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In Association With: Aquafor Beech Limited

Bolton Residential Expansion Study
Infrastructure Report

Prepared by BluePlan for:

The Town of Caledon

C001-0021

June 16, 2014

TOWN OF CALEDON

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Town of Caledon

Bolton Residential Expansion Study (BRES)

Infrastructure Servicing Study

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1 Introduction and Background

1.1 Background

The Town of Caledon initiated the Bolton Residential Expansion Study (BRES) to identify and review potential option areas to expand the current Bolton settlement boundary to support residential growth to 2031.

The need for residential growth was identified through the Town's Provincial Policy Conformity Exercise, Official Plan Amendment (OPA) 226, and further refined through the Town's recently consolidated June 2014 Official Plan. The forecasts in the Town's Official Plan sets out a Bolton settlement boundary expansion for residential growth to reach a total population of 39,898 by 2031.

Meridian Planning, as the Principal Consultant, is overseeing the overall BRES, which is being conducted in the following five stages:

- Phase 1 – Identification of potential boundary expansion alternatives in the Bolton area
- Phase 2 – Evaluation of all boundary expansion alternative(s) using the evaluation matrix developed in Phase 1
- Phase 3 – Undertaking of detailed component studies which will help in a) determining the suitability of the boundary expansion area(s), b) developing community plan concepts, and c) supporting the final recommended community plan
- Phase 4 – Development and establishment of planning and design principles for the community plan that reflect the Town's growth objectives and meets the requirements of the Growth Plan
- Phase 5 – Finalization of the community plan at the Secondary Plan level, and preparation of Secondary Plan level policies to be submitted for both a regional and local Official Plan amendments

BluePlan was retained by the Town of Caledon to carry out the water wastewater and stormwater infrastructure servicing component of the BRES, and is one of a number of consultants undertaking detailed studies for subject areas including infrastructure, transportation, agriculture, cultural heritage, archaeology and the environment. For the stormwater component of the infrastructure study, BluePlan is being supported by Aquafor Beech Limited.

The information contained herein is intended to support the water, wastewater, and stormwater infrastructure planning and decision making process for the evaluation and selection of the preferred growth option.

A more detailed description of the BRES process and the objectives of this report are discussed in the following sections.

1.2 Overview of BRES Process

This section provides a detailed overview of the BRES process as it relates to the infrastructure servicing component. The context of the BRES process is summarized in Table 1.

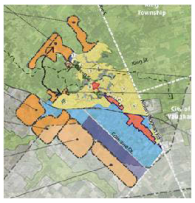
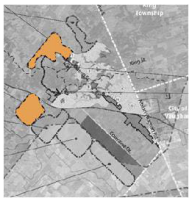
In Phase 1 of the BRES, six (6) potential boundary expansion alternatives were identified in the Bolton area, located largely to the west and north of the existing settlement boundary. An evaluation matrix was developed and the public was solicited for input.

Phase 2 focused on the evaluation of the six (6) boundary expansion alternatives using the evaluation matrix developed in Phase 1. Following individual technical evaluations and public and stakeholder consultation, Town Council provided direction on shortlisting two (2) growth options for further detailed study. The two options carried forward for further evaluation were identified as Option 1 and Option 3.

In Phase 3 of the BRES, detailed studies were carried out to further evaluate the merits of the two (2) shortlisted growth options, Option 1 and Option 3, and recommend a preferred expansion area. Each growth option was subject to a full comprehensive evaluation, whereby a list of alternative water and wastewater servicing strategies was generated for Option 1 and Option 3. Phase 3 is the focus of this report.

Phases 4 and 5 will provide a detailed servicing refinement for the preferred growth option that will tie into a larger Comprehensive Environmental Impact Study and Management Plan (CEISMP) process for the BRES. This approach is consistent with the policies set out in both the Regional and Caledon Official Plans to expand existing settlement boundaries.

Table 1. Overview of BRES Process

	Phase	Description	Status
	Phase 1 & 2	Preliminary Servicing Review (6 Options)	Complete
	Phase 3	Detailed Review/Evaluation of Option 1 vs 3 (2 Options)	This Report
	Phase 4 & 5	Detailed servicing refinement for preferred growth option & final MP documentation (1 Preferred Option)	To be Completed

1.3 Objectives and Summary of Approach

This section summarizes the objectives of this report in the context of the BRES process and the general methodology undertaken as part of Phase 3 of the BRES.

As part of Phase 1 and 2 of the BRES, a high level screening of the six (6) growth options within the study area was undertaken. The preliminary servicing analysis and its conclusions were summarized in a Technical Memorandum dated June 18, 2013. Following the completion of the preliminary servicing assessment, the two (2) growth options that were carried forward for further evaluation under Phase 3 of the BRES were: Option 1 (north of Columbia Way) and Option 3 (North Hill West). Option 1 and Option 3 are shown in Figure 1.

Three (3) Rounding Out Areas were also identified as part of the BRES, and are also located outside the existing urban settlement boundary, adjacent to Greenbelt lands. These Rounding Out Areas are addressed in the servicing strategies for Option 1 and Option 3, such that all three areas could be serviced if either Option is selected as preferred.

This report is intended to present the detailed servicing analysis and evaluation of Option 1 and Option 3 as well as the three Rounding Out Areas, undertaken as part of Phase 3 of the BRES, including:

- Establishing water, wastewater and stormwater servicing needs
- Identifying alternative water servicing, wastewater servicing, and stormwater management strategies for Option 1 and Option 3
- Evaluating alternative water and wastewater servicing strategies for Option 1 and Option 3, using a five-point criteria
- Developing cost estimates for water, wastewater, and stormwater alternatives for Option 1 and Option 3
- Comparison of Option 1 vs Option 3 from a servicing perspective
- Recommendation of preferred growth option

The evaluation and decision making process undertaken for infrastructure as part of Phases 1, 2 and 3 of the BRES is depicted in Figure 2.

The BRES Infrastructure Servicing evaluation follows a similar approach as the Municipal Engineers Association (MEA) Class EA process typically used in master planning projects. Principles taken from the original matrix evaluation have been integrated within the five-point evaluation, such as:

- making best use of existing infrastructure;
- minimizing the cost of new infrastructure;
- considering operation and maintenance costs to ensure financial sustainability;
- ensuring the long term reliability and security of the water and wastewater systems; and,
- performing financial evaluation

1.4 Related Studies and Background Information

This infrastructure study has drawn on both historical and recent studies and resources including the following:

- Region of Peel 2013 Water and Wastewater Master Plan (BluePlan & AECOM, Mar 2014)
- North Bolton Elevated Tank and Feedermain Environmental Study Report (AECOM, Oct 2011)
- Water and Wastewater Servicing Plan for the South Albion-Bolton Community Plan Employment Land and North Hill Supermarket Areas (AECOM, Mar 2010)
- Bolton Urban Community Water and Wastewater Analysis (AECOM, Mar 2010)

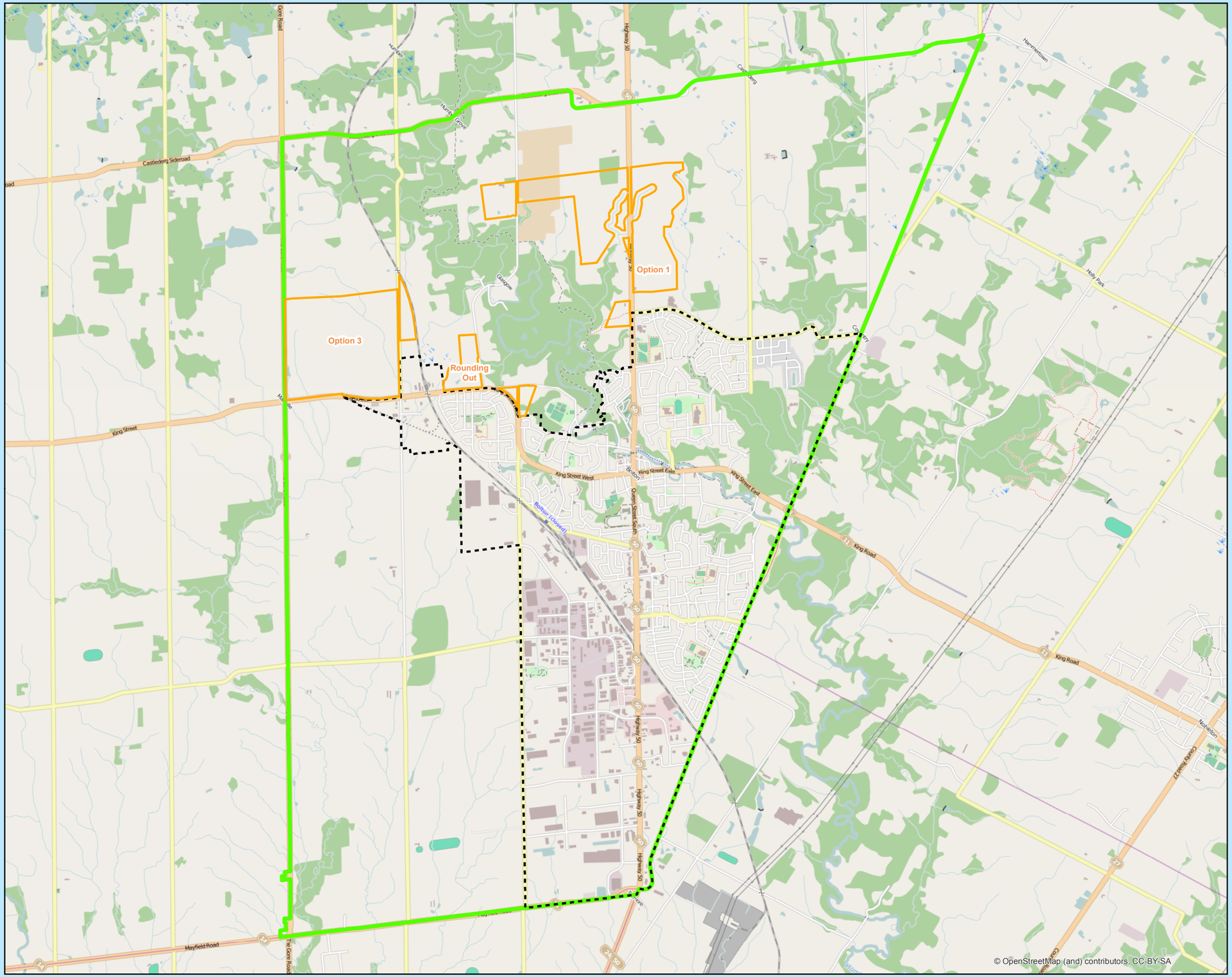


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Figure 1 Study Area

Legend

- Study Area
- UrbanSettlementBndry
- Study_Area

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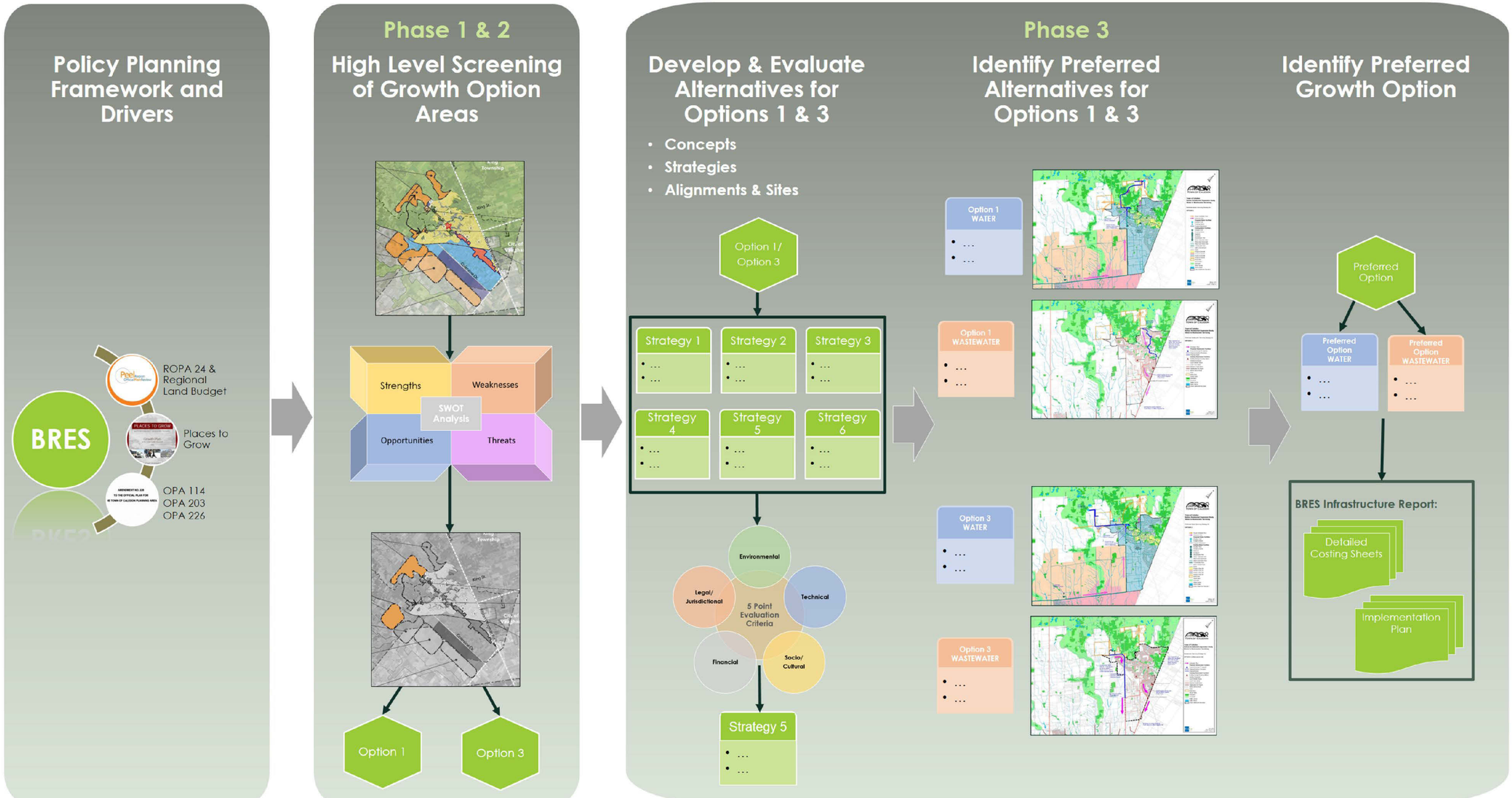
Figure 2. Infrastructure Planning and Decision Making Process for the BRES



2 Existing Conditions

2.1 Planning Context

As part of Places to Grow, the province has allocated population and employment to the Region of Peel. The Region of Peel has allocated a portion of that growth to Caledon. The Town of Caledon has allocated that growth to Bolton, Mayfield West, and Caledon East, a strategy referred to as "the tri-nodal" strategy.

Caledon commenced a review of the existing Official Plan policies, known as the Provincial Policy Conformity (PPC) exercise in Spring 2007. This exercise culminated in the approval of Caledon's Provincial Policy Conformity Amendment, Official Plan Amendment Number 226 (OPA 226), which was adopted on June 8, 2010 and approved by the Ontario Municipal Board in October 2013.

In June 2014, the Town of Caledon released a consolidated Official Plan which includes all approved Official Plan Amendments to date. The 2014 Town Official Plan is being implemented by Caledon through a series of settlement area boundary expansions. An expansion to the Bolton settlement area boundary is required to accommodate the growth forecasts for Bolton contained in the 2014 Town Official Plan.

The intent of the BRES is to implement the 2014 Official Plan which projects a total population of 39,898 people for Bolton by 2031. On the basis of OPA 226, it has been determined that 190 hectares of additional urban land in Bolton is required to accommodate 10,348 additional people and 2,635 jobs to 2031. These growth numbers are the basis for the analysis undertaken under the BRES.

The Bolton Residential Expansion Study was initiated to determine where and how to accommodate the residential and employment growth anticipated for Bolton post 2021.

2.2 Population and Employment Forecasts

2.2.1 BRES Area

Based on the Regional Official Plan Amendment (ROPA) 24 and the Regional Land Budget, as well as the Town of Caledon's approved OPA 226, any settlement area boundary expansion in Bolton is limited to 190 hectares.

Town Council also selected three Rounding Out Areas (ROA) by the Greenbelt Plan to be reviewed under the BRES, including:

- ROA1 – North of King Street and west of Duffy's Lane
- ROA2 – West of Queen Street North and Columbia Way
- ROA3 – South of King St, west of Chickadee Lane

The servicing strategies and capital programs developed as part of the 2013 Region of Peel Water and Wastewater Master Plan are based on 2031 projections for Bolton of 30,076 population and 20,004

employment specifically within the Bolton urban boundary. As such, all population and employment within the BRES projections, which require urban boundary expansion, are over and above the 2031 projections within the Bolton urban boundary.

Table 2 presents the population and employment forecasts for the BRES expansion area utilized as the basis for this study.

Table 2. BRES Population and Employment Forecasts

Growth Area	Area (ha)	2031 Population / Employment Forecast [1]
BRES Residential	-	10,348
BRES Employment	-	2,635
Total	190	12,983
[1] Per direction received from Town of Caledon Council.		

The Rounding Out Areas identified as part of the BRES are also outside the current Bolton urban settlement boundary. Population estimates for the three Rounding Out Areas are provided in Table 3.

2.2.2 Rounding Out Areas

Table 3. Rounding Out Area Population Forecasts

Rounding Out Area	Area (ha)	2031 Population Estimate [1]
ROA1 – King/Duffy's Lane	18	1,759
ROA2 – Queen St N/Columbia Way	6	775
ROA3 – King/Chickadee Lane	7	614
Total	31	3,148
[1] Population estimates for rounding out areas based on available land area and density assumptions, provided by Meridian Planning, and are included in the total BRES population forecast of 10,348.		

