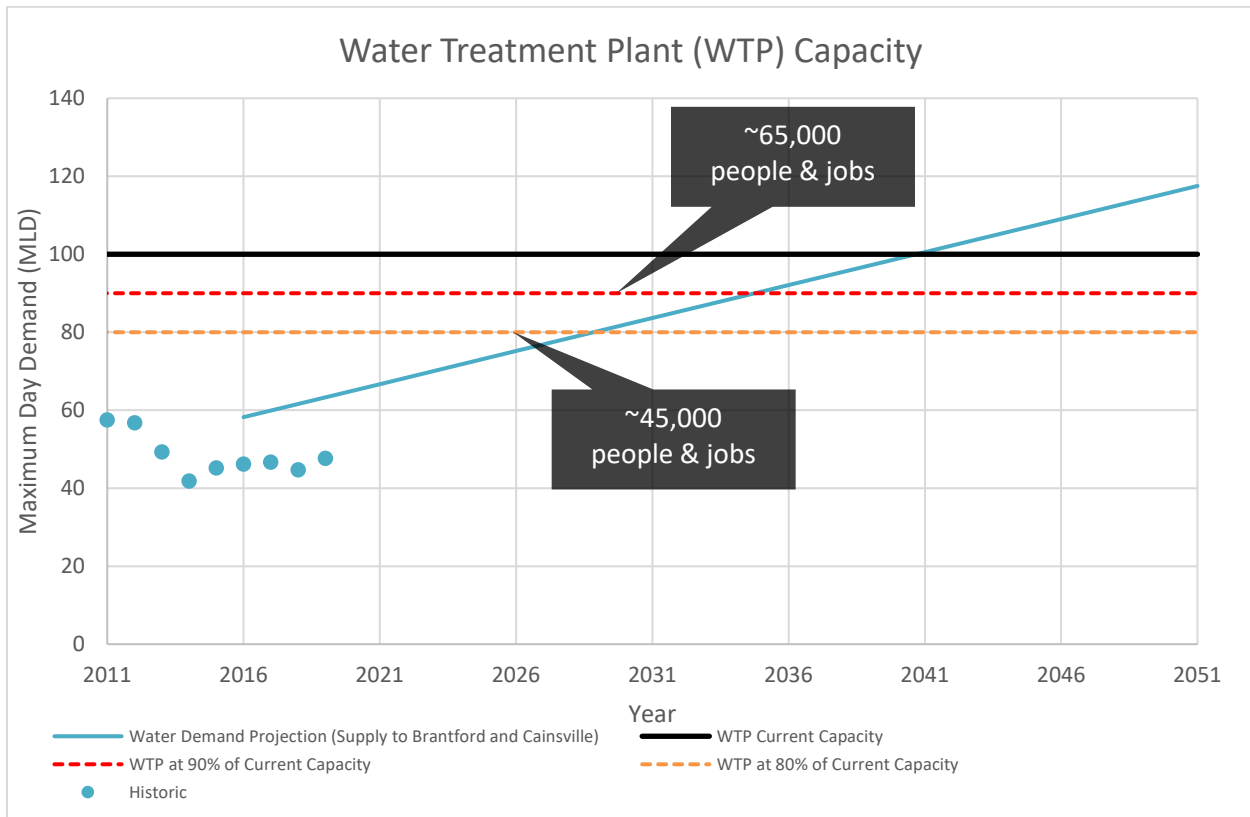


Figure 12: Holmedale Water Treatment Plant Capacity Triggers

10.2 Area Servicing Plans

The following sections outline the trunk servicing needs, triggers and overall servicing requirements for each “development area” with the objective of providing direction on the project timing and triggers in terms of municipal servicing. The following subsections also summarize the magnitude of growth that can be accommodated before any upgrades are triggered.

10.2.1 North Expansion Employment Lands

Within the North Expansion Lands, the timing was broken into two categories: Pressure District 2/3 and Pressure District 4. For the North Expansion Employment Lands, the Oak Park Road trunk watermain will need to be extended north to Powerline Road, requiring both a Highway 403 crossing and railway crossing. This trunk watermain is required to service any growth north of Highway 403.

To support storage needs for the North Expansion Employment Lands, a new PD4 Elevated Tank will be required. Timing for the new ET will be dependent on the North Expansion Lands buildout timing; however, based on the identified growth, it will be required before 2041 buildout.

An overview of the projects required to service the North Expansion Employment Lands, including timing and triggers are presented in **Table 47**.

Table 47: North Expansion Employment Lands Implementation

North Expansion Employment Lands (Pressure District 4)		
Overview		
<ul style="list-style-type: none"> Triggered by any growth north of Highway 403 		
Key Projects		
<ul style="list-style-type: none"> Highway 403 watermain crossing: Immediate (to service any growth) Pressure District 4 ET: Later; to service further growth 		
Other Comments		
<ul style="list-style-type: none"> Oak Park Road to be completed first over Paris Road due to opportunity for shared alignment with wastewater trunk sewer Remaining trunks related to local development 		
	W-M-002: Oak Park Road Trunk Watermain	W-ET-002: Pressure District 4 Elevated Tanks
Why	<ul style="list-style-type: none"> Trunk watermain crossing Highway 403 Railway crossing and overhead powerlines Optimize through local development Coordinate with wastewater sewer 	<ul style="list-style-type: none"> Requirements for a new ET Determine preferred location
Study	Schedule 'B' EA	Schedule 'B' EA
Trigger	Any growth north of Highway 403	Future growth (before 2041 buildout)
Timing	0-5 Years Initiate EA within next year	10-20 Years

10.2.2 North Expansion Residential Lands

Water will be supplied to the North Expansion Lands in PD2/3 through a trunk connection at King George Road. To accommodate additional growth in PD2/3, a new ET is required and should be initiated immediately. The existing King George Road watermain from Tollgate PS to the new PD2/3 ET will also need to be upsized to accommodate the new ET requirements.

Additionally, upgrades at the existing Wayne Gretzky PS and Tollgate PS will be required support the new PD2/3 ET with timing dependent on the ET strategy. In PD2/3, the Fairview/Lynden Road watermain will also require upgrades to support growth, with flexible timing as it will be required before approximately 50% of all growth in PD2/3.

An overview of the projects required to service the North Expansion Residential Lands, including timing and triggers are presented in **Table 48**.

Table 48: North Expansion Residential Lands Implementation

North Expansion Residential Lands (Pressure District 2/3)				
Overview				
<ul style="list-style-type: none"> Triggered by growth 				
Key Projects				
<ul style="list-style-type: none"> Pressure District 2/3 Elevated Tank: Immediate King George Road Watermain: With ET Wayne Gretzky Pump Upgrades: To support PD2/3 ET Tollgate Pump Upgrades: To support PD2/3 ET Fairview Drive/Lynden Road Trunk Watermain: Later; to support additional growth 				
	W-ET-001: Pressure District 2/3 Elevated Tank	W-M-001: King George Road Watermain	W-P-002 & W-P-003: Wayne Gretzky & Tollgate Pump Upgrades	W-M-027: Fairview Drive/Lynden Road Trunk Watermain
Why	<ul style="list-style-type: none"> Requirements for a new PD2/3 ET Determine the preferred location Optimization of PD2/3 	<ul style="list-style-type: none"> Provide capacity for new PD2/3 ET 	<ul style="list-style-type: none"> Improve operational capacity Support new HGL in PD2/3 	<ul style="list-style-type: none"> Support growth in PD2/3
Study	Schedule 'B' EA	Group with ET Schedule 'B' EA	No further study required	No further study required
Trigger	Immediately	Dependent on PD2/3 ET construction	Dependent on PD2/3 ET strategy	Flexible; before 50% of PD2/3 buildout
Timing	0-5 Years Initiate EA now	0-5 Years	5-10 Years Potential to advance dependent on EA outcome	5-10 Years

10.2.3 East Expansion Lands

Servicing for the East Expansion Lands is triggered by growth east of Garden Avenue. To service, a connection to PD2/3 can be made at either Lynden Road or Sinclair Boulevard, both require a PRV to create a new sub-zone due to the decreased elevations in the East Expansion Lands.

Upgrades are required for the existing Lynden Road Trunk Watermain, with timing dependent on growth and fire flow requirements in the East Expansion Lands. Additionally, a watermain upgrade along Garden Avenue will be required to create a looped system within PD2/3, with flexible timing as it will be required before approximately 50% of all growth in PD2/3.

An overview of the projects required to service the East Expansion Lands, including timing and triggers are presented in **Table 49**.

Table 49: East Expansion Lands Implementation

East Expansion Lands			
Overview			
<ul style="list-style-type: none"> Triggered by growth east of Garden Avenue 			
Key Projects			
<ul style="list-style-type: none"> PRVs located on Garden Avenue and Sinclair Boulevard: Timing dependent on growth Lynden Road Trunk Watermain Upgrades: Later; to support further growth Garden Avenue Watermain Upgrade: Later; to loop PD2/3 			
	W-M-019 & W-M-021: Pressure Reducing Valves	W-M-018: Lynden Road Trunk Watermain Upgrades	W-M-029: Garden Avenue Watermain Upgrades
Why	<ul style="list-style-type: none"> High pressures due to low elevations 	<ul style="list-style-type: none"> Upsize existing watermain to accommodate growth 	<ul style="list-style-type: none"> Upsize to create loop within PD2/3 New PRVs will create sub-zone
Study	No further study required	No further study required	No further study required
Trigger	Any growth east of Garden Avenue	Dependent on growth and fire flow requirement	Provide benefits now; before 50% of PD2/3 buildout
Timing	0-5 Years	5-10 Years	5-10 Years

10.2.4 Tutela Heights

To integrate Tutela Heights into the City’s existing PD1 system, a connection at either Mount Pleasant Road or Conklin Road is required. The timing for this connection is as soon as the City is to supply Tutela Heights. To support growth, the trunk watermains along Tutela Heights and Conklin Road will need to be upsized to increase or maintain existing fire flows. Timing for these upgrades will be dependent on local growth in Tutela Heights.

An overview of the projects required to service Tutela Heights by integrating into the City’s system, including timing and triggers are presented in **Table 50**.

Table 50: Tutela Heights Implementation

Tutela Heights		
Overview		
<ul style="list-style-type: none"> • Triggered by County/City agreement (before 2026) • Existing watermain upsizing needed to support fire flow and growth 		
Key Projects		
<ul style="list-style-type: none"> • Mount Pleasant or Conklin Road connection: to integrate into City's system • Conklin & Tutela Heights Loop: Later; to support growth 		
Other Comments	<ul style="list-style-type: none"> • Watermain loop may trigger EA; loop is adjacent to Phelps Creek, which is part of the recommended NHS and along an unopened road allowance 	
	W-M-022 & W-M-023: Conklin & Mount Pleasant Connection	W-M-024, W-M-025 & W-M-026: Conklin & Tutela Heights Loop
Why	<ul style="list-style-type: none"> • Integrates existing Tutela Heights into the City's water system • Increases or maintains existing fire flows • Accommodates future growth area 	<ul style="list-style-type: none"> • Increases or maintains existing fire flows • Accommodates future growth areas
Study	No further study required	Possible Schedule 'B' EA
Trigger	Tutela Heights integration into City system; needed to meet City level of service (Fire Flow)	Local growth
Timing	0-5 Years	5-20 Years

10.3 Local Servicing Needs

The following sections outline the local servicing needs, triggers and overall servicing requirements for each "local development area" with the objective of providing direction on the project timing and triggers in terms of municipal servicing.

10.3.1 Colborne Street West BPS

A new BPS is required to service the proposed development on Colborne Street West extending west to the municipal boundary in PD1. The BPS is triggered by growth and will align with the timing of the local development. An overview of the project is presented in **Table 51**.

Table 51: Colborne Street West BPS Implementation

W-P-004: Colborne Street West Booster Pumping Station	
Why	<ul style="list-style-type: none"> • New BPS to service development • To service low pressures (<40 psi)
Study	Schedule 'B' EA (part of planning process)
Trigger	Local Development
Timing	Based on developers

10.3.2 Strawberry Hill BPS

A BPS is required in the existing Strawberry Hill area to service additional growth. The BPS will be triggered by growth and will align with the timing of the local development. An overview of the project is presented in **Table 52**.

Table 52: Strawberry Hill BPS Implementation

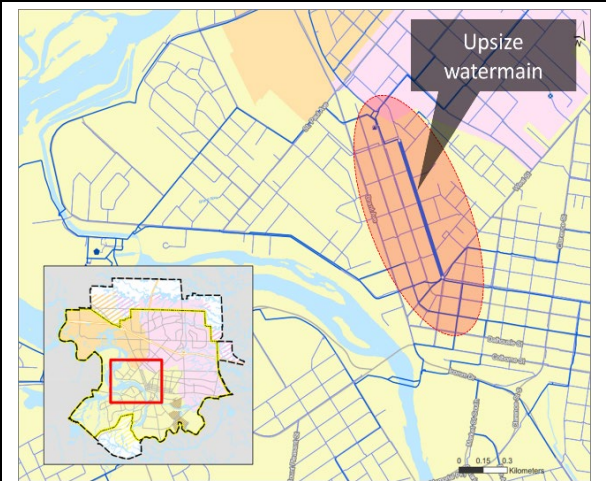
W-P-005: Strawberry Hill Booster Pumping Station	
Why	<ul style="list-style-type: none"> • New BPS to service development • To service low pressures (<40 psi)
Study	Schedule 'B' EA (likely City lead)
Trigger	Local Development
Timing	Based on developers

10.3.3 Downtown Trunk Watermain

Upgrading the existing watermain along Pearl Street will create a loop to support intensification in the downtown core to maintain the current level of service. This watermain would provide benefits to the City’s existing system; however, isn’t required until further growth in the downtown occurs. An overview of the project is presented in **Table 53**.

Table 53: Downtown Trunk Watermain Implementation

W-M-028: Downtown Trunk Watermain	
Why	<ul style="list-style-type: none"> To support intensification Maintain current level of service Create loop in downtown core
Study	No further study required
Trigger	Provides benefits to the existing system
Timing	5-10 Years



10.4 Facility Decommissioning

Once the new PD2/3 ET is constructed, the existing King George ET and Albion BPS can be decommissioned. Timing for the decommissioning will be dependent on the construction of the new PD2/3 ET as new capacity will be needed first. An overview of the projects is presented in **Table 54**.

Table 54: Facility Decommissioning

W-D-001 & W-D-002: King George Elevated Tank and Albion Booster Pumping Station		
Why	<ul style="list-style-type: none"> Old infrastructure Capacity not needed 	
Study	No further study required	
Trigger	Once new PD2/3 ET is constructed	
Timing	5-10 Years	

10.5 Fire Flow Watermain Upgrades

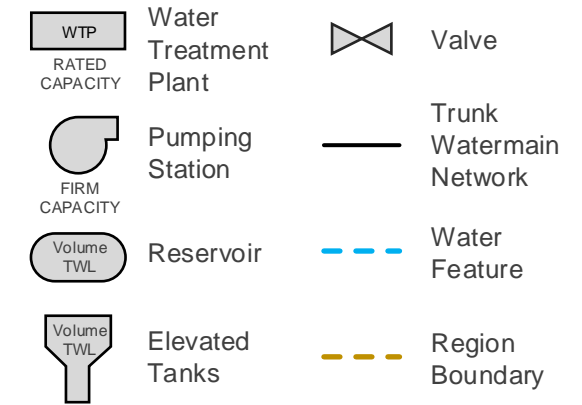
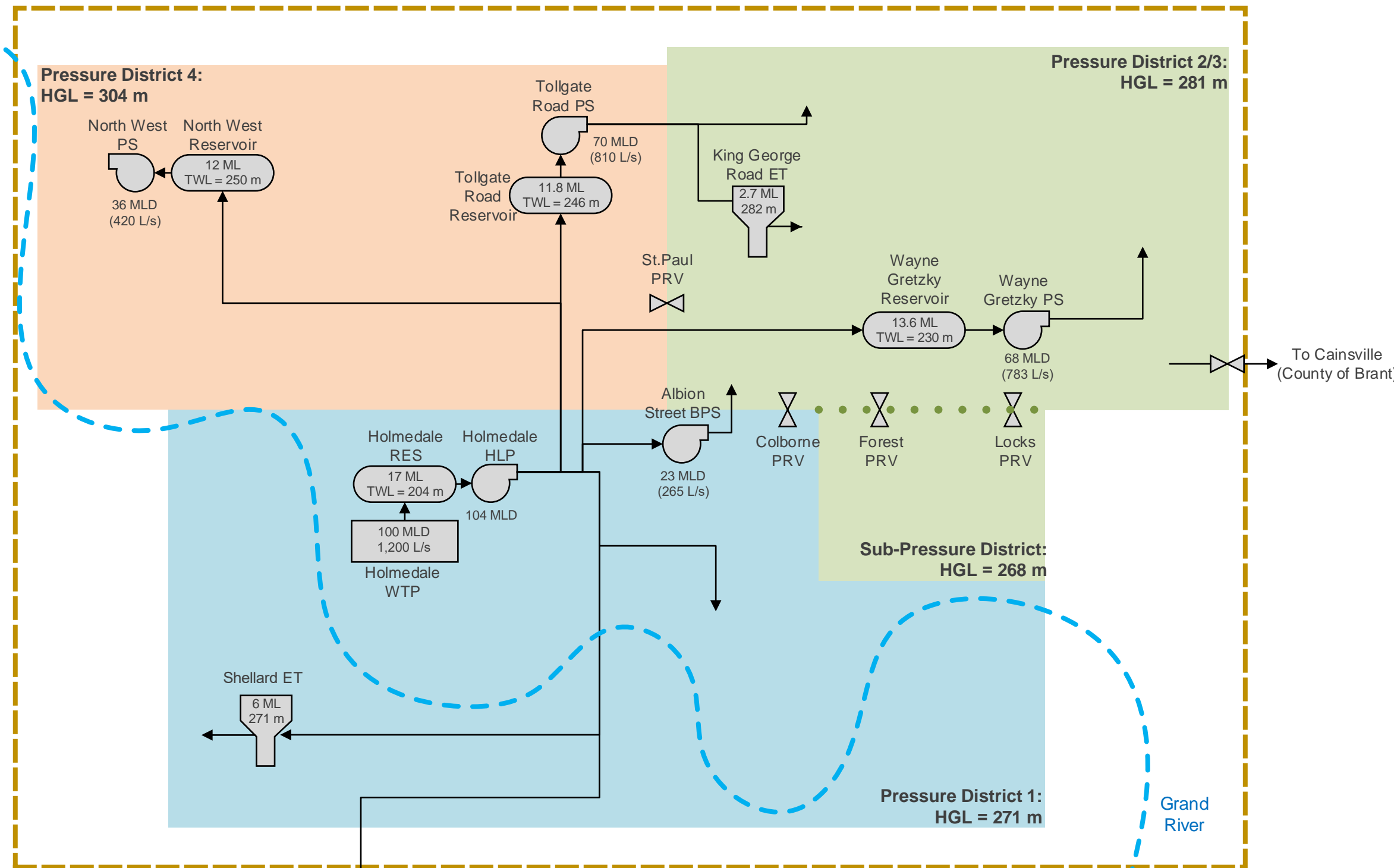
A fire flow program has been developed to include the replacement of watermains less than or equal to 100mm, replacing Cast Iron watermains, replacing Asbestos Cement/Ductile Iron watermains (installed before 1990) and upsizing and looping to strengthen local trunk network to improve existing and future system fire flows. All watermains that are flagged, detailed in **Table 55**, to be upsized have been provided to the City and should be monitored when completing local work through the SOGR program or identified as local development occurs.

Table 55: Fire Flow Watermain Upgrades Implementation

Fire Flow Watermain Upgrades	
Overview	
Trigger	
Why	
Overview	<ul style="list-style-type: none"> • Ongoing; no specific timeline
Trigger	<ul style="list-style-type: none"> • As local development occurs • Align existing deficiencies with SOGR program or corridor works
Why	<ul style="list-style-type: none"> • Fire flow deficiencies under existing conditions • Growth development deficiencies within areas of infill/intensification • Strengthen local trunk network



City of Brantford
APPENDIX A
WATER SYSTEM SCHEMATIC



Pressure Districts (HGL)

- Pressure District 1: 271 m
- Pressure District 2/3: 281m
- Pressure District 4: 304 m
- Mt. Pleasant: 286 m*

* Future Service

Existing Water System Schematic



City of Brantford
APPENDIX B
TRAFFIC ZONE DEMAND

Traffic Zone Name	Water Pressure District	Growth-RES (People)	Growth-EMP (People)	Growth-TOTAL (People)	ADD-RES (L/s)	ADD-EMP (L/s)	ADD-TOTAL (L/s)
1001	PD 2/3	819	184	1,003	2.6	0.6	3.1
1002	PD 2/3	406	79	485	1.3	0.2	1.5
1003	PD 2/3	-15	152	137	0.0	0.5	0.4
1004	PD 2/3	0	78	78	0.0	0.2	0.2
1005	PD 2/3	-5	112	107	0.0	0.4	0.3
1006	PD 2/3	0	13	13	0.0	0.0	0.0
1007	PD 2/3	0	141	141	0.0	0.4	0.4
1008	PD 2/3	0	296	296	0.0	0.9	0.9
101	PD 4	-105	144	39	-0.3	0.4	0.1
102	PD 4	-455	0	-455	-1.4	0.0	-1.4
103	PD 2/3	127	308	435	0.4	1.0	1.4
104	PD 4	-107	67	-39	-0.3	0.2	-0.1
105	PD 2/3	-121	61	-60	-0.4	0.2	-0.2
106	PD 4	-74	43	-31	-0.2	0.1	-0.1
107	PD 4	-47	41	-6	-0.1	0.1	0.0
108	PD 4	178	45	223	0.6	0.1	0.7
109	PD 2/3	336	140	476	1.0	0.4	1.5
110	PD 2/3	40	30	71	0.1	0.1	0.2
1101	PD 1	-30	10	-20	-0.1	0.0	-0.1
1102	PD 1	-45	14	-31	-0.1	0.0	-0.1
1103	PD 1	-14	4	-10	0.0	0.0	0.0
1104	PD 1	29	28	57	0.1	0.1	0.2
1105	PD 1	-5	45	40	0.0	0.1	0.1
1106	PD 2/3	333	80	414	1.0	0.3	1.3
1107	PD 1	-36	56	20	-0.1	0.2	0.1
1108	PD 1	-23	26	3	-0.1	0.1	0.0
1109	PD 1	-19	25	6	-0.1	0.1	0.0
111	PD 4	-6	5	0	0.0	0.0	0.0
1110	PD 2/3	-29	29	0	-0.1	0.1	0.0
1201	PD 2/3	131	56	187	0.4	0.2	0.6
1202	PD 2/3	71	22	93	0.2	0.1	0.3
1203	PD 2/3	222	292	514	0.7	0.9	1.6
1204	PD 2/3	-18	73	54	-0.1	0.2	0.2
1205	PD 2/3	0	49	49	0.0	0.2	0.2
1206	PD 2/3	657	31	689	2.1	0.1	2.2
1301	PD 1	71	26	97	0.2	0.1	0.3
1302	PD 2/3	-6	13	7	0.0	0.0	0.0
1303	PD 1	-25	51	26	-0.1	0.2	0.1
1304	PD 2/3	82	50	132	0.3	0.2	0.4
1305	PD 1	-60	5	-55	-0.2	0.0	-0.2
1306	PD 2/3	5	9	14	0.0	0.0	0.0
1307	PD 2/3	-18	24	6	-0.1	0.1	0.0
1308	PD 2/3	-18	4	-14	-0.1	0.0	0.0
1309	PD 1	85	26	110	0.3	0.1	0.3
1310	PD 2/3	312	20	332	1.0	0.1	1.0
1311	PD 1	-21	55	35	-0.1	0.2	0.1
1312	PD 1	-60	8	-52	-0.2	0.0	-0.2
1401	PD 2/3	61	63	124	0.2	0.2	0.4

Appendix B Traffic Zone Details - Water Demands

Traffic Zone Name	Water Pressure District	Growth-RES (People)	Growth-EMP (People)	Growth-TOTAL (People)	ADD-RES (L/s)	ADD-EMP (L/s)	ADD-TOTAL (L/s)
1402	PD 2/3	-33	16	-17	-0.1	0.1	-0.1
1403	PD 2/3	-15	24	9	0.0	0.1	0.0
1404	PD 2/3	14	16	30	0.0	0.1	0.1
1405	PD 2/3	-24	25	1	-0.1	0.1	0.0
1406	PD 2/3	-23	18	-5	-0.1	0.1	0.0
1407	PD 2/3	-11	42	30	0.0	0.1	0.1
1408	PD 2/3	-42	116	74	-0.1	0.4	0.2
1501	PD 2/3	47	273	320	0.1	0.9	1.0
1502	PD 2/3	77	29	106	0.2	0.1	0.3
1503	PD 2/3	30	6	36	0.1	0.0	0.1
1504	PD 2/3	-5	19	13	0.0	0.1	0.0
1505	PD 2/3	-18	2	-17	-0.1	0.0	-0.1
1506	PD 2/3	39	5	45	0.1	0.0	0.1
1507	PD 2/3	4	20	24	0.0	0.1	0.1
1508	PD 2/3	73	53	127	0.2	0.2	0.4
1509	PD 2/3	55	47	102	0.2	0.1	0.3
1510	PD 2/3	106	92	198	0.3	0.3	0.6
1511	PD 2/3	-14	25	12	0.0	0.1	0.0
1512	PD 2/3	-3	35	33	0.0	0.1	0.1
1601	PD 4	-6	68	62	0.0	0.2	0.2
1602	PD 4	178	65	243	0.6	0.2	0.8
1603	PD 4	-65	53	-13	-0.2	0.2	0.0
1604	PD 4	-40	100	60	-0.1	0.3	0.2
1605	PD 4	-13	13	0	0.0	0.0	0.0
1606	PD 4	-76	61	-16	-0.2	0.2	0.0
1607	PD 4	65	66	131	0.2	0.2	0.4
1608	PD 4	-76	63	-13	-0.2	0.2	0.0
1609	PD 4	-16	28	12	0.0	0.1	0.0
1610	PD 4	-10	29	19	0.0	0.1	0.1
1611	PD 4	-38	37	-1	-0.1	0.1	0.0
1612	PD 4	-17	25	8	-0.1	0.1	0.0
1701	PD 4	0	1,131	1,131	0.0	3.5	3.5
1702	PD 4	33	2,926	2,959	0.1	9.1	9.2
1703	PD 4	0	2,943	2,943	0.0	9.2	9.2
1704	PD 4	-5	586	581	0.0	1.8	1.8
1801	PD 4	-36	82	47	-0.1	0.3	0.1
1802	PD 4	-36	176	140	-0.1	0.5	0.4
1803	PD 1	-12	19	7	0.0	0.1	0.0
1804	PD 1	-55	41	-14	-0.2	0.1	0.0
1805	PD 4	-1	127	127	0.0	0.4	0.4
1806	PD 1	8	30	37	0.0	0.1	0.1
1901	PD 1	114	241	355	0.4	0.8	1.1
1902	PD 1	0	94	94	0.0	0.3	0.3
1903	PD 1	-37	93	56	-0.1	0.3	0.2
1904	PD 1	-19	18	-1	-0.1	0.1	0.0
1905	PD 1	64	48	112	0.2	0.1	0.3
2001	PD 1	-95	104	9	-0.3	0.3	0.0
2002	PD 1	0	67	67	0.0	0.2	0.2

Traffic Zone Name	Water Pressure District	Growth-RES (People)	Growth-EMP (People)	Growth-TOTAL (People)	ADD-RES (L/s)	ADD-EMP (L/s)	ADD-TOTAL (L/s)
2003	PD 1	0	19	19	0.0	0.1	0.1
2004	PD 1	-85	165	80	-0.3	0.5	0.2
2005	PD 1	59	41	100	0.2	0.1	0.3
2006	PD 1	-45	24	-21	-0.1	0.1	-0.1
2007	PD 1	50	16	66	0.2	0.0	0.2
2008	PD 1	54	22	76	0.2	0.1	0.2
201	PD 2/3	709	182	891	2.2	0.6	2.8
202	PD 2/3	-49	38	-11	-0.2	0.1	0.0
203	PD 2/3	7	21	28	0.0	0.1	0.1
204	PD 2/3	-31	21	-10	-0.1	0.1	0.0
205	PD 2/3	74	32	106	0.2	0.1	0.3
206	PD 2/3	-5	40	35	0.0	0.1	0.1
207	PD 2/3	-109	76	-34	-0.3	0.2	-0.1
2101	PD 1	-11	34	24	0.0	0.1	0.1
2102	PD 1	65	68	132	0.2	0.2	0.4
2103	PD 1	3	20	24	0.0	0.1	0.1
2104	PD 1	6	7	13	0.0	0.0	0.0
2105	PD 1	-27	1	-26	-0.1	0.0	-0.1
2106	PD 1	-2	132	130	0.0	0.4	0.4
2201	PD 1	47	10	57	0.1	0.0	0.2
2202	PD 1	-77	2	-75	-0.2	0.0	-0.2
2203	PD 1	-80	2	-78	-0.3	0.0	-0.2
2204	PD 1	-45	2	-43	-0.1	0.0	-0.1
2205	PD 1	-51	1	-50	-0.2	0.0	-0.2
2206	PD 1	-85	4	-81	-0.3	0.0	-0.3
2207	PD 1	-55	3	-52	-0.2	0.0	-0.2
2208	PD 1	106	28	134	0.3	0.1	0.4
2209	PD 1	-72	2	-69	-0.2	0.0	-0.2
2210	PD 1	-65	2	-63	-0.2	0.0	-0.2
2211	PD 1	-25	2	-23	-0.1	0.0	-0.1
2212	PD 1	-55	2	-53	-0.2	0.0	-0.2
2213	PD 1	29	9	38	0.1	0.0	0.1
2214	PD 1	14	10	24	0.0	0.0	0.1
2215	PD 1	42	15	57	0.1	0.0	0.2
2216	PD 1	98	26	124	0.3	0.1	0.4
2217	PD 1	-42	3	-39	-0.1	0.0	-0.1
2218	PD 1	-49	4	-45	-0.2	0.0	-0.1
2301	PD 1	-36	53	16	-0.1	0.2	0.1
2302	PD 1	49	55	104	0.2	0.2	0.3
2303	PD 1	-35	30	-5	-0.1	0.1	0.0
2304	PD 1	67	86	153	0.2	0.3	0.5
2305	PD 1	-33	41	8	-0.1	0.1	0.0
2306	PD 1	-2	42	40	0.0	0.1	0.1
2307	PD 1	-45	60	15	-0.1	0.2	0.0
2308	PD 1	-35	113	77	-0.1	0.4	0.2
2309	PD 1	16	63	79	0.1	0.2	0.2
2310	PD 1	61	65	126	0.2	0.2	0.4
2401	PD 1	0	12	12	0.0	0.0	0.0

Traffic Zone Name	Water Pressure District	Growth-RES (People)	Growth-EMP (People)	Growth-TOTAL (People)	ADD-RES (L/s)	ADD-EMP (L/s)	ADD-TOTAL (L/s)
2402	PD 1	26	24	51	0.1	0.1	0.2
2403	PD 1	23	40	63	0.1	0.1	0.2
2404	PD 1	14	33	46	0.0	0.1	0.1
2405	PD 1	106	129	235	0.3	0.4	0.7
2406	PD 1	18	26	44	0.1	0.1	0.1
2407	PD 1	13	24	37	0.0	0.1	0.1
2408	PD 1	-6	43	38	0.0	0.1	0.1
2409	PD 1	-31	25	-6	-0.1	0.1	0.0
2410	PD 1	34	38	72	0.1	0.1	0.2
2411	PD 1	45	60	105	0.1	0.2	0.3
2412	PD 1	20	102	122	0.1	0.3	0.4
2413	PD 1	90	77	167	0.3	0.2	0.5
2414	PD 1	0	39	39	0.0	0.1	0.1
2415	PD 1	0	20	20	0.0	0.1	0.1
2416	PD 1	-33	21	-13	-0.1	0.1	0.0
2417	PD 1	0	65	65	0.0	0.2	0.2
2418	PD 1	2	71	74	0.0	0.2	0.2
2419	PD 1	37	31	69	0.1	0.1	0.2
2420	PD 1	69	97	166	0.2	0.3	0.5
2421	PD 1	41	30	71	0.1	0.1	0.2
2422	PD 1	242	74	316	0.8	0.2	1.0
2423	PD 1	32	29	61	0.1	0.1	0.2
2424	PD 1	-40	29	-11	-0.1	0.1	0.0
2425	PD 1	115	134	249	0.4	0.4	0.8
2501	PD 1	-35	54	19	-0.1	0.2	0.1
2502	PD 1	14	75	89	0.0	0.2	0.3
2503	PD 1	75	42	117	0.2	0.1	0.4
2504	PD 1	28	32	59	0.1	0.1	0.2
2505	PD 1	48	47	95	0.1	0.1	0.3
2506	PD 1	80	52	132	0.3	0.2	0.4
2507	PD 1	88	44	132	0.3	0.1	0.4
2508	PD 1	-15	8	-7	0.0	0.0	0.0
2509	PD 1	4	21	25	0.0	0.1	0.1
2510	PD 1	-10	19	8	0.0	0.1	0.0
2511	PD 1	-11	11	0	0.0	0.0	0.0
2512	PD 1	17	12	29	0.1	0.0	0.1
2513	PD 1	15	11	25	0.0	0.0	0.1
2514	PD 1	60	8	68	0.2	0.0	0.2
2601	PD 1	-55	6	-49	-0.2	0.0	-0.2
2602	PD 1	-24	20	-4	-0.1	0.1	0.0
2603	PD 1	-7	16	10	0.0	0.1	0.0
2604	PD 1	-15	6	-9	0.0	0.0	0.0
2605	PD 1	-95	4	-91	-0.3	0.0	-0.3
2606	PD 1	-30	2	-28	-0.1	0.0	-0.1
2607	PD 1	11	0	11	0.0	0.0	0.0
2608	PD 2/3	-95	7	-88	-0.3	0.0	-0.3
2609	PD 2/3	-8	27	19	0.0	0.1	0.1
2610	PD 2/3	-47	32	-15	-0.1	0.1	0.0