Table 3 provides a further breakdown of the BRES population and land area estimates specific to the three rounding out areas. The total population estimate across the three rounding out areas is 3,148 and is included in the 10,348 projected BRES population growth target.

2.2.3 Summary

The BRES 2031 population and employment growth forecasts are 10,348 and 2,635, respectively. This growth could occur within either Option 1 or Option 3, and potentially in one, two, or all three rounding out areas identified in the BRES. It is important to note that the total population for whichever growth option is selected (Option 1 or Option 3), including the rounding out areas, is 10,348. Table 4 summarizes the potential breakdown of the BRES population and employment forecasts by location.

Table 4. Summary of BRES Population and Employment Forecasts by Location

Area	2031 Residential Population	2031 Employment Force
Option 1 or Option 3	7,200 [1]	2635
ROA1 – King/Duffy's Lane	1,759 [2]	0
ROA2 – Queen St N/Columbia Way	775 [2]	0
ROA3 – King/Chickadee Lane	614 [2]	0
Total	10,348	2,635

[1] Residential population estimate within Option 1 or Option 3, assuming all three rounding areas are developed per Table 3.

[2] Population estimates for rounding out areas based on available land area and density assumptions, provided by Meridian Planning.

2.3 Existing Land Use and the Environment

This section provides a brief description of the existing land use and environmental features within Option 1 and Option 3 lands.

Option 1 is surrounded by Greenbelt lands and is located north of Columbia Way, on either side of Queen Street North. There are topographic constraints within Option 1, mainly to the southwest where the land falls toward the Humber River valley. There are no Provincially Significant Wetlands within Option 1 but there are small wetlands west of Queen Street North and small wetlands within Significant Woodland. Generally, the Option 1 lands are currently used for farming purposes.

Option 3 is not adjacent to any Greenbelt lands (with the exception of lands on the east side of the CN rail line) and is located north of King Street, east of The Gore Road, and west of the C.N. rail line. There are various streams within Option 1, mostly headwaters. One watercourse is ranked as "Conservation" in the southwest corner. There are no Provincially Significant Wetlands or Significant Woodlands within Option 3. It is also located across the street from the future potential Go Station / Transit Hub. Option 3 is also largely being used for farming purposes.

Preliminary hydrogeological field work has been undertaken. Further work will be undertaken by Aquafor Beech to better define hydrogeology conditions and evaluate downstream impacts on watercourses, as the process moves forward in the selection of the preferred growth option.

3 Water Demand Criteria

3.1 Water Design Criteria

3.1.1 Demand Criteria

The BRES hydraulic water modelling analysis utilized the Region of Peel Master Plan water criteria to estimate future demands within the study area. The BRES water criteria is summarized in Table 5 below.

Table 5. BRES Water Criteria

DESIGN CRITERIA			
Residential	Res Avg Day Demand Criteria	280	L/cap/d
	Max Day Peak Factor (MDF)	2.0	
	Peak Hour Factor (PHF)	3.0	
Non-Residential	Non-Res Avg Day Demand Criteria	280	L/emp/d
	Max Day Peak Factor (MDF)	1.4	
	Peak Hour Factor (PHF)	3.0	

3.1.2 Service Levels

To ensure an adequate level of service to the local distribution system, the size of watermains were determined based on Region of Peel standards and practices. Minimum watermain sizes are as follows:

- 150 mm diameter watermain for main lines in residential areas; 50 mm diameter watermains are allowed in cul-de-sacs and shall be looped back to the main line;
- 300 mm diameter watermain for main lines servicing schools and high density residential areas; and,
- 300 mm diameter watermain for main lines servicing industrial/commercial/institutional areas.

As per MOE Guidelines, the water system is to be designed based on maximum day demands with consideration to fire flow and peak hour demand requirements.

Operating pressures within the distribution system are as follows:

- Minimum of 40 psi (275 kPa) and a maximum operating pressure of 100 psi (690 kPa) shall be maintained within the distribution system under maximum day conditions
- A minimum operating pressure of 40 psi shall be maintained under peak hour demand
- Under fire flow conditions, it is permissible to have pressure drop to a minimum of 20 psi (140 kPa).

4 Existing Water Distribution System

4.1 Description

Bolton is serviced via the Peel East Trunk Transmission System. Water is pumped up to Bolton from the Lakeview WTP. An existing 750 mm feedermain along Mayfield Road currently feeds supply from the North Brampton Pumping Station and East Brampton Pumping Station to Bolton. The Tullamore Pumping Station and Reservoir has been completed and will replace supply to Bolton Zone 6 via a future transmission main along Mayfield Road and Coleraine Road. The existing Bolton water system is shown in Figure 3.

The existing Bolton service area is serviced by two local water pressure zones, Zone 5 and Zone 6. Zone 5 is located in the Humber River Valley, in the downtown Bolton area, and is serviced via Zone 6 through pressure reducing valves (PRV) at the Bolton Standpipes located just west of Queen Street South and north of William Street. Water pressure zones and key elevation contours within the study and surrounding area are shown in Figure 4.

The Bolton Zone 5 Standpipes have a combined storage capacity of 5.2 ML and a top water level of 274.1 m. The tanks are connected to Zone 5 via a 300 mm diameter watermain.

The South Booster Pumping Station (BPS) is located near the Standpipes, east of Queen Street, north of Norton Boulevard. The South BPS operates based on levels in the Bolton Elevated Tank on Coleraine Drive. There are currently three (3) pumps installed, each with a capacity of 80 L/s and a total dynamic head of 36 m. The South BPS is only occasionally used.

The North BPS is located west of King Street East and north of Humber Lea Road. The station recently had 3 new pumps installed (2 duty, 1 standby), each rated at 52 L/s with a total dynamic head of 42 m. The North BPS was built to minimize pressure fluctuations and enhance levels of service in the North Hill (Zone 6).

Storage for Bolton Zone 6 is provided from the existing Elevated Tank on Coleraine Drive and the Elevated Tank currently under construction further south on Coleraine Drive.

The North Bolton Elevated Tank is currently under construction. It has been designed to store a total volume of 9.0 ML, which will provide a total Zone 6 storage for Bolton of 12.7 ML.

A new feedermain route of 5.0 km connecting the Elevated Tanks at Coleraine Drive to the North Hill of Bolton is currently under construction. The feedermain consist of sections of 1050 mm along Coleraine Drive, 600 mm along King Street West, and 400 mm diameter watermain on Queen Street North. This feedermain serves as supply and stability of level of service for the Zone 6 system.

4.2 Master Plan Water Servicing Strategy

The 2013 Master Plan was completed to determine the ability of existing and planned water and wastewater infrastructure in the Region of Peel to efficiently and effectively service the Region's existing

and anticipated growth up to the year 2031, and to evaluate and develop recommended servicing strategies.

The preferred water servicing strategy is described as follows:

- Build off planned 2031 infrastructure as per the 2007 Master Plan while shifting the planned East-Central-West servicing boundary to match system hydraulics;
- Expand transmission, storage and pumping as outlined in the 2007 Master Plan;
- Allow intra-zone boundaries to be defined by hydraulics within the system and adjust the planning boundaries accordingly; and
- Continue to implement the Region's water conservation program.

Key projects and facilities within this strategy that involve the East Trunk Transmission System include:

- Lakeview WTP, Silverthorn, Hanlan Beckett-Sproule, Airport Road, Tullamore Pumping Stations and Reservoirs,
- East trunk system including the Hanlan Feedermain and the East Brampton Transmission Main twinning;
- New North Bolton Elevated Tank; and,
- Extension of the distribution system in Bolton.

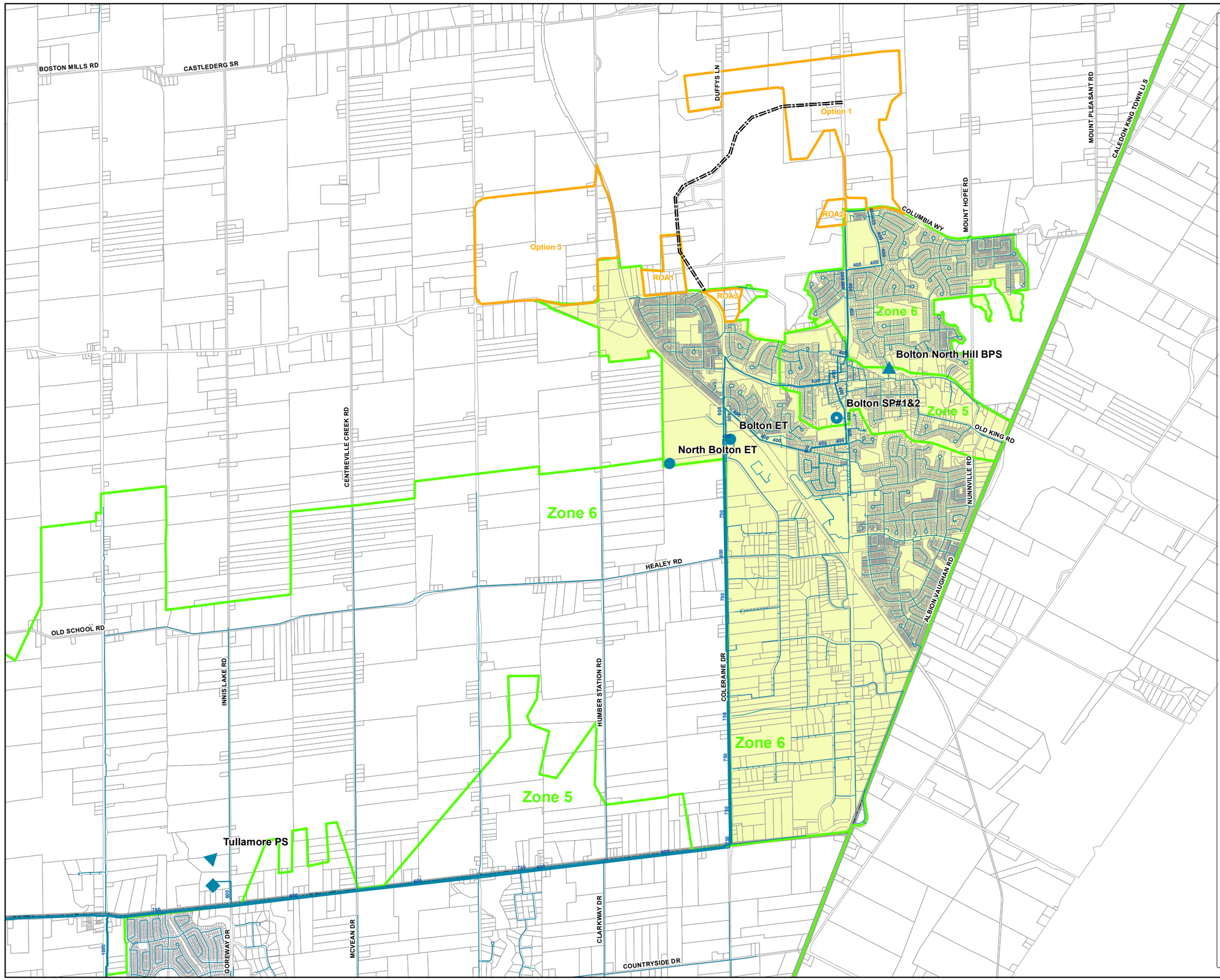


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Figure 3
Existing Water Infrastructure

Legend

Existing Water Facilities

- Elevated Tank
- Pumping Station
- Reservoir
- Standpipe
- Groundwater Well
- Water Treatment Plant
- Local Watermain (< 400mm)
- Local Distribution Main (400mm - 600mm)
- Major Distribution Main (> 600mm)
- Pressure Zone Boundary (2031 Master Plan)
- BAR
- Study Area
- Parcel Fabric
- Urban Settlement Boundary

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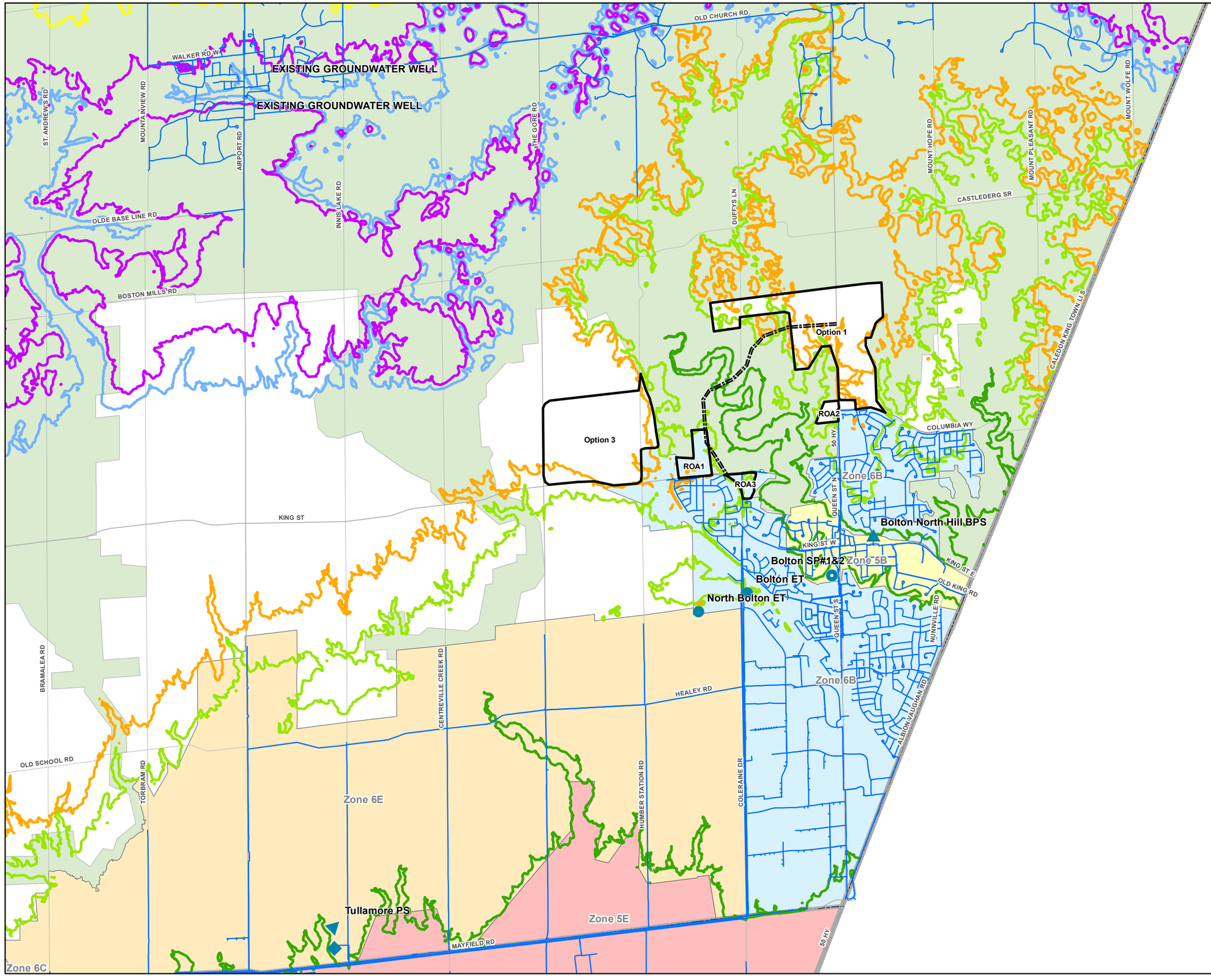

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Figure 4
Water Pressure Zones
and Key Area Elevation Contours

Legend

- Elevated Tank
- Pumping Station
- Reservoir
- Standpipe
- Existing Watermain

Existing Service Area by WPZ (2031 MP)

- Zone 5B (sub of 6B)
- Zone 5E
- Zone 6B
- Zone 6E

- Road
- Bolton Arterial Road
- Study Area
- Peel Region Greenbelt Boundary

Elevation Contours

- 230 (Bottom of Zone 6)
- 260 (Top of Zone 6)
- 265 (Zone 5 TWL - 266.7 m)
- 290 (Top of Zone 7)
- 295 (Zone 6 TWL - 297.2 m)
- 325 (Zone 7 TWL - 327.7 m)

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5 Assessment of Existing and Future Water Infrastructure

5.1 Overview

The objective of the hydraulic water servicing analysis was to identify alternatives for servicing the preferred growth option and select a strategy that considers the following key aspects of servicing impacts including:

- Impact of existing level of service
- Impact on water quality
- Provision of security of supply
- System redundancy
- Flexibility of servicing
- Complexity and cost of infrastructure upgrades
- Opportunity to support long term servicing of other growth areas

5.2 Water Demand Requirements

5.2.1 BRES Area

Using the criteria in Table 5, the average day demand (ADD), maximum day demand (MDD), peak hour demand (PHD), and maximum day plus fire demands were determined for the BRES service area. These water demands are summarized in Table 6.

Table 6. Water Demands for BRES Area

BRES Land Use	Area (ha)	Population (persons)	ADD (L/s)	MDD (L/s)	PHD (L/s)	Fire Flow (L/s)
Residential	-	10,348	33.5	67.1	100.6	
Employment	-	2,635	8.5	12.0	25.6	
Total	190	12,983	42.1	79.0	126.2	220.0

Master Plan demands within the Bolton urban area were also referenced to provide an indication as to the level of impact of the BRES service area, and are provided in Table 7. The last column shows demands including the full build-out of the BRES service area.

Table 7. Existing and Future Water Demands for the Bolton Urban Area

Water Demand	2013	2031	2031 (w/ BRES)
Average Day Demand, ADD L/s (MLD)	112.7 (9.74)	131.4 (11.35)	173.5 (14.99)
Maximum Day Demand, MDD L/s (MLD)	217.5 (18.79)	247.0 (21.34)	326.0 (28.17)
Peak Hour Demand, PHD L/s (MLD)	338.2 (29.22)	394.0 (34.04)	520.2 (44.94)

The BRES service area represents approximately a 32% increase in 2031 water demands, above and beyond the current Region of Peel 2031 MDD forecast of 247 L/s (21.34 MLD) for Bolton.