Traffic Zone Name	Water Pressure District	Growth-RES (People)	Growth-EMP (People)	Growth-TOTAL (People)	ADD-RES (L/s)	ADD-EMP (L/s)	ADD-TOTAL (L/s)
2611	PD 1	2	10	12	0.0	0.0	0.0
2612	PD 1	195	28	222	0.6	0.1	0.7
2613	PD 1	25	2	27	0.1	0.0	0.1
2614	PD 2/3	-6	9	4	0.0	0.0	0.0
2615	PD 2/3	88	13	101	0.3	0.0	0.3
2701	PD 2/3	-41	50	9	-0.1	0.2	0.0
2702	PD 2/3	-4	79	76	0.0	0.2	0.2
2703	PD 2/3	-9	19	10	0.0	0.1	0.0
2704	PD 2/3	-95	13	-82	-0.3	0.0	-0.3
2705	PD 2/3	23	9	31	0.1	0.0	0.1
2706	PD 2/3	-7	57	51	0.0	0.2	0.2
2707	PD 2/3	186	38	224	0.6	0.1	0.7
2708	PD 2/3	113	61	173	0.4	0.2	0.5
2709	PD 2/3	64	22	86	0.2	0.1	0.3
2710	PD 2/3	283	57	340	0.9	0.2	1.1
2801	PD 2/3	-70	38	-32	-0.2	0.1	-0.1
2802	PD 2/3	-87	9	-78	-0.3	0.0	-0.2
2803	PD 2/3	133	25	158	0.4	0.1	0.5
2804	PD 2/3	-66	85	19	-0.2	0.3	0.1
2805	PD 2/3	-70	4	-66	-0.2	0.0	-0.2
2806	PD 2/3	69	62	131	0.2	0.2	0.4
2807	PD 1	0	1	1	0.0	0.0	0.0
2808	PD 1	0	26	26	0.0	0.1	0.1
2901	PD 1	104	13	117	0.3	0.0	0.4
2902	PD 1	155	5	160	0.5	0.0	0.5
2903	PD 1	0	5	5	0.0	0.0	0.0
2904	PD 2/3	224	67	291	0.7	0.2	0.9
3001	PD 1	154	72	226	0.5	0.2	0.7
3002	PD 1	35	31	66	0.1	0.1	0.2
3003	PD 1	123	75	197	0.4	0.2	0.6
3004	PD 1	10	65	76	0.0	0.2	0.2
301	PD 2/3	2	61	64	0.0	0.2	0.2
302	PD 2/3	-35	74	39	-0.1	0.2	0.1
303	PD 2/3	-103	66	-37	-0.3	0.2	-0.1
304	PD 2/3	-22	14	-8	-0.1	0.0	0.0
305	PD 2/3	-80	94	14	-0.3	0.3	0.0
306	PD 2/3	81	65	146	0.3	0.2	0.5
3101	PD 1	313	884	1,197	1.0	2.8	3.7
3102	PD 1	1,378	501	1,879	4.3	1.6	5.9
3103	PD 1	0	1	1	0.0	0.0	0.0
3104	PD 1	0	70	70	0.0	0.2	0.2
3105	PD 1	0	287	287	0.0	0.9	0.9
3201	PD 1	-122	112	-10	-0.4	0.4	0.0
3202	PD 1	129	64	193	0.4	0.2	0.6
3203	PD 1	342	70	413	1.1	0.2	1.3
3204	PD 1	170	17	187	0.5	0.1	0.6
3205	PD 1	0	9	9	0.0	0.0	0.0
3301	PD 1	2,278	155	2,433	7.1	0.5	7.6

Traffic Zone Name	Water Pressure District	Growth-RES (People)	Growth-EMP (People)	Growth-TOTAL (People)	ADD-RES (L/s)	ADD-EMP (L/s)	ADD-TOTAL (L/s)
3302	PD 1	-101	97	-4	-0.3	0.3	0.0
3401	PD 1	666	429	1,095	2.1	1.3	3.4
3402	PD 1	124	213	337	0.4	0.7	1.1
3403	PD 1	3,557	339	3,896	11.1	1.1	12.2
3404	PD 1	1,031	88	1,119	3.2	0.3	3.5
3405	PD 1	23	402	425	0.1	1.3	1.3
3406	PD 1	295	193	488	0.9	0.6	1.5
3407	PD 1	393	70	464	1.2	0.2	1.4
3501	PD 1	-19	39	20	-0.1	0.1	0.1
3502	PD 1	-4	13	9	0.0	0.0	0.0
3503	PD 1	-53	29	-24	-0.2	0.1	-0.1
3504	PD 1	-4	7	3	0.0	0.0	0.0
3505	PD 1	51	38	90	0.2	0.1	0.3
3506	PD 1	58	43	101	0.2	0.1	0.3
3507	PD 1	1,302	67	1,369	4.1	0.2	4.3
3508	PD 1	-10	20	10	0.0	0.1	0.0
3509	PD 1	522	17	539	1.6	0.1	1.7
3510	PD 1	23	64	88	0.1	0.2	0.3
3511	PD 1	-10	2	-8	0.0	0.0	0.0
3512	PD 1	616	18	633	1.9	0.1	2.0
3601	PD 1	-21	45	24	-0.1	0.1	0.1
3602	PD 1	-32	37	4	-0.1	0.1	0.0
3603	PD 1	40	32	72	0.1	0.1	0.2
3604	PD 1	-5	78	73	0.0	0.2	0.2
3701	PD 1	3,225	91	3,316	10.1	0.3	10.4
3702	PD 1	3,838	178	4,016	12.0	0.6	12.6
3703	PD 1	-67	22	-45	-0.2	0.1	-0.1
3704	PD 1	1,001	168	1,168	3.1	0.5	3.7
3705	PD 1	-33	73	40	-0.1	0.2	0.1
3706	PD 1	158	33	190	0.5	0.1	0.6
3707	PD 1	-178	94	-83	-0.6	0.3	-0.3
3708	PD 1	342	183	525	1.1	0.6	1.6
3709	PD 1	-195	157	-37	-0.6	0.5	-0.1
3710	PD 1	-9	23	14	0.0	0.1	0.0
3901	PD 1	0	335	335	0.0	1.0	1.0
401	PD 2/3	-62	81	20	-0.2	0.3	0.1
402	PD 2/3	-26	24	-2	-0.1	0.1	0.0
403	PD 2/3	56	50	106	0.2	0.2	0.3
404	PD 2/3	-16	25	9	-0.1	0.1	0.0
405	PD 2/3	1,027	118	1,145	3.2	0.4	3.6
406	PD 2/3	461	67	528	1.4	0.2	1.6
407	PD 2/3	252	64	316	0.8	0.2	1.0
4501	PD 1	2,556	326	2,882	8.0	1.0	9.0
4502	PD 1	409	39	448	1.3	0.1	1.4
4503	PD 1	123	309	432	0.4	1.0	1.3
4601	PD 4	0	102	102	0.0	0.3	0.3
4602	PD 4	1,062	131	1,193	3.3	0.4	3.7
4603	PD 4	53	3	56	0.2	0.0	0.2

Appendix B Traffic Zone Details - Water Demands

Traffic Zone Name	Water Pressure District	Growth-RES (People)	Growth-EMP (People)	Growth-TOTAL (People)	ADD-RES (L/s)	ADD-EMP (L/s)	ADD-TOTAL (L/s)
4701	PD 2/3	-60	104	44	-0.2	0.3	0.1
4702	PD 2/3	-36	23	-13	-0.1	0.1	0.0
4703	PD 2/3	-35	26	-9	-0.1	0.1	0.0
4704	PD 2/3	747	27	774	2.3	0.1	2.4
4705	PD 2/3	-39	14	-26	-0.1	0.0	-0.1
4706	PD 2/3	-19	22	3	-0.1	0.1	0.0
4801	PD 1	-28	222	193	-0.1	0.7	0.6
4802	PD 1	219	127	346	0.7	0.4	1.1
4803	PD 1	227	60	286	0.7	0.2	0.9
4901	PD 2/3	-25	45	20	-0.1	0.1	0.1
4902	PD 2/3	-44	32	-12	-0.1	0.1	0.0
4903	PD 2/3	-110	62	-48	-0.3	0.2	-0.1
4904	PD 2/3	-66	51	-15	-0.2	0.2	0.0
4905	PD 2/3	621	69	690	1.9	0.2	2.2
4906	PD 2/3	-26	31	5	-0.1	0.1	0.0
5001	PD 2/3	0	657	657	0.0	2.1	2.1
5002	PD 2/3	-5	509	504	0.0	1.6	1.6
5003	PD 2/3	0	323	323	0.0	1.0	1.0
5004	PD 2/3	-20	1,065	1,045	-0.1	3.3	3.3
501	PD 2/3	-35	50	15	-0.1	0.2	0.0
502	PD 2/3	-107	61	-46	-0.3	0.2	-0.1
503	PD 2/3	-60	47	-12	-0.2	0.1	0.0
504	PD 2/3	594	48	642	1.9	0.2	2.0
505	PD 2/3	-66	45	-21	-0.2	0.1	-0.1
506	PD 2/3	-95	94	-1	-0.3	0.3	0.0
507	PD 2/3	-47	29	-18	-0.1	0.1	-0.1
508	PD 2/3	-87	59	-28	-0.3	0.2	-0.1
509	PD 2/3	-109	56	-52	-0.3	0.2	-0.2
510	PD 2/3	-55	48	-7	-0.2	0.1	0.0
5101	PD 2/3	0	2	2	0.0	0.0	0.0
5102	PD 2/3	0	0	0	0.0	0.0	0.0
5103	PD 2/3	0	4	4	0.0	0.0	0.0
5104	PD 2/3	0	0	0	0.0	0.0	0.0
5105	PD 2/3	652	18	670	2.0	0.1	2.1
5106	PD 2/3	223	6	230	0.7	0.0	0.7
5107	PD 2/3	1,896	87	1,983	5.9	0.3	6.2
511	PD 2/3	-113	56	-57	-0.4	0.2	-0.2
512	PD 2/3	275	118	393	0.9	0.4	1.2
513	PD 2/3	183	22	205	0.6	0.1	0.6
514	PD 2/3	72	58	130	0.2	0.2	0.4
515	PD 2/3	-16	101	85	0.0	0.3	0.3
516	PD 2/3	167	12	179	0.5	0.0	0.6
5201	PD 2/3	0	0	0	0.0	0.0	0.0
5202	PD 2/3	0	0	0	0.0	0.0	0.0
5203	PD 2/3	356	16	372	1.1	0.0	1.2
5204	PD 2/3	224	6	230	0.7	0.0	0.7
5205	PD 2/3	805	67	871	2.5	0.2	2.7
5206	PD 2/3	719	21	740	2.2	0.1	2.3

Appendix B Traffic Zone Details - Water Demands

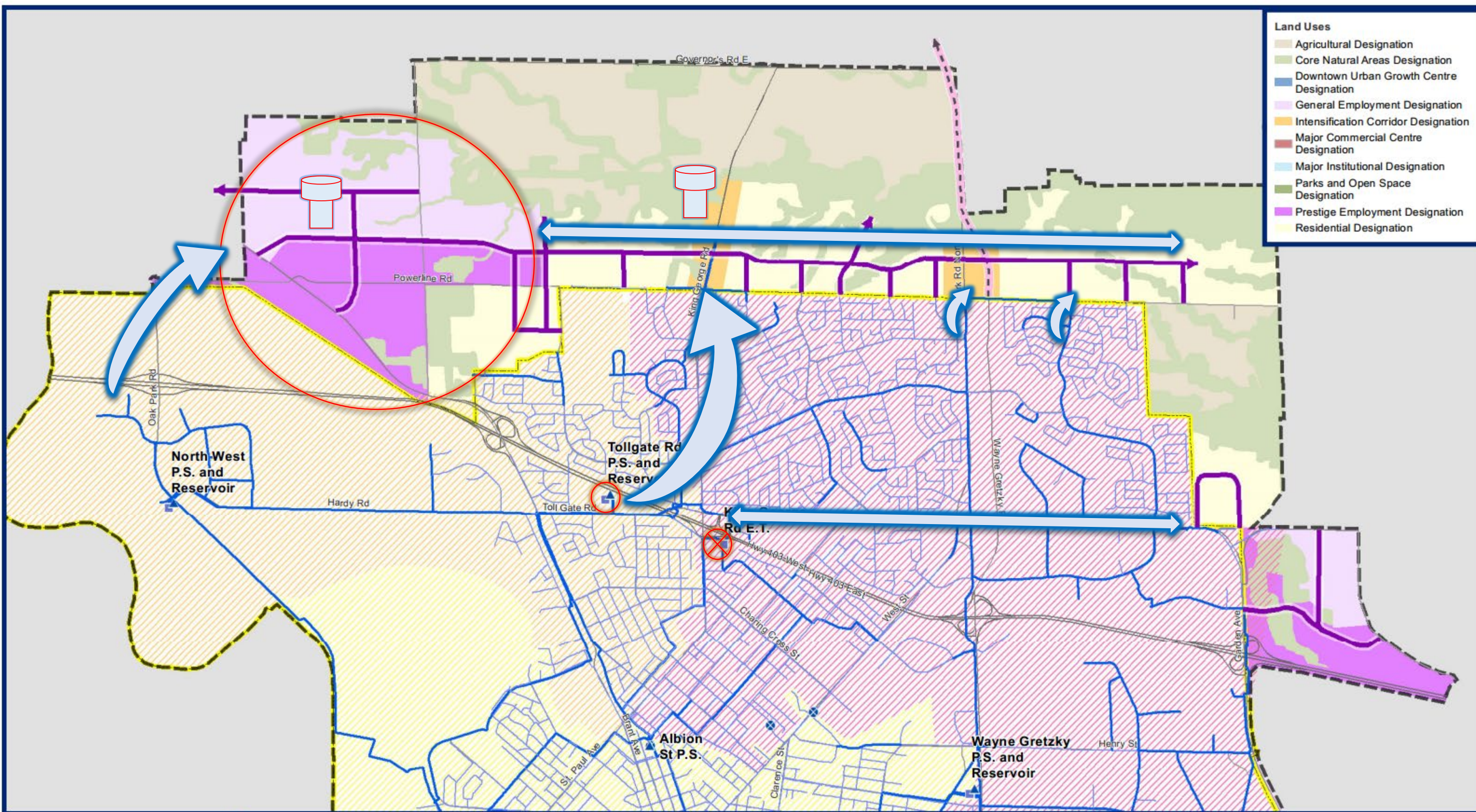
Traffic Zone Name	Water Pressure District	Growth-RES (People)	Growth-EMP (People)	Growth-TOTAL (People)	ADD-RES (L/s)	ADD-EMP (L/s)	ADD-TOTAL (L/s)
5301	PD 2/3	61	2	63	0.2	0.0	0.2
5302	PD 2/3	54	1	55	0.2	0.0	0.2
5303	PD 2/3	0	0	0	0.0	0.0	0.0
5401	PD 2/3	183	226	409	0.6	0.7	1.3
5402	PD 2/3	564	32	596	1.8	0.1	1.9
5403	PD 2/3	591	22	613	1.8	0.1	1.9
5404	PD 2/3	555	64	619	1.7	0.2	1.9
5405	PD 2/3	420	718	1,138	1.3	2.2	3.6
5406	PD 2/3	1,182	57	1,238	3.7	0.2	3.9
5407	PD 2/3	503	22	525	1.6	0.1	1.6
5408	PD 2/3	625	29	654	2.0	0.1	2.0
5501	PD 2/3	1,059	275	1,334	3.3	0.9	4.2
5502	PD 2/3	939	36	975	2.9	0.1	3.0
5503	PD 2/3	425	13	438	1.3	0.0	1.4
5504	PD 2/3	206	10	216	0.6	0.0	0.7
5505	PD 2/3	137	10	147	0.4	0.0	0.5
5506	PD 2/3	448	88	537	1.4	0.3	1.7
5507	PD 2/3	741	162	903	2.3	0.5	2.8
5508	PD 2/3	739	44	783	2.3	0.1	2.4
5509	PD 2/3	498	35	533	1.6	0.1	1.7
5510	PD 2/3	411	31	442	1.3	0.1	1.4
5511	PD 2/3	703	85	788	2.2	0.3	2.5
5512	PD 2/3	793	155	948	2.5	0.5	3.0
5601	PD 2/3	-15	0	-15	0.0	0.0	0.0
5602	PD 2/3	0	0	0	0.0	0.0	0.0
5603	PD 2/3	-15	0	-15	0.0	0.0	0.0
5604	PD 2/3	0	0	0	0.0	0.0	0.0
5605	PD 2/3	0	0	0	0.0	0.0	0.0
5606	PD 2/3	0	0	0	0.0	0.0	0.0
5607	PD 2/3	0	0	0	0.0	0.0	0.0
5608	PD 2/3	0	0	0	0.0	0.0	0.0
5609	PD 2/3	0	0	0	0.0	0.0	0.0
5610	PD 2/3	0	0	0	0.0	0.0	0.0
5611	PD 2/3	7	35	42	0.0	0.1	0.1
5612	PD 2/3	7	0	7	0.0	0.0	0.0
5613	PD 2/3	0	0	0	0.0	0.0	0.0
5614	PD 2/3	0	0	0	0.0	0.0	0.0
5615	PD 2/3	0	0	0	0.0	0.0	0.0
5701	PD 2/3	-25	0	-25	-0.1	0.0	-0.1
5702	PD 2/3	0	0	0	0.0	0.0	0.0
5703	PD 2/3	-30	0	-30	-0.1	0.0	-0.1
5704	PD 2/3	0	0	0	0.0	0.0	0.0
5705	PD 2/3	0	0	0	0.0	0.0	0.0
5706	PD 2/3	-5	2	-3	0.0	0.0	0.0
5707	PD 2/3	489	30	518	1.5	0.1	1.6
5708	PD 2/3	534	31	565	1.7	0.1	1.8
5709	PD 2/3	609	213	822	1.9	0.7	2.6
5710	PD 2/3	917	97	1,014	2.9	0.3	3.2

Appendix B Traffic Zone Details - Water Demands

Traffic Zone Name	Water Pressure District	Growth-RES (People)	Growth-EMP (People)	Growth-TOTAL (People)	ADD-RES (L/s)	ADD-EMP (L/s)	ADD-TOTAL (L/s)
5711	PD 2/3	789	44	833	2.5	0.1	2.6
5712	PD 2/3	361	80	441	1.1	0.3	1.4
5801	PD 4	0	209	209	0.0	0.7	0.7
5802	PD 4	0	0	0	0.0	0.0	0.0
5803	PD 4	-10	844	834	0.0	2.6	2.6
5804	PD 4	232	462	694	0.7	1.4	2.2
5805	PD 4	0	478	478	0.0	1.5	1.5
5806	PD 4	191	375	566	0.6	1.2	1.8
5900	PD 4	-20	747	727	-0.1	2.3	2.3
5901	PD 4	-10	810	800	0.0	2.5	2.5
5902	PD 4	0	563	563	0.0	1.8	1.8
5903	PD 4	1,212	44	1,256	3.8	0.1	3.9
5904	PD 4	2,190	92	2,282	6.8	0.3	7.1
6001	PD 4	0	196	196	0.0	0.6	0.6
6002	PD 4	0	169	169	0.0	0.5	0.5
6003	PD 4	0	156	156	0.0	0.5	0.5
6004	PD 4	0	391	391	0.0	1.2	1.2
6005	PD 4	0	425	425	0.0	1.3	1.3
6006	PD 4	0	1,152	1,152	0.0	3.6	3.6
6007	PD 4	-5	1,089	1,084	0.0	3.4	3.4
6008	PD 4	0	21	21	0.0	0.1	0.1
6009	PD 4	-10	681	671	0.0	2.1	2.1
601	PD 2/3	-46	45	0	-0.1	0.1	0.0
6010	PD 4	0	548	548	0.0	1.7	1.7
602	PD 2/3	-57	60	2	-0.2	0.2	0.0
603	PD 2/3	-124	61	-63	-0.4	0.2	-0.2
604	PD 2/3	-120	49	-70	-0.4	0.2	-0.2
605	PD 2/3	-90	50	-41	-0.3	0.2	-0.1
606	PD 2/3	-133	74	-59	-0.4	0.2	-0.2
7001	PD 4	0	0	0	0.0	0.0	0.0
701	PD 2/3	0	159	159	0.0	0.5	0.5
702	PD 2/3	174	122	296	0.5	0.4	0.9
703	PD 2/3	141	66	207	0.4	0.2	0.6
704	PD 2/3	267	76	343	0.8	0.2	1.1
705	PD 2/3	696	204	900	2.2	0.6	2.8
706	PD 2/3	357	110	467	1.1	0.3	1.5
707	PD 2/3	0	354	354	0.0	1.1	1.1
708	PD 2/3	1,251	174	1,425	3.9	0.5	4.5
7901	PD 4	-20	4	-17	-0.1	0.0	-0.1
801	PD 2/3	0	556	556	0.0	1.7	1.7
8501	PD 1	596	19	614	1.9	0.1	1.9
8502	PD 1	1,690	69	1,759	5.3	0.2	5.5
8600	PD 1	4,333	181	4,514	13.5	0.6	14.1
8701	PD 1	92	9	102	0.3	0.0	0.3
901	PD 2/3	644	1,348	1,993	2.0	4.2	6.2
902	PD 2/3	0	99	99	0.0	0.3	0.3
903	PD 2/3	0	92	92	0.0	0.3	0.3



City of Brantford
APPENDIX C
EXPANSION LANDS CONCEPTS



Land Uses

- Agricultural Designation
- Core Natural Areas Designation
- Downtown Urban Growth Centre Designation
- General Employment Designation
- Intensification Corridor Designation
- Major Commercial Centre Designation
- Major Institutional Designation
- Parks and Open Space Designation
- Prestige Employment Designation
- Residential Designation

Water Network

- Water Treatment Plant
- Pumping Station
- Elevated Tank / Reservoir
- Pressure Reducing Valve
- Watermains (<= 250 mm)
- Water Transmission (> 250 mm)

Water Pressure Districts

- Pressure District 1
 - Pressure District 2/3
 - Pressure District 4
- General Features**
- 2016 Municipal Boundary
 - New Municipal Boundary

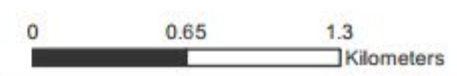
Road Options

- Collector Roads
 - Major Arterial Roads
 - Controlled Access Major Arterial
- New Elevated Tank
 - Trunk Watermains

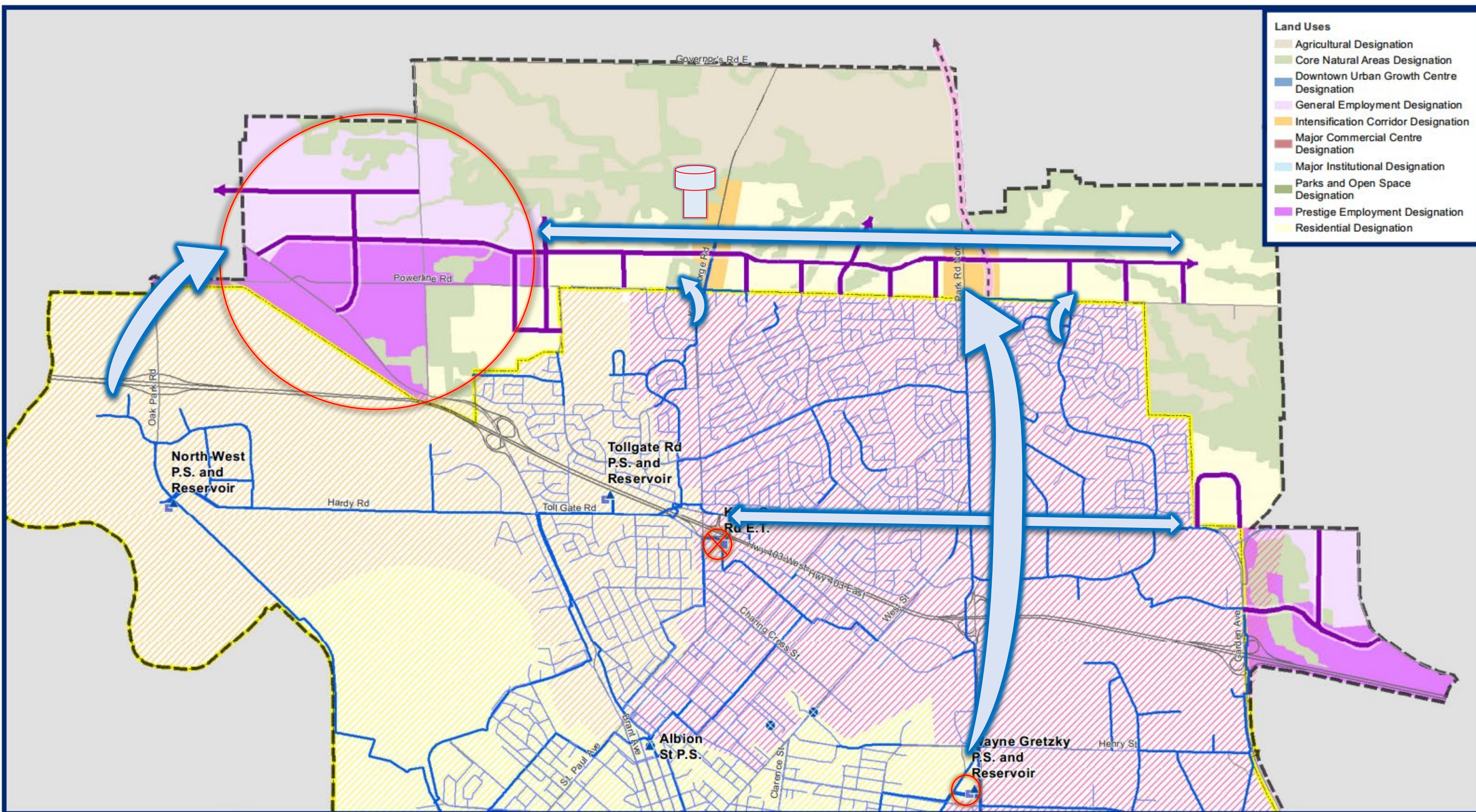
Water, Wastewater and Stormwater Master Servicing Plan Update

Water Servicing Concepts

King George and Oak Park Supply Concept



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Water, Wastewater and Stormwater
Master Servicing Plan Update

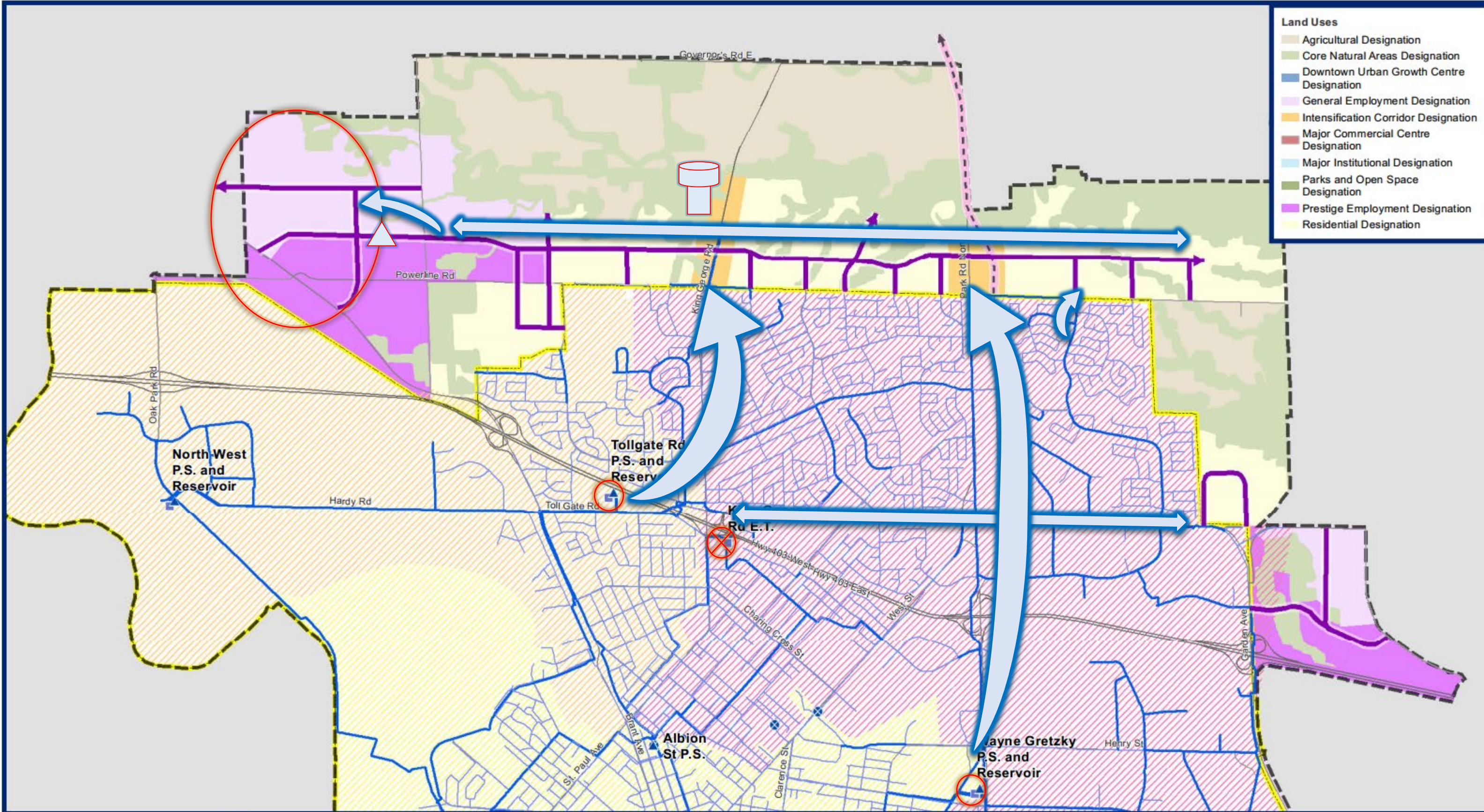
Water Servicing Concepts

Park Road Supply Concept

0 0.65 1.3
Kilometers

N

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Trunk Watermains



New Elevated Tank

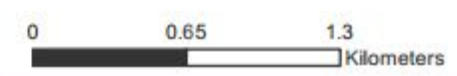


New Pumping Station

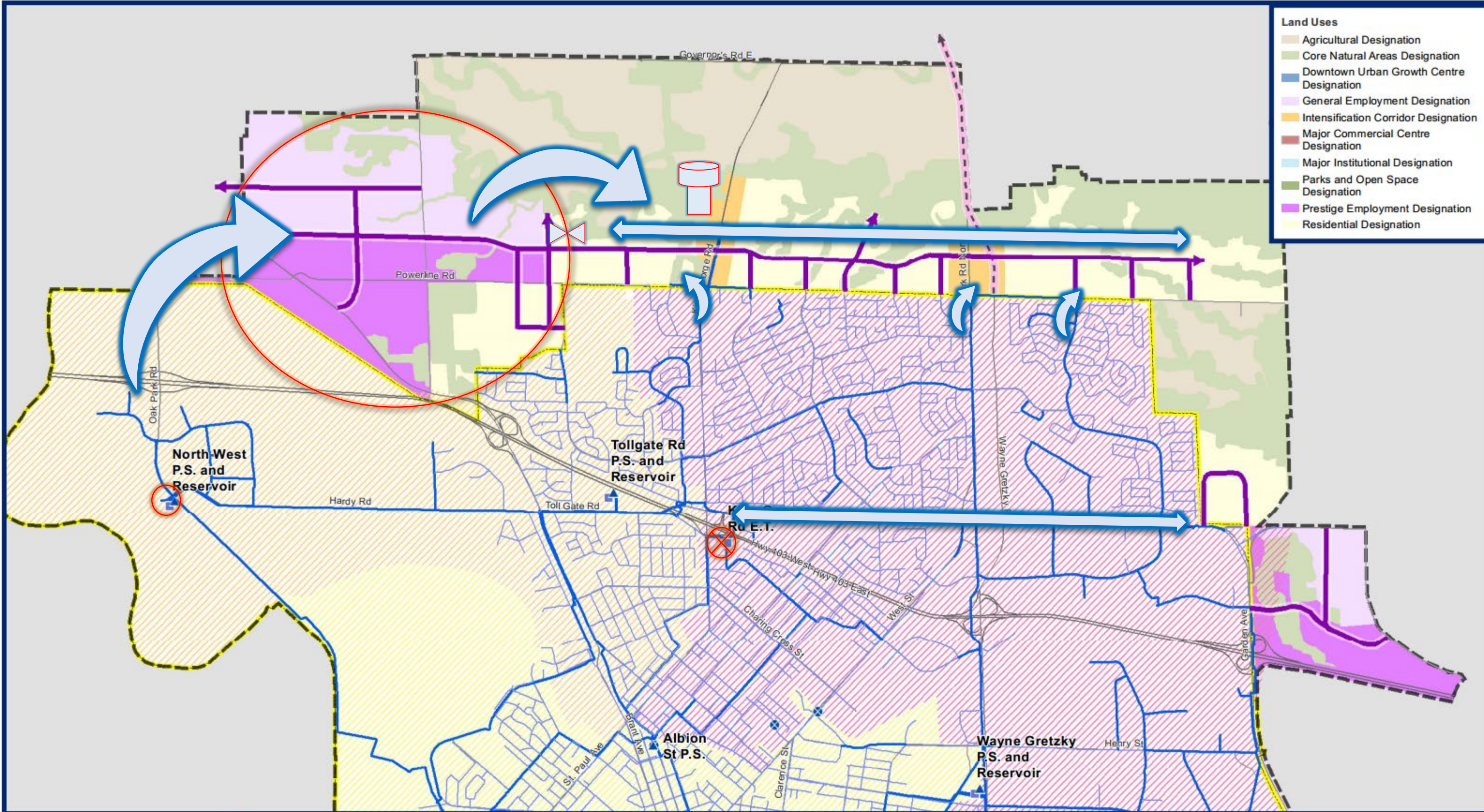
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Water Servicing Concepts