5.2.2 Rounding Out Areas

Preliminary population densities indicate that these areas could potentially be developed as medium and higher density residential, and/or mixed use. The preferred water servicing strategies will need to address extension of servicing to the Rounding Out Areas.

Demands for the three Rounding Out Areas are summarized in Table 7.

Table 8. Water Demand Estimates for Rounding Out Areas

Rounding Out Area	Area (ha)	Population (persons)[1]	ADD (L/s)	MDD (L/s)	PHD (L/s)
ROA1	18	1,759	5.7	11.4	17.1
ROA2	6	775	2.5	5.0	7.5
ROA3	7	614	2.0	4.0	6.0
Total	31	3,148	10.2	20.4	30.6

[1] Population estimates are based on available land area and density assumptions, provided by Meridian Planning.

5.3 Water Pressure Zones

5.3.1 BRES Area

Elevation contours were evaluated to determine the range of topography across the Option 1 and Option 3 expansion areas.

Option 1 ground elevations range between 250 m and 270 m, and as such fall between Peel pressure zones 6 and 7, herein referred to as zone 6A/7. The top water level required to service this zone is approximately 315 m.

Option 3 ground elevations are generally higher than Option 1 and range between 265 m and 280 m. As such Option 3 falls within Peel pressure zone 7. The top water level required to service this zone is approximately 327.7 m.

5.3.2 Rounding Out Areas

Ground elevations within the three Rounding Out Areas indicate that they are at elevations at the upper range of Zone 6 or could be within elevation ranges of Zone 7. In general, all three Rounding Out Areas are serviceable via extension of the existing Zone 6 distribution system.

Rounding Out Area 1 is located on higher ground, and ranges between 258 m and 265 m, in some local spots. ROA1 can potentially be serviced through connection to the 300 mm Zone 6 watermain just south of King Street at the north end of Trailview Lane. However, given the local high topography within ROA1, ROA1 would benefit from an augmented Pressure Zone 7.

Rounding Out Area 2 is located on ground elevation ranging between 260 m to 262 m and can potentially be serviced through connection to the existing 400 mm Zone 6 feedermain on Queen Street North and Columbia Way.

Rounding Out Area 3 is located on ground elevation ranging between 258 m and 261 m and can potentially be serviced via the existing 300 mm Zone 6 watermain on Chickadee Lane.

Figure 5 depicts the potential independent servicing strategies for ROAs 1, 2 and 3. The strategies could proceed regardless of the preferred growth option. However, depending on the preferred growth option and the associated servicing strategy, the ROA servicing could be optimized. ROAs 1 and 3 could benefit from the preferred servicing for growth option 3. ROA 2 could benefit from the preferred servicing for growth option 1.

5.4 Storage Analysis

The planned 2031 storage volume for Zone 6 was determined for the 2031 projections within the Bolton urban boundary. As such, the potential Bolton expansion areas outside the existing settlement boundary, will require additional storage and will require hydraulic grade line evaluation as they are located in a higher pressure zone.

Water storage requirements for the BRES service area (Zone 6A/7) are calculated in accordance with MOE Guidelines as follows:

Total Storage Requirement, S = A + B + C

Where,

A = Fire storage in accordance with the standard of Municipal Fire Protection of the Canada Underwriters Association (modified from the MOE criteria)
B = Equalization Storage = 25% of Maximum Day Demand of Pressure Zone
C = Emergency Storage = 25% of (A + B)

For a service population of 12,983 and a MDD of 6.828 MLD, the storage requirement is calculated as follows:

A = 220 L/s for 3 hours = 2.376 ML
B = 25% of 6.828 = 1.707 ML
C = 25% of (2.376 + 1.707) = 1.021 ML
S = A + B + C = 5.104 ML

Estimated demands and storage requirements for the BRES growth area are summarized in Table 8.

Table 9. Storage Requirements for BRES Service Area

Year	Demands		Storage Requirements (ML)			
	ADD	MDD	Fire Storage (A)	Equalization Storage (B)	Emergency Storage (C)	Total Storage (A+B+C)
2031	42.1 L/s 3.635 MLD	79.0 L/s 6.828 MLD	2.37	1.71	1.02	5.10

Therefore, a storage facility with a capacity of 5.1 ML is required to provide the storage requirements of either Option 1 (Zone 6A/7) or Option 3 (Zone 7) growth area.

The 5.1 ML storage requirement is based on the servicing needs of the BRES population and employment forecasts and does not include any additional future potential growth areas. It is anticipated that the exact volume requirement will be refined during detailed design.

A high level evaluation of in-ground floating versus elevated floating storage was undertaken. Based on the extensive feedermain length requirements and hence higher costs with the in-ground option, elevated floating storage was selected as the preferred method of storage for the BRES service area.

Top water level (TWL) requirements would depend on the selection of the preferred growth option, as Option 3 is located at higher ground elevations than Option 1. Therefore the pedestal height would be greater for an Option 3 elevated tank compared to Option 1.

Tank location is often dictated by topography and land availability. Alternative storage sites were provided by Region in the Duffy's Lane & King Street area, however ground elevations at these locations were determined too low to construct a reasonable pedestal height for an elevated tank. Therefore alternative locations of higher ground elevation were identified for both Options 1 and 3.

5.4.1 Rounding Out Areas

Ground elevations within the three Rounding Out Areas indicate that they are located at the top of Zone 6 or beyond. Rounding Out Areas 2 and 3 are generally located between 258 m and 262 m and could be serviced through extension of existing servicing through the North Hill system. Rounding Out Area 1 is located on higher ground, and ranges between 258 m and 265 m in some local spots. As such, ROA1 would best be serviced via the new pressure zone to ensure that service levels are maintained.

5.4.2 Option 1 Elevated Storage

Ground elevations within Option 1 range between 250 m and 270 m. A TWL of 315 m would adequately service the Option 1 service area, requiring an intermediary zone falling between Zone 6 and Zone 7, herein referred to as Zone 6A. This Option 3 TWL would maintain minimum pressures above 60 psi and maximum pressures slightly hovering above 90 psi.

A site west of Queen Street North was selected as the preferred site for the Option 1 elevated tank. The location of the tank would be at the east central quadrant of what appears to be an existing farm, adjacent and south of three existing residential lots. The ground elevation at this site is approximately 273 m. To achieve the required TWL of 315 m, a pedestal height of approximately 42 m would be required.

5.4.3 Option 3 Elevated Storage

Ground elevations within Option 3 range between 265 m and 280 m. Therefore, a TWL of 327.7 m would adequately service the Option 3 service area, coinciding with a Regional Zone 7 hydraulic gradient. This TWL would maintain minimum pressures in the range of 65 psi and maximum pressures below 90 psi within the future service area.

A site west of Gore Road was selected as the preferred site for the Option 3 elevated tank. The location of the tank would be at the northwest corner of what appears to be an existing farm land. The ground elevation at this site is approximately 283 m. To achieve the required TWL of 327.7 m, a pedestal height of approximately 45 m would be required.

5.4.4 Pumped Storage

In-ground pumped storage was also considered as an option for provision of storage. With a pumped storage system, there must be sufficient pumping capacity and transmission capacity to deliver the greater of i) peak hour demand, or ii) maximum day demand plus fire demands. This could result in a greater investment in pumping capacity, as variable speed pumps or multiple pumps would likely be required. Furthermore, standby power would need to be provided at the pumping facilities.

The impacts of a pumped storage system were evaluated for the BRES service area. The in-ground pumped storage tank would likely be located at the site of the potential Zone 6A/7 BPS. The site on King Street, east of Innis Lake Road provides a suitable location to place a Zone 5 in-ground reservoir with potential Zone 6 and 7 pumping capabilities. A minimum 600 mm diameter feedermain would be required to deliver the maximum day plus fire demand of 299 L/s (25.8 MLD). These impacts were considered in the costing of alternative servicing strategies that were based on a pumped storage approach.

Notwithstanding, it is recognized that elevated storage provides a more robust, reliable, and useful form of storage, particularly for fire suppression. Therefore, an elevated storage system is considered more favourable from a hydraulics optimization standpoint.

Servicing strategy & connection points would be optimized based on preferred servicing solution

Connect to new 400mm Zone 6 North Bolton Feedermain at Queen St. N and Columbia Way

Connect to existing 300mm Zone 6 watermain on Chickadee Ln

Connect to existing 300mm Zone 6 watermain south of King St. at north limit of Trailview Ln

Option 1

Option 1

Option 3

ROA1

ROA2

ROA3

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Figure 5
Extension of Water Servicing to Rounding Out Areas

Legend

- Elevated Tank
- Pumping Station
- Reservoir
- Standpipe
- Local Watermain (< 400mm)
- Local Distribution Main (400mm - 600mm)
- Major Distribution Main (> 600mm)
- Study Area
- Parcel Fabric
- Urban Settlement Boundary
- Bolton Arterial Road
- Water Course
- Elevation Contour

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6 Wastewater Flow Criteria

6.1 Wastewater Design Criteria

6.1.1 Design Criteria

The Bolton Residential Expansion Study utilized the Region of Peel Master Plan wastewater criteria to estimate future flows (litres/capita/day) within the study area. The wastewater criteria is summarized in Table 10 below.

Table 10. BRES Wastewater Criteria

DESIGN CRITERIA		
Residential Avg Day Wastewater Generation Criteria	300	L/cap/d
Employment Avg Day Wastewater Generation Criteria	300	L/cap/d
Peaking Formula	Harmon (min 2 max 4)	
Inflow and Infiltration Allowance	0.2	L/s/ha

6.1.2 Service Levels

Establishing hydraulic performance criteria is required in determining the need and scope of upgrades required to service future growth within the existing system. Assessing the impact of growth on the existing collection system was undertaken following the 2013 Master Plan approach.

For example, the trigger for a linear project is based on the following criteria:

- Pipe is surcharged; and
- Maximum water level is within 1.8 meters of ground level, indicating the potential for basement flooding.
- Under a 1 in 5 year design storm, Soil Conservation Service (SCS) Type II

The trigger for a sewage pumping station is based on exceeding the firm capacity of the station. The firm capacity of a pumping station is based on the Certificate of Approval (C of A, where cited) or is defined as the linear sum of the pump capacities with the largest pump out of service. The station's firm capacity should be sized to handle the peak wet weather flow.

7 Existing Wastewater Collection System

7.1 Description

Bolton is located to the northeast of the Peel Region wastewater catchment and within the east trunk sewer system. Flows are conveyed through the east trunk sewer system to the G.E. Booth Wastewater Treatment Facility (WWTF) and ultimately discharged to Lake Ontario.

Currently the majority of flow in Bolton drains to the Bolton Sewage Pumping Station (SPS) and is pumped to a discharge point near the junction of Strawberry Hill Court and Allan Drive. The pumped flow and additional flow south of the pumping station is then conveyed down Highway 50 and McEwan Drive, eventually connecting to the Coleraine Drive Trunk Sewer. The Coleraine Trunk Sewer currently conveys the majority of Bolton's wastewater flows to the lake based system.

The existing Bolton wastewater system is shown in Figure 6.

7.2 Wastewater Opportunities and Constraints

South of Bolton is the McVean SPS, a large pumping station with an existing capacity of 1400 L/s (C of A) that conveys flows across the Humber River valley to the Brampton East Industrial Sanitary Trunk Sewer. The McVean SPS is a known 'pinch point' downstream of Bolton and will be impacted equally whether Option 1 or Option 3 is selected as the preferred expansion area.

Capacity limitations have also been observed in previous master plans in the trunk sewer along Queen Street North (Highway 50) and Ebenezer Road. This trunk sewer from the intersection of Highway 50 and Coleraine Drive to McVean SPS is currently being twinned and the twinning was reflected in the model used for this analysis.

The additional 166 L/s generated from the BRES area does not have a detrimental impact on capacity in the downstream trunk sewer which is currently undergoing major upgrades.

7.3 Master Plan Wastewater Servicing Strategy

As part of the Region's current wastewater servicing strategy, a new trunk sewer is being constructed to the east of Bolton along Albion-Vaughan Road. A key piece of infrastructure, the Albion-Vaughan Trunk Sewer will service a large portion of the existing Bolton service area, through a number of upgrades to redirect flows southeast to the new trunk sewer. As part of this strategy, two local pumping stations, Harvestview SPS and Albion-Vaughan SPS, will be decommissioned.

Flows downstream of the Bolton SPS will be diverted to a sewer at Queensgate Blvd and Landsbridge St. From this point, flows will be conveyed southeast via the 675 mm on Landsbridge Street, Pavin Crescent, and-Waterbury Street. This diversion strategy to the Albion-Vaughan Trunk Sewer was confirmed with Region staff through the process of this study.

Figure 6 delineates the approximate catchment area that would be diverted to the Albion-Vaughan Trunk Sewer.

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Figure 6
Existing Bolton Wastewater System

Legend

- Existing Sewage Pumping Station
- Local Collector Sewer (< 375 mm)
- Local Trunk Sewer (375 mm - 675 mm)
- Regional Trunk Sewer (> 675 mm)
- Bolton Arterial Road
- Road
- Study Area
- Urban Settlement Boundary
- Parcel Fabric

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Figure 7
Albion-Vaughan Trunk Sewer
Diversion Area

Legend

- Existing Sewage Pumping Station
- Local Collector Sewer (< 375 mm)
- Local Trunk Sewer (375 mm - 675 mm)
- Regional Trunk Sewer (> 675 mm)
- WWP_2014_TO_2031
- WWL_2013
- WWL_2014_TO_2031
- WWP_2013
- Bolton Arterial Road
- Study Area
- Parcel Fabric
- Urban Settlement Boundary
- Albion-Vaughan Diversion Area

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8 Assessment of Existing and Future Wastewater Infrastructure

8.1 Overview

The objective of the hydraulic analysis was to identify alternatives for servicing the preferred growth option and select a strategy that considers the following key aspects of servicing impacts including:

- Impact of existing level of service
- System capacity
- Complexity and cost of infrastructure upgrades
- Opportunity to support long term servicing of other growth areas

8.2 Wastewater Flow Requirements

8.2.1 BRES Area

The theoretical average dry weather flow (DWF), peak dry weather flow (PDWF), and peak wet weather flow (PWWF) were determined based on the BRES forecasts and criteria set out in Table 10. The estimated wastewater flows for the BRES area are summarized in Table 11.

Table 11. Wastewater Flow Estimates for BRES Area

BRES Land Use	Area (ha)	Population (persons)	Average DWF (L/s)	Peak DWF (L/s)	Peak WWF (L/s)
Residential	-	10,348	35.9	105.6	135.9
Employment	-	2,635	9.1	31.9	39.6
Total	190	12,983	45.1	128.1	166.1

Master Plan flow projections for the existing Bolton urban settlement boundary were referenced to provide an indication as to the level of impact of the BRES service area, and are provided in Table 12. The last column shows flows including the full build-out of the BRES service area.

Table 12. Existing and Future Wastewater Flows for the Bolton Urban Area

Wastewater Flow	2011	2031	2031 (w/ BRES)
Average Dry Weather Flow,	91.0	99.0	144.1
DWF L/s (MLD)	(7.9)	(8.6)	(12.5)
Peak Dry Weather Flow,	261.0	281.0	409.1
PDWF L/s (MLD)	(22.6)	(24.3)	(35.3)
Peak Wet Weather Flow,	405.0	424.0	590.1
PWWF L/s (MLD)	(35.0)	(36.6)	(51.0)

The BRES service area represents approximately a 39% increase in 2031 wastewater flows, above and beyond the current Region of Peel 2031 PWWF forecast of 424 L/s (36.6 MLD) for Bolton.

8.2.2 Rounding Out Areas

Preliminary population densities indicate that the Rounding Out Areas could potentially be developed as medium and higher density residential, and/or mixed use. The preferred water servicing strategies will need to address extension of servicing to the Rounding Out Areas.

Theoretical DWF, PDWF, and PWWF for the three ROAs were also calculated based on preliminary land use, population densities, area, and the criteria set out in Table 10. Wastewater flow estimates for DWF, PDWF, and PWWF conditions for the three Rounding Out Areas are summarized in Table 13.

Table 13. Wastewater Flows for Rounding Out Areas

Rounding Out Area	Area (Ha)[1]	Population (persons)[1]	Average DWF (L/s)	Peak DWF (L/s)	Peak WWF (L/s)
ROA1	18	1,759	6.1	22.2	25.8
ROA2	6	775	2.7	10.4	11.6
ROA3	7	614	2.1	8.4	9.8
Total	31	3,148	10.9	37.4	43.6

[1] Population estimates are based on available land area and density assumptions, provided by Meridian Planning.

8.3 Catchment Areas

8.3.1 BRES Area

The catchment through which BRES flows will be conveyed largely depends on the location of the expansion area, as extension of existing servicing will be required.

With Option 1, flows will potentially be conveyed via the North Hill (Bolton SPS catchment) to the existing Bolton SPS. From the Bolton SPS, flows could be conveyed via i) the existing forcemain to a future diversion sewer that will convey flows east to the Albion-Vaughan Trunk Sewer, or ii) a new forcemain that will pump flows east to the Albion-Vaughan Trunk Sewer. In either case, flows from Option 1 would largely be conveyed via the Albion-Vaughan Trunk Sewer to the McVean SPS.

There is also a local SPS catchment within the Option 1 area that would be required to overcome topography. A separate alternative for splitting Option 1 flows to drain east and west by gravity was considered but was screened out, as pumping would still be required downstream due to the crossing of the Humber River valley.

With Option 3, flows would be conveyed via the existing Coleraine Trunk Sewer (Coleraine Trunk Sewer catchment), which presently conveys all of Bolton's wastewater flow to the lake-based system. Another alternative considered was to convey all flows directly south to connect to a future Regional trunk sewer at Mayfield Road and Clarkway Drive. This strategy does not utilize any part of the existing collection system, as it would require a new primary collector along Humber Station Road.

No local SPSs are required within the Option 3 expansion area, as the area can be serviced by gravity alone.

It should be noted that the Albion-Vaughan Trunk Sewer diversion strategy will provide additional capacity within the sewers on McEwan Drive and Coleraine Drive and will benefit both Option 1 and Option 3 servicing strategies.

8.3.2 Rounding Out Areas

Given the location of the Rounding Out Areas, Rounding Out Areas 1 and 2 will likely be serviced by gravity via the Coleraine Trunk Sewer catchment, via extension of servicing from the North Hill West system along King Street. Rounding Out Area 2 will likely be serviced by gravity via extension of servicing from the North Hill / Bolton SPS catchment along Columbia Way.

Figure 8.depicts the potential independent wastewater servicing strategies for ROAs 1, 2 and 3. The strategies could proceed regardless of the preferred growth option. However, depending on the preferred growth option and the associated servicing strategy, the ROA servicing could be optimized. ROAs 1 and 3 could benefit from the preferred servicing for growth option 3. ROA 2 could benefit from the preferred servicing for growth option 1.

8.4 Pumping Requirements

8.4.1 Local Servicing

With Growth Option 1, there is one (1) local SPS required to overcome topography. This pumping station could be phased in as development occurs but will need to have an ultimate firm capacity of approximately 166 L/s.

There are no local pumping requirements with Option 3.

8.4.2 Trunk Servicing

With Growth Option 1, there is a need for upgrading the existing Bolton SPS, a large pumping station within the Peel East Trunk System.

The 2013 Master Plan has identified that the Bolton North Hill sanitary servicing will require utilization of available capacity at the Bolton SPS. As part of the Master Plan, review of existing operational data of the Bolton SPS was undertaken. This review indicated that existing peak flows have approached the firm rated capacity of the SPS. As such, the BRES expansion to the urban boundary tributary to the Bolton SPS will require expansion of the facility. Due to the age, site layout, and current state of the Bolton SPS, upgrades to this facility will be significant.

Servicing strategy and connection points would be optimized based on preferred servicing solution

New 250 mm diameter sewer required to connect to existing 250 mm diameter sewer at Columbia Way and Kingsview Drive

Connect to existing 250 mm diameter sewer on Harvest Moon Drive

Alternative Connection Point

Alternative Connection Point

New 250 mm diameter sewer required to connect to existing 375 mm diameter sewer on Coleraine Drive

Option 1

Option 1

Option 3

ROA1

ROA2

ROA3

INDIAN

HUMBER

CEDAR

DUFFYS

IGLASGOW

CHICKADEE

HUMBER STATION

BETOMAT

KING

TARQUINI

HUMBERSHED

LAMREE

DEANGELIS

FLINTWOOD

TRAILVIEW

HARVEST MOON

LOONTAIL

HEADWATER

LISMER

CEDARGROVE

EMILY CARR

IRONHORSE

FRANK JOHNSTON

GRAPEVINE

COLERAINE

BOWES

DE ROSE

TOMEL

BAMBI

DOEPATH

DEER VALLEY

FOUNDRY

HILLTOP

VALLEYVIEW

RIVERPARK

HESP

SACKVILLE

HICKMAN

WARBRICK

SLANCY

STERNE

ANN

CHAPEL

ELM

MILL

CENTENNIAL

QUEEN

BOLTON HEIGHTS

NATUREVIEW

SHANGRILA

CROSS COUNTRY

ENGLISH ROSE

GRAY PARK

MAPLE

WHITEHEAD

WRIGHT

KINGSVIEW

BIRCHVIEW

FOREST

SHERIN

HUMBER LEA

BRIDLEFIELD

COLEMAN

THORNBUR

TAY

HERSEY

Legend

- Proposed Sewer Extension
- Existing Sewage Pumping Station
- Local Collector Sewer (< 375 mm)
- Local Trunk Sewer (375 mm - 675 mm)
- Regional Trunk Sewer (> 675 mm)
- Study Area
- Parcel Fabric
- Urban Settlement Boundary
- Bolton Arterial Road
- Water Course
- Elevation Contour

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Figure 8
Extension of Wastewater Servicing to Rounding Out Areas

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9 Assessment of Future Stormwater Infrastructure

9.1 Stormwater

The future residential expansion lands will need to incorporate stormwater management measures to mitigate the hydrologic impacts of the proposed future urban development. Stormwater management targets to be applied will generally be defined by the Toronto and Region Conservation Authority (TRCA) Stormwater Management Criteria document (August 2012), and the MOE Stormwater Management Planning and Design Manual (March 2003).

The key control elements to be incorporated include the following:

- Water quality control;
- Erosion control;
- Flood (quantity) control;
- Water balance

Further description of the anticipated requirements for each of these controls is provided below.

9.1.1 Water Quality Control

In terms of water quality control, Level 1, or "Enhanced" water quality control is required. The MOE Stormwater Management Planning Manual defines the targets for water quality control. For stormwater management ponds servicing residential-type land uses (50% impervious), the following is required for water quality control:

- 140 m^3/ha of permanent pool storage; and
- 40 m^3/ha of active, extended detention storage.

It should be noted that the overall active storage required within the stormwater ponds will be governed by the larger requirements for flood control (see below). Therefore, the small amount of active storage specified above can be incorporated into the larger flood control storage requirements.

9.1.2 Erosion Control

Erosion control requirements are often determined based on the sensitivity and characteristics of the receiving streams. However, where detailed geomorphologic assessments and/or erosion threshold analyses are not available, a more general stormwater management target is often selected such that the majority of the most frequent storm events are captured and released at gradual flow rate.

Based on discussions with TRCA staff, it is recommended that, at this preliminary stage, erosion control targets similar to those applied in the recent 2012 Bolton Employment Lands Expansion Study be applied. For erosion control, sufficient extended detention storage is required within the future stormwater ponds to capture and release runoff from a 25mm storm event over 48 hours.

Assuming a runoff coefficient of 0.5 for future residential land uses, the following conceptual targets are identified:

- 125 m^3/ha of extended detention storage; and
- an average release rate of 0.72 L/s/ha.

It is understood that more detailed requirements may be defined once a preferred land use option is selected.

9.1.3 Flood Control

To prevent an increase in downstream flood flow rates, quantity control storage will be necessary to attenuate stormwater runoff from the proposed future urban lands to pre-development levels. Pre-development release rates for the Humber River watershed are defined through a series of unit flow relationships which were established as part of the 1997 Humber River Watershed Hydrology/Hydraulics and Stormwater Management Study. Based on discussions with TRCA staff, it is understood that these unit flow rates are expected to be updated as part of a current TRCA hydrologic modelling study for the Humber River Watershed. Further, TRCA anticipates that post-to-pre control will be required for a full range of flood events from the 2-year to 100-year storm and for the Regional Storm event.

The precise storage requirements for the residential expansion lands cannot be determined until the TRCA hydrologic modeling study is complete, however, based on experience from the recent 2012 Bolton Employment Lands Expansion Study, stormwater ponds designed for Regional Storm control are anticipated to require up to approximately 1,200 m^3/ha of extended detention storage, and occupy approximately 10% to 15% of the drainage areas which they serve.

9.1.4 Water Balance

The residential expansion lands will also require stormwater measures to minimize impacts to the overall hydrologic cycle, maintain the current water balance and groundwater recharge. It is anticipated that this will be accomplished through the use of low impact development (LID) source and conveyance control techniques within the future development lands which infiltrate, evapotranspirate, or re-use stormwater. Source control LIDs would be implemented on individual lots, while conveyance control LIDs would be incorporated into the overland flow routes between lots and/or within road rights-of-way.

The water balance target criteria will ultimately be chosen based on the current soils and groundwater recharge characteristics of the area, which are anticipated to be similar for both expansion Options 1 and Option 3. A design target of 5mm of retention was applied for LID measures in the recent 2012 Bolton Employment Lands Expansion Study.

9.1.5 Summary

In summary, it is anticipated that the water balance targets will be met through the use of LID source and conveyance control measures which will be incorporated into individual lots and/or roadways. The water quality control, erosion control, and flood control targets will be met through the use of permanent pool and extended detention storage within future stormwater management ponds.

10 Methodology

10.1 Evaluation Methodology

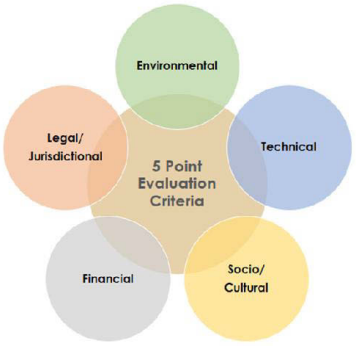
Following Phase 1 and 2 of the study, alternative water and wastewater servicing strategies identified and developed in further detail in Phase 3 (this report) of the study to allow for a comprehensive evaluation process.

Where applicable, servicing strategies were further subdivided into sub-components such as alignments/sites, which were in turn, subject to their own separate evaluation. As such, the evaluation process progressed from complete servicing strategies to individual alignments/sites. The progression from a high level to an increasing level of detail screened out non-feasible and unfavourable servicing strategies before being carried forward for detailed evaluation.

This process of infrastructure planning and decision making process is depicted in Figure 2.

10.1.1 Evaluation of Servicing Alternatives

Servicing strategies and appropriate alignments/sites were subject to a five-point evaluation, which focussed on five major areas of impact, including environmental, technical, socio/cultural, financial, and legal/jurisdictional.



The full evaluation process is documented in Appendix D.

The five-point evaluation criteria and its associated impacts are described in Table 14.

Table 14. Five-Point Evaluation Criteria for Strategy, Alignment and Site Evaluations

CRITERIA	DESCRIPTION
Technical Impact	• Describes any overall technical advantage/disadvantage to a strategy related to: • capacity requirements and level of service • performance under power outage conditions • alignments that can maximize a service area • utilization of existing infrastructure • Describes difficulty of construction (construction in limited/constrained areas, crossings, protection of utilities, trees or structures) • Assesses whether existing infrastructure upgrades are required • Describes risk considerations: - Level of security of water supply/transmission or wastewater treatment/conveyance - Considers impact of deep sewers versus sewage pumping stations • Describes the ability for phasing:

CRITERIA	DESCRIPTION
	• staged growth and maximizing the use of existing or planned infrastructure • incremental extensions of infrastructure as growth progresses • balanced infrastructure costs with staged level of growth (high-level comment) • Describes impact on the sizing of planned and existing infrastructure • Highlights trunk infrastructure that potentially should be oversized to benefit future growth • Comments on whether growth areas will need to be serviced by existing or new infrastructure • Compares relative sizing differences between alternatives • Describes the technical consideration required for construction: - Highlights need for deep pipe construction, creek/highway/railway crossings, alignment changes, and potential challenges during construction - Where applicable, comments on construction of projects that can be coordinated with road improvements or construction • Describes potential opportunities/constraints to servicing build out • Notes flexibility of servicing the mature state growth (post 2031)
Environmental Impact	• Describes the potential impacts of the servicing strategy on the natural environment, proximity to existing natural features and designations including but not limited to Greenbelt, Niagara Escarpment, ESAs, ANSIs, conservation authority regulation limits, vegetation, woodlands, wildlife, aquatic resources and fisheries • Highlights requirements for major environmental crossings, deep sewers, development through environmental designated areas, and requirements for mitigative action
Financial Impact	• Describes the capital cost relative to other servicing strategies • Considers construction costs for new infrastructure and for upgrades to existing system • Highlights major projects that differ from other servicing strategies that significantly contribute to the capital costs • Describes large up-front costs required for phasing of growth • Comments on post-construction impacts such as operation and maintenance costs and requirements, and compares to other servicing strategies
Legal/Jurisdictional Impact	• Notes any land requirement issues and agency concerns that may arise related to project alignments, land acquisition, planning permits, crossings etc. • Comments on compliance with Regional Guidelines and Policies • Describes the potential impacts related to opportunity or requirements for integrated planning, design, construction with other servicing such as bridge, road construction etc. • Notes if coordination with involved parties is required
Socio-Cultural Impact	• Describes the potential impacts to residents, archaeological/heritage resources, and visual aesthetics • Describes any potential noise, dust, vibrations, traffic disruptions to residents and businesses during and following construction

10.2 Scoring of Alternatives

Each strategy/alignment/site was scored based on the positive and negative aspects identified for each impact category using a rating system of high, medium, and low, where high is more favourable. The highest scoring strategy/alignment/site was selected as the preferred.

10.3 Costing Methodology

10.3.1 Overview

This section summarizes the methodology and assumptions utilized to derive the costs for the Bolton Residential Expansion Study (BRES) water and wastewater servicing strategies. The full costing is provided in Appendix C.

Costs were derived in 2013 dollars. It should be noted that these costs reflect BRES trunk infrastructure only and do not include internal servicing. The costs also do not include trunk infrastructure related to the Region of Peel Master Servicing Plan and Development Charge Programs. As such, the infrastructure is not currently carried in the Region capital plan.

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

Base costs for linear infrastructure were calculated based on length and unit cost. Unit costs varied based on diameter, depth of installation (for sewers), and nature of crossing. Vertical infrastructure such as pumping stations, elevated tanks, and reservoirs were calculated based on capacity (L/s) and or volume (ML or m^3).

Based on the linear and vertical unit rates, detailed costing sheets were developed to support the financial evaluation for each alignment, storage facility, pumping station, and storage facility. This costing sheet considers base costs, including: construction, geo-technical, property requirements, permit and approval requirements, overhead and project contingencies.

Construction/Urban Uplifts

An uplift to the total base cost was applied for projects where constructability challenges were foreseeable due to physical or environmental constraints. An uplift was applied to the base cost for projects in built-up areas. In part, the uplift was dependent on the existing land use, and proximity to residential / downtown areas.

Additional Costs

Additional Costs represent the sum of construction uplift, urban uplift, valves, crossings (minor creeks, major creeks, Regional Roads, railways, and trenchless crossings), construction contingency, geotechnical/hydrogeological and property/easements.

10.3.2 Linear Infrastructure

Linear unit rates were based on the 2013 Master Plan costs which were recently updated based using a peer review process. These unit rates are within the range of costs to be expected on competitively tendered jobs in the Region of Peel, accounting for add-ons that may be applied on a project specific basis (e.g. for urban areas, difficult construction conditions, and project-specific considerations). As such, these unit rates are considered appropriate for infrastructure planning purposes.

10.3.3 Vertical Infrastructure

Vertical unit rates were slightly modified from the 2013 Master Plan costs. After discussion with Region staff, it was felt that the cost estimates for some facilities, including sewage pumping stations, were too low than would be expected on competitively tendered jobs in the Region of Peel. As such, the unit rates for some facilities were increased. These unit rates are provided in Appendix C.

11 Alternative Water Servicing Strategies

11.1 Overview

This section presents the identification and evaluation of alternative water servicing strategies to service the two short-listed growth options: Option 1 and Option 3. The evaluation process undertaken follows the approach described in Section 10.1.

Each servicing strategy, as it is described herein, is considered a complete solution. Each servicing strategy was subject to the five-point evaluation.

From an infrastructure servicing standpoint, key differences between the strategies lie in pipe sizing, alignments, crossings, storage provision, and pumping requirements. However, there are also a lot of commonalities shared between each servicing strategy for each growth option. A generalized comparison between Option 1 and Option 3 was subsequently carried out, leveraging the analysis carried out in Phases 1 and 2 and incorporating servicing impacts determined through the technical analyses carried out in Phase 3 of the study.

11.2 Water Servicing - Option 1 vs Option 3

Table 15 summarizes the water servicing requirements for Option 1 and Option 3.

Table 15. Water Servicing Evaluation - Option 1 vs Option 3

	Option 1	Option 3
Technical	Will create new Zone 6A/7 service area and could augment Zone 6 near Columbia Way, which could enhance Level of Service in North Hill.	Will create new Zone 7 service area and could augment Zone 6 near Harvest Moon Dr, which could enhance Level of Service in North Hill West area.
	Ground elevations within service area require approximately 315m Top Water Level (TWL).	Ground elevations within service area require approximately 325m Top Water Level (TWL).
	For elevated floating storage, there is potential for a site located within service area, as ground elevations support a reasonable pedestal height to achieve required TWL.	For elevated floating storage, ground elevations to support this TWL at a reasonable pedestal height lie within 1.5 km outside the service area.
	Requires Zone 6A/7 booster pumping station, potential site near Rounding Out Area 3, east of the Chickadee Ln/Glasgow Rd intersection.	Requires Zone 7 booster pumping station, potential site near Rounding Out Area 3, east of the Chickadee Ln/Glasgow Rd intersection.
	Greater feedermain length required to supply Option 1 demands.	Less feedermain length required to supply Option 3 demands.
	Extension of water distribution network does not require any rail crossings.	Extension of water distribution network requires one (1) rail crossing on King St.
	Similar complexity in water servicing as Option 3.	Similar complexity in water servicing as Option 1.
Environmental	Extension of water distribution network requires crossing of the Humber River, Greenbelt, and TRCA lands. Increased potential for impact compared to Option 3.	Extension of water distribution network does not require crossing of the Humber River, Greenbelt, or other Natural Areas. Decreased potential for impact compared to Option 1.
	Growth area bounded by Greenbelt and Natural Area.	Growth area mainly bounded by existing agricultural land, and Greenbelt lands east of Humber Station Rd.
Social	Potential for elevated tank within the new service area. Potential for perceived visual impact caused by elevated tank in near proximity to Queen Street North (Highway 50).	Potential for elevated tank outside the new service area, and further removed from Gore Rd. Less potential for perceived visual impact caused by elevated tank outside service area.
		Greater opportunity to service existing land uses and specifically industrial lands adjacent to Option 3
	Easily accessible, just north of downtown core, located off of Queen Street North (Highway 50).	Located across future potential Go Station / Transit hub.
Financial	Higher water servicing costs than Option 3 due to longer feedermain length required to extend to service area.	Lower water servicing costs than Option 1 due to less feedermain length required to extend to service area.
Legal/ Jurisdiction	Requires site acquisition for elevated tank and booster pumping station.	Requires site acquisition for elevated tank, booster pumping station, and easement to access the elevated tank (outside service area).
	Potential need for Conservation Area Permits for feedermain works around Humber River crossing.	Minimal permitting requirements, relative to Option 1.