PD 2/3 Supply Only Concept



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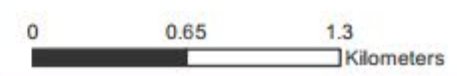
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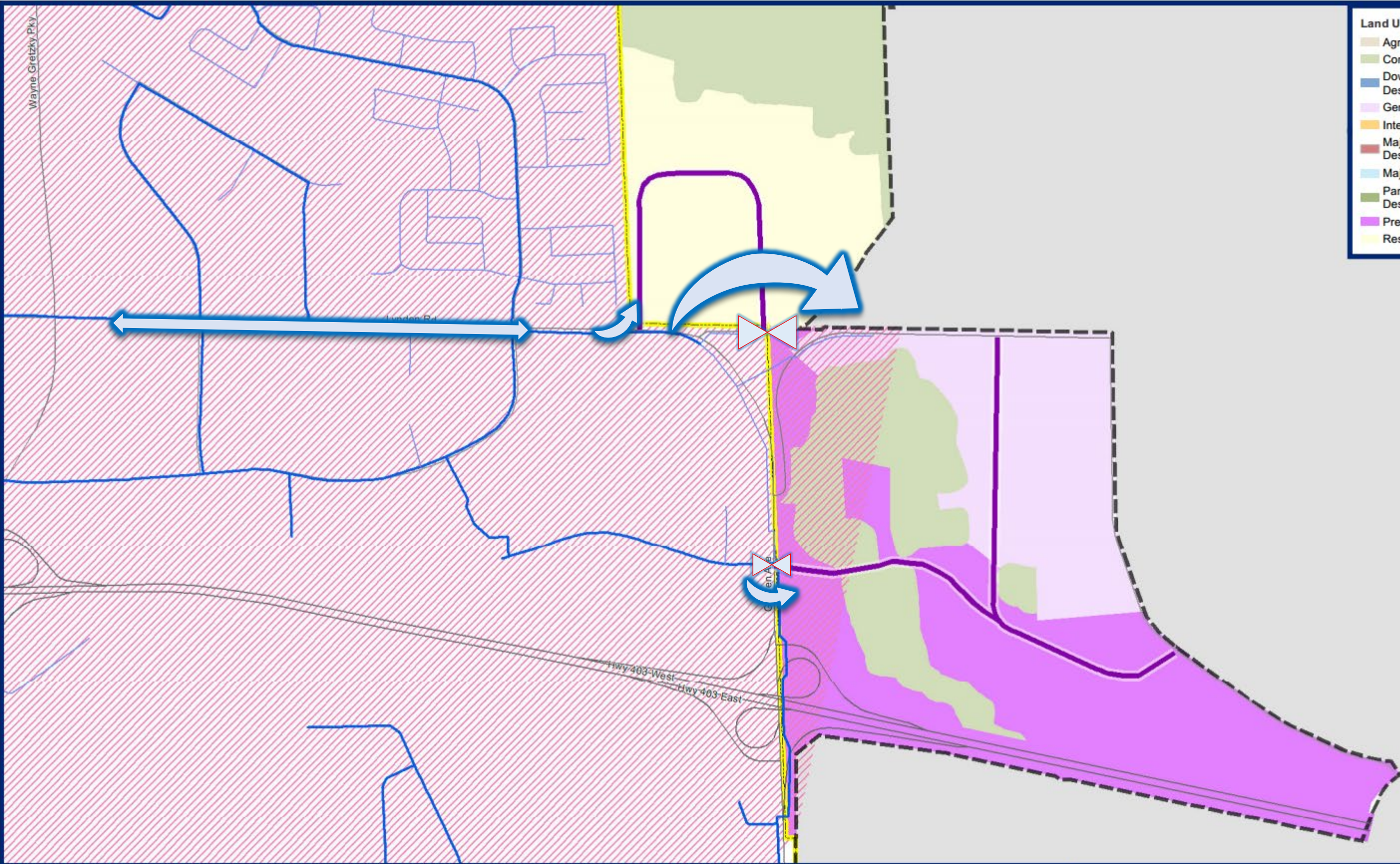
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**Water, Wastewater and Stormwater
 Master Servicing Plan Update**

Water Servicing Concepts

PD 4 Supply Only Concept



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BRANTFORD
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 Water, Wastewater and Stormwater
 Master Servicing Plan Update

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Road Options

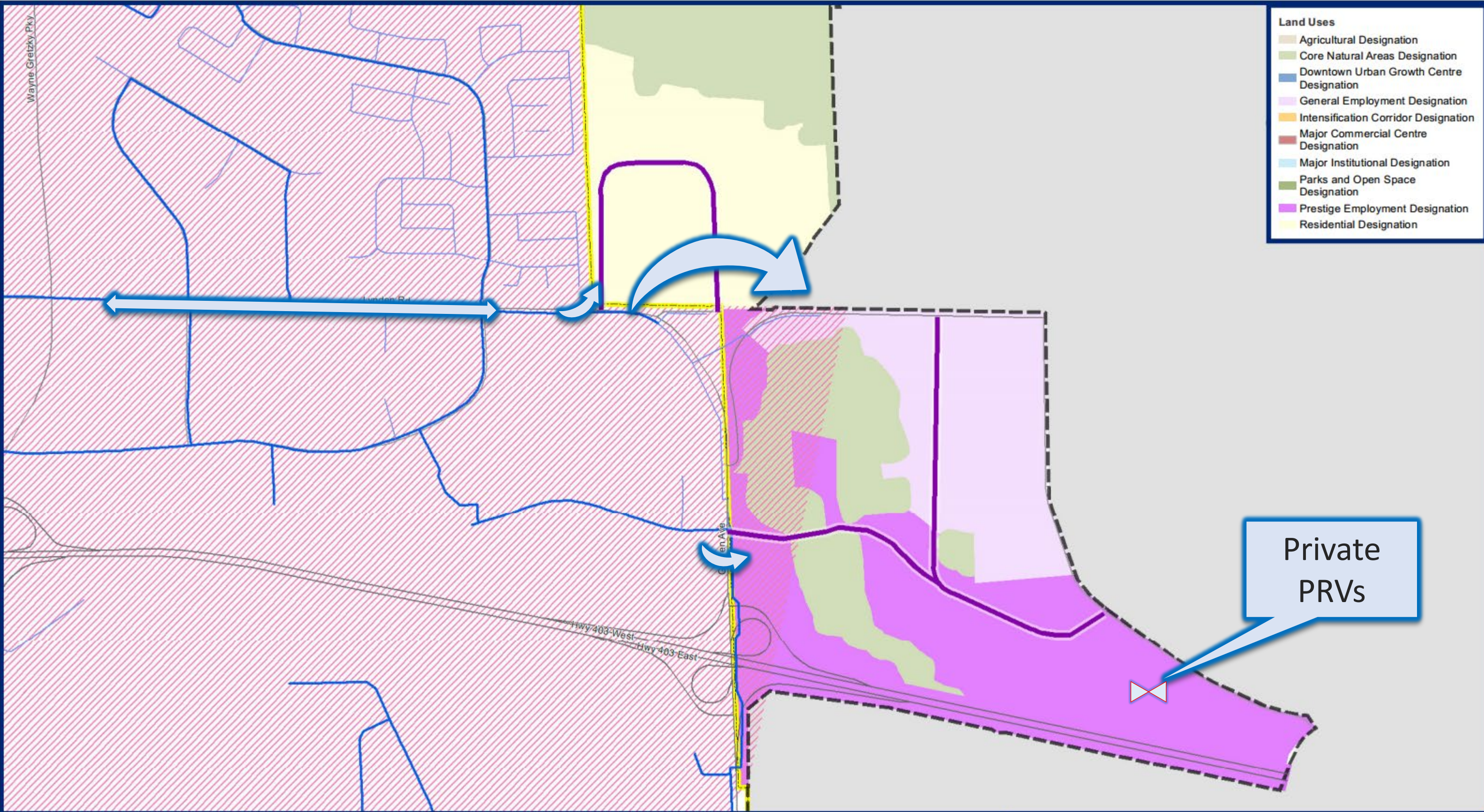
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Water Servicing Concepts

New Pressure District Concept

0 0.2 0.4
 Kilometers

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Private PRVs



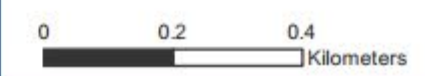
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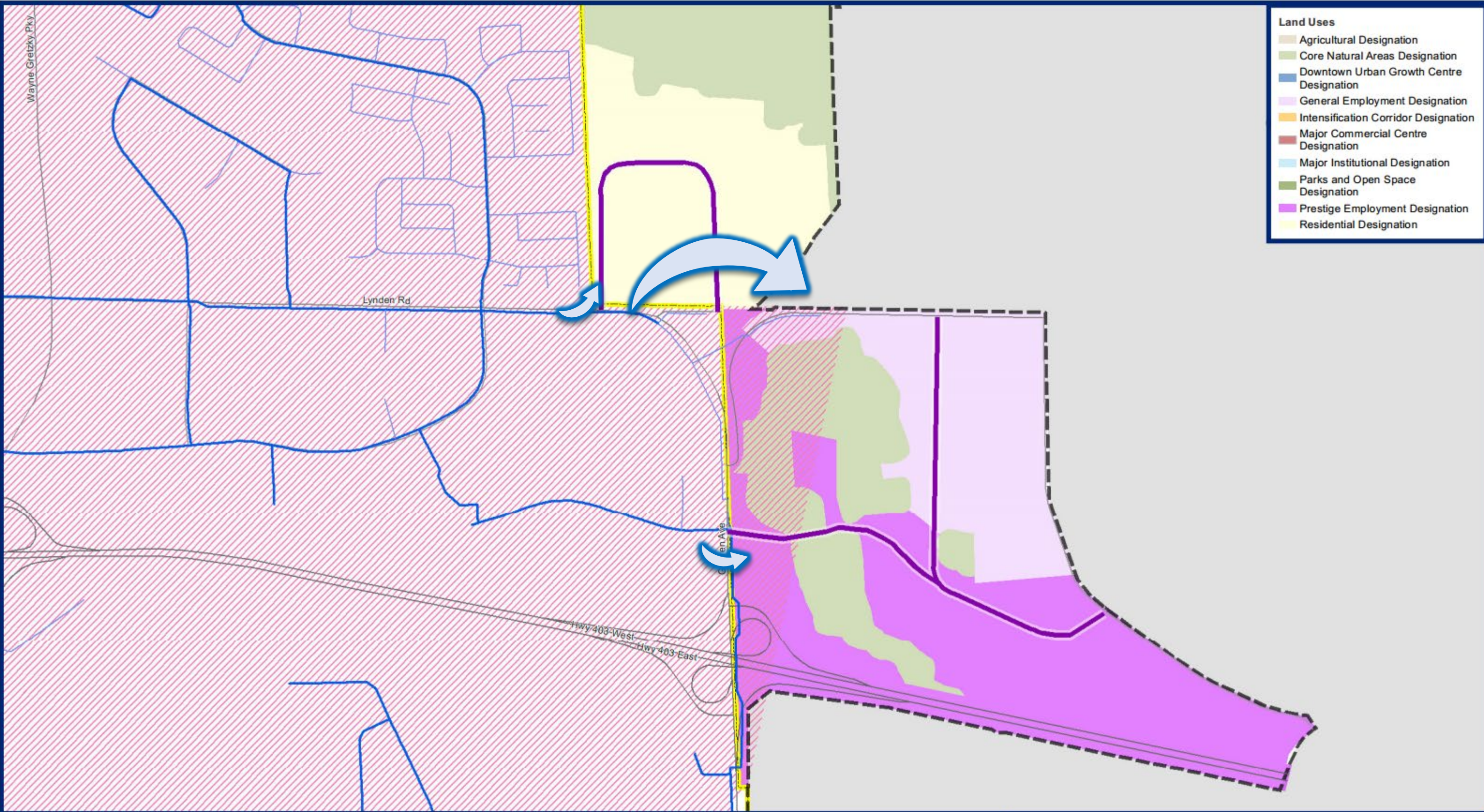
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Water Servicing Concepts

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 - Pressure District 4
- General Features**
- 2016 Municipal Boundary
 - New Municipal Boundary

Road Options

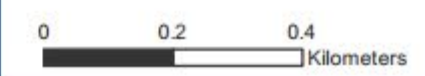
- Collector Roads
 - Major Arterial Roads
 - Controlled Access Major Arterial
- Trunk Watermains

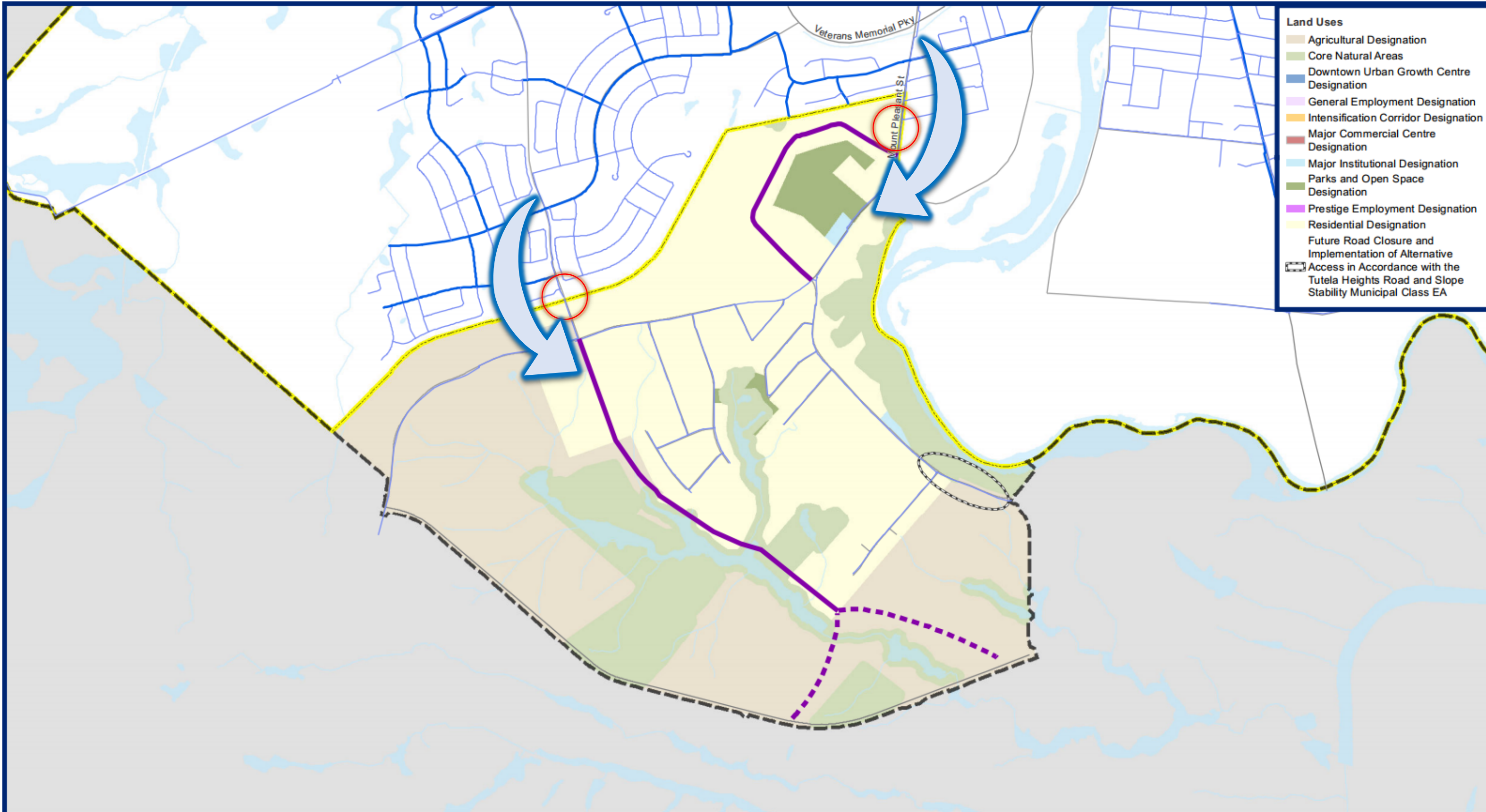


BRANTFORD
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 Water, Wastewater and Stormwater
 Master Servicing Plan Update

Water Servicing Concepts

PD 2/3 Split Concept





- Land Uses**
- Agricultural Designation
 - Core Natural Areas
 - Downtown Urban Growth Centre Designation
 - General Employment Designation
 - Intensification Corridor Designation
 - Major Commercial Centre Designation
 - Major Institutional Designation
 - Parks and Open Space Designation
 - Prestige Employment Designation
 - Residential Designation
 - Future Road Closure and Implementation of Alternative Access in Accordance with the Tutela Heights Road and Slope Stability Municipal Class EA

Water Network

- Water Treatment Plant
- Pumping Station
- Elevated Tank / Reservoir
- Pressure Reducing Valve
- Watermains (<= 250 mm)
- Water Transmission (> 250 mm)

General Features

- 2016 Municipal Boundary
- New Municipal Boundary

Road Options

- Collector Roads
- Major Arterial Roads
- Controlled Access Major Arterial



Connection to City's PD1

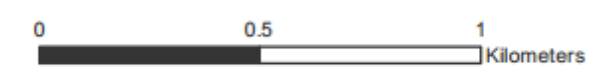


Trunk Watermains

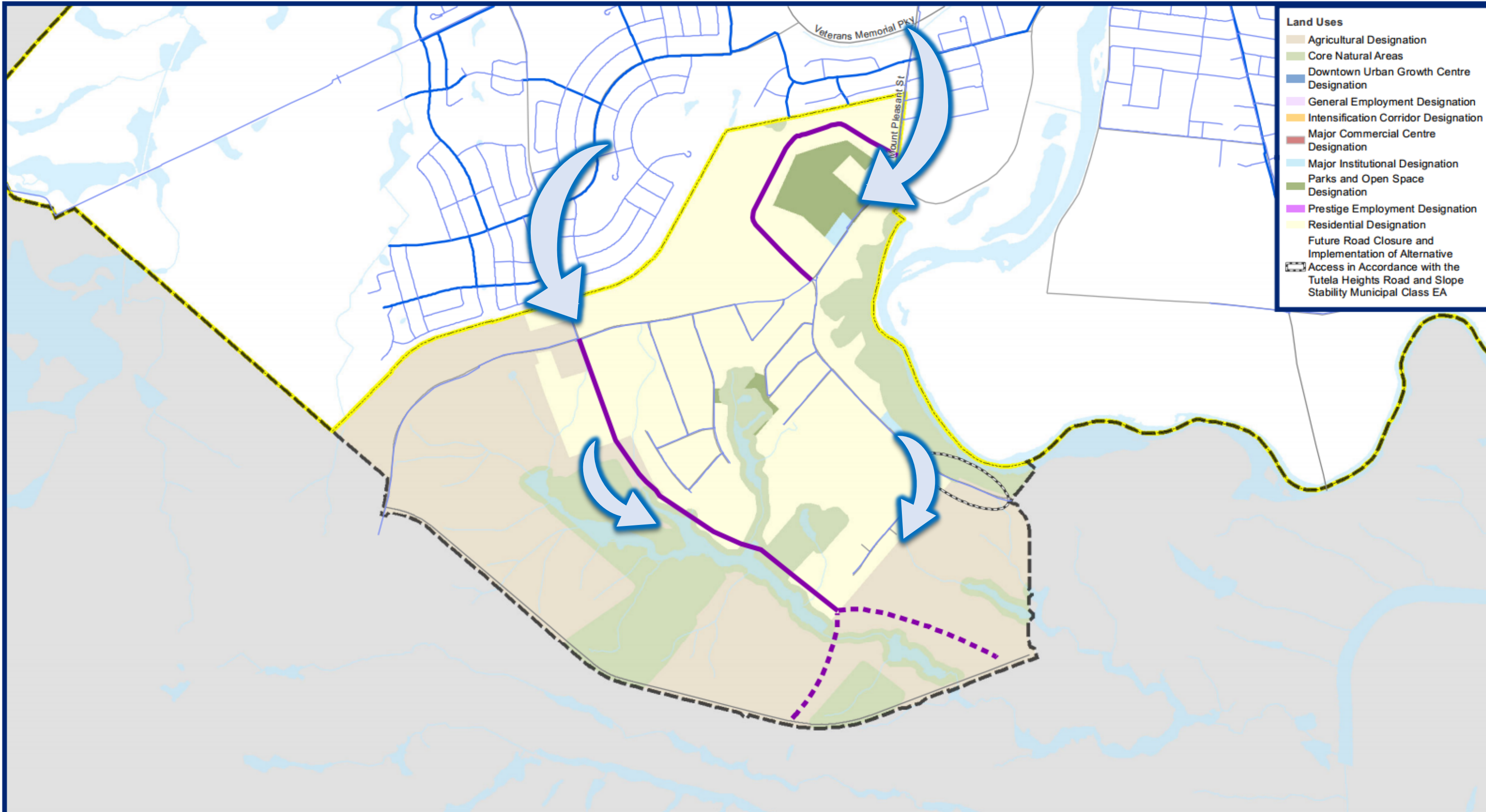
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Water Servicing Concepts

Connect Only Concept



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- Land Uses**
- Agricultural Designation
 - Core Natural Areas
 - Downtown Urban Growth Centre Designation
 - General Employment Designation
 - Intensification Corridor Designation
 - Major Commercial Centre Designation
 - Major Institutional Designation
 - Parks and Open Space Designation
 - Prestige Employment Designation
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 - Future Road Closure and Implementation of Alternative Access in Accordance with the Tutela Heights Road and Slope Stability Municipal Class EA

Water Network

- Water Treatment Plant
- Pumping Station
- Elevated Tank / Reservoir
- Pressure Reducing Valve
- Watermains (<= 250 mm)
- Water Transmission (> 250 mm)

General Features

- 2016 Municipal Boundary
 - New Municipal Boundary
- Road Options**
- Collector Roads
 - Major Arterial Roads
 - Controlled Access Major Arterial

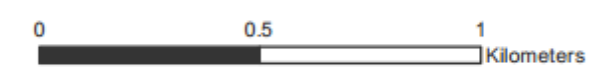
- Connection to City's PD1
- Trunk Watermains




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 Master Servicing Plan Update

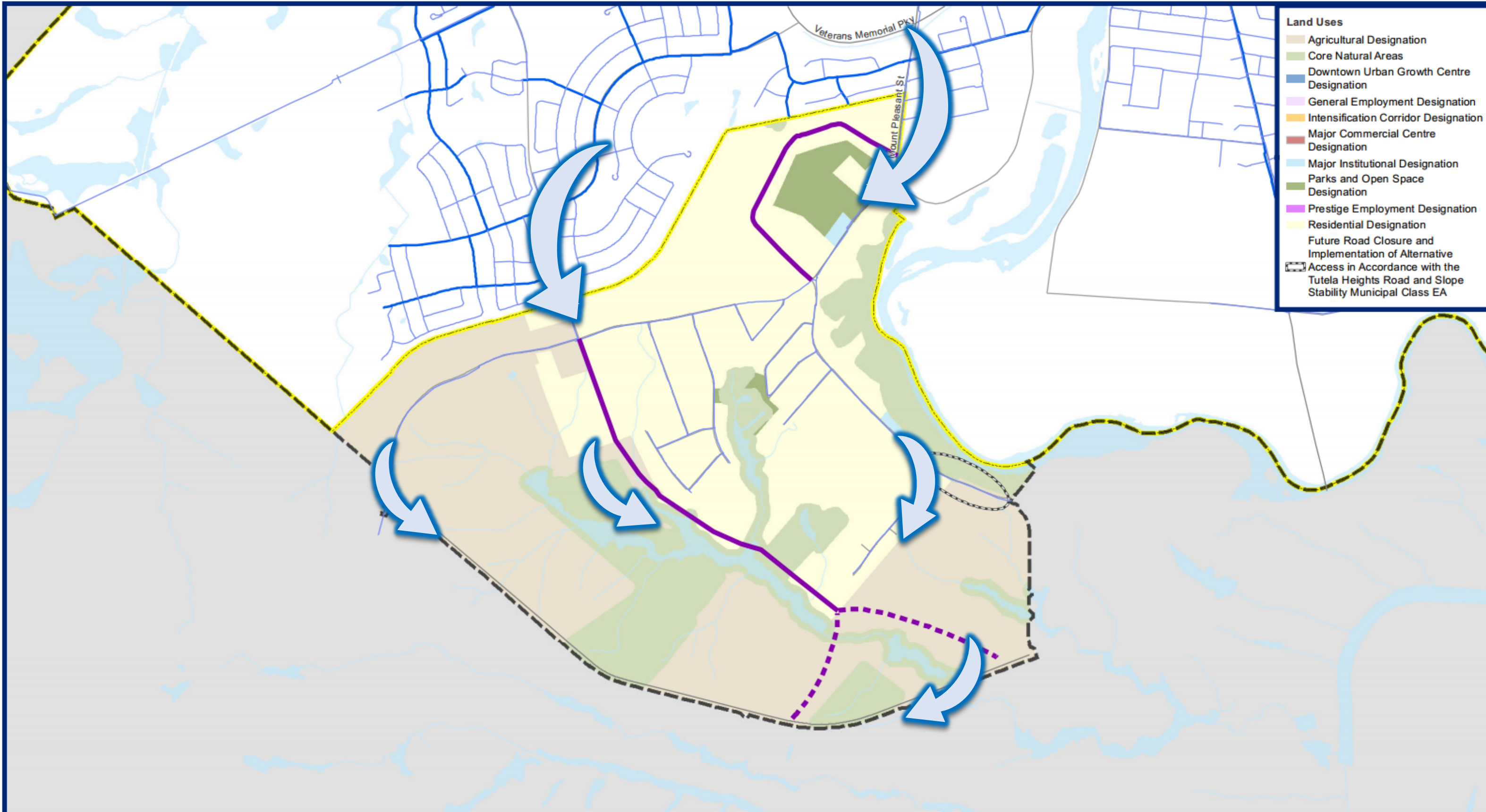
Water Servicing Concepts

Connect and Upgrade Local Network Concept



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- Land Uses**
- Agricultural Designation
 - Core Natural Areas
 - Downtown Urban Growth Centre Designation
 - General Employment Designation
 - Intensification Corridor Designation
 - Major Commercial Centre Designation
 - Major Institutional Designation
 - Parks and Open Space Designation
 - Prestige Employment Designation
 - Residential Designation
 - Future Road Closure and Implementation of Alternative Access in Accordance with the Tutela Heights Road and Slope Stability Municipal Class EA

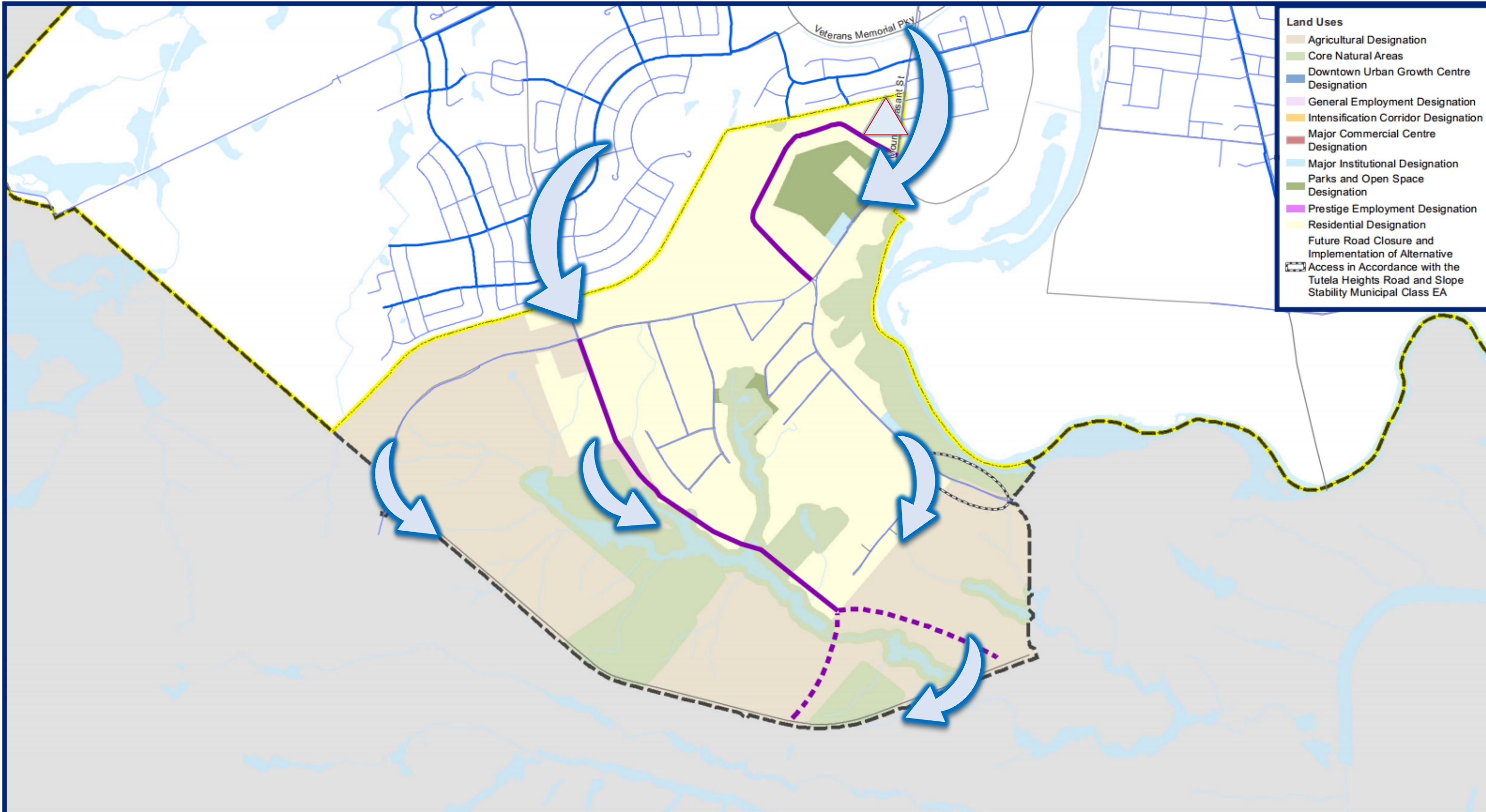
- Water Network**
- Water Treatment Plant
 - Pumping Station
 - Elevated Tank / Reservoir
 - Pressure Reducing Valve
 - Watermains (<= 250 mm)
 - Water Transmission (> 250 mm)
- General Features**
- 2016 Municipal Boundary
 - New Municipal Boundary
 - Connection to City's PD1
 - Trunk Watermains
- Road Options**
- Collector Roads
 - Major Arterial Roads
 - Controlled Access Major Arterial



Water Servicing Concepts
 Connect, Upgrade, and Loop Concept

0 0.5 1 Kilometers

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- Land Uses**
- Agricultural Designation
 - Core Natural Areas
 - Downtown Urban Growth Centre Designation
 - General Employment Designation
 - Intensification Corridor Designation
 - Major Commercial Centre Designation
 - Major Institutional Designation
 - Parks and Open Space Designation
 - Prestige Employment Designation
 - Residential Designation
 - Future Road Closure and Implementation of Alternative Access in Accordance with the Tutela Heights Road and Slope Stability Municipal Class EA

Water Network

- Water Treatment Plant
- Pumping Station
- Elevated Tank / Reservoir
- Pressure Reducing Valve
- Watermains (<= 250 mm)
- Water Transmission (> 250 mm)

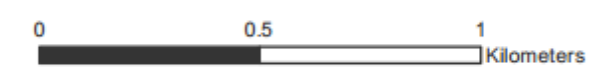
General Features

- 2016 Municipal Boundary
 - New Municipal Boundary
- Road Options**
- Collector Roads
 - Major Arterial Roads
 - Controlled Access Major Arterial

- New Pumping Station
- Connection to City's PD1
- Trunk Watermains

Water Servicing Concepts

Connect, Upgrade, Loop, and BPS Concept



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Water, Wastewater and Stormwater
Master Servicing Plan Update