11.3 Alternative Water Servicing Strategies for Option 1 and Option 3

A long list of alternative servicing strategies was developed for each growth option. From the long list, three (3) strategies were short listed and were developed in more detail for Growth Option 1, and three (3) strategies were short listed and developed in more detail for Growth Option 3.

11.3.1 Growth Option 1 Water Strategies

OPTION 1 – STRATEGY 1
The Coleraine/B.A.R. feedermain consists of 1.0 km of 400 mm diameter Zone 6 feedermain on Coleraine / Glasgow Rd to the proposed Zone 6A/7 pumping station, plus another 4.4 km of 400 mm diameter Zone 6A/7 feedermain along the Bolton Arterial Road to reach the Option 1 elevated tank within the growth area. This alignment represents a total feedermain length of approximately 6.5 km, including trunk distribution feedermain.

Figure 9 depicts Option 1 – Strategy 1.

It is anticipated that the crossing of the Humber River along the Bolton Arterial Road will require either extensive trenchless installation or could potentially be suspended from the future bridge. Either method of installation will incur additional costs for construction and permitting, as this section crosses TRCA lands.

OPTION 1 – STRATEGY 2
The Innis Lake/King/B.A.R. feedermain consists of 6.8 km of 600 mm diameter Zone 5 feedermain from the Tullamore Zone 5 Pumping Station, along Innis Lake Road and King Street to the proposed Zone 6A/7 Pumping Station, plus another 4.3 km of 600 mm diameter (required to transfer max day plus fire demand) Zone 6A/7 feedermain on King Street and 3.7 km along the Bolton Arterial Road to reach the Option 1 growth area. This alignment represents a total feedermain length of approximately 15.9 km, including trunk distribution feedermain.

Figure 10 depicts Option 1 – Strategy 2.

It is anticipated that the crossing of the rail line on King Street will require a trenchless installation with permitting required from Canadian Pacific Railway. Furthermore, the crossing of the Humber River along the Bolton Arterial Road will require either extensive trenchless installation or could potentially be suspended from the future bridge. Either method of installation will incur additional costs for construction and permitting, as this section crosses TRCA lands.

This feedermain alignment provides opportunity for a longer term servicing strategy and presents a logical extension of Regional trunk infrastructure in Caledon. However, this strategy requires a longer term investment (with the extensive Zone 5 feedermain and Zone 5 Reservoir) that the Region is not in a position to commit to at this time. In terms of servicing needs, the Regional Zone 5 storage is sufficient to service long term growth in Brampton, such that additional storage provided by this new Zone 5 reservoir would be above and beyond current system requirements. There were also concerns with water quality related to prolonged residence time in the pipes along Innis Lake Road and turnover at the Zone 5 reservoir.

OPTION 1 – STRATEGY 3
The Innis Lake/King/B.A.R. feedermain consists of 6.8 km of 400 mm diameter Zone 6 feedermain from the Tullamore Zone 6 Pumping Station along Innis Lake Road and King Street to the proposed Zone 6A/7 Pumping Station, plus another 4.3 km of 400 mm diameter Zone 6A/7 feedermain on King Street and 3.7 km along the Bolton Arterial Road to reach the Option 1 elevated tank. This alignment represents a total feedermain length of approximately 15.9 km, including trunk distribution feedermain.

Figure 11 depicts Option 1 – Strategy 3.

This feedermain alignment shares many of the issues presented with Option 1 – Strategy 2 (Humber crossing and rail crossing). As such, it was not considered favourable.

11.3.2 Growth Option 3 Water Strategies

OPTION 3 – STRATEGY 1
The Coleraine/B.A.R. feedermain consists of 1.0 km of 400 mm diameter Zone 6 feedermain on Coleraine / Glasgow Rd to the proposed Zone 6A/7 pumping station, plus another 5.2 km of 400 mm diameter Zone 7 feedermain along King Street and the Bolton Arterial Road to reach the proposed site of the Option 3 elevated tank northwest of the growth area. This alignment represents a total feedermain length of approximately 7.8 km, including trunk distribution feedermain.

Figure 12 depicts Option 3 – Strategy 1.

It is anticipated that the crossing of the rail line on King Street will require a trenchless installation with permitting required from Canadian Pacific Railway.

OPTION 3 – STRATEGY 2
The Innis Lake/King/Gore feedermain consists of 6.8 km of 600 mm diameter feedermain from the Tullamore Zone 5 Pumping Station along Innis Lake King Road and King Street to the proposed Zone 6A/7 pumping station, plus another 3.3 km of 600 mm diameter (required to transfer max day plus fire demand) Zone 7 feedermain along King Street and Gore Road to reach the Option 3 growth area. This alignment represents a total feedermain length of approximately 10.1 km, including trunk distribution feedermain.

Figure 13 depicts Option 3 – Strategy 2.

OPTION 3 – STRATEGY 3
The Innis Lake/King/Gore feedermain consists of 6.8 km of 400 mm diameter Zone 6 feedermain from the Tullamore Zone 6 Pumping Station along Innis Lake King Road and King Street to the proposed Zone 6A/7 pumping station, plus another 5.2 km of 400 mm Zone 7 feedermain to reach the Option 3 elevated tank. This alignment represents a total feedermain length of approximately 13.6 km, including trunk distribution feedermain.

Figure 14 depicts Option 3 – Strategy 3.

11.3.3 Servicing of Rounding Out Areas

The three Rounding Out Areas were considered in the servicing analysis. Given the close proximity to the existing system, it is anticipated that ROA1 (Duffy's Lane/King Street), ROA2 (Queen Street North/Columbia Way), and ROA3 (Chickadee Lane/Glasgow Road) could potentially be serviced as follows (as shown in Figure 5):

- ROA1: via connection to the existing Zone 6 distribution network south of King Street. However given localized high points, this area would best be serviced via connection to a new pressure zone to ensure optimal level of service.
- ROA2: via connection to the newly installed Zone 6 North Bolton Feedermain on Queen Street North and Columbia Way.
- ROA3: via connection to the existing Zone 6 distribution network on Chickadee Lane.

11.3.4 Summary of Water Servicing Impacts

The following section summarizes the analysis undertaken for future 2031 conditions with servicing of the BRES growth area and the three Rounding Out Areas. The water modelling undertaken as part of the BRES was carried out using the full pipe Regional water model in InfoWater (Innovyze).

Levels of service in the BRES area under all the water servicing strategies were generally around 57 psi – 58 psi. Water modelling analyses indicate that pressures in Rounding Out Area 1, if connected to the existing Zone 6 distribution network, would be near the lower limit of acceptable level of service, at approximately 44 psi. Rounding Out Areas 2 and 3 were similar, hovering around 52 psi – 53 psi, assuming connection to the existing Zone 6 distribution system. Pressures to the Rounding Out Areas could be improved by connecting to the new pressure zone system.

All areas were considered within acceptable levels of service. The full water modelling analysis is provided in Appendix A.

11.3.5 Other Considerations

This section summarizes other servicing strategies that were considered but screened out through the study process.

Extension of the new North Bolton Feedermain on Queen Street North to service Option 1 lands. With this strategy, demands would be supplied through the urban core to a new Zone 6A/7 booster pumping station at Columbia Way and Queen Street North. Floating storage would be provided by an elevated tank at the north end of Option 1 area.

Hydraulic analysis was undertaken of the Bolton system to determine the impact on the existing and currently being constructed Zone 6 feedermains from the additional Option 1 demands. The analysis indicated that the water supply requirements, including demands and fire flows, exceeded the available capacity in the feedermains.

Furthermore, hydraulic modelling shows that the two feedermains supplying the new Zone 6A/7 BPS cannot support two concurrent fire events in the North Hill and the BRES growth area, while maintaining acceptable levels of service.

Innis Lake/Castlederg Feedermain to service Option 1 lands.
The Innis Lake / Castlederg feedermain alignment was screened out based on the extensive feedermain requirements associated with this servicing strategy. This alignment would require approximately 8.0 km of 400 mm Zone 6 feedermain from the Tullamore Zone 6 Pumping Station along Innis Lake Road to a future Zone 6 Reservoir at Castlederg Road, plus another 8.4 km to reach the Option 1 elevated tank. This alignment would represent a total feedermain length of approximately 17.6 km, including trunk distribution feedermain.

11.3.6 Servicing of Other Growth Areas

As part of the South Albion-Bolton Employment Servicing Plan, water and wastewater servicing recommendations were made for the future potential North Hill supermarket north of Columbia Way and the employment lands west of Coleraine Drive.

The potential North Hill supermarket water demands represent approximately 0.37 L/s under ADD, 0.74 L/s under MDD, and 1.11 L/s under PHD conditions. The supermarket would be serviced through connection to existing servicing at Columbia Way, east of Queen Street North. The employment lands west of Coleraine Drive represent approximately 18.14 L/s under ADD, 36.28 L/s under MDD, and 54.43 L/s under PHD conditions. The employment lands would be serviced through extension of infrastructure from Coleraine Drive

The base 2031 scenarios considered servicing to the North Hill supermarket under MDD conditions, and no major constraints were identified. From review of the hydraulic model, it was not clear how the future employment lands were modelled in the Region's base 2031 scenarios. Given that these employment lands fall outside the scope of this study, further analysis of these areas was not carried out.

11.4 Preferred Water Servicing Strategies for Option 1 and Option 3

Based on the evaluations carried out in Section 11.2 and Section 11.3, a preferred water servicing strategy was identified and capital costing was developed for Option 1 and Option 3.

The strategy with the highest overall score from the five-point strategy evaluation for Option 1 was:

- Option 1 – Strategy 1 (Water): Supply from Tullamore Zone 6 PS via Coleraine Drive and the Bolton Arterial Road, new BPS and elevated tank within Option 1 lands

The strategy with the highest overall score from the five-point strategy evaluation for Option 3 was:

- Option 3 – Strategy 1 (Water): Supply from Tullamore Zone 6 PS through Coleraine Drive, new BPS and elevated tank outside Option 3 lands

The preferred Option 1 water and wastewater costing and implementation plan is provided in Appendix F. It is recommended that all water infrastructure required to service Option 1 and Option 3, including feedermains, booster pumping stations, and storage be in service on day 1, as there could be some but limited ability to phase in infrastructure as development progresses.

Table 16. Water Servicing Strategies (Option 1) Evaluation Table

OPTION 1	WATER SERVICING STRATEGY DESCRIPTION	PUMPING REQUIREMENTS	STORAGE REQUIREMENTS	FEEDERMAIN / WATERMAIN REQUIREMENTS	ENVIRONMENTAL CROSSINGS	REGIONAL ROAD / RAIL CROSSINGS	LAND ACQUISITION REQUIREMENTS	VISUAL IMPACTS	TRANSPORTATION IMPACTS	PERMIT REQUIREMENTS	FINANCIAL COST	KEY ISSUES / CONSTRAINTS	OVERALL RATING
STRATEGY 1	Supply from Tullamore Zone 6 Pumping Station, via Coleraine Dr / Chickadee Ln to the new booster pumping station to service Option 1, supply along Coleraine Dr / B.A.R., with floating storage provided by an elevated tank located within the Option 1 lands.	Zone 6A/7 BPS, Cap=80 L/s	Zone 6A E.T. - TWL @ 315m - Cap = 5.1 ML (potential for shorter pedestal height than Option 3).	400mm, on Coleraine / B.A.R., requires total of 6.11km of feedermain.	One (1) major creek crossing, Four (4) minor creek crossings. One (1) Greenbelt crossing.	No rail crossings. One (1) Regional Rd crossing (King).	PS ~ 0.50 ha E.T. ~ 1.25 ha Total ~ 1.75 ha	Potential for perceived visual impact caused by elevated tank within service area.	Construction could cause temporary traffic disruption to the following roads: Coleraine Dr (north limit), King St, and the B.A.R.	B.A.R. feedermain will potentially require permitting and approvals from TRCA.	$38.92M (open-cut) $48.22 M (trenchless)	Ability to augment existing Zone 6 local Northwest area and potentially North Hill. High contingency related to B.A.R. feedermain and Humber River crossing. B.A.R. feedermain will likely require trenchless (~1080m) installation.	High
STRATEGY 2	Supply from Tullamore Zone 5 Pumping Station, via Innis Lake Rd to a new pumping station on King Street, supply along King St / B.A.R., with pumped storage provided by in-ground Zone 5 reservoir to service Option 1 lands.	Zone 6A/7 BPS, Cap=300 L/s	Zone 5 RES - Cap = 7.0 ML (potential for low turnover, which could lead to water quality issues).	600mm, on Innis Lake / King / B.A.R., requires total of 15.94km of feedermain.	One (1) major creek crossing, Fourteen (14) minor creek crossings. Two (2) Greenbelt crossings.	One (1) rail crossing. Two (2) Regional Rd crossings (King, Gore & Hwy 50)	PS ~ 0.50 ha RES ~ 2.00 ha Total ~ 2.50 ha	None.	Construction could cause temporary traffic disruption to the following roads: Innis Lake Rd, King St, and the B.A.R.	B.A.R. feedermain will potentially require permitting and approvals from TRCA.	$88.11 M	Leverages opportunity to service future potential west Caledon expansion areas. Pumped storage not considered favourable from a storage and life cycle standpoint.	Low
STRATEGY 3	Supply from Tullamore Zone 5 Pumping Station, via Innis Lake Rd to a new pumping station on King Street, supply along King St / B.A.R., with in-ground storage provided by Zone 5 reservoir and floating storage provided by an elevated tank located within the Option 1 lands.	Zone 6A/7 BPS, Cap=80 L/s	Zone 5 RES - Cap = 7.0 ML Zone 6A E.T. - TWL @ 315m - Cap = 5.1 ML (potential for shorter pedestal height than Option 3).	400mm, on Innis Lake Rd / King St / B.A.R., requires total of 16.60km of feedermain.	One (1) major creek crossing, Fourteen (14) minor creek crossings. Two (2) Greenbelt crossings.	One (1) rail crossing. Two (2) Regional Rd crossings (King & Gore)	PS ~ 0.50 ha E.T. ~ 1.25 ha RES ~ 2.00 ha Total ~ 3.75 ha	Potential for perceived visual impact caused by elevated tank within service area. If reservoir is partially in-ground, minimal potential for visual impact.	Construction could cause temporary traffic disruption to the following roads: Innis Lake Rd, King St, and the B.A.R.	B.A.R. feedermain will potentially require permitting and approvals from TRCA.	$81.90 M	Leverages opportunity to service future potential west Caledon expansion areas.	Medium

OPTION 1 - WATER - SUMMARY OF SCORING

STRATEGY 1	Good	Good	Good	Good	Good	Good	Good	Neutral	Neutral	Poor	Overall Good
STRATEGY 2	Good	Neutral	Neutral	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Overall Poor
STRATEGY 3	Good	Neutral	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Overall Poor

Table 17. Water Servicing Strategies (Option 3) Evaluation Table

OPTION 3	WATER SERVICING STRATEGY DESCRIPTION	PUMPING REQUIREMENTS	STORAGE REQUIREMENTS	FEEDERMAIN / WATERMAIN REQUIREMENTS	ENVIRONMENTAL CROSSINGS	REGIONAL ROAD / RAIL CROSSINGS	LAND ACQUISITION REQUIREMENTS	VISUAL IMPACTS	TRANSPORTATION IMPACTS	PERMIT REQUIREMENTS	FINANCIAL COST	KEY ISSUES / CONSTRAINTS	OVERALL RATING
STRATEGY 1	Supply from Tullamore Zone 6 Pumping Station, via Coleraine Dr/ Chickadee Ln to the new booster pumping station to service Option 3, supply along King St/Gore Rd, with floating storage provided by an elevated tank located outside Option 3 lands.	Zone 6A/7 BPS, Cap=80 L/s	Zone 7 E.T. - TWL @ 327.7m - Cap = 5.1 ML (potential for taller pedestal height than Option 1).	400mm, on Coleraine / King / Gore, requires total of 7.78km of feedermain.	No major creek crossings. Seven (7) minor creek crossings. No Greenbelt crossings.	One (1) rail crossing. Two (2) Regional Rd crossings (King St & The Gore Rd).	PS ~ 0.50 ha E.T. ~ 1.25 ha Easement ~ 2.00 ha Total ~ 3.75 ha	Potential for perceived visual impact caused by elevated tank on surrounding landowners. Closest potential site is just west off Gore Rd.	Construction could cause temporary traffic disruption to the following roads: Coleraine Dr (north limit), King St, and Gore Rd.	None.	$36.56 M	Ability to augment existing Zone 6 local Northwest area. Opportunity to service existing land uses, specifically industrial lands adjacent to Option 3 area.	High
STRATEGY 2	Supply from Tullamore Zone 5 Pumping Station, via Innis Lake Rd to a new pumping station on King Street, supply along King St/Gore Rd, pumped storage provided by in-ground Zone 5 reservoir to service Option 3 lands.	Zone 6A/7 BPS, Cap=300 L/s	Zone 5 RES - Cap = 7.0 ML (potential for low turnover, which could lead to water quality issues).	600mm, on Innis Lake / King St / Gore, requires 10.08km of feedermain.	No major creek crossings. Seven (7) minor creek crossings. One (1) Greenbelt crossing.	No rail crossings. One (1) Regional Rd crossing (King).	PS ~ 0.50 ha RES ~ 2.00 ha Total ~ 2.50 ha	None.	Construction could cause temporary traffic disruption to the following roads: Innis Lake Rd, King St, and Gore Rd.	None.	$51.51 M	Leverages opportunity to service future potential west Caledon expansion areas. Pumped storage not considered favourable from a storage and life cycle standpoint.	Medium
STRATEGY 3	Supply from Tullamore Zone 5 Pumping Station, via Innis Lake Rd to a new pumping station on King Street, supply along King St/Gore Rd, in-ground storage provided by Zone 5 reservoir, with floating storage provided by an elevated tank located within the Option 3 lands.	Zone 6A/7 BPS, Cap=80 L/s	Zone 5 RES - Cap = 7.0 ML Zone 7 E.T. - TWL @ 327.7m - Cap = 5.1 ML (potential for taller pedestal height than Option 1).	400mm, on Innis Lake / King / Gore, requires 13.56km of feedermain.	No major creek crossings. Seven (7) minor creek crossings. One (1) Greenbelt crossing.	No rail crossings. Two (2) Regional Rd crossings (King St & The Gore Rd).	PS ~ 0.50 ha E.T. ~ 1.25 ha RES ~ 2.00 ha Easement ~2.00 ha Total ~ 5.75 ha	Potential for perceived visual impact caused by elevated tank on surrounding landowners. Closest potential site is just west off Gore Rd. If reservoir is partially in-ground, minimal potential for visual impact.	Construction could cause temporary traffic disruption to the following roads: Innis Lake Rd, King St, and Gore Rd.	None.	$62.10 M	Leverages opportunity to service future potential west Caledon expansion areas.	Low

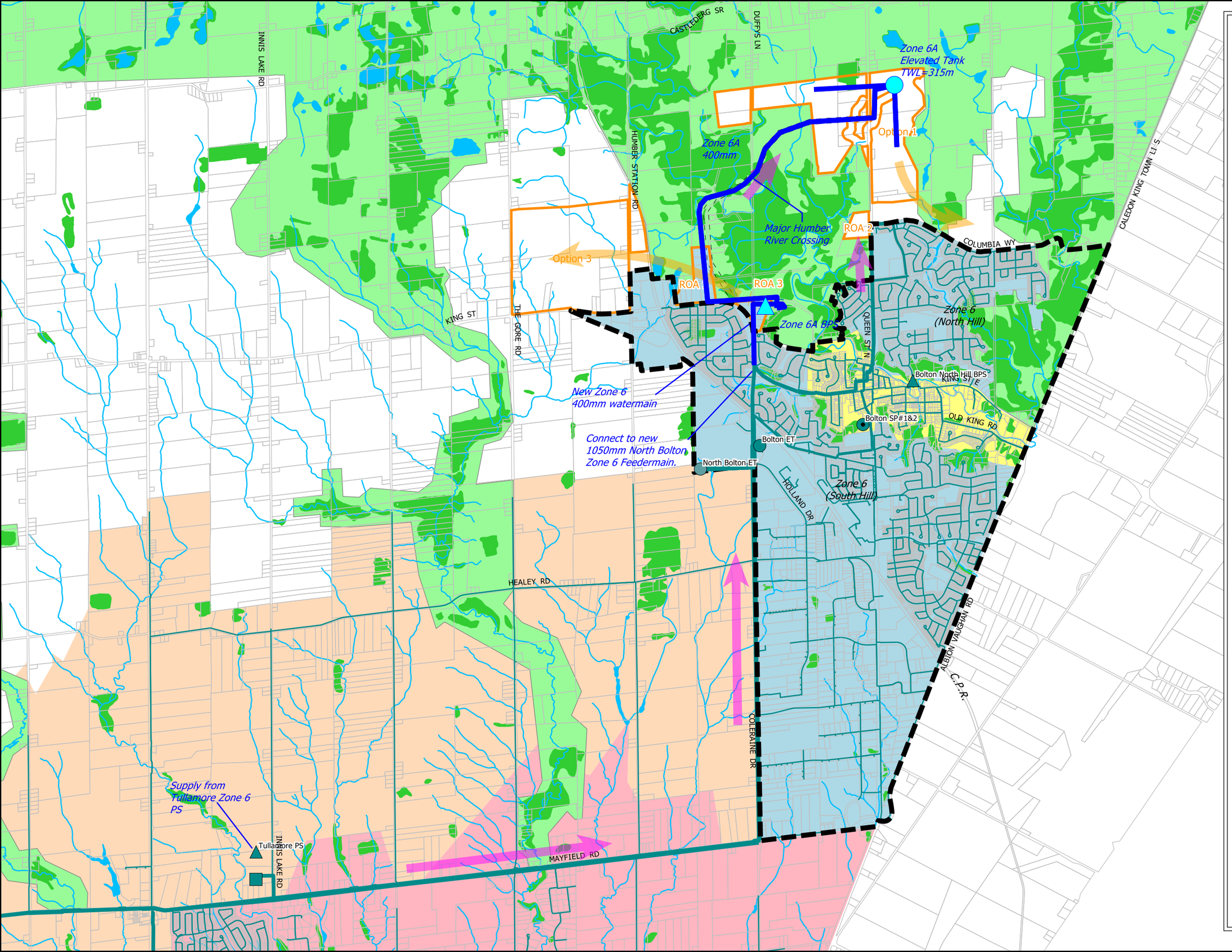


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Figure 9
Water Servicing Strategy for
Option 1 - Strategy 1

- Schematic Flow
- Future Schematic Flow

Proposed Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Proposed Watermain

Existing Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Standpipe
- Minor Local Watermain
- Major Local Water Main
- Transmission Main
- Bolton Arterial Road
- Roads
- Pressure Zone 5B
- Pressure Zone 5E
- Pressure Zone 6B
- Pressure Zone 6E
- Study Area
- Parcel Fabric
- Woodlands
- Greenbelt
- Water Course
- Water Bodies
- Urban Settlement Boundary

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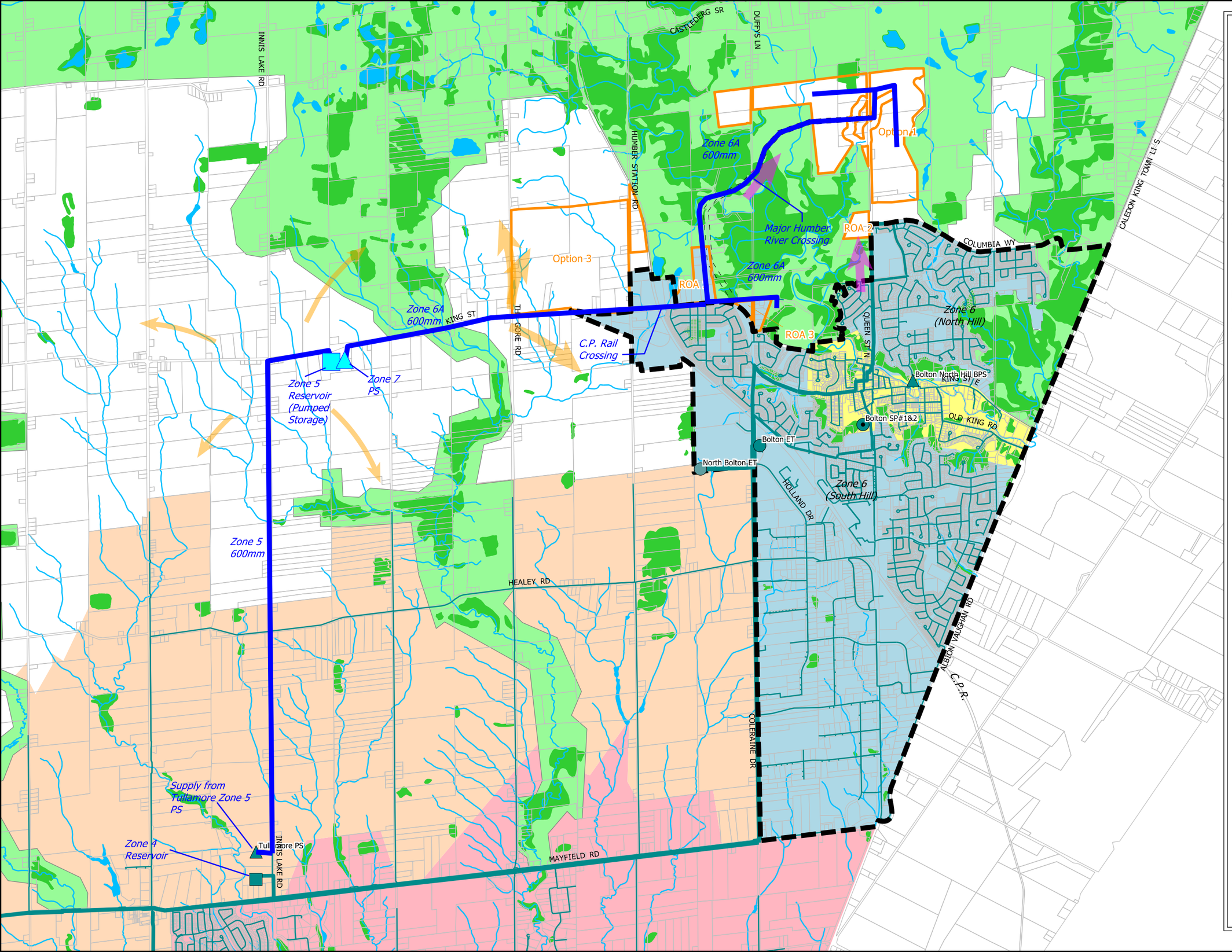

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Figure 10
Water Servicing Strategy for
Option 1 - Strategy 2

- Schematic Flow
- Future Schematic Flow

Proposed Water Facilities

- Pumping Station
- Elevated Tank
- Reservoir
- Proposed Watermain

Existing Water Facilities

- Pumping Station
- Elevated Tank
- Reservoir
- Standpipe
- Minor Local Watermain
- Major Local Water Main
- Transmission Main
- Bolton Arterial Road
- Roads
- Pressure Zone 5B
- Pressure Zone 5E
- Pressure Zone 6B
- Pressure Zone 6E
- Study Area
- Parcel Fabric
- Woodlands
- Greenbelt
- Water Course
- Water Bodies
- Urban Settlement Boundary

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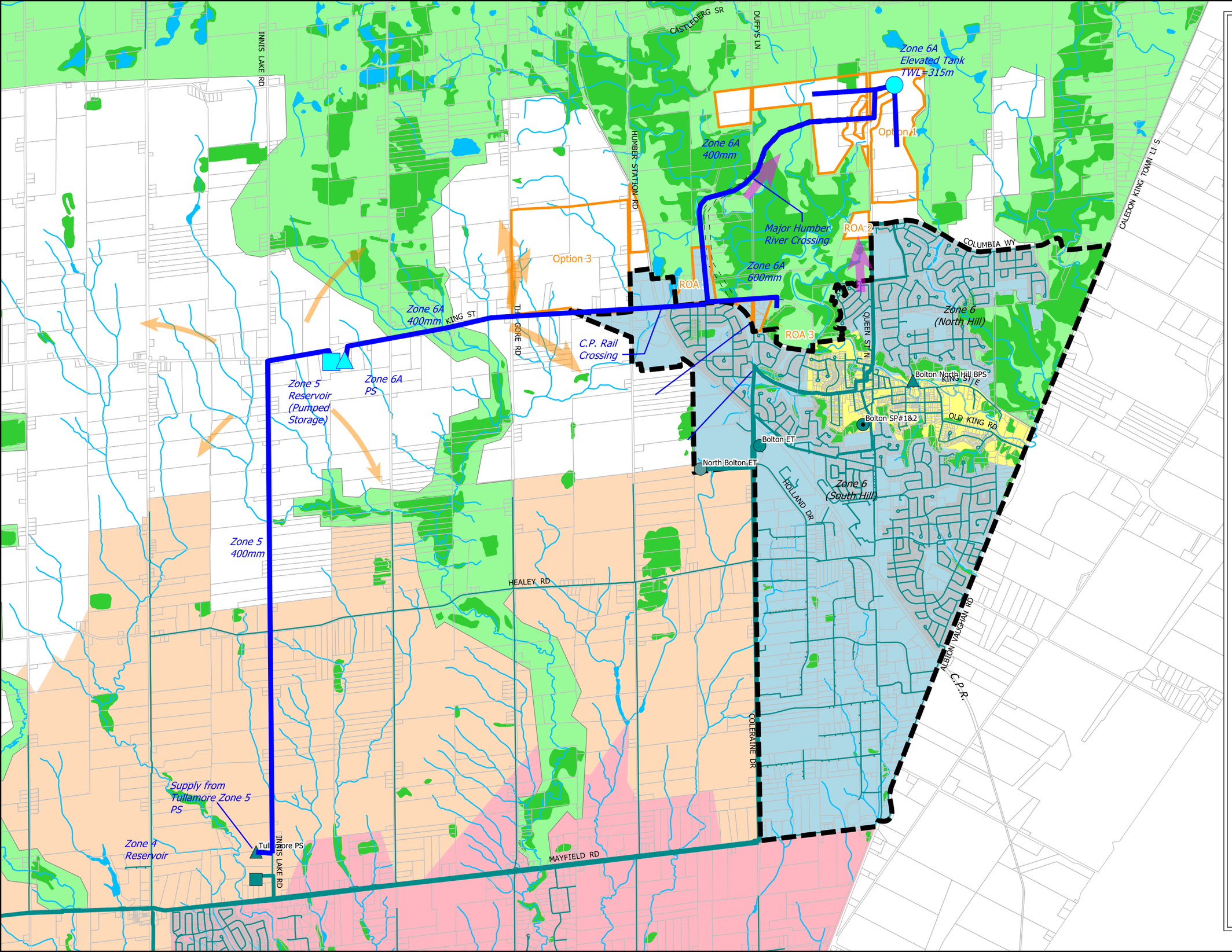

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Figure 11
Water Servicing Strategy for
Option 1 - Strategy 3

- Schematic Flow
- Future Schematic Flow

Proposed Water Facilities

- Pumping Station
- Elevated Tank
- Reservoir
- Proposed Watermain

Existing Water Facilities

- Pumping Station
- Elevated Tank
- Reservoir
- Standpipe
- Minor Local Watermain
- Major Local Water Main
- Transmission Main
- Bolton Arterial Road
- Roads
- Pressure Zone 5B
- Pressure Zone 5E
- Pressure Zone 6B
- Pressure Zone 6E
- Study Area
- Parcel Fabric
- Woodlands
- Greenbelt
- Water Course
- Water Bodies
- Urban Settlement Boundary

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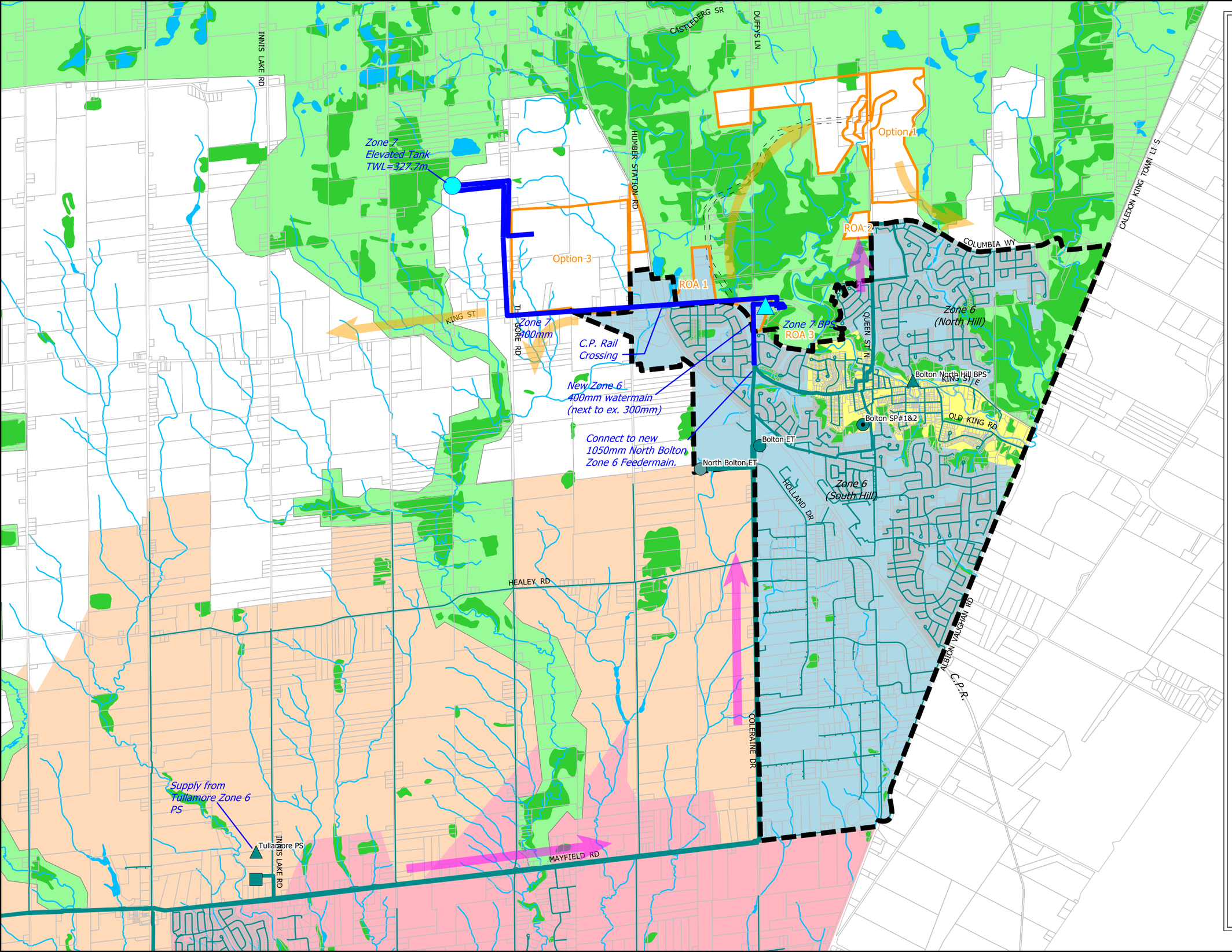