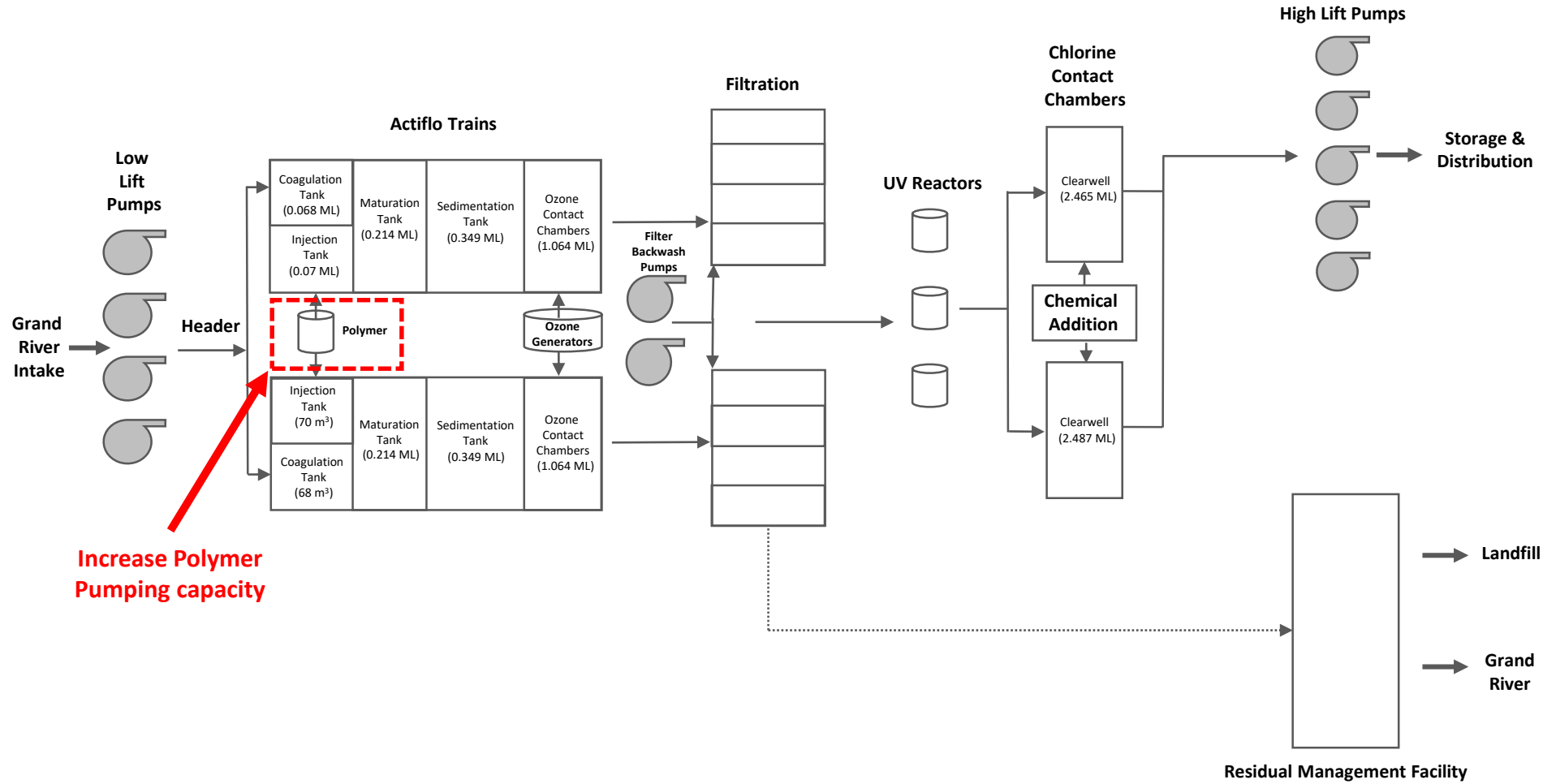


City of Brantford
APPENDIX D

WATER TREATMENT PLANT CONCEPTS

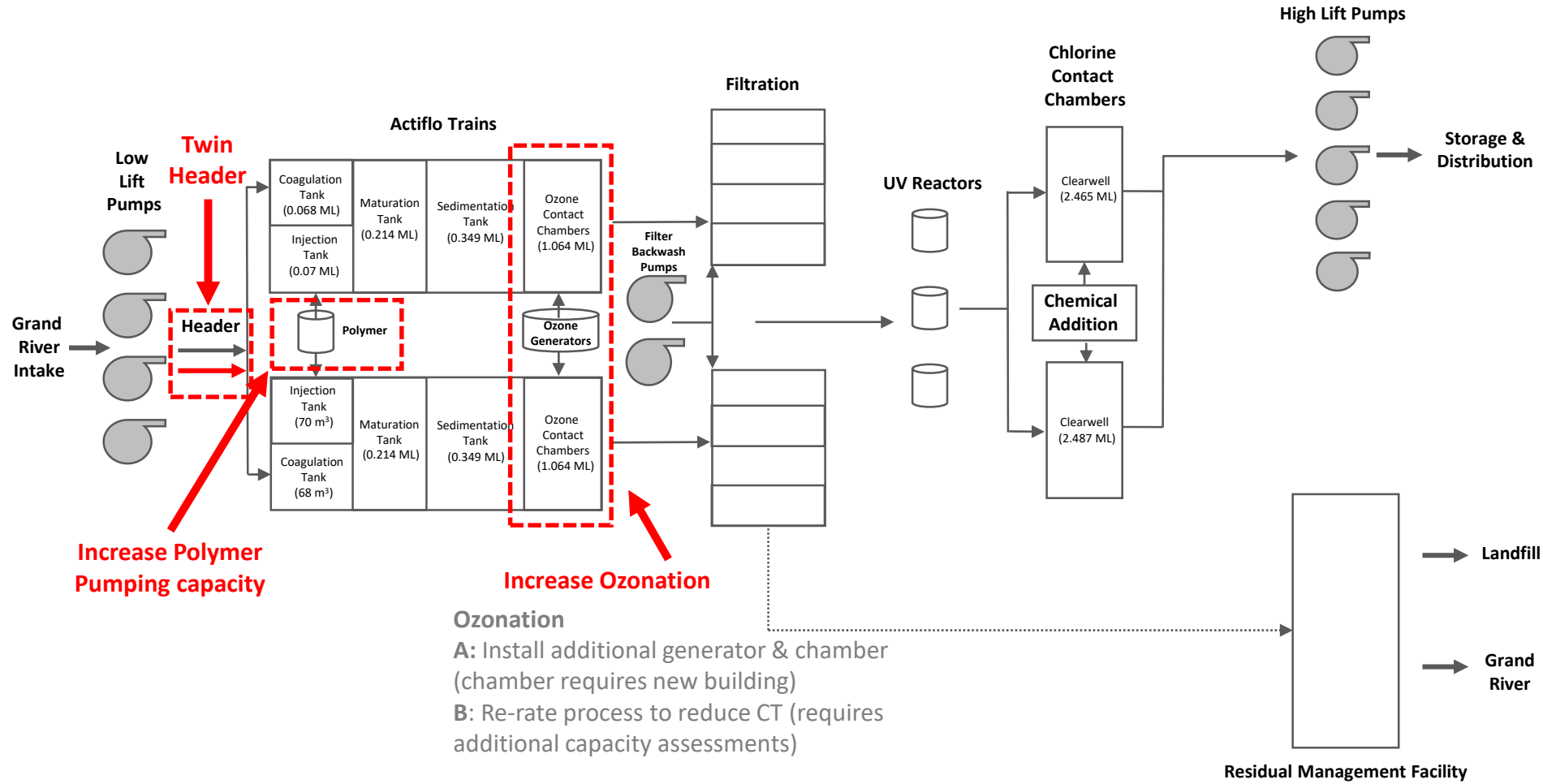
WTP Alternative 1: Minimal Upgrades

Rated Capacity: 100 MLD (100,000 m³/day)



WTP Alternative 2A: Moderate Process Upgrades

Rated Capacity: 125 MLD (125,000 m³/day)



Ozonation

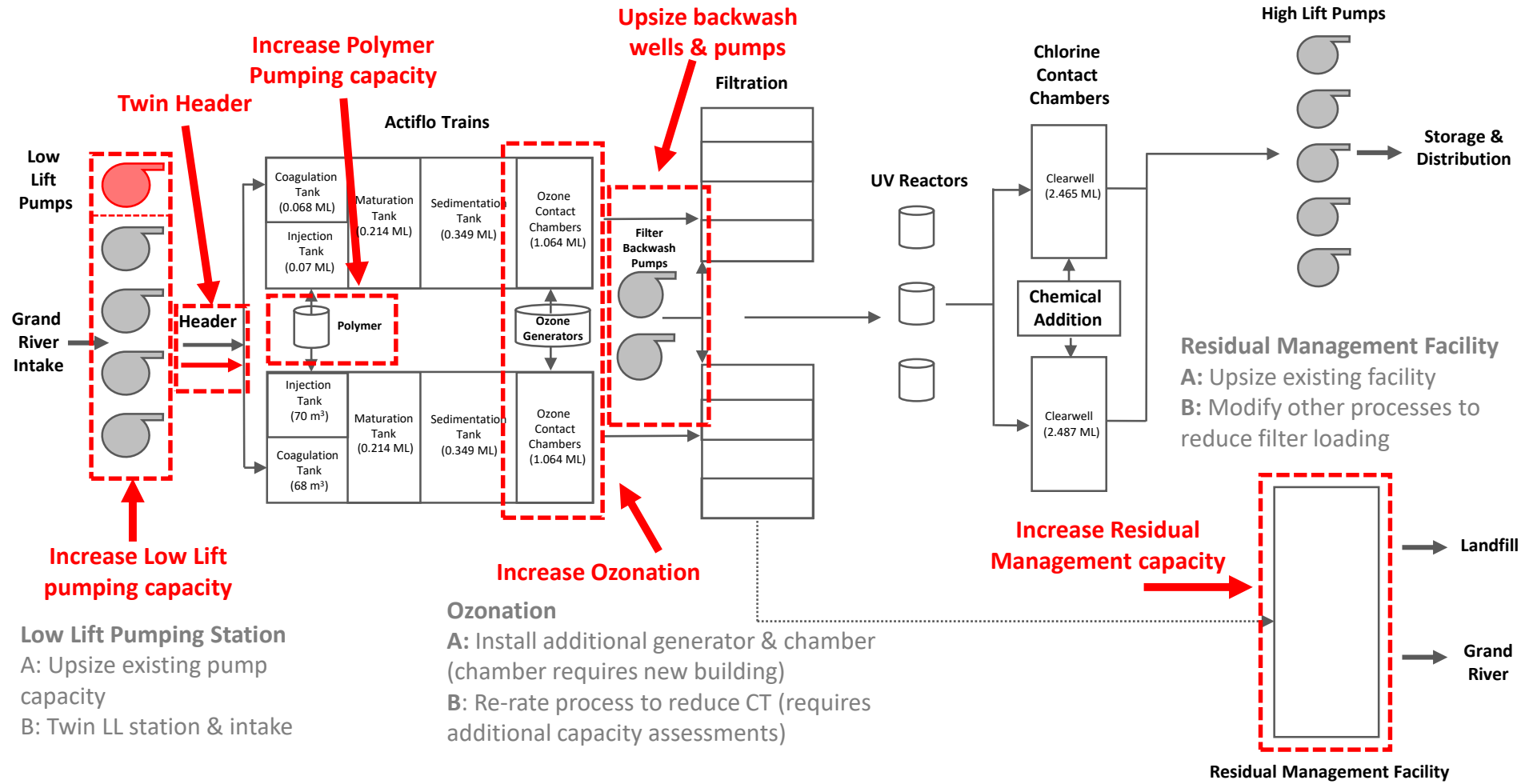
- A:** Install additional generator & chamber (chamber requires new building)
- B:** Re-rate process to reduce CT (requires additional capacity assessments)

Hydrogen Peroxide (future)

- new system upsized to 125 MLD (125,000 m³/day)

WTP Alternative 2B: Moderate Process Upgrades

Rated Capacity: 130 MLD (130,000 m³/day)



Ozonation

- A: Install additional generator & chamber (chamber requires new building)
- B: Re-rate process to reduce CT (requires additional capacity assessments)

Residual Management Facility
 A: Upsize existing facility
 B: Modify other processes to reduce filter loading

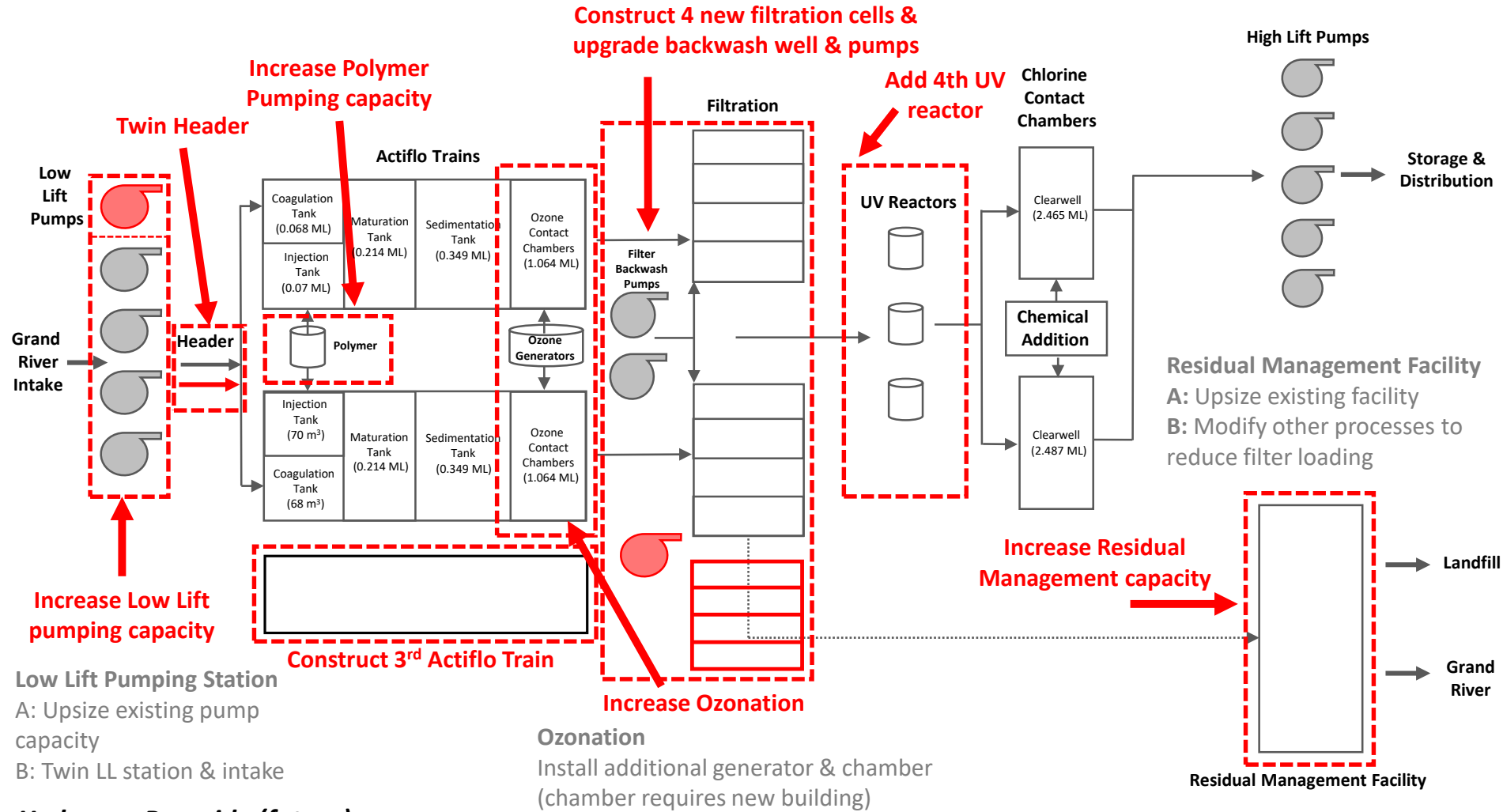
Residual Management Facility

Hydrogen Peroxide (future)

- new system upsized to 130 MLD (130,000 m³/day)

WTP Alternative 3: Major Capacity Upgrades

Rated Capacity: 180 MLD (180,000 m³/day)



Hydrogen Peroxide (future)

- new system upsized to 200 MLD (200,000 m³/day)



City of Brantford

APPENDIX E

EVALUATION TABLES

Appendix E Table 1: Holmedale Water Treatment Plant Evaluation

Category	Criteria	Alternative 1: Minimal Process Upgrades – 100 MLD	Alternative 2A: Moderate Process Upgrades – 125 MLD	Alternative 2B: Moderate Process Upgrades – 130 MLD	Alternative 3: Major Capacity Upgrades – 200 MLD
Technical Impacts	Meets existing and future servicing needs	● - Only services existing system and City growth to 2031	● - Services City growth and Cainsville lands, no flexibility to service growth post 2051	● - Services all growth in the City including flexibility to support growth post 2051	● - Supports growth post 2051
	Provides a reliable service	● - No focus on security of supply	● - Minimal focus on security of supply	● - Provides some redundancy	● - Provides redundancy for major system processes
	Minimizes and manages construction risk	● - Minimal impacts during construction	● - Moderate impacts during construction	● - Moderate impacts during construction	● - Major impacts during construction
	Supports phased expansion of the system	● - Does not service all City growth	● - No flexibility to service growth post 2041	● - Services all City growth	● - Services all City growth
	Operational Complexity	● - Minimal changes to existing operations	● - Moderate changes to existing operations	● - Moderate changes to existing operations	● - Major changes to existing operations
	Resiliency to climate change	● - No additional measures at to improve system resiliency	● - No additional measures for to improve system resiliency	● - Supports further expansion of plant	● - Allows processes to be taken offline for maintenance
Environmental Impacts	Protects environment features	● - Construction to avoid	● - Construction to avoid	● - Construction to avoid	● - Construction to avoid
	Protects wildlife and species at risk	● - Construction to avoid	● - Construction to avoid	● - Construction to avoid	● - Construction to avoid
	Minimizes climate change impacts	● - Minimal to no changes to existing GHG production	● - Moderate increase in GHG due to increased facility operations	● - Moderate increase in GHG due to increased facility operations	● - Major increase in GHG due to increased facility operations
Social and Cultural Impacts	Protects resident quality of life	● - Minimal to no impacts to existing residents	● - Some impacts to existing residents	● - Some impacts to existing residents	● - Greatest impacts to existing residents
	Manages and minimizes construction impacts	● - Construction impacts at existing facility	● - Increased construction impacts at existing facility	● - Increased construction impacts at existing facility	● - Greatest construction impacts at existing facility
	Protects cultural heritage and archeological features	● - Unknown impacts to cultural heritage and archeological	● - Unknown impacts to cultural heritage and archeological	● - Unknown impacts to cultural heritage and archeological	● - Unknown impacts to cultural heritage and archeological
Financial Impacts	Capital and life-cycle costs	● ~\$1 M	● ~\$7 M	● ~\$15 M	● ~\$200 M
	Operation and maintenance costs	● - Minimal increase of O&M costs	● - Moderate increase of O&M costs	● - Increased O&M costs	● - Highest O&M costs
	Aligns with approval and permitting process	● - At existing site	● - At existing site	● - At existing site	● - At existing site

Appendix E Table 2: Pressure District Alternative Evaluation

Category	Criteria	Alternative 1 – Existing Pressure District Boundary	Alternative 3 – Maximize Pressure District 4
Technical Impacts	Meets existing and future servicing needs	● - Yes	● - Yes
	Provides a reliable service	● - Reliance on conveyance to north lands - ET provides more reliable service	● - Reliance on conveyance to north lands - ET provides more reliable service
	Minimizes and manages construction risk	● - Potential construction delays related to land acquisition - Setbacks needed for residential ET	● - Complex implementation of boundary change including valving & connections - New ET in employment lands
	Supports phased expansion of the system	● - KG ET can be decommissioned - Moderate modifications to facilities	● - KG ET can be decommissioned - Complex modification to facilities and watermains
	Operational Complexity	● - More hydraulically efficient	● - More hydraulically efficient - Operation of storage surplus in PD4
	Resiliency to climate change	● - ET to reduce energy consumption and operations in event of a power failure	● - ET to reduce energy consumption and operations in event of a power failure
Environmental Impacts	Protects environment features	● - ET site location to avoid	● - ET site location to avoid
	Protects wildlife and species at risk	● - ET site location to avoid	● - ET site location to avoid
	Minimizes climate change impacts	● - Reduced GHG production due to operational efficiency	● - Reduced GHG production due to operational efficiency
Social and Cultural Impacts	Protects resident quality of life	● - Construction disruptions in developed and greenfield areas	● - Construction disruptions in developed and greenfield areas
	Manages and minimizes construction impacts	● - Moderate watermain construction - Coordination potential with other projects	● - Major watermain construction - Coordination potential with other projects
	Protects cultural heritage and archeological features	● - Unknown impacts to Cultural Heritage and Archeological	● - Unknown impacts to Cultural Heritage and Archeological
Financial Impacts	Capital and life-cycle costs	● \$\$\$ - \$86-87M	● \$\$\$ - \$89-91M + \$6 for implementation
	Operation and maintenance costs	● - Decreased O&M costs due to new ET	● - Decreased O&M costs due to new ET
	Aligns with approval and permitting process	● - Land acquisition in residential greenfield development	● - Land acquisition in employment greenfield development

Appendix E Table 3: PD1 and PD2/3 Storage Alternative Evaluation

Category	Criteria	Alternative 1 – Existing Pressure District Boundary	Alternative 3 – Maximize Pressure District 4
Technical Impacts	Meets existing and future servicing needs	● - Yes	● - Yes
	Provides a reliable service	● - PD1 is reliant on pumped storage, less efficient - Additional emergency storage at the WTP	● - PD1 security of supply is provided by ET
	Minimizes and manages construction risk	● - Construction needed for two facilities (WTP and ET)	● - Construction needed only at ET, minor construction needs at WG PS for new PRV
	Supports phased expansion of the system	● - Maximizes use of pumping and storage at WTP - Opportunity to oversize storage to accommodate post-2041 needs	● - Reliant on watermain upgrades to accommodate flows - ET may be oversized in the interim - Oversizing can be used by trigger lands post 2041
	Operational Complexity	● - Increased reliance on WTP pumping due to reduced floating storage	● - Oversized ET may result in WQ constraints in the interim - More complex operation of PD to accommodate
	Resiliency to climate change	● - Reliant on PS and emergency power	● - PRV to reduce energy consumption and operations in event of a power failure due to less pumping needs
Environmental Impacts	Protects environment features	● - Construction to avoid	● - Construction to avoid
	Protects wildlife and species at risk	● - Construction to avoid	● - Construction to avoid
	Minimizes climate change impacts	● - Increased GHG production due to increased pumping	● - Minimal increase in GHG production due to reliance on
Social and Cultural Impacts	Protects resident quality of life	● - Minimal impact to existing residents	● - Minimal impact to existing residents
	Manages and minimizes construction impacts	● - Construction impacts at existing facility and greenfield area	● - Construction impacts at existing facility and greenfield area
	Protects cultural heritage and archeological features	● - Unknown impacts to Cultural Heritage and Archeological	● - Unknown impacts to Cultural Heritage and Archeological
Financial Impacts	Capital and life-cycle costs	● \$\$ - \$4.5 M	● \$\$ - \$4 M
	Operation and maintenance costs	● - Additional O&M costs needed to maintain pumping capacity at WTP	● - Reduced O&M costs due to new PRV
	Aligns with approval and permitting process	● - WTP reservoir expansion at existing site	● - New PRV at existing site

Appendix E Table 4: PD4 Storage Alternative Evaluation

Category	Criteria	Alternative 1 – Upgrade storage at Northwest Reservoir	Alternative 2 – New Pressure District 4 Elevated Tank
Technical Impacts	Meets existing and future servicing needs	● - Yes	● - Yes
	Provides a reliable service	● - Reliant on pumped storage, less efficient	● - PD4 security of supply is provided by ET ● - ET location can be optimized
	Minimizes and manages construction risk	● - Minimal construction risk as there is currently sufficient space on existing site	● - Potential construction delays due to site acquisition ● - Surrounding land use is employment
	Supports phased expansion of the system	● - Maximizes use of pumping and storage at NW as existing facility has space to accommodate	● - Phasing needs to be aligned with storage deficiency and development blocks
	Operational Complexity	● - Reliance on pumping due to no floating storage ● - Large closed PD	● - Reduced operational constraints with ET
	Resiliency to climate change	● - Reliant on PS and emergency power	● - ET to reduce energy consumption and operations in event of a power failure
Environmental Impacts	Protects environment features	● - Construction to avoid	● - Construction to avoid
	Protects wildlife and species at risk	● - Construction to avoid	● - Construction to avoid
	Minimizes climate change impacts	● - Increased GHG production due to increased pumping	● - Minimal increase in GHG production due to ET
Social and Cultural Impacts	Protects resident quality of life	● - Minimal impact to existing residents	● - Two ETs may be viewed negatively by the public
	Manages and minimizes construction impacts	● - Land acquisition needed and construction at existing facility	● - Construction impacts in employment greenfield area
	Protects cultural heritage and archeological features	● - Unknown impacts to Cultural Heritage and Archeological	● - Unknown impacts to Cultural Heritage and Archeological
Financial Impacts	Capital and life-cycle costs	● \$\$ - \$3.5-7.5 M	● \$\$ - \$4M
	Operation and maintenance costs	● - Additional O&M costs needed to maintain pumping capacity	● - Reduced O&M costs due to new ET
	Aligns with approval and permitting process	● - Land acquisition may not be needed to expand reservoir	● - New ET within employment development lands, agreement with developer and set backs are needed

Appendix E Table 5: Tutela Heights Alternative Evaluation

Category	Criteria	Alternative 1: Connect Only	Alternative 2: Connect and Upgrade Local Network	Alternative 3: Connect, Upgrade, and Loop	Alternative 4: Connect, Upgrade, Loop, and Booster Pumping Station
Technical Impacts	Meets existing and future servicing needs	● - Will not service all growth	● - Services most of growth	● - Accommodates all future growth	● - Accommodates all future growth
	Provides a reliable service	● - Localized reduction in available fire flow	● - Increases/maintains fire flows	● - Increased fire flow	● - Increased fire flow
	Minimizes and manages construction risk	● - Minimal construction required	● - Moderate construction required	● - Moderate construction required; may require land acquisition	● - Major construction required; may require land acquisition
	Supports phased expansion of the system	● - Future staging can occur for further expansion of system	● - Future staging can occur for further expansion of system	● - System accommodates expansion of system	● - System accommodates expansion of system
	Operational Complexity	● - Automatic flushers required	● - Automatic flushers required	● - Minimizes need to flush	● - No need to flush - Increased operations with BPS
	Resiliency to climate change	● - No changes to energy consumption	● - Minimal changes to energy consumption	● - Minimal changes to energy consumption	● - BPS to increase energy consumption
Environmental Impacts	Protects environment features	● - Construction to avoid	● - Construction to avoid	● - Construction to avoid	● - Construction to avoid
	Protects wildlife and species at risk	● - Construction to avoid	● - Construction to avoid	● - Construction to avoid	● - Construction to avoid
	Minimizes climate change impacts	● - Minimal to no increase in GHG	● - Minimal to no increase in GHG	● - Minimal increase in GHG	● - Increase in GHG for BPS
Social and Cultural Impacts	Protects resident quality of life	● - Pressure drop expected for existing users	● - Pressure drop is expected for existing users	● - Pressure drop is expected for existing users	● - System pressures and LOS can be provided
	Manages and minimizes construction impacts	● - Minimal construction	● - Increased construction; longer to implement	● - Increased construction; longer to implement	● - Greatest construction; longest to implement
	Protects cultural heritage and archeological features	● - Unknown impacts to Cultural Heritage and Archeological	● - Unknown impacts to Cultural Heritage and Archeological	● - Unknown impacts to Cultural Heritage and Archeological	● - Unknown impacts to Cultural Heritage and Archeological
Financial Impacts	Capital and life-cycle costs	● \$	● \$\$	● \$\$\$\$	● \$\$\$\$\$\$
	Operation and maintenance costs	● - No increase in O&M costs	● - Minimal increase in O&M costs	● - Moderate increase in O&M costs	● - High increase in O&M costs
	Aligns with approval and permitting process	● - Land acquisition not required - Short term implementation	● - Land acquisition likely not required - Longer time to implement	● - Land acquisition may be required - Longer time to implement	● - Land acquisition required - Longest time to implement