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Figure 12
Water Servicing Strategy for
Option 3 - Strategy 1

- Schematic Flow
- Future Schematic Flow

Proposed Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Proposed Watermain

Existing Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Standpipe
- Minor Local Watermain
- Major Local Water Main
- Transmission Main
- Bolton Arterial Road
- Roads
- Pressure Zone 5B
- Pressure Zone 5E
- Pressure Zone 6B
- Pressure Zone 6E
- Study Area
- Parcel Fabric
- Woodlands
- Greenbelt
- Water Course
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- Urban Settlement Boundary

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Figure 13
Water Servicing Strategy for
Option 3 - Strategy 2

- Schematic Flow
- Future Schematic Flow

Proposed Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Proposed Watermain

Existing Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Standpipe
- Minor Local Watermain
- Major Local Water Main
- Transmission Main
- Bolton Arterial Road
- Roads
- Pressure Zone 5B
- Pressure Zone 5E
- Pressure Zone 6B
- Pressure Zone 6E
- Study Area
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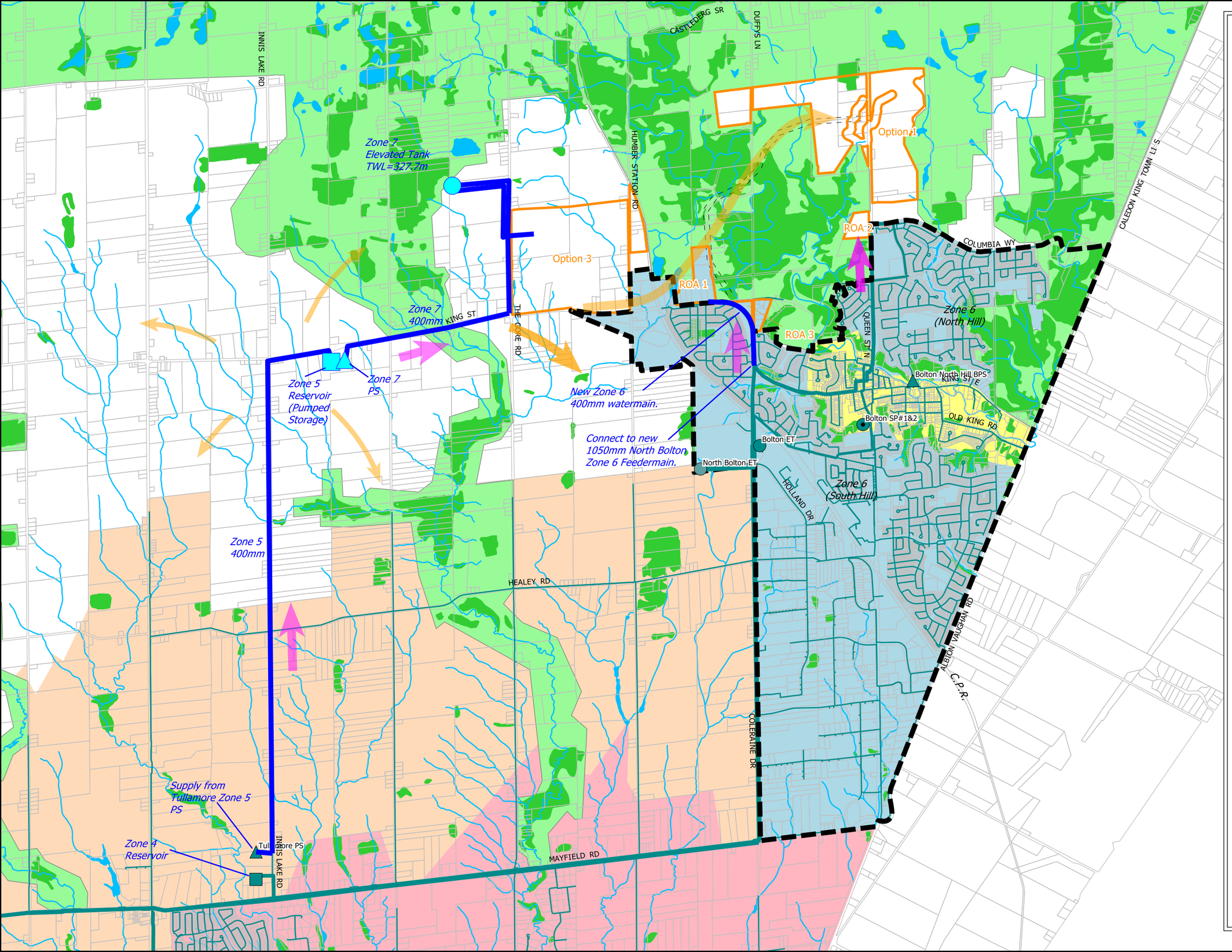

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Figure 14
Water Servicing Strategy for
Option 3 - Strategy 3

- Schematic Flow
- Future Schematic Flow

Proposed Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Proposed Watermain

Existing Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Standpipe
- Minor Local Watermain
- Major Local Water Main
- Transmission Main
- Bolton Arterial Road
- Roads
- Pressure Zone 5B
- Pressure Zone 5E
- Pressure Zone 6B
- Pressure Zone 6E
- Study Area
- Parcel Fabric
- Woodlands
- Greenbelt
- Water Course
- Water Bodies
- Urban Settlement Boundary

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12 Alternative Wastewater Servicing Strategies

12.1 Overview

This section presents the identification and evaluation of alternative wastewater servicing strategies to service the two short-listed growth options: Option 1 and Option 3. The evaluation process undertaken follows the approach described in Section 10.1.

Each servicing strategy, as it is described herein, is considered a complete solution and was subject to the five-point evaluation.

From an infrastructure servicing standpoint, key differences between the strategies lie in pipe sizing, alignments, crossings, storage provision, and pumping requirements. However, there are also a lot of commonalities shared between each servicing strategy for each growth option. For example, the main difference between some of the wastewater servicing strategies is the alignment of sewer twinning, with all other pumping and forcemain requirements being equal. As such, a separate sewer twinning evaluation was undertaken in efforts to present the evaluation in a clear and concise manner.

12.2 Objective of Hydraulic Wastewater Servicing Analysis

The objective of the hydraulic analysis was to identify alternatives for servicing the preferred growth option and select a strategy that considers the following key aspects of servicing impacts including:

- Impact of existing level of service
- Impact of wastewater flow diversions
- Flexibility of servicing
- Complexity and cost of infrastructure upgrades
- Opportunity to support long term servicing of other growth areas

12.3 Wastewater Servicing – Option 1 vs Option 3

Table 18 summarizes the wastewater servicing requirements for Option 1 against those of Option 3.

Table 18. Wastewater Servicing Evaluation – Option 1 vs Option 3

	Option 1	Option 3
Technical	Requires one (1) local sewage pumping station within the service area to overcome topography.	Internal and external servicing may be achieved by gravity sewers only.
	Bolton SPS will require major expansion to pump additional growth flows. Forcemain will also need to be upgraded, via a new forcemain or twinning of the existing forcemain.	Bolton SPS does not require any upgrades.
	New service area will connect to existing urban core system.	New service area will avoid the need to connect to the urban core system. Connection to the Coleraine trunk sewer will maximize use of capacity in existing sewer and will avoid new long trunk sewer to future sewer at Mayfield Rd/Humber Station Rd.
	Requires more wastewater upgrades than Option 3 and is more complex than Option 3 servicing.	Requires fewer wastewater upgrades than Option 1 and is less complex than Option 1 servicing.
	Upgrades to existing infrastructure in urban core will present higher potential for conflict with existing utilities compared to Options 3 which minimizes urban core upgrades.	Minimizes need for urban core upgrades and thus lower potential for conflict with existing utilities compared to Option 1.
	Wastewater collection network upgrades do not require any rail crossings.	Wastewater collection network upgrades require one (1) rail crossing on King St.
	Upgrades to North Hill collection system would benefit expansion areas north of Columbia Way	Coleraine Trunk Sewer twinning provides greater flexibility to coordinate with post-period needs
Environmental	Extension of wastewater collection network and system upgrades requires a few minor crossings of the Humber River, including the siphon at Humber Lea Rd and Old King Rd. Increased potential for impact compared to Options 3.	Extension of wastewater collection network and system upgrades does not require crossing of the Humber River. Decreased potential for impact compared to Option 1.
	Wastewater servicing requires major expansion of the Bolton SPS and one (1) new local pumping station. Greater environmental impacts associated with increase in pumping requirements (i.e. increased energy usage and greenhouse gas emissions).	Wastewater servicing does not require any pumping station upgrades and can be serviced locally by gravity only. Less environmental impacts than Option 1.
	Growth area bounded by Greenbelt and Natural Area.	Growth area mainly bounded by existing agricultural land, and Greenbelt lands east of Humber Station Rd.
Socio/ Cultural	Potential need for infrastructure upgrades within the existing urban core creates higher potential for disturbance (noise, dust, traffic) due to construction.	Ability to avoid urban core and thus lower potential for disturbance (noise, dust, traffic) due to construction.

	Option 1	Option 3
	Option 1 is easily accessible, just north of downtown core, located off of Queen Street North (Highway 50).	Located across future potential Go Station / transit hub.
Financial	Higher wastewater servicing costs than Option 3 due to need for one local pumping station and forcemain, and need for major expansion at Bolton SPS and new forcemain.	Lower wastewater servicing costs than Option 1 due to ability to drain by gravity within and outside growth option. Opportunity to oversize sewer for potential future growth within Caledon expansion areas. Savings in cost due to lack of pumping upgrade requirements."
Legal/ Jurisdiction	Requires site acquisition for one (1) sewage pumping station.	No site acquisitions required.
	Potential need for Conservation Area Permits for wastewater collection upgrades around Humber River.	Minimal permitting requirements, relative to Option 1.

12.4 Alternative Wastewater Servicing Strategies for Option 1 and Option 3

A long list of alternative servicing strategies was developed for each growth option. From the long list, five (5) wastewater strategies were short listed and were developed in more detail for Growth Option 1, and six (6) strategies were short listed and developed in more detail for Growth Option 3.

As with water, many of these servicing strategies share commonalities. As such, servicing alternatives including sewer twinning in the North Hill East and the North Hill West systems were evaluated separately.

It is important to note that all servicing strategies assume the current (baseline) Regional wastewater servicing strategy of diverting flows to the Albion-Vaughan Trunk Sewer via gravity connection at Queensgate Boulevard and Landsbridge Street. This strategy was confirmed through discussions with the Region and is part of the 2014 DC Wastewater Capital Program. The DC Water and Wastewater Capital Programs are provided in Appendix E. Ultimately, the strategy will add relief capacity to sewers downstream of Queensgate Blvd/Landsbridge St, namely the Coleraine Trunk Sewer.

The wastewater servicing strategies are described in the following sections.

12.4.1 Growth Option 1 Wastewater Strategies

OPTION 1 – STRATEGY 1

Convey Option 1 growth flows via twinned sewers in the existing to the Bolton SPS. Expand the Bolton SPS, twin existing forcemain, and twin downstream sewers to Queensgate Blvd and Landsbridge St.

OPTION 1 – STRATEGY 2

Convey Option 1 growth flows via twinned sewers (three alternative routes A, B, and C) in the existing North Hill system to the Bolton SPS. Expand the Bolton SPS, install new forcemain to convey flows and discharge to Albion-Vaughan Trunk Sewer.

OPTION 1 – STRATEGY 3

Convey Option 1 growth flows via new collection system along Columbia Way / Albion-Vaughan Road. Two (2) new pumping stations and two (2) new forcemains would potentially be required. All growth flows would discharge to the Albion-Vaughan Trunk Sewer, bypassing urban core.

12.4.2 Growth Option 3 Wastewater Strategies

OPTION 3 – STRATEGY 1

Convey Option 3 growth flows via new sewer along future easement south of C.P.R. Connect to existing Coleraine Trunk Sewer, south of rail line and twin down to north of George Bolton Parkway.

OPTION 3 – STRATEGY 2

Convey Option 3 growth flows via new sewer along King Street and Coleraine Drive. Connect to existing Coleraine Trunk Sewer north of Harvest Moon Drive and twin down to north of George Bolton Parkway.

OPTION 3 – STRATEGY 3

Convey Option 3 growth flows via twinned sewers (two alternative routes A & B) in the existing North Hill West system. Connect to existing Coleraine Trunk Sewer north of Harvest Moon Drive and twin down to north of George Bolton Parkway.

OPTION 3 – STRATEGY 4

Convey Option 3 growth flows via new sewer along Humber Station Road and Healey Road. Connect to existing Coleraine Trunk Sewer at Healey Road and twin down to north of George Bolton Parkway.

OPTION 3 – STRATEGY 5A

Convey Option 3 growth flows via new primary collector along future potential easement west of Coleraine Drive, bypassing existing system, to connect to future sewer at Mayfield Road and Clarkway Drive.

OPTION 3 – STRATEGY 5B

Convey Option 3 growth flows via new primary collector along Humber Station Rd, bypassing existing system, to connect to future sewer at Mayfield Road and Clarkway Drive.

The wastewater servicing strategies are depicted in Figure 15 to Figure 23 at the end of this section.

12.4.3 Servicing of Rounding Out Areas

The three Rounding Out Areas were considered in the servicing analysis. Given the close proximity to the existing system, it is anticipated that ROA1 (Duffy's Lane/King Street), ROA2 (Queen Street North/Columbia Way), and ROA3 (Chickadee Lane/Glasgow Road) will potentially be serviced as follows (as shown in Figure 8):

- ROA1: via connection to the Harvest Moon Drive sewer south of King Street. From here, flows would be conveyed via Harvest Moon Drive to the Coleraine Trunk Sewer.
- ROA2: via connection to a future sewer extension on Columbia Way, west of Kingsview Drive. From here flows would be conveyed via the Kingsview Drive/Taylorwood Avenue route to the Bolton SPS.
- ROA3: via connection to a future sewer extension north of Coleraine Drive and Harvest Moon Drive. From here flows would be conveyed via the Coleraine Trunk Sewer. Alternative connection points are also shown in Figure 8.

12.4.4 Summary of Wastewater Servicing Impacts

Hydraulic analysis and wastewater modelling was undertaken to assess existing and future (2031) impacts from the BRES expansion area and Rounding Out Areas. The wastewater modelling undertaken as part of the BRES was carried out using the full pipe Regional wastewater model in InfoWorks CS (Innovyze). Separate scenarios were set up in the model to determine impacts on the existing collection system. Growth Option 1 will likely be tributary to the Bolton SPS and will impact conveyance capacities in the upstream North Hill sewers. The BRES flow of 166 L/s exceeds capacities in the North Hill system and as such, sewer twinning will be required to convey flows to the Bolton SPS. Given that peak flows are said to be approaching the firm rated capacity of the Bolton SPS, the BRES expansion in Growth Option 1 will also trigger an expansion of the facility.

Growth Option 3 will likely be tributary to the Coleraine Trunk Sewer. The additional BRES flow of 166 L/s exceeds capacities in the upper reaches of the Coleraine Trunk Sewer, between Harvest Moon Drive and McEwan Drive, and as such, twinning of the Coleraine Trunk Sewer will be required north of the McEwan sewer connection point.

Further details of the wastewater servicing impacts are summarized in Table 19 and Table 20. The full wastewater modelling analysis is provided in Appendix B.

12.4.5 Sewer Twinning Alternatives

Various alternatives were considered for the servicing strategies involving sewer twinning in the North Hill.

Three (3) distinct sewer twinning routes were identified and evaluated in the North Hill (east) to service Option 1 growth:

- Sewer Twinning Route A (via Taylorwood Avenue): This alignment meanders through the North Hill, starting at Kingsview Drive and Columbia Way, continuing along Taylorwood Avenue, and ending at the Bolton SPS south of Old King Road. This route is the closest point of connection to the existing system.
- Sewer Twinning Route B (via Kingsview Drive): This alignment requires a new sewer on Queen Street North to connect to the existing sewer at Kingsview Drive and Bolton Heights Drive, and would convey flows south to the Bolton SPS.
- Sewer Twinning Route C (via Cross Country Boulevard): This alignment requires a new sewer on Queen Street North to connect to the existing sewer at Cross Country Boulevard

and Bolton Heights Drive, and would convey flows from west of Queen Street North to the Bolton SPS.

It should be noted that splitting the growth flows amongst the three sewer twinning routes in the North Hill does not eliminate the trigger for sewer conveyance upgrades. At least one of the routes in the North Hill would require twinning as the combined conveyance capacities are not sufficient to support the required BRES flows.

Two (2) distinct sewer twinning routes were identified and evaluated in the North Hill (west) to service Option 3 growth:

- Sewer Twinning Route A (via Cedargrove Road): This alignment requires a new sewer on King Street to connect to the existing sewer on Tarquini Crescent, and would convey flows via Cedargrove Road to connect to the Coleraine Trunk Sewer north of Harvest Moon Drive / Coleraine Drive. The minimum available spare capacity along Route A is approximately 36 L/s.
- Sewer Twinning Route B (via Harvest Moon Drive): This alignment requires a new sewer on King Street to connect to the existing sewer on Tarquini Crescent, and would convey flows via Harvest Moon Drive to connect to the Coleraine Trunk Sewer north of Harvest Moon Drive / Coleraine Drive. The minimum available spare capacity along Route B is approximately 35 L/s.

The sewer twinning alternatives are further described in the Wastewater Servicing Strategies Evaluation found in Table 19.

12.4.6 Other Considerations

This section summarizes other servicing strategies considered through the study process.