City of Brantford

APPENDIX F

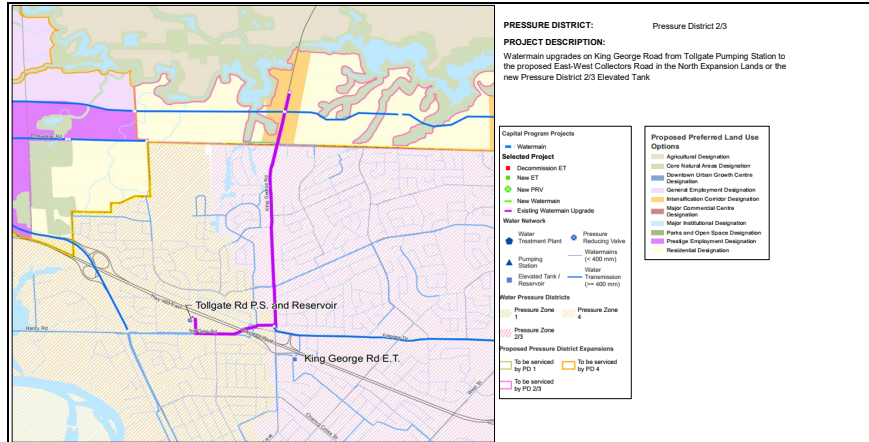
CAPITAL PROGRAM PROJECT SHEETS

Water Capital Program

Capital Program ID	Name	Overview	Pressure District	Project Description	Required Studies	Study Scope	Objectives	Class EA Schedule	Project Type	Size/Capacity	Length (m)	Class Estimate Type	Project Complexity	Accuracy Range	Area Condition	Funding Source/Responsibility	Total Estimated Cost (2025)	Timeline	DC Benefit to Existing Class
W-M-001	King George Road Watermain	Watermain upgrades on King George Road from Tollgate Pumping Station to the proposed East-West Collectors Road	Pressure District 2/3	Watermain upgrades on King George Road from Tollgate Pumping Station to the proposed East-West Collectors Road in the North Expansion Lands or the Pressure District 2/3 Elevated Tank	-	-	-	A+	Watermain	750 mm	3,578	Class 4	High	50%	Suburban	DC Eligible	\$ 17,421,000	0-5 Years	C
W-M-002	Oak Park Road Trunk Watermain	New trunk watermain from Oak Park Road to Powerline Road	Pressure District 4	New trunk watermain extending from Oak Park Road watermain limit to Powerline Road in Pressure District 4	Municipal Class Environmental Assessment (EA)	This Study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment. This study will evaluate the preferred watermain alignment as either Oak Park Road or Paris Road (W-M-002 or W-M-006) as well as cover both Capital Program Project W-M-003 and be done in conjunction with the Oak Park Road Trunk Sewer alignment (Capital Program project WW-SS-001) with costs shared between water and wastewater.	Determine the best alignment and construction type (ie. Open cut or tunnel) for the trunk watermain crossing Highway 403 including a railway crossing and overhead powerlines along Powerline Road. Determine if alignment can be coordinated with local development.	B	Watermain	600 mm	1,090	Class 4	High	50%	Suburban	DC Eligible	\$ 14,407,000	0-5 Years	A
W-M-003	Powerline Road Trunk Watermain	New trunk watermain from Powerline Road to East-West Collector Road	Pressure District 4	New trunk watermain in Pressure District 4 along Powerline Road from new Oak Park Road watermain to the proposed East-West Collector's Road	Municipal Class Environmental Assessment (EA)	This Study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment. This study will evaluate the preferred watermain alignment as either Oak Park Road or Paris Road (W-M-002 or W-M-006) as well as cover both Capital Program Project W-M-003 and be done in conjunction with the Oak Park Road Trunk Sewer alignment (Capital Program project WW-SS-001) with costs shared between water and wastewater.	Determine the best alignment and construction type (ie. Open cut or tunnel) for the trunk watermain crossing Highway 403 including a railway crossing and overhead powerlines along Powerline Road. Determine if alignment can be coordinated with local development.	B	Watermain	600 mm	1,853	Class 4	Med	40%	Suburban	DC Eligible	\$ 7,682,000	0-5 Years	A
W-M-004	North-South Collector Road Trunk Watermain	New trunk watermain from Powerline Road to East-West Collector Road	Pressure District 4	New trunk watermain in Pressure District 4 along proposed North-South Collector Road from Powerline Road to proposed East-West Collector Road	-	-	-	A	Watermain	600 mm	405	Class 4	Low	30%	Rural	DC Eligible	\$ 1,088,000	10-20 Years	A
W-M-005	North-South Collector Road Local Watermain	New local watermain from East-West Collector Road to North Expansion Lands Boundary	Pressure District 4	New local watermain in Pressure District 4 along proposed North-South Collector Road from proposed East-West Collector Road to North expansion limit	-	-	-	A	Watermain	300 mm	426	Class 4	Low	30%	Rural	DC Eligible	\$ 524,000	10-20 Years	A
W-M-006	Paris Road Trunk Watermain	New trunk watermain from Tollgate Road to North-South Collector Road at Powerline Road	Pressure District 4	New watermain in Pressure District 4 along Paris Road from Tollgate Road to proposed North-South Collector Road at Powerline Road	Municipal Class Environmental Assessment (EA)	This Study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment. This study will evaluate the preferred watermain alignment as either Oak Park Road or Paris Road (W-M-002 or W-M-006) as well as cover both Capital Program Project W-M-003 and be done in conjunction with the Oak Park Road Trunk Sewer alignment (Capital Program project WW-SS-001) with costs shared between water and wastewater.	Determine the best alignment and construction type (ie. Open cut or tunnel) for the trunk watermain crossing Highway 403 including a railway crossing and overhead powerlines along Powerline Road. Determine if alignment can be coordinated with local development.	B	Watermain	600 mm	3,108	Class 4	High	50%	Suburban	DC Eligible	\$ 11,184,000	5-10 Years	C
W-M-007	Powerline Road Distribution Watermain	New distribution watermain east of North-South Collector Road	Pressure District 4	New distribution watermain in Pressure District 4 along Powerline Road from proposed North-South Collector Road 400 m east of Golf Road	-	-	-	A+	Watermain	300 mm	1,028	Class 4	Med	40%	Rural	DC Eligible	\$ 1,357,000	5-10 Years	A
W-M-008	Powerline Road Distribution Watermain	New distribution watermain east of North-South Collector Road	Pressure District 4	New distribution watermain in Pressure District 4 along Powerline Road 400 m east of Golf Road to Balmoral Drive Road extension	-	-	-	A+	Watermain	300 mm	823	Class 4	Med	40%	Rural	DC Eligible	\$ 1,457,000	5-10 Years	A
W-M-009	Pressure District 4 East-West Collector Road Trunk Watermain	New trunk watermain along East-West Collector Road from North-South Collector Road to Pressure District 4 Boundary	Pressure District 4	New trunk watermain in Pressure District 4 along East-West Collector Road from North-South Collector Road to Pressure District 4 Boundary at Balmoral Drive Road extension	-	-	-	A	Watermain	400 mm	1,738	Class 4	Low	30%	Rural	DC Eligible	\$ 3,329,000	10-20 Years	A
W-M-010	Pressure District 2/3 East-West Collector Road Trunk Watermain	New trunk watermain along East-West Collector Road in Pressure District 2/3 west of King George	Pressure District 2/3	New trunk watermain in Pressure District 2/3 along East-West Collector Road from Pressure District 4 trunk watermain to King George Road	-	-	-	A	Watermain	400 mm	1,554	Class 4	Low	30%	Rural	DC Eligible	\$ 2,712,000	10-20 Years	A
W-M-011	Pressure District 2/3 East-West Collector Road Trunk Watermain	New trunk watermain along East-West Collector Road in Pressure District 2/3 east of King George	Pressure District 2/3	New trunk watermain in Pressure District 2/3 along East-West Collector Road from King George Road to Ivanhoe Road extension	-	-	-	A	Watermain	600 mm	1,233	Class 4	Low	30%	Rural	DC Eligible	\$ 3,389,000	10-20 Years	A
W-M-012	Pressure District 2/3 East-West Collector Road Trunk Watermain	New trunk watermain along East-West Collector Road in Pressure District 2/3 east of King George	Pressure District 2/3	New trunk watermain in Pressure District 2/3 along East-West Collector Road from Ivanhoe Road extension to Park Road North	-	-	-	A	Watermain	600 mm	1,152	Class 4	Low	30%	Rural	DC Eligible	\$ 3,208,000	10-20 Years	A
W-M-013	East-West Collector Road Trunk Watermain	New trunk watermain along East-West Collector Road in Pressure District 2/3 east of Park Road North	Pressure District 2/3	New trunk watermain in Pressure District 2/3 along East-West Collector Road from Park Road North to Brantwood Road	-	-	-	A	Watermain	400 mm	653	Class 4	Low	30%	Rural	DC Eligible	\$ 1,070,000	0-5 Years	A
W-M-014	Brantwood Park Road Trunk Watermain	New trunk watermain along Brantwood Road in Pressure District 2/3	Pressure District 2/3	New trunk watermain in Pressure District 2/3 along Brantwood Road from Powerline Road to East-West Collector Road	-	-	-	A	Watermain	400 mm	367	Class 4	Low	30%	Rural	DC Eligible	\$ 651,000	0-5 Years	A
W-M-015	Park Road North Trunk Watermain	New trunk watermain from Powerline Road to East-West Collector Road	Pressure District 2/3	New trunk watermain in Pressure District 2/3 along Park Road North from Powerline Road to East-West Collector Road	-	-	-	A+	Watermain	600 mm	383	Class 4	Low	30%	Suburban	DC Eligible	\$ 1,125,000	0-5 Years	A
W-M-016	Powerline Road Local Watermain	New local watermain from Brantwood Park Road to East-West Collector Road	Pressure District 2/3	New local watermain in Pressure District 2/3 along Powerline Road from Brantwood Park Road to East-West Collector Road eastern limit	-	-	-	A+	Watermain	300 mm	1,027	Class 4	Low	30%	Suburban	DC Eligible	\$ 1,431,000	0-5 Years	A
W-M-017	East-West Collector Road Local Watermain	New local watermain from Powerline Road to Brantwood Park Road	Pressure District 2/3	New local watermain in Pressure District 2/3 along East-West Collector Road from Powerline Road eastern limit to Brantwood Park Road	-	-	-	A	Watermain	300 mm	1,401	Class 4	Low	30%	Rural	DC Eligible	\$ 1,679,000	0-5 Years	A
W-M-018	Lynden Road Trunk Watermain Upgrades	Watermain upgrades on Lynden Road from Brantwood Park Road to eastern limit	Pressure District 2/3	Upgrade existing watermain on Lynden Road from Brantwood Park Road to Eastern limit for East Expansion Lands	-	-	-	A+	Watermain	400 mm	599	Class 4	Med	40%	Suburban	DC Eligible	\$ 1,184,000	5-10 Years	C
W-M-019	Lynden Road Distribution Main Extension	New watermain extension from existing Lynden Road trunk watermain to East Expansion Lands	Pressure District 2/3	New local watermain in Pressure District 2/3 along Lynden Road from Lynden Road trunk watermain to East Expansion Lands limit	-	-	-	A+	Watermain	300 mm	925	Class 4	High	50%	Suburban	DC Eligible	\$ 2,998,000	0-5 Years	A
W-M-020	East Expansion Lands Residential Loop	New distribution watermain loop in residential lands north of Lynden Road	Pressure District 2/3	New local watermain in East Expansion Lands along proposed Collector Road north of Lynden Road	-	-	-	A	Watermain	300 mm	1,280	Class 4	Low	30%	Rural	DC Eligible	\$ 1,535,000	0-5 Years	A
W-M-021	East Expansion Lands Employment Loop	New distribution watermain along employment lands collector road and Sinclair Road	Pressure District 2/3	New local watermain in East Expansion Lands along employment lands collector Road from Lynden Road watermain extension to Sinclair Road connection including PRV for East Expansion Lands	-	-	-	A	Watermain	300 mm	1,608	Class 4	Low	30%	Rural	DC Eligible	\$ 2,502,000	5-10 Years	A
W-M-022	Mount Pleasant Road Watermain Upgrades	Upsize existing watermain on Mount Pleasant Road from Beckett Drive to new collector road	Pressure District 1	Upsize existing 200 mm watermain on Mount Pleasant Road in Tutela Heights	-	-	-	A+	Watermain	300 mm	2,367	Class 4	Med	40%	Suburban	DC Eligible	\$ 3,417,000	0-5 Years	D
W-M-023	Conklin Road Watermain Upgrades	Upsize existing watermain on Conklin Road	Pressure District 1	Upsize existing 200 mm watermain on Conklin Road from Blackburn Drive to Mount Pleasant Road	-	-	-	A+	Watermain	300 mm	653	Class 4	Low	30%	Suburban	DC Eligible	\$ 870,000	0-5 Years	D
W-M-024	Tutela Heights Road Upgrades	Upsize existing watermain on Tutela Heights	Pressure District 1	Upsize existing 200 mm watermain on Tutela Heights from Mount Pleasant Road to Davern Road	-	-	-	A+	Watermain	300 mm	1,180	Class 4	Med	40%	Suburban	DC Eligible	\$ 1,709,000	5-10 Years	B
W-M-025	Tutela Heights Collector Road Distribution Watermain	New distribution watermain along Tutela Heights Collector Road	Pressure District 1	New distribution watermain along Collector Road from Mount Pleasant Road to Phelps Road in Tutela Heights	-	-	-	A	Watermain	300 mm	1,883	Class 4	Low	30%	Rural	DC Eligible	\$ 2,316,000	10-20 Years	A
W-M-026	Davern Road Distribution Watermain	New distribution watermain along Davern Road	Pressure District 1	New distribution watermain along Davern Road from Mount Pleasant Road southern limit to collector road	-	-	-	A+	Watermain	300 mm	836	Class 4	Low	30%	Suburban	DC Eligible	\$ 1,108,000	10-20 Years	A
W-M-027	Watermain upgrades on Fairview Drive/Lynden Road from King George Road to Brantwood Park Road	Watermain upgrades on Fairview Drive/Lynden Road from King George Road to Brantwood Park Road to support growth in Pressure District 2/3	Pressure District 2/3	Watermain upgrades on Fairview Drive/Lynden Road from King George Road to Brantwood Park Road to support growth in Pressure District 2/3	-	-	-	A+	Watermain	600 mm	4,168	Class 4	Med	40%	Suburban	DC Eligible	\$ 11,949,000	5-10 Years	C
W-M-028	Downtown Trunk Watermain	Upsize existing watermain in downtown to create trunk loop	Pressure District 1	Upsize existing watermain along Pearl Street from St. James Street to West Street	-	-	-	A+	Watermain	400 mm	860	Class 4	Med	40%	Urban	DC Eligible	\$ 1,782,000	5-10 Years	C
W-M-029	Garden Avenue Watermain Upgrade	Upsize existing watermain along Garden Avenue to create loop	Pressure District 2/3	Upsize existing watermain along Garden Avenue from Lynden Road to Sinclair Boulevard to create loop within Pressure District 2/3	-	-	-	A+	Watermain	300 mm	719	Class 4	Med	40%	Urban	City	\$ 1,574,000	5-10 Years	B
W-M-030	Fire Flow Watermain Upgrades	Replace watermain including upsizing and looping to strengthen local trunk network for fire flows.	All Pressure Districts	Fire Flow program to include replacing watermain less than or equal to 100 mm, replacing CI watermain, replacing AC/DI watermain (installed before 1990), and upsizing and looping to strengthen local trunk network. Watermain will be replaced with PVC.	-	-	-	A+	Watermain	300 mm	-	Class 4	Med	40%	Urban	-	\$ 3,818,000	0-5 Years	D
W-ET-001	Pressure District 2/3 Elevated Tank	New Elevated Tank along King George Road in North Expansion Lands	Pressure District 2/3	New Elevated Tank in Pressure District 2/3. Sized to service Pressure District 2/3 and Pressure District 1 storage deficit including North Expansions Lands until 2051 and Pressure District 2/3 and Trigger Lands post 2051 with additional storage needed in decommissioned.	Municipal Class Environmental Assessment (EA)	The study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment	Determine the requirements for a new water tower, including preferred locations.	B	Storage	11.7 ML	-	Class 4	Med	40%	Rural	DC Eligible	\$ 22,002,000	0-5 Years	C
W-ET-002	Pressure District 4 Elevated Tank	New Elevated Tank North of Highway 403 in North Expansion Lands	Pressure District 4	New Elevated Tank in Pressure District 4 to service Pressure District 4 storage deficit including North Expansions Lands and Trigger Lands.	Municipal Class Environmental Assessment (EA)	The study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment	Determine the requirements for a new water tower, including preferred location	B	Storage	2.7 ML	-	Class 4	Med	40%	Rural	DC Eligible	\$ 6,252,000	10-20 Years	C
W-ET-003	Pressure District 1 Elevated Tank	New Elevated Tank along Shellard Lane in Pressure District 1	Pressure District 1	New Elevated Tank in Pressure District 1 along Shellard Lane currently under construction.	Municipal Class Environmental Assessment (EA)	The study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment	Determine the requirements for a new water tower, including preferred location	B	Storage	6.0 ML	-	Class 4	Low	30%	Suburban	DC Eligible	\$ 10,828,000	Completion 2021	C
W-D-001	Decommissioning of King George ET	Decommissioning of King George ET to be replaced by new Pressure District 2/3 ET	Pressure District 2/3	Decommissioning of King George ET to be replaced by new Pressure District 2/3 ET	-	-	-	A+	Storage	-	-	Class 4	Med	40%	Suburban	City	\$ 929,000	5-10 Years	C
W-D-002	Decommissioning of Albion Booster Pumping Station	Decommissioning of Albion Booster PS following the commissioning of the new Pressure District 2/3 ET	Pressure District 1	Decommissioning of the Albion Booster PS following the commissioning of the new Pressure District 2/3 ET	-	-	-	A+	Pumping	-	-	Class 4	Med	40%	Suburban	City	\$ 463,000	5-10 Years	C
W-P-001	Holmesdale WTP High Lift Pump Upgrades	Install additional pump to supply elevated tank and reservoirs from reservoirs	Pressure District 1	Install additional pump to supply elevated tank and reservoirs in Pressure District 1.	-	-	-	A+	Pumping	-	-	Class 4	Med	40%	Rural	DC Eligible	\$ 2,320,000	0-5 Years	C
W-P-002	Wayne Gretzky Pump Upgrades	Pumping capacity upgrades at Wayne Gretzky PS.	Pressure District 2/3	Install 3 new pumps at Wayne Gretzky Pump Station to improve operational capacity and support new Pressure District HGL. Install new PRV to allow Pressure District 2/3 to backfeed Pressure District 1.	-	-	-	A+	Pumping	-	-	Class 4	Med	40%	Rural	DC Eligible	\$ 6,497,000	5-10 Years	C
W-P-003	Tollgate Pump Upgrades	Pumping capacity upgrades at Tollgate PS	Pressure District 2/3	Install 3 new pumps at Tollgate Pump Station to improve operational capacity and support new Pressure District HGL. Install new PRV to allow Pressure District 2/3 to backfeed Pressure District 1.	-	-	-	A+	Pumping	-	-	Class 4	Med	40%	Rural	DC Eligible	\$ 7,425,000	5-10 Years	C
W-P-004	Coborne Street West Booster Pumping Station	New Booster Pumping Station to service development off of Coborne Street West at municipal boundary.	Pressure District 1	Install new Booster Pumping station to be serviced off of Pressure District 1 to service existing properties on Coborne Street and development extending west to the municipal boundary. Pumping station includes single jockey pump and a fire pump.	Municipal Class Environmental Assessment (EA)	The study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment.	Determine the best construction methodology for the new pumping station including location of buildings.	B	Pumping	128 L/s	-	Class 4	Med	40%	Rural	Developer	\$ 5,564,000	0-5 Years	B
W-P-005	Strawberry Hill Booster Pumping Station	New Booster Pumping Station to service development off of Coborne Street West at municipal boundary.	Pressure District 1	Install new Booster Pumping station to be serviced off of Pressure District 1 to service new sub-pressure district to extend from Shellard Lane to Mount Pleasant Street. BPS required to service future development. Sized to provide MDD with fire flow provided via check valves.	Municipal Class Environmental Assessment (EA)	The study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment.	Determine the best construction methodology for the new pumping station including location of buildings.	B	Pumping	-	-	Class 4	Med	40%	Suburban	Developer	\$ 2,056,000	10-20 Years	B
W-TP-001	Water Treatment Plant Upgrades - 0-5 Years	Moderate process upgrades at the WTP to meet 130 MLD (130,000 m3/day) to support combined growth and operational reserve capacity needs.	Pressure District 1	Moderate process upgrades to increase the capacity including construct second low lift pump station including new intake, twin header, increase polymer pumping capacity, install additional ozone generator and new contact chamber, upsize filtration well and backwash pumps and size residual management facility. All upgrades will be completed at the existing property.	-	-	-	A+	Treatment	-	-	Class 4	Med	40%	Rural	DC Eligible	\$ 929,000	0-5 Years	B
W-TP-002	Water Treatment Plant Upgrades - 5-10 Years	Moderate process upgrades at the WTP to meet 130 MLD (130,000 m3/day) to support combined growth and operational reserve capacity needs.	Pressure District 1	Moderate process upgrades to increase the capacity including construct second low lift pump station including new intake, twin header, increase polymer pumping capacity, install additional ozone generator and new contact chamber, upsize filtration well and backwash pumps and upsize residual management facility. All upgrades will be completed at the existing property.	-	-	-	A+	Treatment	-	-	Class 4	Med	40%	Rural	DC Eligible	\$ 12,993,000	5-10 Years	A
TOTAL																	\$ 188,734,000		

PROJECT NO.: W-M-001 **TIMELINE:** 0-5 Years
PROJECT NAME: King George Road Watermain
PROJECT OVERVIEW: Watermain upgrades on King George Road from Tollgate Pumping Station to the proposed East-West Collectors Road

MAP



REQUIRED STUDIES:

STUDY SCOPE:

OBJECTIVES:

CONSTRUCTION

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

PROPOSED DIAMETER:	750 mm
TOTAL LENGTH:	3578 m
Tunnelled	0 m 0%
Open Cut	3578 m 100%

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

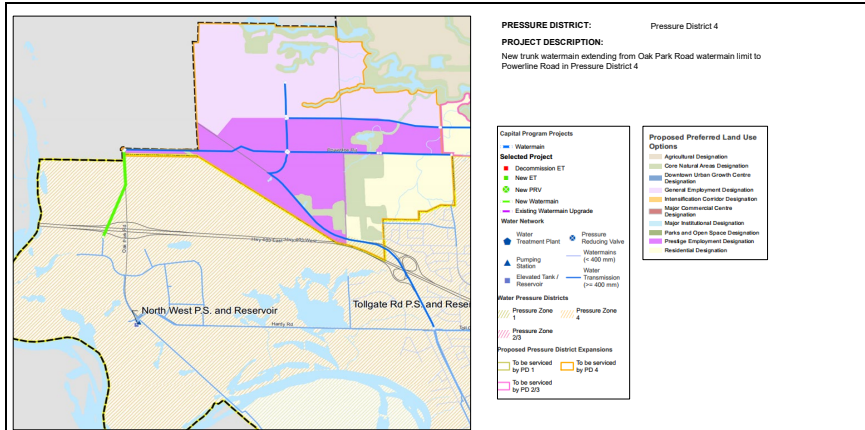
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs					
Construction Cost					
Pipe Construction - Open Cut		m	3578 m	\$1,533	\$5,485,097 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$8,200	\$0
Minor Creek Crossings		ea.	0	\$334,000	\$0
Major Creek Crossings		ea.	0	\$1,400,000	\$0
Road Crossings		ea.	1	\$662,000	\$662,000 Powerline Road
Major Road Crossings (Highway)		ea.	1	\$1,400,000	\$1,400,000 Highway 403
Utility Crossings		ea.	0	\$662,000	\$0
Valve and Chamber		ea.	4	\$85,000	\$340,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$754,710
Additional Construction Costs	20%	ea.			\$1,728,361 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$864,181 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs					
\$11,234,000					
Geotechnical / Hydrogeological / Materials	2.0%				\$224,700
Geotechnical Sub-Total Cost					
\$224,700					
Property Requirements	2.0%				\$ 224,700
Property Requirements Sub-Total					
\$224,700					
Consultant Engineering/Design	12%				\$ 1,348,100 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total					
\$1,348,100					
In House Labour/Engineering/Wages/CA	6%				\$ 674,000
In-house Labour/Wages Sub-Total					
\$674,000					
Project Contingency	25%				\$3,426,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total					
\$3,426,000					
Non-Refundable HST	1.76%				\$289,700
Non-Refundable HST Sub-Total					
\$289,700					
Total (2020 Dollars)					
\$17,421,000 Rounded to nearest \$1,000					
Other Estimate					
Chosen Estimate					
\$17,421,000 2020 Estimate					

PROJECT NO.: W-M-002
PROJECT NAME: Oak Park Road Trunk Watermain
PROJECT OVERVIEW: New trunk watermain from Oak Park Road to Powerline Road

TIMELINE: 6-5 Years

MAP



REQUIRED STUDIES: Municipal Class Environmental Assessment (EA)

STUDY SCOPE: This Study will be a Schedule "B" project in accordance with all requirements of the Municipal Class Environmental Assessment. This study will evaluate the preferred watermain alignment as either Oak Park Road or Paris Road (W-M-002 or W-M-006) as well as cover both Capital Program Project W-M-003 and be done in conjunction with the Oak Park Road Trunk Sewer alignment (Capital Program project WW-SS-001) with costs shared between water and wastewater.

OBJECTIVES: Determine the best alignment and construction type (i.e. Open cut or tunnel) for the trunk watermain crossing Highway 403 including a railway crossing and overhead powerlines along Powerline Road. Determine if alignment can be coordinated with local development.

CONSTRUCTION

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

PROPOSED DIAMETER:	600 mm
TOTAL LENGTH:	1090 m
Tunnelled	500 m 46%
Open Cut	590 m 54%

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Watermain

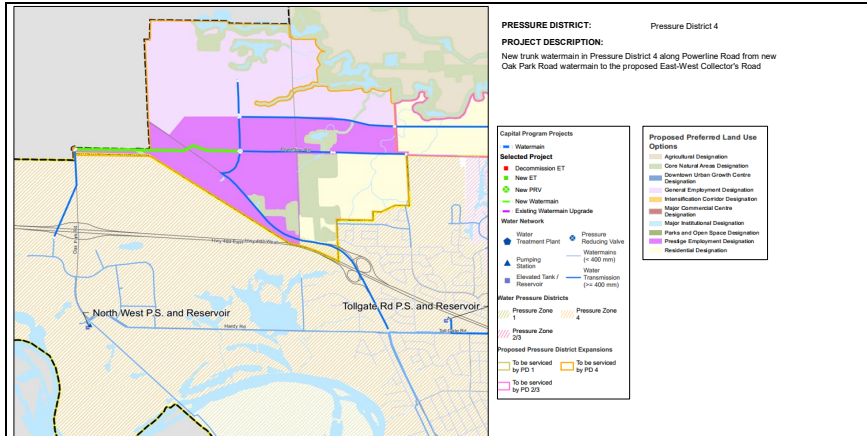
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	1	\$100,000	\$100,000	
Sub-Total Study Costs				\$100,000	
Construction Cost					
Pipe Construction - Open Cut		m	590 m	\$1,337	\$788,836 Existing road ROW
Pipe Construction - Tunneling		m	500 m	\$8,000	\$4,000,000
Minor Creek Crossings		ea.	0	\$270,000	\$0
Major Creek Crossings		ea.	0	\$1,310,000	\$0
Road Crossings		ea.	0	\$590,000	\$0 Powerline Road
Major Road Crossings (Highway)		ea.	1	\$1,310,000	\$1,310,000 Highway 403
Utility Crossings		ea.	0	\$590,000	\$0
Valve and Chamber		ea.	2	\$55,000	\$110,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$809,894
Additional Construction Costs	20%	ea.			\$1,363,744
Provisional & Allowance	10%	ea.			\$661,872
Sub-Total Construction Base Costs				\$8,864,000	
Geotechnical / Hydrogeological / Materials	2.0%				\$177,300
Geotechnical Sub-Total Cost				\$177,300	
Property Requirements	2.0%				\$ 177,300
Property Requirements Sub-Total				\$177,300	
Consultant Engineering/Design	15%				\$ 1,329,600
Engineering/Design Sub-Total				\$1,329,600	Includes planning, pre-design, detailed design, training, CA, commissioning
In House Labour/Engineering/Wages/CA	8%				\$ 709,100
In-house Labour/Wages Sub-Total				\$709,100	
Project Contingency	25%				\$2,814,000
Project Contingency Sub-Total				\$2,814,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Non-Refundable HST	1.76%				\$235,200
Non-Refundable HST Sub-Total				\$235,200	
Total (2020 Dollars)				\$14,407,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$14,407,000	2020 Estimate

PROJECT NO.: W-M-003
PROJECT NAME: Powerline Road Trunk Watermain
PROJECT OVERVIEW: New trunk watermain from Powerline Road to East-West Collector Road

TIMELINE: 0-5 Years

MAP



REQUIRED STUDIES: Municipal Class Environmental Assessment (EA)
STUDY SCOPE: This Study will be a Schedule "B" project in accordance with all requirements of the Municipal Class Environmental Assessment. This study will evaluate the preferred watermain alignment as either Oak Park Road or Paris Road (W-M-002 or W-M-005) as well as cover both Capital Program Project W-M-003 and be done in conjunction with the Oak Park Road Trunk Sewer alignment (Capital Program project WW-SS-001) with costs shared between water and wastewater.
OBJECTIVES: Determine the best alignment and construction type (i.e. Open cut or tunnel) for the trunk watermain crossing Highway 403 including a railway crossing and overhead powerlines along Powerline Road. Determine if alignment can be coordinated with local development.

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

PROPOSED DIAMETER:	600 mm		
TOTAL LENGTH:	1853 m		
	Tunnelled	0 m	0%
	Open Cut	1853 m	100%

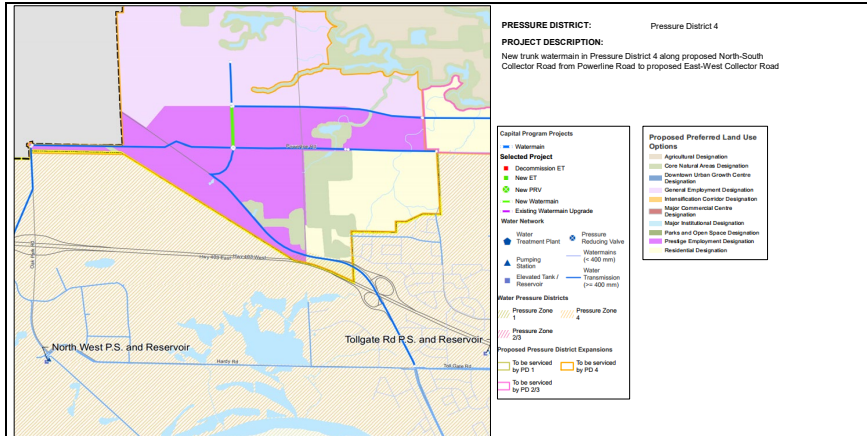
CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET					
COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	1	\$100,000	\$100,000	
Sub-Total Study Costs				\$100,000	
Construction Cost					
Pipe Construction - Open Cut		m	1853 m	\$1,337	\$2,477,480 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$8,000	\$0
Minor Creek Crossings		ea.	0	\$270,000	\$0
Major Creek Crossings		ea.	0	\$1,310,000	\$0
Road Crossings		ea.	1	\$590,000	\$590,000 Paris Road
Major Road Crossings (Highway)		ea.	0	\$1,310,000	\$0
Utility Crossings		ea.	1	\$590,000	\$590,000 Powerlines
Valve and Chamber		ea.	2	\$55,000	\$110,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$365,746
Additional Construction Costs	15%	ea.			\$619,384 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$413,322 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$5,167,000	
Geotechnical / Hydrogeological / Materials	1.0%				\$51,700
Geotechnical Sub-Total Cost				\$51,700	
Property Requirements	1.5%				\$ 77,500
Property Requirements Sub-Total				\$77,500	
Consultant Engineering/Design	15%				\$ 775,100 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$775,100	
In House Labour/Engineering/Wages/CA	8%				\$ 413,400
In-house Labour/Wages Sub-Total				\$413,400	
Project Contingency	15%				\$873,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$873,000	
Non-Refundable HST	1.76%				\$124,000
Non-Refundable HST Sub-Total				\$124,000	
Total (2020 Dollars)				\$7,682,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$7,682,000	2020 Estimate

PROJECT NO.: W-M-004
PROJECT NAME: North-South Collector Road Trunk Watermain
PROJECT OVERVIEW: New trunk watermain from Powerline Road to East-West Collector Road

TIMELINE: 10-20 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION	
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

PROPOSED DIAMETER:	
600 mm	
TOTAL LENGTH:	
405 m	
Tunnelled	
0 m	0%
Open Cut	
405 m	100%

CLASS EA REQUIREMENTS:	A
CONSTRUCTION ASSUMPTION:	Watermain

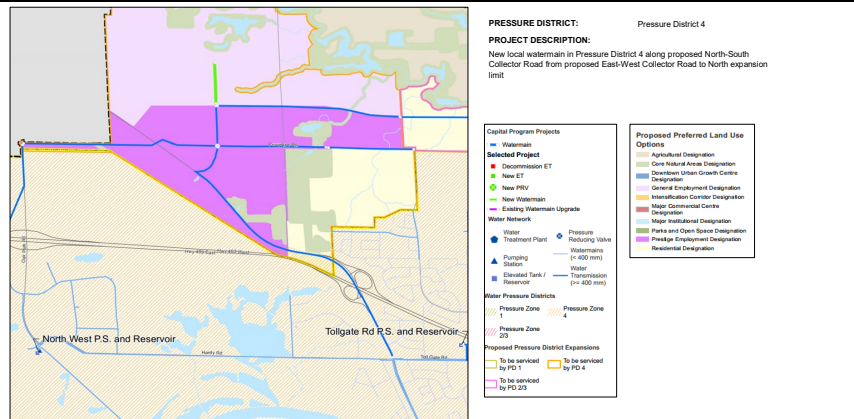
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study	0		\$0	
Study	EA	0		\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	405 m	\$1,337	\$541,485 Proposed Collector Road ROW
Pipe Construction - Tunneling		m	0 m	\$8,000	\$0
Minor Creek Crossings		ea.	0	\$270,000	\$0
Major Creek Crossings		ea.	0	\$1,310,000	\$0
Road Crossings		ea.	0	\$590,000	\$0
Major Road Crossings (Highway)		ea.	0	\$1,310,000	\$0
Utility Crossings		ea.	0	\$590,000	\$0
Valve and Chamber		ea.	2	\$55,000	\$110,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0
Additional Construction Costs	10%	ea.			\$65,149 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$65,149 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$782,000	
Geotechnical / Hydrogeological / Materials	0.5%				\$3,900
Geotechnical Sub-Total Cost				\$3,900	
Property Requirements	1.0%				\$ 7,800
Property Requirements Sub-Total				\$7,800	
Consultant Engineering/Design	15%				\$ 117,300 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$117,300	
In House Labour/Engineering/Wages/CA	8%				\$ 62,600
In-house Labour/Wages Sub-Total				\$62,600	
Project Contingency	10%				\$97,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$97,000	
Non-Refundable HST	1.76%				\$17,700
Non-Refundable HST Sub-Total				\$17,700	
Total (2020 Dollars)				\$1,088,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,088,000	2020 Estimate

PROJECT NO.: W-M-005
PROJECT NAME: North-South Collector Road Local Watermain
PROJECT OVERVIEW: New local watermain from East-West Collector Road to North Expansion Lands Boundary

TIMELINE: 10-20 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

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

PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A
TOTAL LENGTH:	426 m	CONSTRUCTION ASSUMPTION:	Watermain
Tunnelled	0 m		0%
Open Cut	426 m		100%

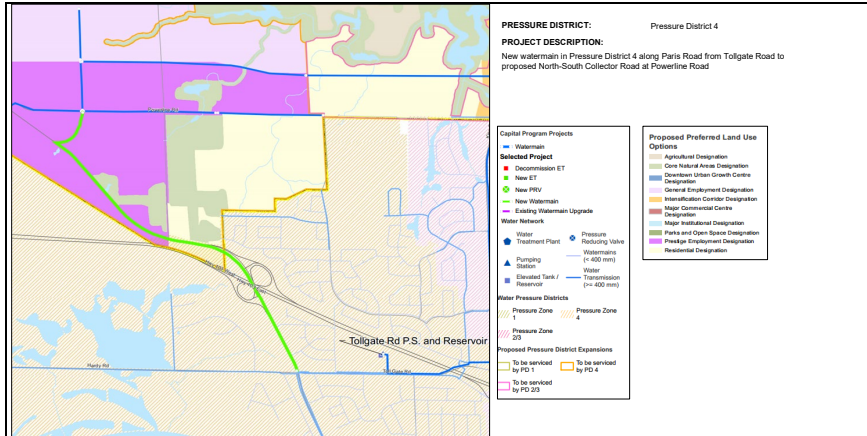
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study	0		\$0	
Study	EA	0		\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	426 m	\$709	\$302,147 Proposed Collector Road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	0	\$40,000	\$0
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	0	\$98,000	\$0
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0
Utility Crossings		ea.	0	\$98,000	\$0
Valve and Chamber		ea.	2	\$5,500	\$11,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0
Additional Construction Costs	10%	ea.			\$31,315 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$31,315 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$376,000	
Geotechnical / Hydrogeological / Materials	0.5%				\$1,900
Geotechnical Sub-Total Cost				\$1,900	
Property Requirements	1.0%				\$ 3,800
Property Requirements Sub-Total				\$3,800	
Consultant Engineering/Design	15%				\$ 56,400 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$56,400	
In House Labour/Engineering/Wages/CA	8%				\$ 30,100
In-house Labour/Wages Sub-Total				\$30,100	
Project Contingency	10%				\$47,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$47,000	
Non-Refundable HST	1.76%				\$8,500
Non-Refundable HST Sub-Total				\$8,500	
Total (2020 Dollars)				\$524,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$524,000	2020 Estimate

PROJECT NO.: W-M-006
PROJECT NAME: Paris Road Trunk Watermain
PROJECT OVERVIEW: New trunk watermain from Tolgate Road to North-South Collector Road at Powerline Road

TIMELINE: 5-10 Years

MAP



REQUIRED STUDIES: Municipal Class Environmental Assessment (EA)

STUDY SCOPE: This Study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment. This study will evaluate the preferred watermain alignment as either Oak Park Road or Paris Road (W-M-022 or W-M-026) as well as cover both Capital Program Project W-M-003 and be done in conjunction with the Oak Park Road Trunk Sewer alignment (Capital Program project WW-SS-001) with costs shared between water and wastewater.

OBJECTIVES: Determine the best alignment and construction type (i.e. Open cut or tunnel) for the trunk watermain crossing Highway 403 including a railway crossing and overhead powerlines along Powerline Road. Determine if alignment can be coordinated with local development.

CONSTRUCTION

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

PROPOSED DIAMETER:	600 mm
TOTAL LENGTH:	3108 m
Tunnelled	0 m 0%
Open Cut	3108 m 100%

CLASS EA REQUIREMENTS:	B
CONSTRUCTION ASSUMPTION:	Watermain

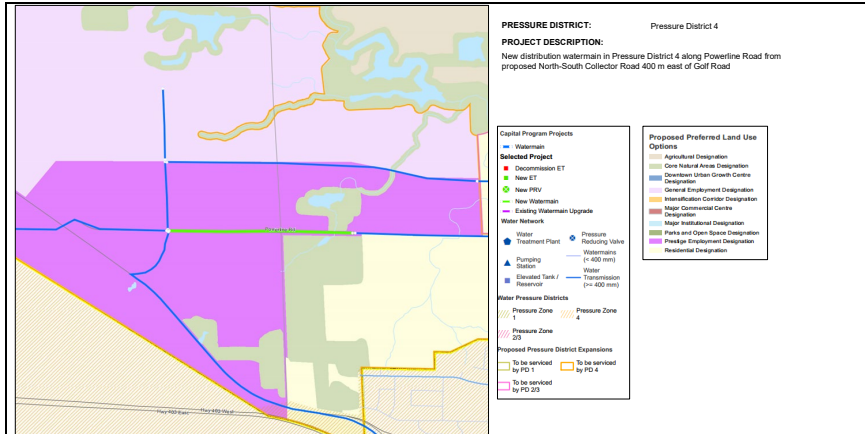
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	3108 m	\$1,337	\$4,155,429 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$8,000	\$0
Minor Creek Crossings		ea.	0	\$270,000	\$0
Major Creek Crossings		ea.	0	\$1,310,000	\$0
Road Crossings		ea.	1	\$590,000	\$590,000 Under High 403
Major Road Crossings (Highway)		ea.	0	\$1,310,000	\$0
Utility Crossings		ea.	0	\$590,000	\$0
Valve and Chamber		ea.	2	\$55,000	\$110,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$474,545
Additional Construction Costs	20%	ea.			\$1,065,994 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$532,997 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$6,929,000	
Geotechnical / Hydrogeological / Materials	2.0%				\$138,600
Geotechnical Sub-Total Cost				\$138,600	
Property Requirements	2.0%				\$ 138,600
Property Requirements Sub-Total				\$138,600	
Consultant Engineering/Design	15%				\$ 1,039,400 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$1,039,400	
In House Labour/Engineering/Wages/CA	8%				\$ 554,300
In-house Labour/Wages Sub-Total				\$554,300	
Project Contingency	25%				\$2,200,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$2,200,000	
Non-Refundable HST	1.76%				\$183,800
Non-Refundable HST Sub-Total				\$183,800	
Total (2020 Dollars)				\$11,184,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$11,184,000	2020 Estimate

PROJECT NO.: W-M-007
PROJECT NAME: Powerline Road Distribution Watermain
PROJECT OVERVIEW: New distribution watermain east of North-South Collector Road

TIMELINE: 5-10 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

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

PROPOSED DIAMETER:	300 mm						
TOTAL LENGTH:	1028 m						
	<table border="1"> <tr> <td>Tunnelled</td> <td>0 m</td> <td>0%</td> </tr> <tr> <td>Open Cut</td> <td>1028 m</td> <td>100%</td> </tr> </table>	Tunnelled	0 m	0%	Open Cut	1028 m	100%
Tunnelled	0 m	0%					
Open Cut	1028 m	100%					

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

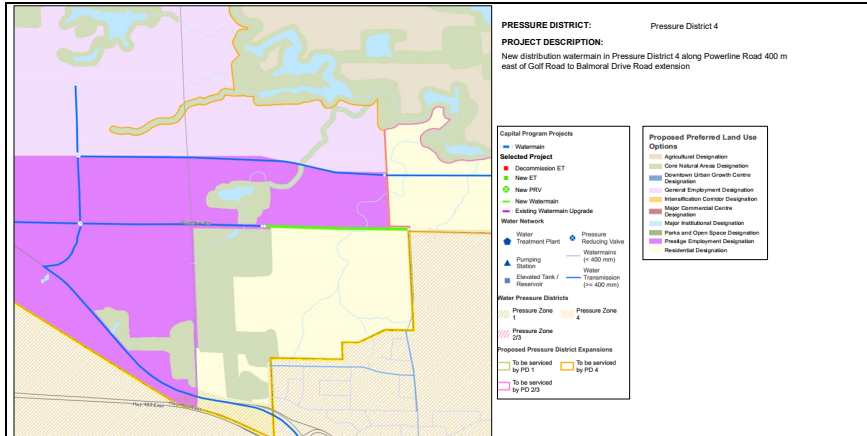
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	1028 m	\$709	\$729,126 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	0	\$40,000	\$0
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	0	\$98,000	\$0
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0
Utility Crossings		ea.	0	\$98,000	\$0
Valve and Chamber		ea.	2	\$5,500	\$11,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0
Additional Construction Costs	15%	ea.			\$111,019 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$74,015 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$925,000	
Geotechnical / Hydrogeological / Materials	1.0%				\$9,300
Geotechnical Sub-Total Cost				\$9,300	
Property Requirements	1.5%				\$13,900
Property Requirements Sub-Total				\$13,900	
Consultant Engineering/Design	15%				\$138,800 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$138,800	
In House Labour/Engineering/Wages/CA	8%				\$74,000
In-house Labour/Wages Sub-Total				\$74,000	
Project Contingency	15%				\$174,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$174,000	
Non-Refundable HST	1.76%				\$22,200
Non-Refundable HST Sub-Total				\$22,200	
Total (2020 Dollars)				\$1,367,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,367,000	2020 Estimate

PROJECT NO.: W-M-008
PROJECT NAME: Powerline Road Distribution Watermain
PROJECT OVERVIEW: New distribution watermain east of North-South Collector Road

TIMELINE: 5-10 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -

OBJECTIVES: -

CONSTRUCTION

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

PROPOSED DIAMETER:	300 mm
TOTAL LENGTH:	823 m
Tunnelled	0 m 0%
Open Cut	823 m 100%

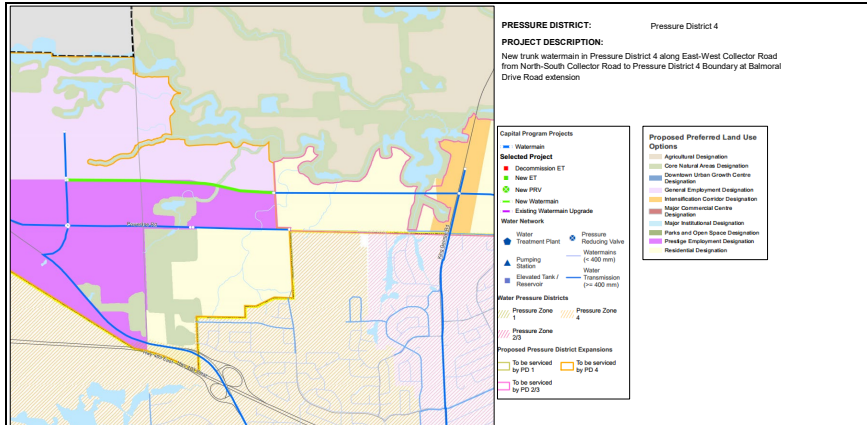
CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	823 m	\$709	\$583,726 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	0	\$40,000	\$0
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	0	\$98,000	\$0
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0
Utility Crossings		ea.	0	\$98,000	\$0
Valve and Chamber		ea.	2	\$5,500	\$11,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%			\$0	
New PRV Chamber		ea.	1	\$250,000	\$250,000 Pressure District 4 to Pressure District 2/3
Additional Construction Costs	15%	ea.		\$89,209	Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.		\$59,473	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$993,000	
Geotechnical / Hydrogeological / Materials	1.0%			\$9,900	
Geotechnical Sub-Total Cost				\$9,900	
Property Requirements	1.5%			\$14,900	
Property Requirements Sub-Total				\$14,900	
Consultant Engineering/Design	15%			\$149,000	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$149,000	
In House Labour/Engineering/Wages/CA	8%			\$79,400	
In-house Labour/Wages Sub-Total				\$79,400	
Project Contingency	15%			\$187,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$187,000	
Non-Refundable HST	1.76%			\$23,800	
Non-Refundable HST Sub-Total				\$23,800	
Total (2020 Dollars)				\$1,457,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,457,000	2020 Estimate

PROJECT NO.: W-M-009 **TIMELINE:** 10-20 Years
PROJECT NAME: Pressure District 4 East-West Collector Road Trunk Watermain
PROJECT OVERVIEW: New trunk watermain along East-West Collector Road from North-South Collector Road to Pressure District 4 Boundary

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

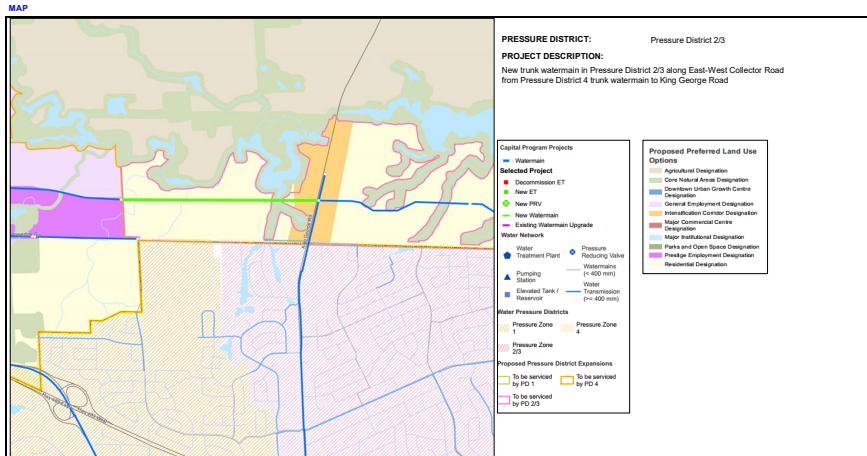
Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	30%	
Area Condition:	Rural	Area Condition uplifts unit cost and restoration

PROPOSED DIAMETER:	400 mm	CLASS EA REQUIREMENTS:	A
TOTAL LENGTH:	1738 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 1738 m 100%		

COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	1738 m	\$873	\$1,517,234 Proposed Collector ROW
Pipe Construction - Tunneling		m	0 m	\$6,350	\$0
Minor Creek Crossings		ea.	1	\$197,000	\$197,000
Major Creek Crossings		ea.	0	\$1,023,000	\$0
Road Crossings		ea.	0	\$451,000	\$0
Major Road Crossings (Highway)		ea.	0	\$1,023,000	\$0
Utility Crossings		ea.	0	\$451,000	\$0
Valve and Chamber		ea.	2	\$35,000	\$70,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0
New PRV Chamber		ea.	1	\$250,000	\$250,000 Pressure District 4 to Pressure District 2/3
Additional Construction Costs	10%	ea.		\$178,423	Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.		\$178,423	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$2,391,000	
Geotechnical / Hydrogeological / Materials	0.5%			\$12,000	
Geotechnical Sub-Total Cost				\$12,000	
Property Requirements	1.0%			\$23,800	
Property Requirements Sub-Total				\$23,800	
Consultant Engineering/Design	15%			\$358,700	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$358,700	
In House Labour/Engineering/Wages/CA	8%			\$191,300	
In-house Labour/Wages Sub-Total				\$191,300	
Project Contingency	10%			\$298,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$298,000	
Non-Refundable HST	1.76%			\$54,300	
Non-Refundable HST Sub-Total				\$54,300	
Total (2020 Dollars)				\$3,329,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$3,329,000	2020 Estimate

PROJECT NO.: W-M-010 **TIMELINE:** 10-20 Years
PROJECT NAME: Pressure District 2/3 East-West Collector Road Trunk Watermain
PROJECT OVERVIEW: New trunk watermain along East-West Collector Road in Pressure District 2/3 west of King George



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

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

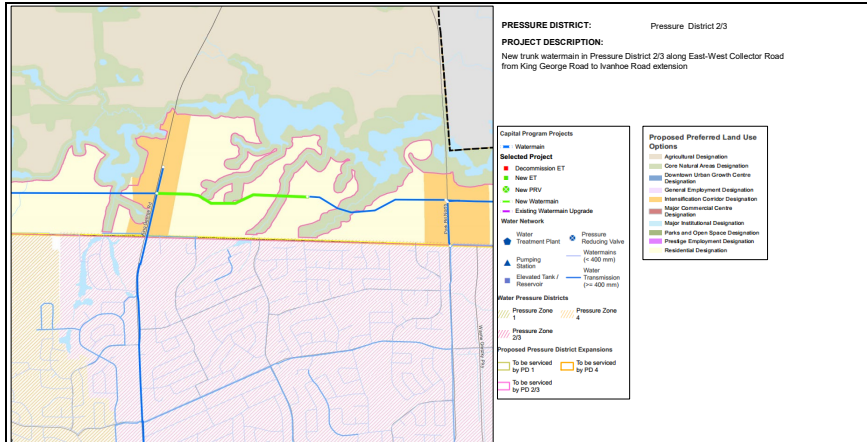
PROPOSED DIAMETER:	400 mm	CLASS EA REQUIREMENTS:	A
TOTAL LENGTH:	1554 m	CONSTRUCTION ASSUMPTION:	Watermain
Tunnelled	0 m		
Open Cut	1554 m		

COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS	
Study Cost						
Study	Feasibility Study			\$0		
Study	EA			\$0		
Sub-Total Study Costs				\$0		
Construction Cost						
Pipe Construction - Open Cut		m	1554 m	\$873	\$1,356,606	Proposed Collector ROW
Pipe Construction - Tunneling		m	0 m	\$6,350	\$0	
Minor Creek Crossings		ea.	1	\$197,000	\$197,000	
Major Creek Crossings		ea.	0	\$1,023,000	\$0	
Road Crossings		ea.	0	\$451,000	\$0	
Major Road Crossings (Highway)		ea.	0	\$1,023,000	\$0	
Utility Crossings		ea.	0	\$451,000	\$0	
Valve and Chamber		ea.	2	\$35,000	\$70,000	Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0	
Additional Construction Costs	10%	ea.			\$162,361	Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$162,361	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$1,948,000		
Geotechnical / Hydrogeological / Materials	0.5%				\$9,700	
Geotechnical Sub-Total Cost				\$9,700		
Property Requirements	1.0%				\$19,900	
Property Requirements Sub-Total				\$19,900		
Consultant Engineering/Design	15%				\$292,200	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$292,200		
In House Labour/Engineering/Wages/CA	8%				\$155,800	
In-house Labour/Wages Sub-Total				\$155,800		
Project Contingency	10%				\$243,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$243,000		
Non-Refundable HST	1.76%				\$44,200	
Non-Refundable HST Sub-Total				\$44,200		
Total (2020 Dollars)				\$2,712,000	Rounded to nearest \$1,000	
Other Estimate						
Chosen Estimate				\$2,712,000	2020 Estimate	

PROJECT NO.: W-M-011 **TIMELINE:** 10-20 Years
PROJECT NAME: Pressure District 2/3 East-West Collector Road Trunk Watermain
PROJECT OVERVIEW: New trunk watermain along East-West Collector Road in Pressure District 2/3 east of King George

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

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

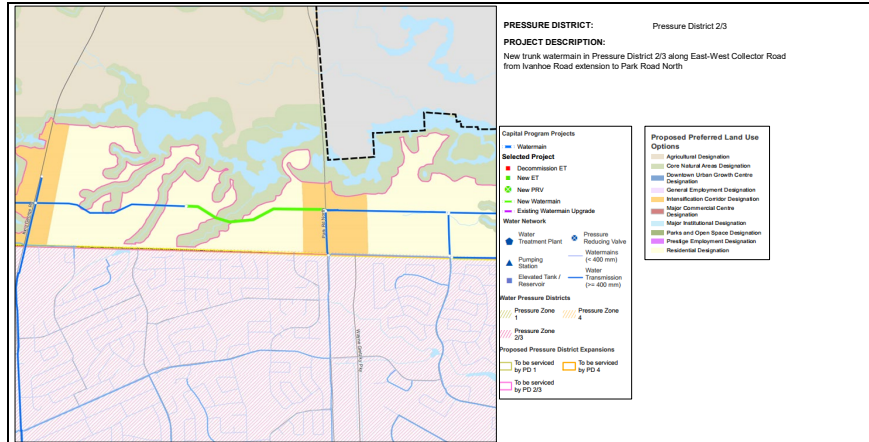
PROPOSED DIAMETER:	600 mm	CLASS EA REQUIREMENTS:	A
TOTAL LENGTH:	1233 m	CONSTRUCTION ASSUMPTION:	Watermain
Tunnelled	0 m		0%
Open Cut	1233 m		100%

COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	1233 m	\$1,337	\$1,648,534 Proposed Collector ROW
Pipe Construction - Tunneling		m	0 m	\$8,000	\$0
Minor Creek Crossings		ea.	1	\$270,000	\$270,000
Major Creek Crossings		ea.	0	\$1,310,000	\$0
Road Crossings		ea.	0	\$590,000	\$0
Major Road Crossings (Highway)		ea.	0	\$1,310,000	\$0
Utility Crossings		ea.	0	\$590,000	\$0
Valve and Chamber		ea.	2	\$55,000	\$110,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0
Additional Construction Costs	10%	ea.		\$202,853	Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.		\$202,853	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$2,434,000	
Geotechnical / Hydrogeological / Materials	0.5%			\$12,200	
Geotechnical Sub-Total Cost				\$12,200	
Property Requirements	1.0%			\$24,300	
Property Requirements Sub-Total				\$24,300	
Consultant Engineering/Design	15%			\$365,100	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$365,100	
In House Labour/Engineering/Wages/CA	8%			\$194,700	
In-house Labour/Wages Sub-Total				\$194,700	
Project Contingency	10%			\$303,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$303,000	
Non-Refundable HST	1.76%			\$55,200	
Non-Refundable HST Sub-Total				\$55,200	
Total (2020 Dollars)				\$3,389,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$3,389,000	2020 Estimate

PROJECT NO.: W-M-012 **TIMELINE:** 10-20 Years
PROJECT NAME: Pressure District 2/3 East-West Collector Road Trunk Watermain
PROJECT OVERVIEW: New trunk watermain along East-West Collector Road in Pressure District 2/3 east of King George Road

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

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

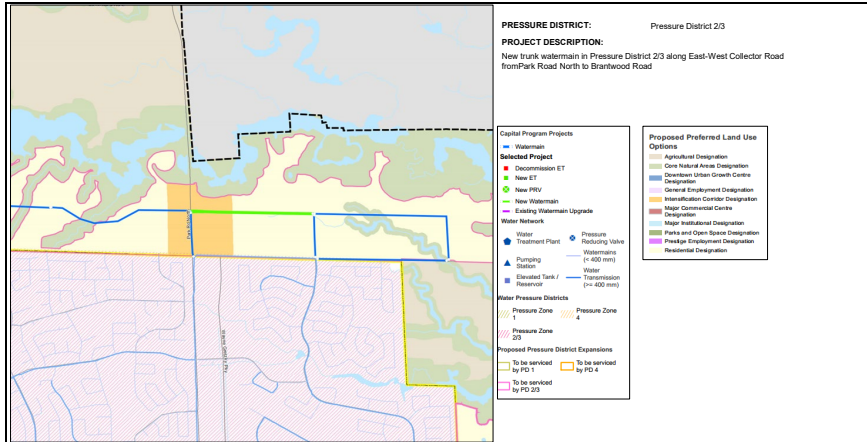
PROPOSED DIAMETER:	600 mm	CLASS EA REQUIREMENTS:	A
TOTAL LENGTH:	1152 m	CONSTRUCTION ASSUMPTION:	Watermain
Tunnelled	0 m		
Open Cut	1152 m		

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	1152 m	\$1,337	\$1,540,296 Proposed Collector Road ROW
Pipe Construction - Tunneling		m	0 m	\$8,000	\$0
Minor Creek Crossings		ea.	1	\$270,000	\$270,000
Major Creek Crossings		ea.	0	\$1,310,000	\$0
Road Crossings		ea.	0	\$590,000	\$0
Major Road Crossings (Highway)		ea.	0	\$1,310,000	\$0
Utility Crossings		ea.	0	\$590,000	\$0
Valve and Chamber		ea.	2	\$55,000	\$110,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0
Additional Construction Costs	10%	ea.			\$192,024 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$192,024 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$2,304,000	
Geotechnical / Hydrogeological / Materials	0.5%				\$11,500
Geotechnical Sub-Total Cost				\$11,500	
Property Requirements	1.0%				\$ 23,000
Property Requirements Sub-Total				\$23,000	
Consultant Engineering/Design	15%				\$ 345,600 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$345,600	
In House Labour/Engineering/Wages/CA	8%				\$ 184,300
In-house Labour/Wages Sub-Total				\$184,300	
Project Contingency	10%				\$287,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$287,000	
Non-Refundable HST	1.76%				\$52,300
Non-Refundable HST Sub-Total				\$52,300	
Total (2020 Dollars)				\$3,208,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$3,208,000	2020 Estimate

PROJECT NO.: W-M-013
PROJECT NAME: East-West Collector Road Trunk Watermain
PROJECT OVERVIEW: New trunk watermain along East-West Collector Road in Pressure District 2/3 east of Park Road North

TIMELINE: 6-5 Years

MAP



REQUIRED STUDIES:

STUDY SCOPE:

OBJECTIVES:

CONSTRUCTION

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

PROPOSED DIAMETER:	400 mm
TOTAL LENGTH:	653 m
Tunnelled	0 m 0%
Open Cut	653 m 100%

CLASS EA REQUIREMENTS:	A
CONSTRUCTION ASSUMPTION:	Watermain

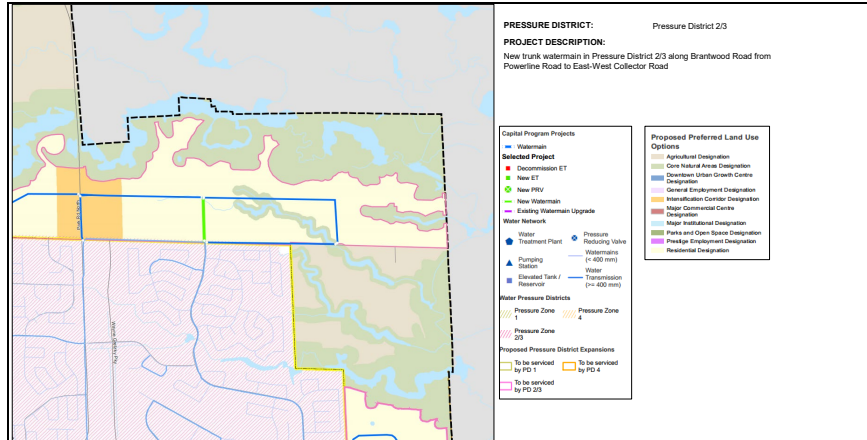
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	653 m	\$873	\$570,054 Proposed Collector Road ROW
Pipe Construction - Tunneling		m	0 m	\$6,350	\$0
Minor Creek Crossings		ea.	0	\$197,000	\$0
Major Creek Crossings		ea.	0	\$1,023,000	\$0
Road Crossings		ea.	0	\$451,000	\$0
Major Road Crossings (Highway)		ea.	0	\$1,023,000	\$0
Utility Crossings		ea.	0	\$451,000	\$0
Valve and Chamber		ea.	2	\$35,000	\$70,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0
Additional Construction Costs	10%	ea.			\$64,005 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$64,005 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$768,000	
Geotechnical / Hydrogeological / Materials	0.5%				\$3,800
Geotechnical Sub-Total Cost				\$3,800	
Property Requirements	1.0%				\$ 7,700
Property Requirements Sub-Total				\$7,700	
Consultant Engineering/Design	15%				\$ 115,200 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$115,200	
In House Labour/Engineering/Wages/CA	8%				\$ 61,400
In-house Labour/Wages Sub-Total				\$61,400	
Project Contingency	10%				\$96,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$96,000	
Non-Refundable HST	1.76%				\$17,400
Non-Refundable HST Sub-Total				\$17,400	
Total (2020 Dollars)				\$1,070,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,070,000	2020 Estimate

PROJECT NO.: W-M-014
PROJECT NAME: Brantwood Park Road Trunk Watermain
PROJECT OVERVIEW: New trunk watermain along Brantwood Road in Pressure District 2/3

TIMELINE: 0-5 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

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

PROPOSED DIAMETER:	400 mm	CLASS EA REQUIREMENTS:	A
TOTAL LENGTH:	367 m	CONSTRUCTION ASSUMPTION:	Watermain
Tunnelled	0 m		0%
Open Cut	367 m		100%

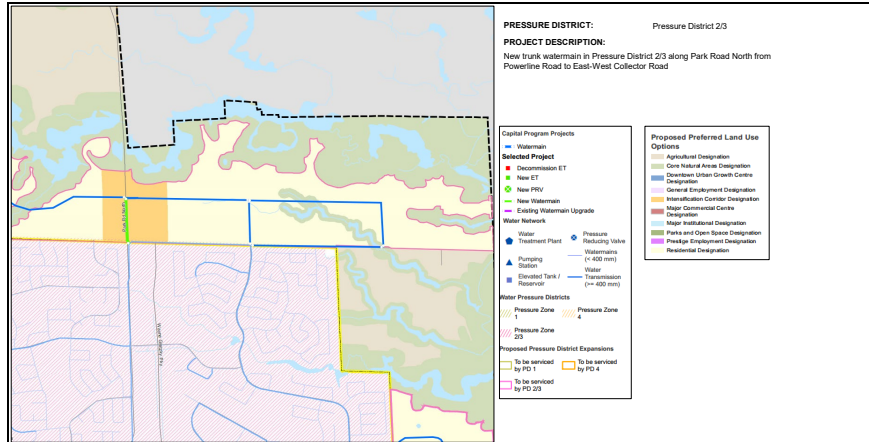
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	367 m	\$873	\$320,383 Proposed Collector Road ROW
Pipe Construction - Tunneling		m	0 m	\$6,350	\$0
Minor Creek Crossings		ea.	0	\$197,000	\$0
Major Creek Crossings		ea.	0	\$1,023,000	\$0
Road Crossings		ea.	0	\$451,000	\$0
Major Road Crossings (Highway)		ea.	0	\$1,023,000	\$0
Utility Crossings		ea.	0	\$451,000	\$0
Valve and Chamber		ea.	2	\$35,000	\$70,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0
Additional Construction Costs	10%	ea.			\$39,038 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$39,038 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$468,000	
Geotechnical / Hydrogeological / Materials	0.5%				\$2,300
Geotechnical Sub-Total Cost				\$2,300	
Property Requirements	1.0%				\$ 4,700
Property Requirements Sub-Total				\$4,700	
Consultant Engineering/Design	15%				\$ 70,200 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$70,200	
In House Labour/Engineering/Wages/CA	8%				\$ 37,400
In-house Labour/Wages Sub-Total				\$37,400	
Project Contingency	10%				\$58,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$88,000	
Non-Refundable HST	1.76%				\$10,600
Non-Refundable HST Sub-Total				\$10,600	
Total (2020 Dollars)				\$651,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$651,000	2020 Estimate

PROJECT NO.: W-M-015
PROJECT NAME: Park Road North Trunk Watermain
PROJECT OVERVIEW: New trunk watermain from Powerline Road to East-West Collector Road

TIMELINE: 6-5 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

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

PROPOSED DIAMETER:	
600 mm	
TOTAL LENGTH:	383 m
Tunnelled	0 m 0%
Open Cut	383 m 100%

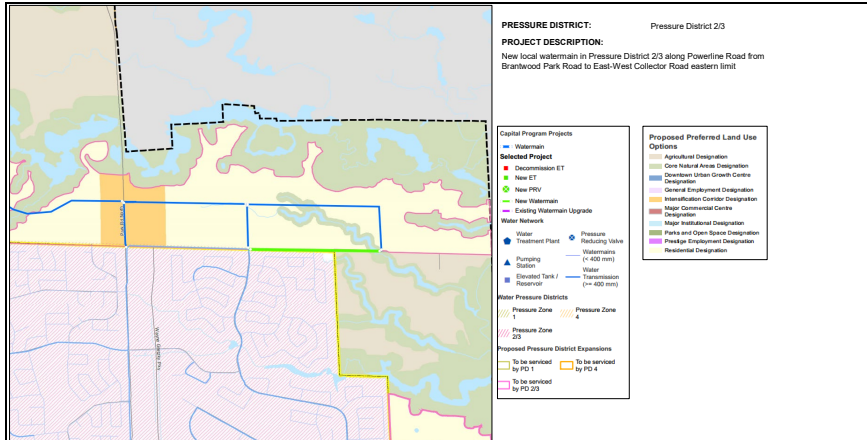
CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Watermain

COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	383 m	\$1,337	\$512,075 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$8,000	\$0
Minor Creek Crossings		ea.	0	\$270,000	\$0
Major Creek Crossings		ea.	0	\$1,310,000	\$0
Road Crossings		ea.	0	\$590,000	\$0
Major Road Crossings (Highway)		ea.	0	\$1,310,000	\$0
Utility Crossings		ea.	0	\$590,000	\$0
Valve and Chamber		ea.	2	\$55,000	\$110,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$51,208
Additional Construction Costs	10%	ea.			\$67,128 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$67,128 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$808,000	
Geotechnical / Hydrogeological / Materials	0.5%				\$4,000
Geotechnical Sub-Total Cost				\$4,000	
Property Requirements	1.0%				\$ 6,100
Property Requirements Sub-Total				\$8,100	
Consultant Engineering/Design	15%				\$ 121,200 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$121,200	
In House Labour/Engineering/Wages/CA	8%				\$ 64,600
In-house Labour/Wages Sub-Total				\$64,600	
Project Contingency	10%				\$101,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$101,000	
Non-Refundable HST	1.76%				\$18,300
Non-Refundable HST Sub-Total				\$18,300	
Total (2020 Dollars)				\$1,125,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,125,000	2020 Estimate

PROJECT NO.: W-M-016 **TIMELINE:** 6-5 Years
PROJECT NAME: Powerline Road Local Watermain
PROJECT OVERVIEW: New local watermain from Brantwood Park Road to East-West Collector Road

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

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

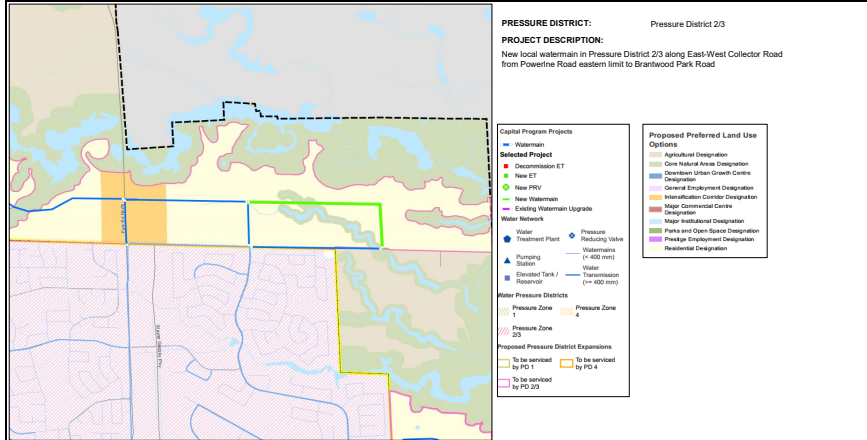
PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A+
TOTAL LENGTH:	1027 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 1027 m 100%		

COST ESTIMATION SPREADSHEET						
COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS	
Study Cost						
Study	Feasibility Study			\$0		
Study	EA			\$0		
Sub-Total Study Costs				\$0		
Construction Cost						
Pipe Construction - Open Cut		m	1027 m	\$709	\$728,416	Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0	
Minor Creek Crossings		ea.	1	\$40,000	\$40,000	
Major Creek Crossings		ea.	0	\$229,000	\$0	
Road Crossings		ea.	0	\$98,000	\$0	
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0	
Utility Crossings		ea.	0	\$98,000	\$0	
Valve and Chamber		ea.	2	\$5,500	\$11,000	Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$76,842	
Additional Construction Costs	10%	ea.			\$85,626	Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$85,626	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$1,028,000		
Geotechnical / Hydrogeological / Materials	0.5%				\$5,100	
Geotechnical Sub-Total Cost				\$5,100		
Property Requirements	1.0%				\$10,300	
Property Requirements Sub-Total				\$10,300		
Consultant Engineering/Design	15%				\$154,200	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$154,200		
In House Labour/Engineering/Wages/CA	8%				\$82,200	
In-house Labour/Wages Sub-Total				\$82,200		
Project Contingency	10%				\$128,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$128,000		
Non-Refundable HST	1.76%				\$23,300	
Non-Refundable HST Sub-Total				\$23,300		
Total (2020 Dollars)				\$1,431,000	Rounded to nearest \$1,000	
Other Estimate						
Chosen Estimate				\$1,431,000	2020 Estimate	

PROJECT NO.: W-M-017
PROJECT NAME: East-West Collector Road Local Watermain
PROJECT OVERVIEW: New local watermain from Powerline Road eastern limit to Brantwood Park Road

TIMELINE: 6-5 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

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

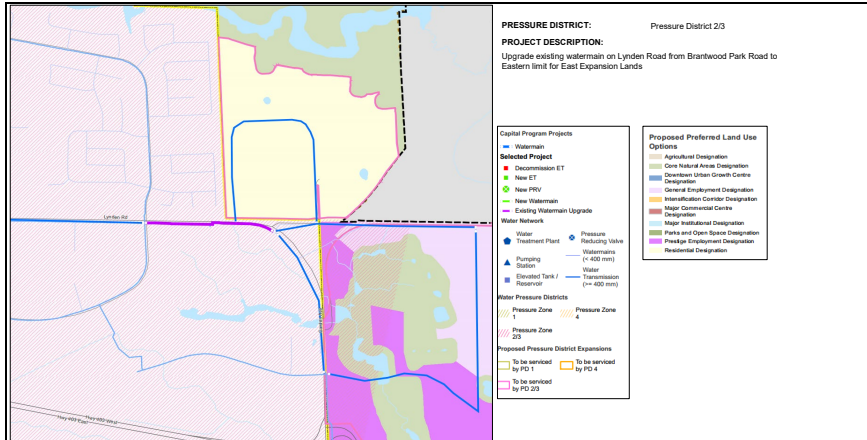
PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A
TOTAL LENGTH:	1401 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 1401 m 100%		

COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	1401 m	\$709	\$993,682 Proposed Collector Road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	0	\$40,000	\$0
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	0	\$98,000	\$0
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0
Utility Crossings		ea.	0	\$98,000	\$0
Valve and Chamber		ea.	2	\$5,500	\$11,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0
Additional Construction Costs	10%	ea.		\$100,468	Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.		\$100,468	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$1,206,000	
Geotechnical / Hydrogeological / Materials	0.5%			\$6,000	
Geotechnical Sub-Total Cost				\$6,000	
Property Requirements	1.0%			\$ 12,100	
Property Requirements Sub-Total				\$12,100	
Consultant Engineering/Design	15%			\$ 180,900	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$180,900	
In House Labour/Engineering/Wages/CA	8%			\$ 96,500	
In-house Labour/Wages Sub-Total				\$96,500	
Project Contingency	10%			\$150,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$150,000	
Non-Refundable HST	1.76%			\$27,400	
Non-Refundable HST Sub-Total				\$27,400	
Total (2020 Dollars)				\$1,679,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,679,000	2020 Estimate

PROJECT NO.: W-M-018 **TIMELINE:** 5-10 Years
PROJECT NAME: Lynden Road Trunk Watermain Upgrades
PROJECT OVERVIEW: Watermain upgrades on Lynden Road from Brantwood Park Road to eastern limit

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

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

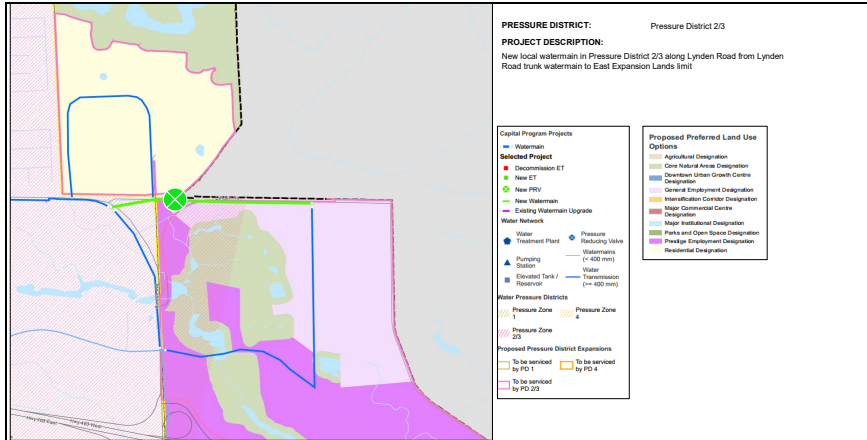
PROPOSED DIAMETER:	400 mm	CLASS EA REQUIREMENTS:	A+
TOTAL LENGTH:	599 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 599 m 100%		

COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	599 m	\$873	\$522,913 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$6,350	\$0
Minor Creek Crossings		ea.	0	\$197,000	\$0
Major Creek Crossings		ea.	0	\$1,023,000	\$0
Road Crossings		ea.	0	\$451,000	\$0
Major Road Crossings (Highway)		ea.	0	\$1,023,000	\$0
Utility Crossings		ea.	0	\$451,000	\$0
Valve and Chamber		ea.	2	\$35,000	\$70,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$52,291
Additional Construction Costs	15%	ea.			\$96,781 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$64,520 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$807,000	
Geotechnical / Hydrogeological / Materials	1.0%				\$8,100
Geotechnical Sub-Total Cost				\$8,100	
Property Requirements	1.5%				\$ 12,100
Property Requirements Sub-Total				\$12,100	
Consultant Engineering/Design	15%				\$ 121,100 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$121,100	
In House Labour/Engineering/Wages/CA	8%				\$ 64,600
In-house Labour/Wages Sub-Total				\$64,600	
Project Contingency	15%				\$152,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$152,000	
Non-Refundable HST	1.76%				\$19,400
Non-Refundable HST Sub-Total				\$19,400	
Total (2020 Dollars)				\$1,184,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,184,000	2020 Estimate

PROJECT NO.: W-M-019 **TIMELINE:** 6-5 Years
PROJECT NAME: Lynden Road Distribution Main Extension
PROJECT OVERVIEW: New watermain extension from existing Lynden Road trunk watermain to East Expansion Lands limit

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

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

PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A+
TOTAL LENGTH:	925 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 925 m 100%		

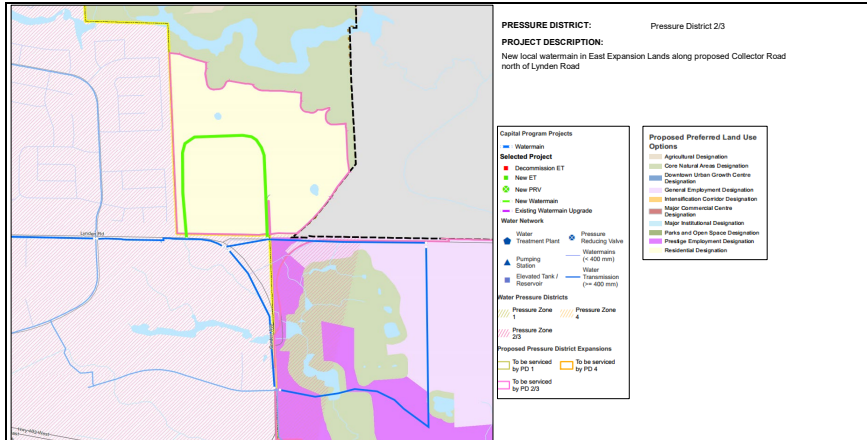
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	925 m	\$709	\$656,071 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	0	\$40,000	\$0
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	0	\$98,000	\$0
Major Road Crossings (Highway)		ea.	2	\$229,000	\$458,000 Railway (two tracks)
Utility Crossings		ea.	0	\$98,000	\$0
Valve and Chamber		ea.	2	\$5,500	\$11,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$111,407
New PRV Chamber		ea.	1	\$250,000	\$250,000
Additional Construction Costs	20%	ea.			\$247,296 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$123,646 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$1,857,000	
Geotechnical / Hydrogeological / Materials	2.0%				\$37,100
Geotechnical Sub-Total Cost				\$37,100	
Property Requirements	2.0%				\$ 37,100
Property Requirements Sub-Total				\$37,100	
Consultant Engineering/Design	15%				\$ 278,600 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$278,600	
In House Labour/Engineering/Wages/CA	8%				\$ 148,800
In-house Labour/Wages Sub-Total				\$148,800	
Project Contingency	25%				\$590,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$890,000	
Non-Refundable HST	1.76%				\$49,300
Non-Refundable HST Sub-Total				\$49,300	
Total (2020 Dollars)				\$2,998,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$2,998,000	2020 Estimate

PROJECT NO.: W-M-020
PROJECT NAME: East Expansion Lands Residential Loop
PROJECT OVERVIEW: New distribution watermain loop in residential lands north of Lynden Road

TIMELINE: 6-5 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

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

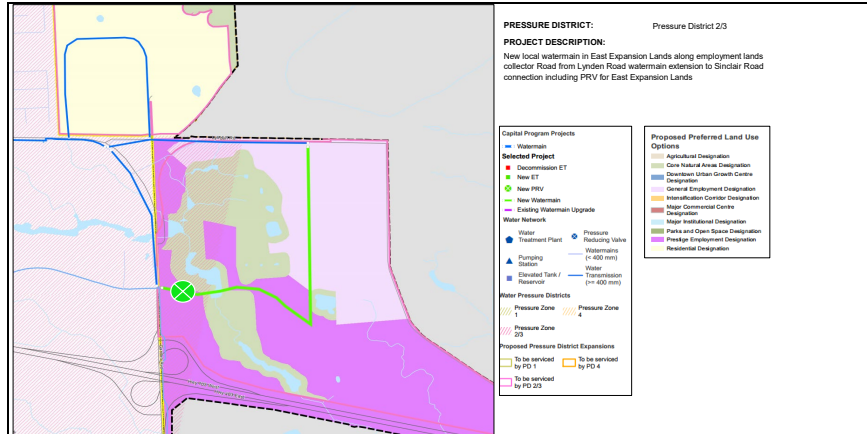
PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A
TOTAL LENGTH:	1280 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 1280 m 100%		

COST ESTIMATION SPREADSHEET					
COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	1280 m	\$709	\$907,861 Proposed Collector Road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	0	\$40,000	\$0
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	0	\$98,000	\$0
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0
Utility Crossings		ea.	0	\$98,000	\$0
Valve and Chamber		ea.	2	\$5,500	\$11,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0
Additional Construction Costs	10%	ea.			\$91,896 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$91,896 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$1,103,000	
Geotechnical / Hydrogeological / Materials	0.5%				\$5,500
Geotechnical Sub-Total Cost				\$5,500	
Property Requirements	1.0%				\$ 11,000
Property Requirements Sub-Total				\$11,000	
Consultant Engineering/Design	15%				\$ 165,500 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$165,500	
In House Labour/Engineering/Wages/CA	8%				\$ 88,200
In-house Labour/Wages Sub-Total				\$88,200	
Project Contingency	10%				\$137,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$137,000	
Non-Refundable HST	1.76%				\$25,000
Non-Refundable HST Sub-Total				\$25,000	
Total (2020 Dollars)				\$1,535,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,535,000	2020 Estimate

PROJECT NO.: W-M-021
PROJECT NAME: East Expansion Lands Employment Loop
PROJECT OVERVIEW: New distribution watermain along employment lands collector road and Sinclair Road

TIMELINE: 5-10 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

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

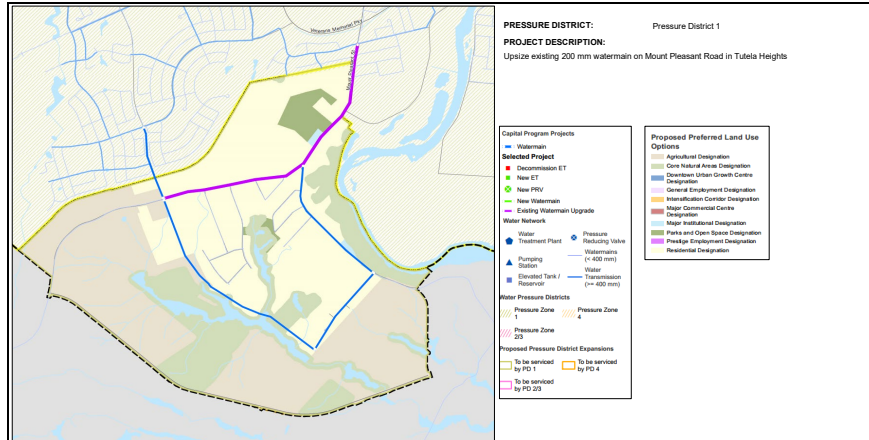
PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A
TOTAL LENGTH:	1608 m	CONSTRUCTION ASSUMPTION:	Watermain
Tunnelled	0 m		0%
Open Cut	1608 m		100%

COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	1608 m	\$709	\$1,140,500 Proposed Collector Road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	1	\$40,000	\$40,000
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	1	\$98,000	\$98,000 Garden Avenue
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0
Utility Crossings		ea.	0	\$98,000	\$0
Valve and Chamber		ea.	2	\$5,500	\$11,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0
New PRV Chamber		ea.	1	\$250,000	\$250,000
Additional Construction Costs	10%	ea.			\$128,950 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$128,950 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$1,797,000	
Geotechnical / Hydrogeological / Materials	0.5%				\$9,000
Geotechnical Sub-Total Cost				\$9,000	
Property Requirements	1.0%				\$ 16,000
Property Requirements Sub-Total				\$18,000	
Consultant Engineering/Design	15%				\$ 269,600 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$269,600	
In House Labour/Engineering/Wages/CA	8%				\$ 143,800
In-house Labour/Wages Sub-Total				\$143,800	
Project Contingency	10%				\$224,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$224,000	
Non-Refundable HST	1.76%				\$40,800
Non-Refundable HST Sub-Total				\$40,800	
Total (2020 Dollars)				\$2,502,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$2,502,000	2020 Estimate

PROJECT NO.: W-M-022 **TIMELINE:** 6-5 Years
PROJECT NAME: Mount Pleasant Road Watermain Upgrades
PROJECT OVERVIEW: Upsize existing watermain on Mount Pleasant Road from Beckett Drive to new collector road

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

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

PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A+
TOTAL LENGTH:	2367 m	CONSTRUCTION ASSUMPTION:	Watermain
Tunnelled	0 m		0%
Open Cut	2367 m		100%

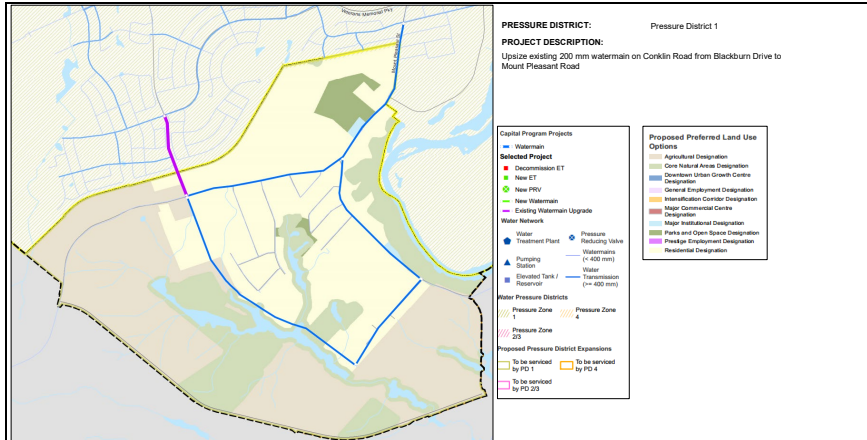
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	2367 m	\$709	\$1,678,833 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	0	\$40,000	\$0
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	0	\$98,000	\$0
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0
Utility Crossings		ea.	0	\$98,000	\$0
Valve and Chamber		ea.	3	\$5,500	\$16,500 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$167,885
New PRV Chamber		ea.	0	\$250,000	\$0
Additional Construction Costs	15%				\$279,482 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%				\$186,322 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$2,329,000	
Geotechnical / Hydrogeological / Materials	1.0%				\$23,300
Geotechnical Sub-Total Cost				\$23,300	
Property Requirements	1.5%				\$34,900
Property Requirements Sub-Total				\$34,900	
Consultant Engineering/Design	15%				\$349,400 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$349,400	
In House Labour/Engineering/Wages/CA	8%				\$186,300
In-house Labour/Wages Sub-Total				\$186,300	
Project Contingency	15%				\$438,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$438,000	
Non-Refundable HST	1.76%				\$55,900
Non-Refundable HST Sub-Total				\$55,900	
Total (2020 Dollars)				\$3,417,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$3,417,000	2020 Estimate

PROJECT NO.: W-M-023
PROJECT NAME: Conklin Road Watermain Upgrades
PROJECT OVERVIEW: Upsize existing watermain on Conklin Road

TIMELINE: 6-5 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

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

PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A+
TOTAL LENGTH:	653 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 653 m 100%		

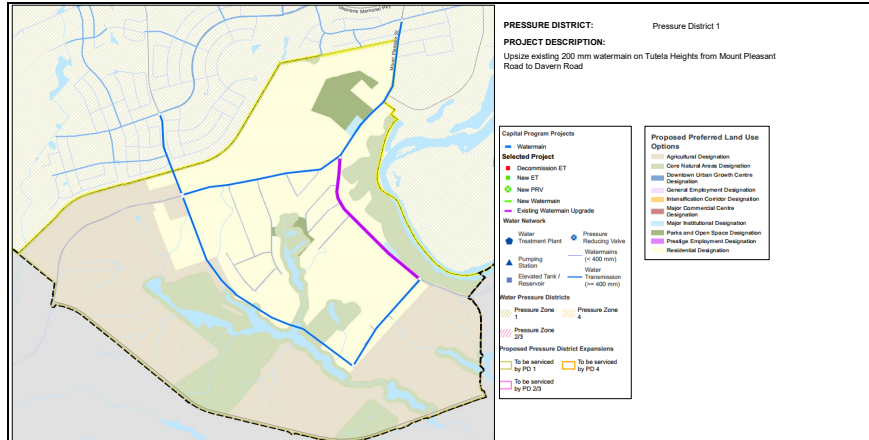
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	653 m	\$709	\$463,151 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	0	\$40,000	\$0
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	0	\$98,000	\$0
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0
Utility Crossings		ea.	0	\$98,000	\$0
Valve and Chamber		ea.	2	\$5,500	\$11,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$46,315
New PRV Chamber		ea.	0	\$250,000	\$0
Additional Construction Costs	10%				\$52,047 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%				\$52,047 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$625,000	
Geotechnical / Hydrogeological / Materials	0.5%				\$3,100
Geotechnical Sub-Total Cost				\$3,100	
Property Requirements	1.0%				\$ 6,300
Property Requirements Sub-Total				\$6,300	
Consultant Engineering/Design	15%				\$ 93,800 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$93,800	
In House Labour/Engineering/Wages/CA	8%				\$ 50,000
In-house Labour/Wages Sub-Total				\$50,000	
Project Contingency	10%				\$78,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$78,000	
Non-Refundable HST	1.76%				\$14,200
Non-Refundable HST Sub-Total				\$14,200	
Total (2020 Dollars)				\$870,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$870,000	2020 Estimate

PROJECT NO.: W-M-024
PROJECT NAME: Tutela Heights Road Upgrades
PROJECT OVERVIEW: Upsize existing watermain on Tutela Heights

TIMELINE: 5-10 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

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

PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A+
TOTAL LENGTH:	1180 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 1180 m 100%		

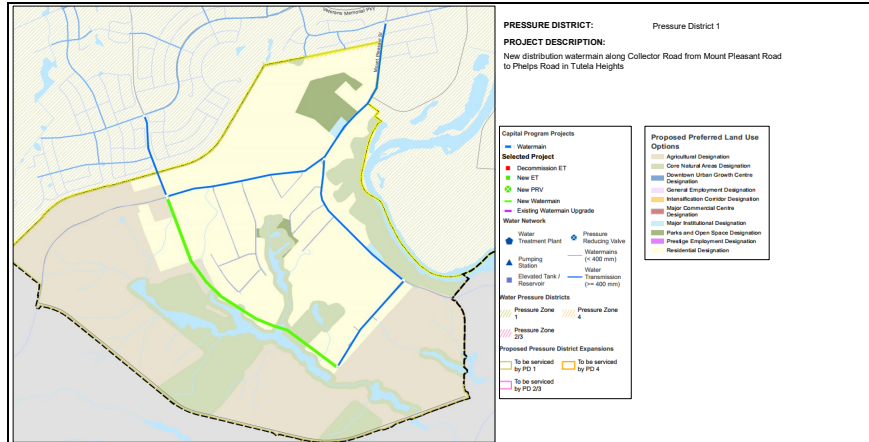
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	1180 m	\$709	\$836,934 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	0	\$40,000	\$0
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	0	\$98,000	\$0
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0
Utility Crossings		ea.	0	\$98,000	\$0
Valve and Chamber		ea.	2	\$5,500	\$11,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$83,800
New PRV Chamber		ea.	0	\$250,000	\$0
Additional Construction Costs	15%	ea.			\$139,744 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$83,155 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$1,165,000	
Geotechnical / Hydrogeological / Materials	1.0%				\$11,700
Geotechnical Sub-Total Cost				\$11,700	
Property Requirements	1.5%				\$ 17,550
Property Requirements Sub-Total				\$17,550	
Consultant Engineering/Design	15%				\$ 174,800 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$174,800	
In House Labour/Engineering/Wages/CA	8%				\$ 93,200
In-house Labour/Wages Sub-Total				\$93,200	
Project Contingency	15%				\$219,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$219,000	
Non-Refundable HST	1.76%				\$27,800
Non-Refundable HST Sub-Total				\$27,800	
Total (2020 Dollars)				\$1,709,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,709,000	2020 Estimate

PROJECT NO.: W-M-025
PROJECT NAME: Tutela Heights Collector Road Distribution Watermain
PROJECT OVERVIEW: New distribution watermain along Tutela Heights Collector Road

TIMELINE: 10-20 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

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

PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A
TOTAL LENGTH:	1883 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 1883 m 100%		

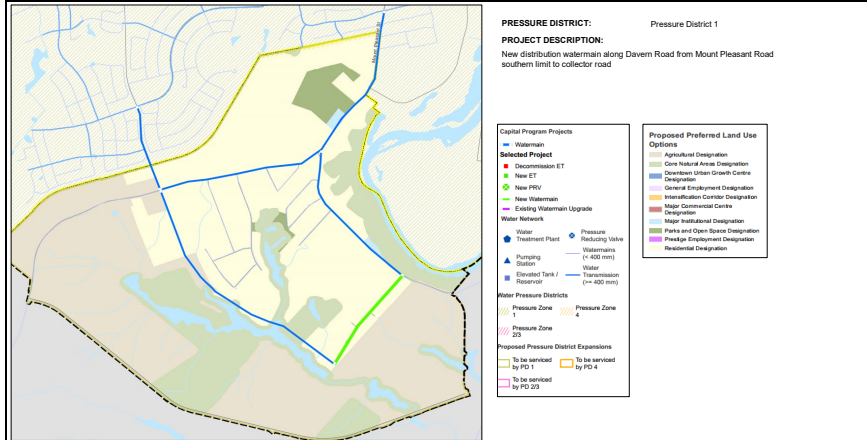
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS	
Study Cost						
Study	Feasibility Study			\$0		
Study	EA			\$0		
Sub-Total Study Costs				\$0		
Construction Cost						
Pipe Construction - Open Cut		m	1883 m	\$709	\$1,335,548	Proposed Collector Road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0	
Minor Creek Crossings		ea.	1	\$40,000	\$40,000	
Major Creek Crossings		ea.	0	\$229,000	\$0	
Road Crossings		ea.	0	\$98,000	\$0	
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0	
Utility Crossings		ea.	0	\$98,000	\$0	
Valve and Chamber		ea.	2	\$5,500	\$11,000	Major Connections
Pipe Construction Uplift (Based on Area Conditions)	0%				\$0	
New PRV Chamber		ea.	0	\$250,000	\$0	
Additional Construction Costs	10%	ea.			\$138,655	Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$138,655	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$1,664,000		
Geotechnical / Hydrogeological / Materials	0.5%				\$8,300	
Geotechnical Sub-Total Cost				\$8,300		
Property Requirements	1.0%				\$16,600	
Property Requirements Sub-Total				\$16,600		
Consultant Engineering/Design	15%				\$249,600	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$249,600		
In House Labour/Engineering/Wages/CA	8%				\$133,100	
In-house Labour/Wages Sub-Total				\$133,100		
Project Contingency	10%				\$207,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$207,000		
Non-Refundable HST	1.76%				\$37,800	
Non-Refundable HST Sub-Total				\$37,800		
Total (2020 Dollars)				\$2,316,000	Rounded to nearest \$1,000	
Other Estimate						
Chosen Estimate				\$2,316,000	2020 Estimate	

PROJECT NO.: W-M-028
PROJECT NAME: Davern Road Distribution Watermain
PROJECT OVERVIEW: New distribution watermain along Davern Road

TIMELINE: 10-20 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

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

PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A+
TOTAL LENGTH:	836 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 836 m 100%		

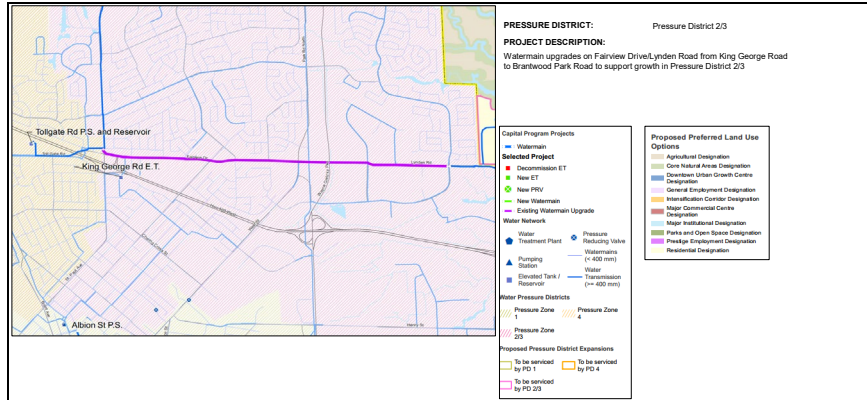
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	836 m	\$709	\$592,947 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	0	\$40,000	\$0
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	0	\$98,000	\$0
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0
Utility Crossings		ea.	0	\$98,000	\$0
Valve and Chamber		ea.	2	\$5,500	\$11,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	10%				\$59,295
New PRV Chamber		ea.	0	\$250,000	\$0
Additional Construction Costs	10%				\$66,324 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%				\$66,324 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$796,000	
Geotechnical / Hydrogeological / Materials	0.5%				\$4,000
Geotechnical Sub-Total Cost				\$4,000	
Property Requirements	1.0%				\$ 6,000
Property Requirements Sub-Total				\$8,000	
Consultant Engineering/Design	15%				\$ 119,400 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$119,400	
In House Labour/Engineering/Wages/CA	8%				\$ 63,700
In-house Labour/Wages Sub-Total				\$63,700	
Project Contingency	10%				\$99,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$99,000	
Non-Refundable HST	1.76%				\$18,100
Non-Refundable HST Sub-Total				\$18,100	
Total (2020 Dollars)				\$1,108,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,108,000	2020 Estimate

PROJECT NO.: W-M-027
PROJECT NAME: Upsize Fairview Drive/Lynden Road Trunk Watermain
PROJECT OVERVIEW: Watermain upgrades on Fairview Drive/Lynden Road from King George Road to Brantwood Park Road

TIMELINE: 5-10 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

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

PROPOSED DIAMETER:	600 mm	CLASS EA REQUIREMENTS:	A+
TOTAL LENGTH:	4168 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 4168 m 100%		

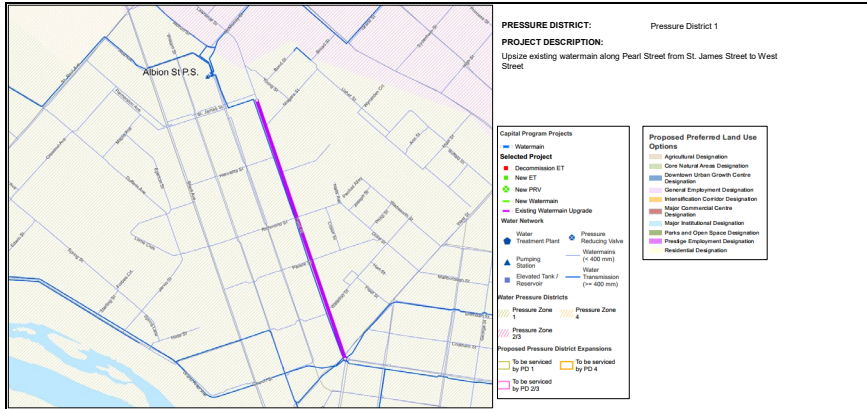
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	4168 m	\$1,337	\$5,572,660 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$8,000	\$0
Minor Creek Crossings		ea.	0	\$270,000	\$0
Major Creek Crossings		ea.	0	\$1,310,000	\$0
Road Crossings		ea.	0	\$590,000	\$0
Major Road Crossings (Highway)		ea.	0	\$1,310,000	\$0
Utility Crossings		ea.	0	\$590,000	\$0
Valve and Chamber		ea.	7	\$55,000	\$385,000
Pipe Construction Uplift (Based on Area Conditions)	10%				\$557,266
New PRV Chamber		ea.	0	\$250,000	\$0
Additional Construction Costs	15%	ea.			\$877,239 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$651,455 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$8,144,000	
Geotechnical / Hydrogeological / Materials	1.0%				\$81,400
Geotechnical Sub-Total Cost				\$81,400	
Property Requirements	1.5%				\$ 122,200
Property Requirements Sub-Total				\$122,200	
Consultant Engineering/Design	15%				\$ 1,221,600 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$1,221,600	
In House Labour/Engineering/Wages/CA	8%				\$ 651,500
In-house Labour/Wages Sub-Total				\$651,500	
Project Contingency	15%				\$1,533,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$1,533,000	
Non-Refundable HST	1.76%				\$195,400
Non-Refundable HST Sub-Total				\$195,400	
Total (2020 Dollars)				\$11,949,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$11,949,000	2020 Estimate

PROJECT NO.: W-M-028
PROJECT NAME: Downtown Trunk Watermain
PROJECT OVERVIEW: Upsize existing watermain in downtown to create trunk loop

TIMELINE: 5-10 Years

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

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

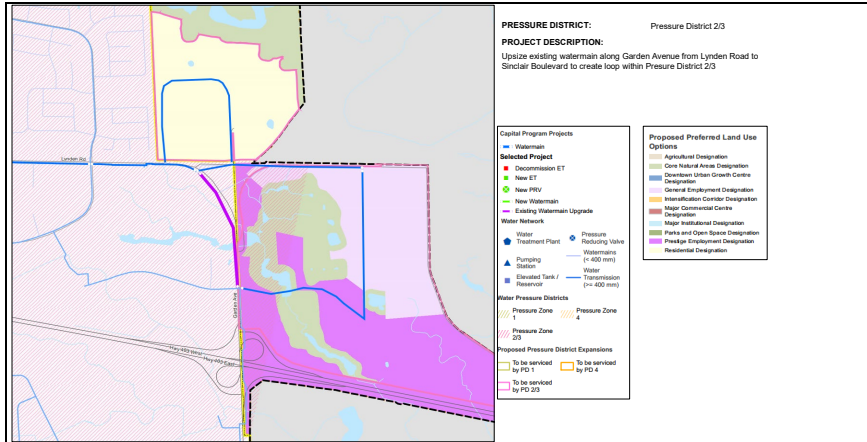
PROPOSED DIAMETER:	400 mm	CLASS EA REQUIREMENTS:	A+
TOTAL LENGTH:	860 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 860 m 100%		

COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	860 m	\$873	\$750,760 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$6,350	\$0
Minor Creek Crossings		ea.	0	\$197,000	\$0
Major Creek Crossings		ea.	0	\$1,023,000	\$0
Road Crossings		ea.	0	\$451,000	\$0
Major Road Crossings (Highway)		ea.	0	\$1,023,000	\$0
Utility Crossings		ea.	0	\$451,000	\$0
Valve and Chamber		ea.	2	\$35,000	\$70,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	20%				\$150,152
New PRV Chamber		ea.	0	\$250,000	\$0
Additional Construction Costs	15%	ea.			\$145,637 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$97,691 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$1,214,000	
Geotechnical / Hydrogeological / Materials	1.0%				\$12,100
Geotechnical Sub-Total Cost				\$12,100	
Property Requirements	1.5%				\$ 16,200
Property Requirements Sub-Total				\$18,200	
Consultant Engineering/Design	15%				\$ 182,100 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$182,100	
In House Labour/Engineering/Wages/CA	8%				\$ 97,100
In-house Labour/Wages Sub-Total				\$97,100	
Project Contingency	15%				\$229,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$229,000	
Non-Refundable HST	1.76%				\$29,100
Non-Refundable HST Sub-Total				\$29,100	
Total (2020 Dollars)				\$1,782,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,782,000	2020 Estimate

PROJECT NO.: W-M-029 **TIMELINE:** 5-10 Years
PROJECT NAME: Garden Avenue Watermain Upgrade
PROJECT OVERVIEW: Upsize existing watermain along Garden Avenue to create loop

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Med	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	80%	
Area Condition:	Urban	Area Condition uplifts unit cost and restoration

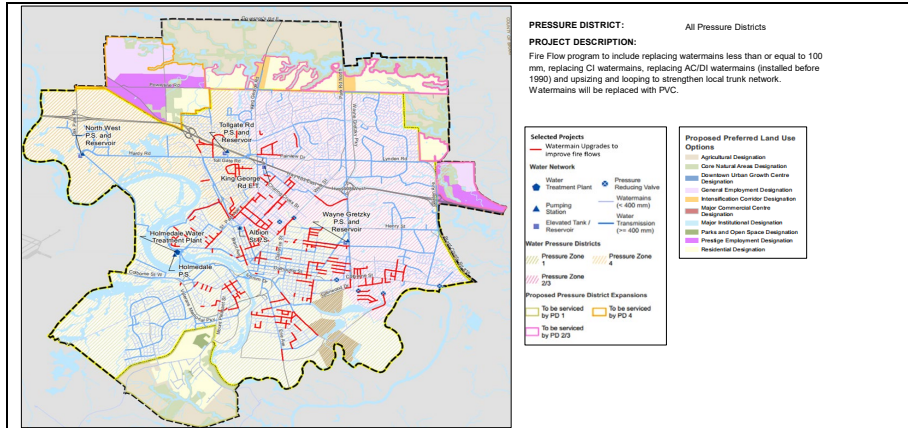
PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A+
TOTAL LENGTH:	719 m	CONSTRUCTION ASSUMPTION:	Watermain
	Tunnelled 0 m 0%		
	Open Cut 719 m 100%		

COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
Pipe Construction - Open Cut		m	719 m	\$709	\$509,962 Existing road ROW
Pipe Construction - Tunneling		m	0 m	\$1,450	\$0
Minor Creek Crossings		ea.	0	\$40,000	\$0
Major Creek Crossings		ea.	0	\$229,000	\$0
Road Crossings		ea.	0	\$98,000	\$0
Major Road Crossings (Highway)		ea.	0	\$229,000	\$0
Utility Crossings		ea.	2	\$98,000	\$196,000 Railway (two tracks)
Valve and Chamber		ea.	2	\$5,500	\$11,000 Major Connections
Pipe Construction Uplift (Based on Area Conditions)	20%				\$141,102
New PRV Chamber		ea.	0	\$250,000	\$0
Additional Construction Costs	15%	ea.			\$128,723 Includes Mobil/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.			\$85,815 Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$1,073,000	
Geotechnical / Hydrogeological / Materials	1.0%				\$10,700
Geotechnical Sub-Total Cost				\$10,700	
Property Requirements	1.5%				\$ 16,100
Property Requirements Sub-Total				\$16,100	
Consultant Engineering/Design	15%				\$ 161,000 Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$161,000	
In House Labour/Engineering/Wages/CA	8%				\$ 85,800
In-house Labour/Wages Sub-Total				\$85,800	
Project Contingency	15%				\$202,000 Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$202,000	
Non-Refundable HST	1.76%				\$25,700
Non-Refundable HST Sub-Total				\$25,700	
Total (2020 Dollars)				\$1,674,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$1,574,000	2020 Estimate

PROJECT NO.: W-46-030 **TITLELINE:** 0-5 Years
PROJECT NAME: Fire Flow Watermain Upgrades
PROJECT OVERVIEW: Replace watermains including upsizing and looping to strengthen local trunk network for fire flows.

MAP



REQUIRED STUDIES: -
STUDY SCOPE: -
OBJECTIVES: -

CONSTRUCTION

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

PROPOSED DIAMETER:	300 mm	CLASS EA REQUIREMENTS:	A+
TOTAL LENGTH:	0 m	CONSTRUCTION ASSUMPTION:	Watermain
Tunnelled	0 m	#DIV/0!	
Open Cut	0 m	#DIV/0!	

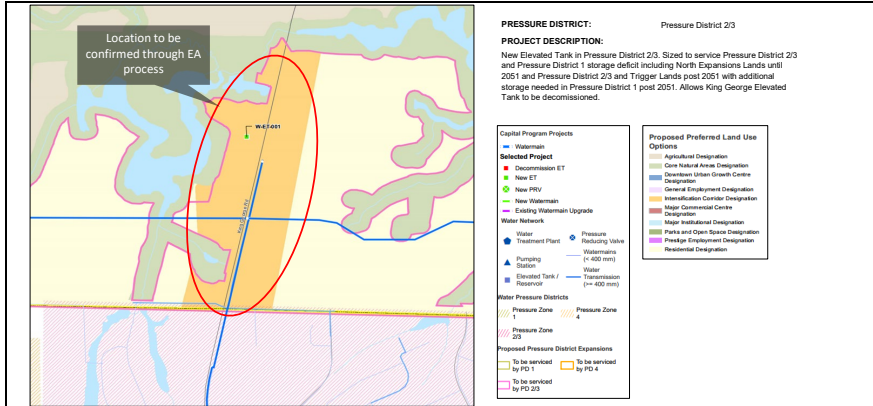
COST ESTIMATION SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	
Construction Cost					
150 mm Replacement		m	33700 m	\$0	Part of State of Good Repair
200 mm Replacement/Upsize		m	27300 m	\$0	Part of State of Good Repair
250 mm Replacement/Upsize		m	600 m	\$250	Upsize cost
300 mm Replacement/Upsize		m	2000 m	\$709	Full Replacement Cost
Pipe Construction Uplift (Based on Area Conditions)	20%			\$313,600	
New PRV Chamber		ea.	1	\$250,000	
Additional Construction Costs	15%	ea.		\$282,240	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%	ea.		\$188,160	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs				\$2,602,000	
Geotechnical / Hydrogeological / Materials	1.0%			\$26,000	
Geotechnical Sub-Total Cost				\$26,000	
Property Requirements	1.5%			\$39,000	
Property Requirements Sub-Total				\$39,000	
Consultant Engineering/Design	15%			\$390,300	Includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total				\$390,300	
In House Labour/Engineering/Wages/CA	8%			\$208,200	
In-house Labour/Wages Sub-Total				\$208,200	
Project Contingency	15%			\$490,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total				\$490,000	
Non-Refundable HST	1.76%			\$62,400	
Non-Refundable HST Sub-Total				\$62,400	
Total (2020 Dollars)				\$3,818,000	Rounded to nearest \$1,000
Other Estimate					
Chosen Estimate				\$3,818,000	2020 Estimate

PROJECT NO.: W-ET-001
PROJECT NAME: Pressure District 2/3 Elevated Tank
PROJECT DESCRIPTION: New Elevated Tank along King George Road in North Expansion Lands

TIMELINE: 0-5 Years

MAP



REQUIRED STUDIES: Municipal Class Environmental Assessment (EA)
STUDY SCOPE: The study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment
OBJECTIVES: Determine the requirements for a new water tower, including preferred locations.

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

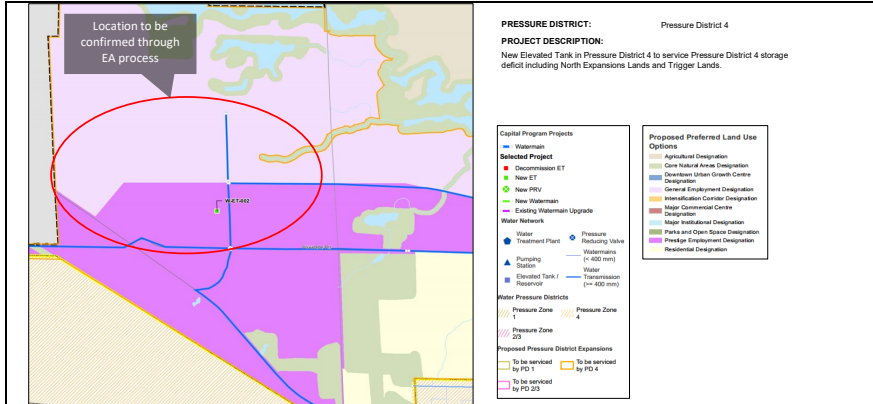
PROPOSED CAPACITY	11.7 ML	CLASS EA REQUIREMENTS:	B
		CONSTRUCTION ASSUMPTION:	Other

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	1	\$500,000	\$500,000	
Sub-Total Study Costs				\$500,000	

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Facility Construction			ML	12 ML	\$900,000	\$10,530,000	
Watermain Contingency (750 mm)			m	1000 m	\$1,533	\$1,533,000	Existing road ROW
Additional Construction Costs	15%		ea.			\$1,809,450	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$1,387,246	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						\$15,260,000	
Geotechnical / Hydrogeological / Materials	1.0%					\$152,600	
Geotechnical Sub-Total Cost						\$152,600	
Property Requirements	1.5%					\$228,900	
Property Requirements Sub-Total						\$228,900	
Consultant Engineering/Design	12%					\$1,831,200	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						\$1,831,200	
In House Labour/Engineering/Wages/CA	6%					\$915,600	
In-house Labour/Wages Sub-Total						\$915,600	
Project Contingency	15%					\$2,758,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						\$2,758,000	
Non-Refundable HST	1.76%					\$356,100	
Non-Refundable HST Sub-Total						\$356,100	
Total (2020 Dollars)						\$22,002,000	Rounded to nearest \$1,000
Other Estimate							
Chosen Estimate						\$22,002,000	2020 Estimate

PROJECT NO.: W-ET-002
PROJECT NAME: Pressure District 4 Elevated Tank
PROJECT DESCRIPTION: New Elevated Tank North of Highway 403 in North Expansion Lands
TIMELINE: 10-20 Years

MAP



REQUIRED STUDIES: Municipal Class Environmental Assessment (EA)
STUDY SCOPE: The study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment
OBJECTIVES: Determine the requirements for a new water tower, including preferred location

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

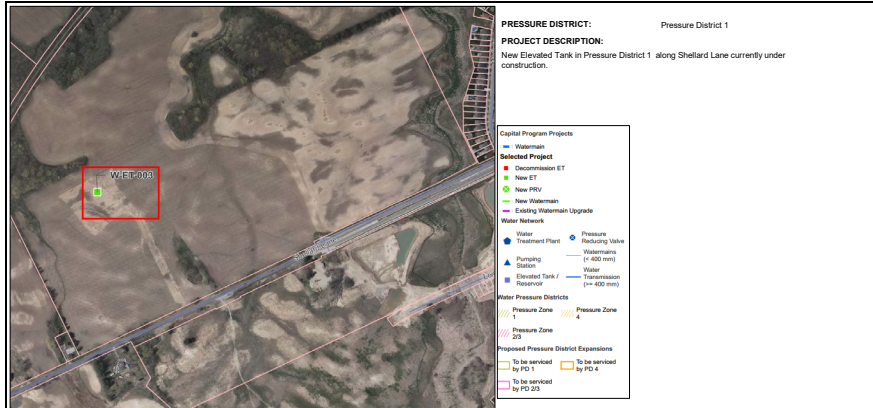
PROPOSED CAPACITY	2.7 ML	CLASS EA REQUIREMENTS:	B
		CONSTRUCTION ASSUMPTION:	Other

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	1	\$500,000	\$500,000	
Sub-Total Study Costs				\$500,000	

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
CONSTRUCTION COST ESTIMATION SPREADSHEET							
Construction Cost							
Facility Construction			ML	3 ML	\$900,000	\$2,430,000	
Watermain Contingency (750 mm)			m	500 m	\$1,337	\$668,500	Existing road ROW
Additional Construction Costs	15%		ea.			\$464,776	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$356,328	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						\$3,920,000	
Geotechnical / Hydrogeological / Materials	1.0%					\$39,200	
Geotechnical Sub-Total Cost						\$39,200	
Property Requirements	1.5%					\$58,800	
Property Requirements Sub-Total						\$58,800	
Consultant Engineering/Design	15%					\$588,000	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						\$588,000	
In House Labour/Engineering/Wages/CA	8%					\$313,600	
In-house Labour/Wages Sub-Total						\$313,600	
Project Contingency	15%					\$738,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						\$738,000	
Non-Refundable HST	1.76%					\$94,100	
Non-Refundable HST Sub-Total						\$94,100	
Total (2020 Dollars)						\$6,252,000	Rounded to nearest \$1,000
Other Estimate							
Chosen Estimate						\$6,252,000	2020 Estimate

PROJECT NO.: W-ET-003 **TIMELINE:** Completion 2021
PROJECT NAME: Pressure District 1 Elevated Tank
PROJECT DESCRIPTION: New Elevated Tank along Sheppard Lane in Pressure District 1

MAP



REQUIRED STUDIES: Municipal Class Environmental Assessment (EA)
STUDY SCOPE: The study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment
OBJECTIVES: Determine the requirements for a new water tower, including preferred location

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

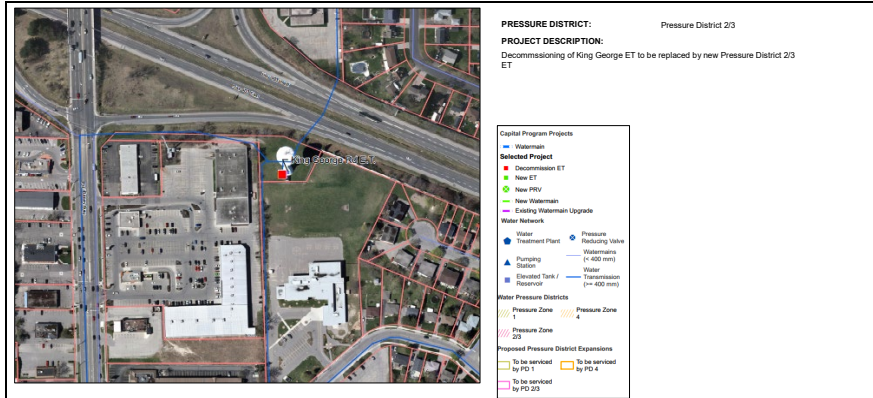
PROPOSED CAPACITY	6.0 ML	CLASS EA REQUIREMENTS:	B
		CONSTRUCTION ASSUMPTION:	Other

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	1	\$500,000	\$500,000	
Sub-Total Study Costs				\$500,000	

COMPONENT	RATE (\$)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
CONSTRUCTION COST ESTIMATION SPREADSHEET							
Construction Cost							
Facility Construction			ML	6 ML		\$7,762,000	
Additional Construction Costs			ea.			\$750,000	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance			ea.				Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						\$8,512,000	
Geotechnical / Hydrogeological / Materials						\$200,000	
Geotechnical Sub-Total Cost						\$200,000	
Property Requirements						\$ -	
Property Requirements Sub-Total						\$0	
Consultant Engineering/Design					\$	1,115,314	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						\$1,115,314	
In House Labour/Engineering/Wages/CA					\$	-	
In-house Labour/Wages Sub-Total						\$0	
Project Contingency						\$1,000,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						\$1,000,000	
Non-Refundable HST						\$0	
Non-Refundable HST Sub-Total						\$0	
Total (2020 Dollars)						\$10,828,000	Rounded to nearest \$1,000
Other Estimate							
Chosen Estimate						\$10,828,000	2020 Estimate

PROJECT NO.: W-D-001 **TIMELINE:** 5-10 Years
PROJECT NAME: Decommissioning of King George ET
PROJECT DESCRIPTION: Decommissioning of King George ET to be replaced by new Pressure District 2/3 ET

MAP



REQUIRED STUDIES:
STUDY SCOPE:

OBJECTIVES:

CONSTRUCTION

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

PROPOSED CAPACITY	N/A
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CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATE SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	

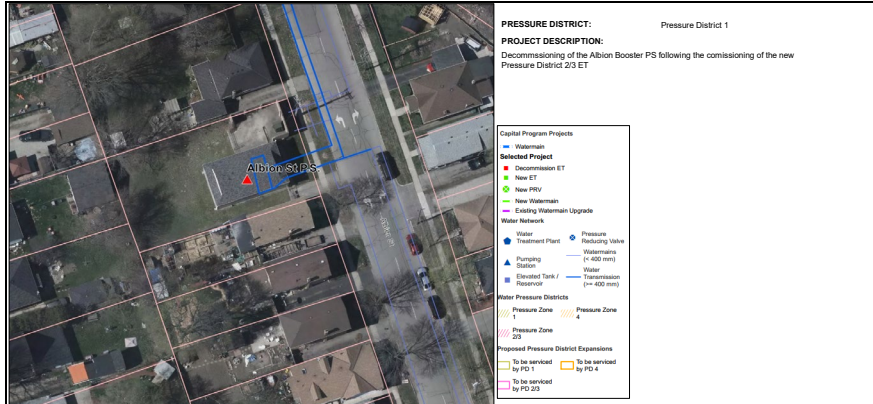
COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS	
Construction Cost								
Decommissioning						\$500,000		
Additional Construction Costs							\$75,000	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$57,500	Provisional Labour and Materials in addition to base construction cost	
Sub-Total Construction Base Costs						\$633,000		
Geotechnical / Hydrogeological / Materials	1.0%					\$6,300		
Geotechnical Sub-Total Cost						\$6,300		
Property Requirements	1.5%					\$ 9,500		
Property Requirements Sub-Total						\$9,500		
Consultant Engineering/Design	15%					\$ 96,000	includes planning, pre-design, detailed design, training, CA, commissioning	
Engineering/Design Sub-Total						\$96,000		
In House Labour/Engineering/Wages/CA	8%					\$ 50,600		
In-house Labour/Wages Sub-Total						\$50,600		
Project Contingency	15%					\$119,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity	
Project Contingency Sub-Total						\$119,000		
Non-Refundable HST	1.76%					\$15,200		
Non-Refundable HST Sub-Total						\$15,200		
Total (2020 Dollars)						\$929,000	Rounded to nearest \$1,000	
Other Estimate								
Chosen Estimate						\$929,000	2020 Estimate	

PROJECT NO.: W-D-002
PROJECT NAME: Decommissioning of Albion Booster Pumping Station
PROJECT DESCRIPTION: Decommissioning of Albion Booster PS

TIMELINE: 5-10 Years

MAP



REQUIRED STUDIES:

STUDY SCOPE:

OBJECTIVES:

CONSTRUCTION

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

PROPOSED CAPACITY N/A

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATE SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA			\$0	
Sub-Total Study Costs				\$0	

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS	
Construction Cost								
Decommissioning						\$250,000		
Additional Construction Costs							\$37,500	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$28,750	Provisional Labour and Materials in addition to base construction cost	
Sub-Total Construction Base Costs						\$316,000		
Geotechnical / Hydrogeological / Materials	1.0%					\$3,200		
Geotechnical Sub-Total Cost						\$3,200		
Property Requirements	1.5%					\$ 4,700		
Property Requirements Sub-Total						\$4,700		
Consultant Engineering/Design	15%					\$ 47,400	includes planning, pre-design, detailed design, training, CA, commissioning	
Engineering/Design Sub-Total						\$47,400		
In House Labour/Engineering/Wages/CA	8%					\$ 25,300		
In-house Labour/Wages Sub-Total						\$25,300		
Project Contingency	15%					\$59,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity	
Project Contingency Sub-Total						\$59,000		
Non-Refundable HST	1.76%					\$7,600		
Non-Refundable HST Sub-Total						\$7,600		
Total (2020 Dollars)						\$463,000	Rounded to nearest \$1,000	
Other Estimate								
Chosen Estimate						\$463,000	2020 Estimate	

PROJECT NO.: W-P-001 **TIMELINE:** 0-5 Years
PROJECT NAME: Holmedale WTP High Lift Pump Upgrades
PROJECT DESCRIPTION: Install additional pump to supply elevated tank and reservoirs from reservoirs

MAP



REQUIRED STUDIES:
STUDY SCOPE:

OBJECTIVES:

CONSTRUCTION

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

PROPOSED CAPACITY	420 L/s
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CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATE SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	0		\$0	
Sub-Total Study Costs				\$0	

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Number of Pumps (including well casing upgrades)			Pumps	1	\$750,000	\$750,000	Additional Pump
Electrical and Process Piping			Lump Sum		\$500,000	\$500,000	Minor upgrade
Additional Construction Costs	15%		ea.			\$187,500	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$143,750	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						\$1,581,000	
Geotechnical / Hydrogeological / Materials	1.0%					\$15,800	
Geotechnical Sub-Total Cost						\$15,800	
Property Requirements	1.5%					\$ 23,700	
Property Requirements Sub-Total						\$23,700	
Consultant Engineering/Design	15%					\$ 237,200	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						\$237,200	
In House Labour/Engineering/Wages/CA	8%					\$ 126,500	
In-house Labour/Wages Sub-Total						\$126,500	
Project Contingency	15%					\$296,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						\$296,000	
Non-Refundable HST	1.76%					\$37,900	
Non-Refundable HST Sub-Total						\$37,900	
Total (2020 Dollars)						\$2,320,000	Rounded to nearest \$1,000
Other Estimate							
Chosen Estimate						\$2,320,000	2020 Estimate

PROJECT NO.: W-P-002
PROJECT NAME: Wayne Gretzky Pump Upgrades
PROJECT DESCRIPTION: Pumping capacity upgrades at Wayne Gretzky PS.

TIMELINE: 5-10 Years

MAP

Wayne Gretzky P.S. and Reservoir

Pressure District: Pressure District 2/3

PROJECT DESCRIPTION:
 Install 3 new pumps at Wayne Gretzky Pump Station to improve operational capacity and support new Pressure District HGL. Install new PRV to allow Pressure District 2/3 to backfeed Pressure District 1.

Capital Program Projects

- Watermain
- Selected Project
- Discontinuation ET
- New ET
- New PRV
- New Watermain
- Existing Watermain Upgrade

Water Network

- Water Treatment Plant
- Pumping Station
- Elevated Tank / Reservoir
- Pressure Reducing Valve
- Watermain (1" - 400 mm)
- Water Transmission (1" - 400 mm)

Water Pressure Districts

- Pressure Zone 1
- Pressure Zone 2/3
- Pressure Zone 4

Proposed Pressure District Expansions

- To be serviced by PD 1
- To be serviced by PD 2/3
- To be serviced by PD 4
- To be serviced by PD 2/3

REQUIRED STUDIES:
STUDY SCOPE:

OBJECTIVES:

CONSTRUCTION

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

PROPOSED CAPACITY

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATE SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	0		\$0	
Sub-Total Study Costs				\$0	

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Number of Pumps (including well casing upgrades)			Pumps	3	\$500,000	\$1,500,000	Pump replacement and upgrades
Electrical and Other Facility Upgrades			Lump Sum		\$1,000,000	\$1,000,000	
Process Piping including PRV			Lump Sum		\$1,000,000	\$1,000,000	
Additional Construction Costs	15%		ea.			\$525,000	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$402,500	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						\$4,428,000	
Geotechnical / Hydrogeological / Materials	1.0%					\$44,300	
Geotechnical Sub-Total Cost						\$44,300	
Property Requirements	1.5%					\$66,400	
Property Requirements Sub-Total						\$66,400	
Consultant Engineering/Design	15%					\$664,200	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						\$664,200	
In House Labour/Engineering/Wages/CA	8%					\$354,200	
In-house Labour/Wages Sub-Total						\$354,200	
Project Contingency	15%					\$834,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						\$834,000	
Non-Refundable HST	1.78%					\$106,200	
Non-Refundable HST Sub-Total						\$106,200	
Total (2020 Dollars)						\$6,497,000	Rounded to nearest \$1,000
Other Estimate							
Chosen Estimate						\$6,497,000	2020 Estimate

PROJECT NO.: W-P-003
PROJECT NAME: Tollgate Pump Upgrades
PROJECT DESCRIPTION: Pumping capacity upgrades at Tollgate PS

TIMELINE: 5-10 Years

MAP



PRESSURE DISTRICT: Pressure District 2/3
PROJECT DESCRIPTION:
 Install 3 new pumps at Tollgate Pump Station to improve operational capacity and support new Pressure District HGL. Install new PRV to allow Pressure District 2/3 to backfeed Pressure District 1.

Capital Program Projects

- Watermain
- Selected Project
- Decommission ET
- New ET
- New PRV
- New Watermain
- Existing Watermain Upgrade

Water Network

- Water Treatment Plant
- Pumping Station
- Elevated Tank / Reservoir
- Pressure Reducing Valve
- Watermain (1" - 400 mm)
- Water Transmission (1" - 400 mm)

Water Pressure Districts

- Pressure Zone 1
- Pressure Zone 2/3
- Pressure Zone 4

Proposed Pressure District Expansions

- To be serviced by PD 1
- To be serviced by PD 4
- To be serviced by PD 2/3

REQUIRED STUDIES:
STUDY SCOPE:

OBJECTIVES:

CONSTRUCTION

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

PROPOSED CAPACITY

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATE SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	0		\$0	
Sub-Total Study Costs				\$0	

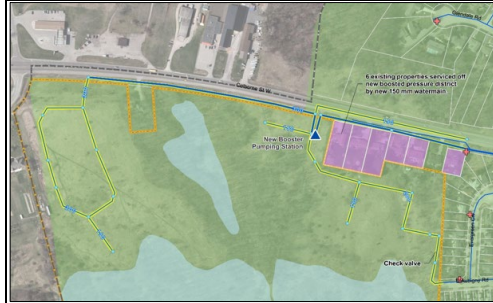
COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Number of Pumps (including well casing upgrades)			Pumps	4	\$500,000	\$2,000,000	Pump replacement and upgrades
Electrical and Other Facility Upgrades			Lump Sum		\$1,000,000	\$1,000,000	
Process Piping including PRV			Lump Sum		\$1,000,000	\$1,000,000	
Additional Construction Costs	15%		ea.			\$600,000	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$460,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						\$5,060,000	
Geotechnical / Hydrogeological / Materials	1.0%					\$50,600	
Geotechnical Sub-Total Cost						\$50,600	
Property Requirements	1.5%					\$75,900	
Property Requirements Sub-Total						\$75,900	
Consultant Engineering/Design	15%					\$759,000	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						\$759,000	
In House Labour/Engineering/Wages/CA	8%					\$404,800	
In-house Labour/Wages Sub-Total						\$404,800	
Project Contingency	15%					\$953,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						\$953,000	
Non-Refundable HST	1.76%					\$121,400	
Non-Refundable HST Sub-Total						\$121,400	
Total (2020 Dollars)						\$7,425,000	Rounded to nearest \$1,000
Other Estimate							
Chosen Estimate						\$7,425,000	2020 Estimate

PROJECT NO.: W-P-004
PROJECT NAME: Colborne Street West Booster Pumping Station
PROJECT DESCRIPTION: New Booster Pumping Station to service development off of Colborne Street West at municipal boundary.

TIMELINE: 0-5 Years

MAP



PRESSURE DISTRICT: Pressure District 1
PROJECT DESCRIPTION: Install new Booster Pumping station to be serviced off of Pressure District 1 to service existing properties on Colborne Street and development extending west to the municipal boundary. Pumping station includes single jockey pump and a fire pump.

REQUIRED STUDIES: Municipal Class Environmental Assessment (EA)
STUDY SCOPE: The study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment.
OBJECTIVES: Determine the best construction methodology for the new pumping station including location of buildings.

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

PROPOSED CAPACITY	128 L/s	CLASS EA REQUIREMENTS:	B
		CONSTRUCTION ASSUMPTION:	Other

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	1	\$100,000	\$100,000	
Sub-Total Study Costs				\$100,000	

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
CONSTRUCTION COST							
Facility Construction			L/s	128 L/s	\$23,000	\$2,944,000	
Additional Construction Costs	15%		ea.			\$441,800	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$338,560	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						\$3,724,000	
Geotechnical / Hydrogeological / Materials	1.0%					\$37,200	
Geotechnical Sub-Total Cost						\$37,200	
Property Requirements	1.5%					\$55,900	
Property Requirements Sub-Total						\$55,900	
Consultant Engineering/Design	15%					\$558,600	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						\$558,600	
In House Labour/Engineering/Wages/CA	8%					\$297,900	
In-house Labour/Wages Sub-Total						\$297,900	
Project Contingency	15%					\$701,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						\$701,000	
Non-Refundable HST	1.76%					\$89,300	
Non-Refundable HST Sub-Total						\$89,300	
Total (2020 Dollars)						\$5,564,000	Rounded to nearest \$1,000
Other Estimate							
Chosen Estimate						\$5,564,000	2020 Estimate

PROJECT NO.: W-P-005 **TIMELINE:** 10-20 Years
PROJECT NAME: Strawberry Hill Booster Pumping Station
PROJECT DESCRIPTION: New Booster Pumping Station to service development off of Colborne Street West at municipal boundary.

MAP



PRESSURE DISTRICT: Pressure District 1
PROJECT DESCRIPTION: Install new Booster Pumping station to be serviced off of Pressure District 1 to service new sub-pressure district to extend from Sheppard Lane to Mount Pleasant Street. BPS required to service future development. Sized to provide MDD with fire flow provided via check valves.

REQUIRED STUDIES: Municipal Class Environmental Assessment (EA)
STUDY SCOPE: The study will be a Schedule 'B' project in accordance with all requirements of the Municipal Class Environmental Assessment.
OBJECTIVES: Determine the best construction methodology for the new pumping station including location of buildings.

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

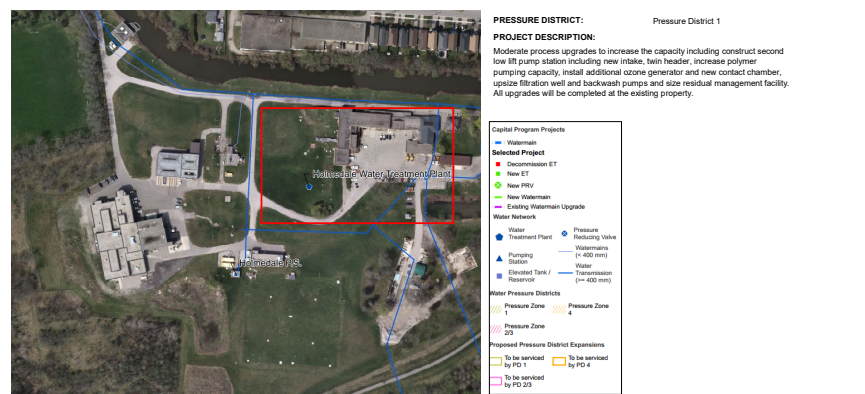
PROPOSED CAPACITY		CLASS EA REQUIREMENTS:	B
		CONSTRUCTION ASSUMPTION:	Other

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	1	\$200,000	\$200,000	
Sub-Total Study Costs				\$200,000	

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
CONSTRUCTION ESTIMATION SPREADSHEET							
Construction Cost							
Facility Construction						\$1,000,000	
Additional Construction Costs	15%		ea.			\$150,000	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$115,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						\$1,265,000	
Geotechnical / Hydrogeological / Materials	1.0%					\$12,700	
Geotechnical Sub-Total Cost						\$12,700	
Property Requirements	1.5%					\$ 19,000	
Property Requirements Sub-Total						\$19,000	
Consultant Engineering/Design	15%					\$ 189,800	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						\$189,800	
In House Labour/Engineering/Wages/CA	8%					\$ 101,200	
In-house Labour/Wages Sub-Total						\$101,200	
Project Contingency	15%					\$238,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						\$238,000	
Non-Refundable HST	1.76%					\$30,400	
Non-Refundable HST Sub-Total						\$30,400	
Total (2020 Dollars)						\$2,056,000	Rounded to nearest \$1,000
Other Estimate							
Chosen Estimate						\$2,056,000	2020 Estimate

PROJECT NO.: W-TP-001 **TIMELINE:** 0-5 Years
PROJECT NAME: Water Treatment Plant Upgrades - 0-5 Years
PROJECT DESCRIPTION: Moderate process upgrades at the WTP to meet 130 MLD (130,000 m3/day) to support combined growth and operational reserve capacity needs.

MAP



PRESSURE DISTRICT: Pressure District 1
PROJECT DESCRIPTION: Moderate process upgrades to increase the capacity including construct second low lift pump station including new intake, twin header, increase polymer pumping capacity, install additional ozone generator and new contact chamber, upsize filtration well and backwash pumps and size residual management facility. All upgrades will be completed at the existing property.

REQUIRED STUDIES:
STUDY SCOPE:

OBJECTIVES:

CONSTRUCTION

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

PROPOSED CAPACITY

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATE SPREADSHEET

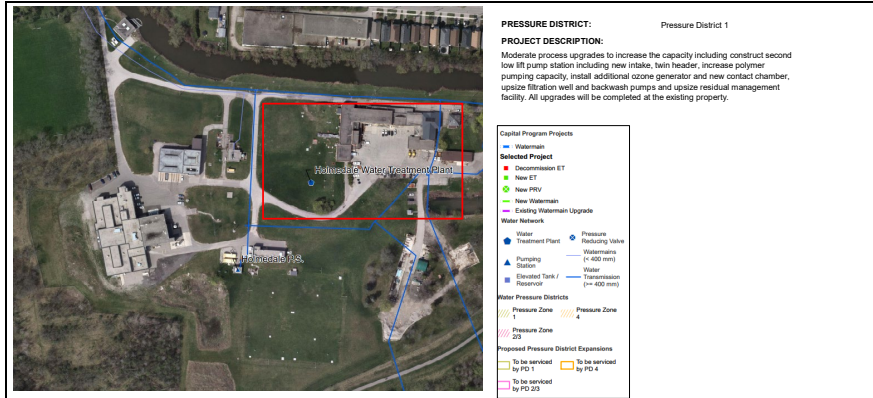
COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	0		\$0	
Sub-Total Study Costs				\$0	

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS	
Construction Cost								
Increase polymer pumping capacity				Lump Sum		\$500,000		
Additional Construction Costs							\$75,000	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$57,500	Provisional Labour and Materials in addition to base construction cost	
Sub-Total Construction Base Costs						\$633,000		
Geotechnical / Hydrogeological / Materials	1.0%					\$6,300		
Geotechnical Sub-Total Cost						\$6,300		
Property Requirements	1.5%					\$ 9,500		
Property Requirements Sub-Total						\$9,500		
Consultant Engineering/Design	15%					\$ 96,000	includes planning, pre-design, detailed design, training, CA, commissioning	
Engineering/Design Sub-Total						\$96,000		
In House Labour/Engineering/Wages/CA	8%					\$ 50,600		
In-house Labour/Wages Sub-Total						\$50,600		
Project Contingency	15%					\$119,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity	
Project Contingency Sub-Total						\$119,000		
Non-Refundable HST	1.76%					\$15,200		
Non-Refundable HST Sub-Total						\$15,200		
Total (2020 Dollars)						\$929,000	Rounded to nearest \$1,000	
Other Estimate								
Chosen Estimate						\$929,000	2020 Estimate	

PROJECT NO.: W-TP-002 **PROJECT NAME:** Water Treatment Plant Upgrades - 5-10 Years **TIMELINE:** 5-10 Years
PROJECT DESCRIPTION: Moderate process upgrades at the WTP to meet 130 MLD (130,000 m3/day) to support combined growth and operational reserve capacity needs.

MAP



REQUIRED STUDIES:

STUDY SCOPE:

OBJECTIVES:

CONSTRUCTION

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

PROPOSED CAPACITY	
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CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Other

COST ESTIMATE SPREADSHEET

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	0	\$200,000	\$0	
Sub-Total Study Costs				\$0	

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Second low lift pump station including new intake and bypass header				Lump Sum		\$3,500,000	
Install additional generator and new contact chamber				Lump Sum		\$2,500,000	
Upsize filtration well and backwash pumps				Lump Sum		\$500,000	
Upsize residual management facility				Lump Sum		\$500,000	
Additional Construction Costs	15%		ea.			\$1,050,000	Includes Mob/Demob, connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$805,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						\$8,855,000	
Geotechnical / Hydrogeological / Materials	1.0%					\$88,600	
Geotechnical Sub-Total Cost						\$88,600	
Property Requirements	1.5%					\$ 132,800	
Property Requirements Sub-Total						\$132,800	
Consultant Engineering/Design	15%					\$ 1,328,300	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						\$1,328,300	
In House Labour/Engineering/Wages/CA	8%					\$ 708,400	
In-house Labour/Wages Sub-Total						\$708,400	
Project Contingency	15%					\$1,667,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						\$1,667,000	
Non-Refundable HST	1.76%					\$212,500	
Non-Refundable HST Sub-Total						\$212,500	
Total (2020 Dollars)						\$12,993,000	Rounded to nearest \$1,000
Other Estimate							
Chosen Estimate						\$12,993,000	2020 Estimate

PROJECT NO.: W-TP-002A **TIMELINE:** 5-20 Years
PROJECT NAME: Water Treatment Plant Upgrades - 5-20 Years
PROJECT DESCRIPTION: Major capacity upgrades at the WTP to meet 160 MLD (160,000 m3/day) to support combined growth and operational reserve capacity needs.

MAP

Capital Program Projects
 - Watermain
 - Selected Project
 - Decommission ET
 - New ET
 - New PIV
 - New Watermain
 - Existing Watermain Upgrade

Water Network
 - Water Treatment Plant
 - Pumping Station
 - Elevated Tank / Reservoir
 - Pressure Reducing Valve
 - Watermain (< 400 mm)
 - Water Transmission Reservoir (>= 400 mm)

Water Pressure Districts
 - Pressure Zone 1
 - Pressure Zone 2
 - Pressure Zone 3
 - Repeated Pressure District Expansions
 - To be serviced by PD 1
 - To be serviced by PD 4
 - To be serviced by PD 3/3

REQUIRED STUDIES:
STUDY SCOPE:
OBJECTIVES:

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

PROPOSED CAPACITY		CLASS EA REQUIREMENTS:	A+
		CONSTRUCTION ASSUMPTION:	Other

COMPONENT	PROJECT COMPONENT DESCRIPTION	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Study Cost					
Study	Feasibility Study			\$0	
Study	EA	0	\$200,000	\$0	
Sub-Total Study Costs				\$0	

COMPONENT	RATE (%)	RATE (\$)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Second low lift pump station including new intake and twinning header					\$2,000	\$110,000,000	
Construct third Actiflo train and parallel processes including increasing polymer pumping capacity and ozonation generator and contact chamber							
Construct two new filtration cells including filtration well and backwash pumps							
Install 4th UV Reactor with capacity of 50,000 m3/day							
Upgrade residual management facility							
Additional Construction Costs	15%		ea.			\$16,500,000	Includes Mob/Demob connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			\$12,650,000	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						\$139,150,000	

Geotechnical / Hydrogeological / Materials	1.0%					\$1,391,000	
Geotechnical Sub-Total Cost						\$1,391,000	
Property Requirements	1.5%					\$ 2,087,000	
Property Requirements Sub-Total						\$2,087,000	
Consultant Engineering/Design	10%					\$ 13,915,000	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						\$13,915,000	
In House Labour/Engineering/Wages/CA	4%					\$ 5,566,000	
In-house Labour/Wages Sub-Total						\$5,566,000	
Project Contingency	15%					\$24,316,000	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						\$24,316,000	
Non-Refundable HST	1.76%					\$3,183,100	
Non-Refundable HST Sub-Total						\$3,183,100	
Total (2020 Dollars)						\$189,609,000	Rounded to nearest \$1,000
Other Estimate							
Chosen Estimate						\$189,609,000	2020 Estimate