An alternative servicing strategy to split Option 1 flows to drain east via Queen Street North and through the North Hill, and west via the Bolton Arterial Road and Coleraine Drive was considered. However, this alternative would still require pumping along the Bolton Arterial Road as flows cross the Humber River Valley. As such, this alternative servicing strategy was screened out for further evaluation.

12.4.7 Servicing of Other Growth Areas

As part of the South Albion-Bolton Employment Servicing Plan, water and wastewater servicing recommendations were made for the future potential North Hill supermarket north of Columbia Way and the employment lands west of Coleraine Drive.

The potential North Hill supermarket wastewater flows represent approximately 0.40 L/s under average DWF, 1.68 L/s under peak DWF, and 2.68 L/s under peak WWF conditions. The supermarket would be serviced through connection to the existing sewer on Kingsview Drive, south of Columbia Way.

The employment lands west of Coleraine Drive represent approximately 19.44 L/s under average DWF, 62.18 L/s under peak DWF, and 118.85 L/s under peak WWF conditions. The employment lands could potentially be serviced through extension of infrastructure from Coleraine Drive or via a new primary collector west of Coleraine Drive.

Given that these other growth areas fall outside the scope of this study, further analysis of these areas was not carried out.

12.5 Preferred Wastewater Servicing Strategies for Option 1 and Option 3

Based on the evaluations carried out in Section 12.3 and Section 12.4, a preferred wastewater servicing strategy was identified and capital costing was developed for Option 1 and Option 3.

The strategy with the highest overall score from the five-point strategy evaluation for Option 1 was:

- Option 1 – Strategy 2A (Wastewater): Convey flows through urban core to Bolton SPS, twinning of existing sewers in the North Hill, major expansion at Bolton SPS, new forcemain to divert flow east to Albion-Vaughan Trunk Sewer

The strategy with the highest overall score from the five-point strategy evaluation for Option 3 was:

- Option 3 – Strategy 2 (Wastewater): Convey flows via new sewer along King St/Coleraine Dr, twinning of Coleraine Trunk Sewer from north of C.N. railway to just north of George Bolton Pkwy

The preferred Option 1 water and wastewater costing and implementation plan is provided in Appendix F. There is some capacity in the existing wastewater system to potentially defer the sewer twinning through the North Hill.

The preferred Option 3 water and wastewater costing and implementation plan is provided in Appendix G. There is some capacity in the existing wastewater system to defer the Coleraine Trunk Sewer twinning. The ability to defer wastewater infrastructure is greater for Growth Option 1 than it is for Growth Option 1.

Table 19. Wastewater Servicing Strategies (Option 1) Evaluation Table

OPTION 1	DESCRIPTION	PUMPING REQUIREMENTS	SEWERMAIN / TWINNING REQUIREMENTS	ENVIRONMENTAL CROSSINGS	REGIONAL ROAD / RAIL CROSSINGS	LAND ACQUISITION REQUIREMENTS	VISUAL IMPACTS	TRANSPORTATION IMPACTS	PERMIT REQUIREMENTS	FINANCIAL COST	KEY ISSUES / CONSTRAINTS	OVERALL RATING
STRATEGY 1	Growth flows from the BRES area would be conveyed via twinned sewers in the existing system to the Bolton SPS. A major expansion at the Bolton SPS would be required, in addition to twinning of existing forcemain, and twinning of existing sewers to Queensgate Blvd and Landsbridge St.	One (1) internal SPS required & major expansion required at Bolton SPS, Cap=100 L/s	3.3 km of sewer twinning (450mm, Taylorwood Ave) in North Hill, 0.98km of forcemain twinning (400mm), 1.0 km of downstream sewer twinning (450mm), 0.24km of local sewer extension (250mm) on Columbia Way Total 5.43km (sewer & forcemain)	Three (3) minor creek crossings, and crossing of Humber River north of King St.	No rail crossings. One (1) Regional Rd crossing, >200m trenchless crossing.	None.	Potential for perceived visual impact caused by new local SPS.	Construction could cause temporary traffic disruption to numerous residential roads in the North Hill, Columbia Way, and other local roads such as Bond St, Strawberry Hill Ct, and Fountainbridge Dr.	Sewer twinning across Humber River, north of King St, will require permitting and approvals from TRCA.	$37.47 M	Longest sewer twinning route. Twinning of existing forcemain crosses residential area. Upgrades would benefit growth areas north of Columbia Way only.	Medium
STRATEGY 2A	Growth flows from the BRES area would be conveyed via twinned sewers in the existing system (via Taylorwood Ave) to the Bolton SPS. A major expansion at the Bolton SPS would be required, in addition to a new forcemain to convey flow east to the future Albion-Vaughan Trunk Sewer at Nunnville Rd and Bateman Ln.	One (1) internal SPS required & major expansion required at Bolton SPS, Cap=100 L/s	3.3 km of sewer twinning (450mm, Taylorwood Ave) in North Hill, 1.24km of new forcemain (400mm) on Old King Rd, 0.24km of local sewer extension (250mm) on Columbia Way Total 4.95km (sewer & forcemain)	Three (3) minor creek crossings, and crossing of Humber River north of King St.	No rail crossings. One (1) Regional Rd crossing, ~110m trenchless crossing.	None.	Potential for perceived visual impact caused by new local SPS.	Construction could cause temporary traffic disruption to numerous residential roads (Kingsview Dr/Taylorwood Ave) in the North Hill, Columbia Way, Old King Rd, and Nunnville Rd.	Sewer twinning across Humber River, north of King St, will require permitting and approvals from TRCA.	$33.02 M	Longest sewer twinning route. Upgrades would benefit growth areas north of Columbia Way only.	High
STRATEGY 2B	Growth flows from the BRES area would be conveyed via a new sewer along Hwy 50 and Bolton Heights Dr, twinning of existing sewers east of Hwy 50 (Kingsview Dr), and twinning of sewers along the Humber River to the Bolton SPS. A major expansion at the Bolton SPS would be required, in addition to a new forcemain to convey flow east to the future Albion-Vaughan Trunk Sewer at Nunnville Rd and Bateman Ln.	One (1) internal SPS required & major expansion required at Bolton SPS, Cap=100 L/s	0.80km of new sewer (450mm) on Queen St N, 2.44km of sewer twinning (450mm, Kingsview Dr) in North Hill, 1.24km of new forcemain (400mm) on Old King Rd Total 4.66km (sewer & forcemain)	Crossing of Humber River north of King St.	No rail crossings. One (1) Regional Rd crossing, ~110m trenchless crossing.	None.	Potential for perceived visual impact caused by new local SPS.	Construction could cause temporary traffic disruption to Queen Street North, as well as numerous residential roads (starting from Kingsview Dr) in the North Hill, Columbia Way, Old King Rd, and Nunnville Rd.	Sewer twinning across Humber River, north of King St, will require permitting and approvals from TRCA.	$31.10 M	New sewer on Queen Street North (Highway 50) could cause significant disruption and delays to local traffic. Upgrades would benefit growth areas north of Columbia Way only.	High
STRATEGY 2C	Growth flows from the BRES area would be conveyed via a new sewer along Hwy 50 and Bolton Heights Dr, twinning of existing sewers west of Hwy 50 (Cross Country Blvd), and twinning of sewers to the Bolton SPS. A major expansion at the Bolton SPS would be required, in addition to a new forcemain to convert flow east to the future Albion-Vaughan Trunk Sewer at Nunnville Rd and Bateman Ln.	One (1) internal SPS required & major expansion required at Bolton SPS, Cap=100 L/s	0.80km of new sewer (450mm) on Queen St N, 2.49km of sewer twinning (450mm, Cross Country Blvd) in North Hill, 1.24km of new forcemain (400mm) on Old King Rd Total 4.70km (sewer & forcemain)	Crossing of Humber River north of King St.	No rail crossings. Two (2) Regional Rd crossings, ~110m trenchless crossing.	None.	Potential for perceived visual impact caused by new local SPS.	Construction could cause temporary traffic disruption to Queen Street North, as well as numerous residential roads (in the North Hill, Columbia Way, Old King Rd, and Nunnville Rd.	Sewer twinning across Humber River, north of King St, will require permitting and approvals from TRCA.	$33.99 M	New sewer on Queen Street North (Highway 50) could cause significant disruption and delays to local traffic. Upgrades would benefit growth areas north of Columbia Way only.	High
STRATEGY 3	Growth flows from the BRES area would be conveyed via new sewers along Columbia Way to Albion Vaughan Rd. Flow to the existing system would be bypassed. Two pumping stations and forcemains would be required to overcome topography on Columbia Way and Albion Vaughan Rd.	One (1) internal SPS required, and two (2) new pumping stations required on Columbia Way & Albion-Vaughan Rd	3.8km of new sewer (450mm), 1.73km of new forcemain (400mm) Total 5.88km (sewer& forcemain)	Five (5) minor creek crossings.	No rail crossings. One (1) Regional Rd crossings, ~220m trenchless crossing.	PS ~ 0.50 ha x 2 Total ~ 1.00 ha	Potential for perceived visual impact caused by new local SPS, and two new SPS on Columbia Way and Albion Vaughan Rd.	Construction could cause temporary traffic disruption to Columbia Way and Albion-Vaughan Rd.	Sewer twinning across Humber River, north of King St, will require permitting and approvals from TRCA.	$48.05 M	Requires several pumping stations and involves more Humber River crossings.	Low

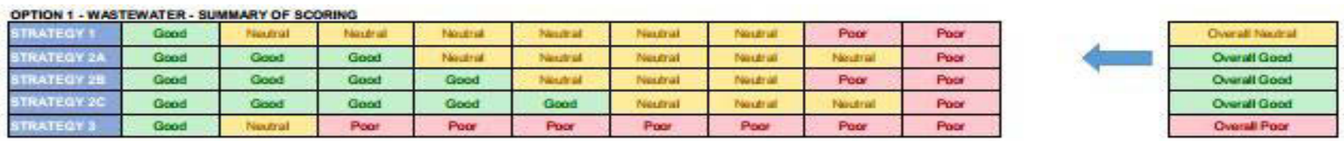

Table 20. Wastewater Servicing Strategies (Option 3) Evaluation Table

OPTION 3	DESCRIPTION	PUMPING REQUIREMENTS	SEWERMAIN / TWINNING REQUIREMENTS	ENVIRONMENTAL CROSSINGS	REGIONAL ROAD / RAIL CROSSINGS	LAND ACQUISITION REQUIREMENTS	VISUAL IMPACTS	TRANSPORTATION IMPACTS	PERMIT REQUIREMENTS	FINANCIAL COST	KEY ISSUES / CONSTRAINTS	OVERALL RATING
STRATEGY 1	Growth flows from the BRES area would be conveyed via new sewer along future easement from King St W to Coleraine Drive. Twinning of the existing Coleraine Trunk Sewer would also be required from the rail line to just north of George Bolton Pkwy.	None.	1.94km of new sewer (450mm) on easement, 2.63km of sewer twinning on Coleraine (525mm) Total 4.57km (sewer & force main)	Two (2) minor creek crossings.	One (1) rail crossing. One (1) Regional Rd crossing. No trenchless crossings.	Easement ~ 4.85 ha	None.	Construction could cause temporary traffic disruption to Coleraine Drive and King St (to lesser extent than Strategy 2).	None.	$15.61 M	Future easement required south of C.N. railway, narrow working conditions could present signicant construction challenges. Coleraine Trunk Sewer twinning could provide greater flexibility to coordinate with post-period servicing needs.	High
STRATEGY 2	Growth flows from the BRES area would be conveyed via new sewers along King St W and Coleraine Dr. Twinning of the existing Coleraine Trunk Sewer would also be required from the rail line to just north of George Bolton Pkwy.	None.	2.62km of new sewer (450mm) on King/Coleraine, 2.91km of sewer twinning on Coleraine (525mm) Total 5.53km (sewer & force main)	Five (5) minor creek crossings.	Two (2) rail crossings. One (1) Regional Rd crossing. No trenchless crossings.	None.	None.	Construction could cause temporary traffic disruption to Coleraine Drive and King St (to greater extent than Strategy 1).	Sewer alignment across King St rail crossing and Coleraine Drive rail crossing will require permitting and approvals from C.N.R.	$18.70 M	Facilitates servicing of Rounding Out Areas 1 and 3. Coleraine Trunk Sewer twinning could provide greater flexibility to coordinate with post-period servicing needs.	High
STRATEGY 3A	Growth flows from the BRES area would be conveyed via twinning of existing sewers in the North Hill West system. Twinning of the existing Coleraine Trunk Sewer would also be required from the rail line to just north of George Bolton Pkwy.	None.	2.40km of new/twinned sewers (450mm) on King/Cedargrove/Harvest Moon/Coleraine, 2.91km of sewer twinning on Coleraine (525mm) Total 5.31km (sewer & force main)	Five (5) minor creek crossings.	Two (2) rail crossings. One (1) Regional Rd crossing. No trenchless crossings.	None.	None.	Construction could cause temporary traffic disruption to Coleraine Drive and King St (to lesser extent than Strategy 2), as well as local residential roads including Cedargrove Ave.	Sewer alignment across King St rail crossing and Coleraine Drive rail crossing will require permitting and approvals from C.N.R.	$26.03 M	Crosses through residential area. Coleraine Trunk Sewer twinning could provide greater flexibility to coordinate with post-period servicing needs.	Medium
STRATEGY 3B	Growth flows from the BRES area would be conveyed via twinning of existing sewers in the North Hill West system. Twinning of the existing Coleraine Trunk Sewer would also be required from the rail line to just north of George Bolton Pkwy.	None.	2.40km of new/twinned sewers (450mm) on King/Harvest Moon/Coleraine, 2.91km of sewer twinning on Coleraine (525mm) Total 5.31km (sewer & force main)	Six (6) minor creek crossings.	Two (2) rail crossings. One (1) Regional Rd crossing. No trenchless crossings.	None.	None.	Construction could cause temporary traffic disruption to Coleraine Drive and King St (to lesser extent than Strategy 2), as well as local residential roads including Harvest Moon Dr.	Sewer alignment across King St rail crossing and Coleraine Drive rail crossing will require permitting and approvals from C.N.R.	$22.60 M	Crosses through residential area. Coleraine Trunk Sewer twinning could provide greater flexibility to coordinate with post-period servicing needs.	Medium
STRATEGY 5A	Growth flows from the BRES area would be conveyed via a new trunk sewer south along a potential future easement, west of Coleraine Drive, to Mayfield Rd and west to connect to the future 525 mm sewer at Clarkway Dr and Mayfield Rd.	None.	6.36km of new sewers (450mm) on easement/Concession limit, 0.83km of new sewer on Mayfield (525mm) Total 7.19km (sewer & force main)	Four (4) minor creek crossings.	No rail crossings. Two (2) Regional Rd crossings. No trenchless crossings.	Easement ~ 13.50 ha required	None.	Construction could cause temporary traffic disruption on Mayfield Rd.	None.	$38.48 M	Extensive easement required. New primary collector along easement could provide greater flexibility to coordinate with post-period servicing needs.	Low
STRATEGY 5B	Growth flows from the BRES area would be conveyed south via Humber Station Rd to connect to the future 525 mm sewer at Clarkway Dr and Mayfield Rd.	None.	6.12km of new sewers (450mm) on Humber Station Rd Total 6.12km (sewer & force main)	Two (2) minor creek crossings.	No rail crossings. Two (2) Regional Rd crossings. No trenchless crossings.	None.	None.	Construction could cause temporary traffic disruption on Humber Station Rd.	None.	$20.13 M	New primary collector along Humber Station Rd could provide greater flexibility to coordinate with post-period servicing needs.	Medium

OPTION 3 - WASTEWATER - SUMMARY OF SCORING

STRATEGY 1	Good	Good	Good	Good	Good	Good	Neutral	Neutral	Neutral	Overall Good
STRATEGY 2	Good	Good	Good	Good	Neutral	Neutral	Neutral	Poor	Poor	Overall Good
STRATEGY 3A	Good	Good	Good	Neutral	Neutral	Neutral	Poor	Poor	Poor	Overall Poor
STRATEGY 3B	Good	Good	Good	Neutral	Neutral	Poor	Poor	Poor	Poor	Overall Poor
STRATEGY 5A	Good	Good	Good	Good	Neutral	Poor	Poor	Poor	Poor	Overall Poor
STRATEGY 5B	Good	Good	Good	Good	Good	Good	Neutral	Poor	Poor	Overall Neutral

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Figure 15
Wastewater Servicing Strategy for Option 1 - Strategy 1

- Schematic Flow

Proposed Wastewater Facilities
- Proposed Sewage PS Upgrade
- Proposed Sanitary Forcemain
- Proposed Sewer

Existing Wastewater Facilities
- Existing Sewage Pumping Station
- Sanitary Forcemain
- Local Collector Sewer
- Local Trunk Sewer
- Regional Trunk Sewer
- Wastewater DC Project
- Bolton Arterial Road
- Road
- Study Area
- Parcel Fabric
- Woodland
- Greenbelt
- Water Course
- Water Bodies
- Urban Settlement Boundary

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Option 1
Option 2
Option 3
ROA 1
ROA 2
ROA 3
Convey Option 1 flows through North Hill
Twin existing sewers.
Major expansion at Bolton SPS, and divert flows east via new forcemain to future Albion-Vaughan Trunk Sewer.
Divert existing service area east to Albion-Vaughan Trunk Sewer.
Discharge to existing Regional Trunk Sewer on Albion-Vaughan Rd.
Bolton North Hill SPS
Bolton SPS
Henderson SPS
Harvestview SPS (to be decommissioned)
Albion-vaughan SPS (to be decommissioned)
CASTLEDERG SR
DUFFYS LN
HUMBER STATION RD
INNIS LAKE RD
KING ST
THE GORE RD
COLUMBIA WY
QUEEN ST N
KING ST E
OLD KING RD
HOLLAND DR
CALEDON KING TOWN LI S
ALBION VAUGHAN RD
HEALEY RD
COLERAINE DR
MAYFIELD RD

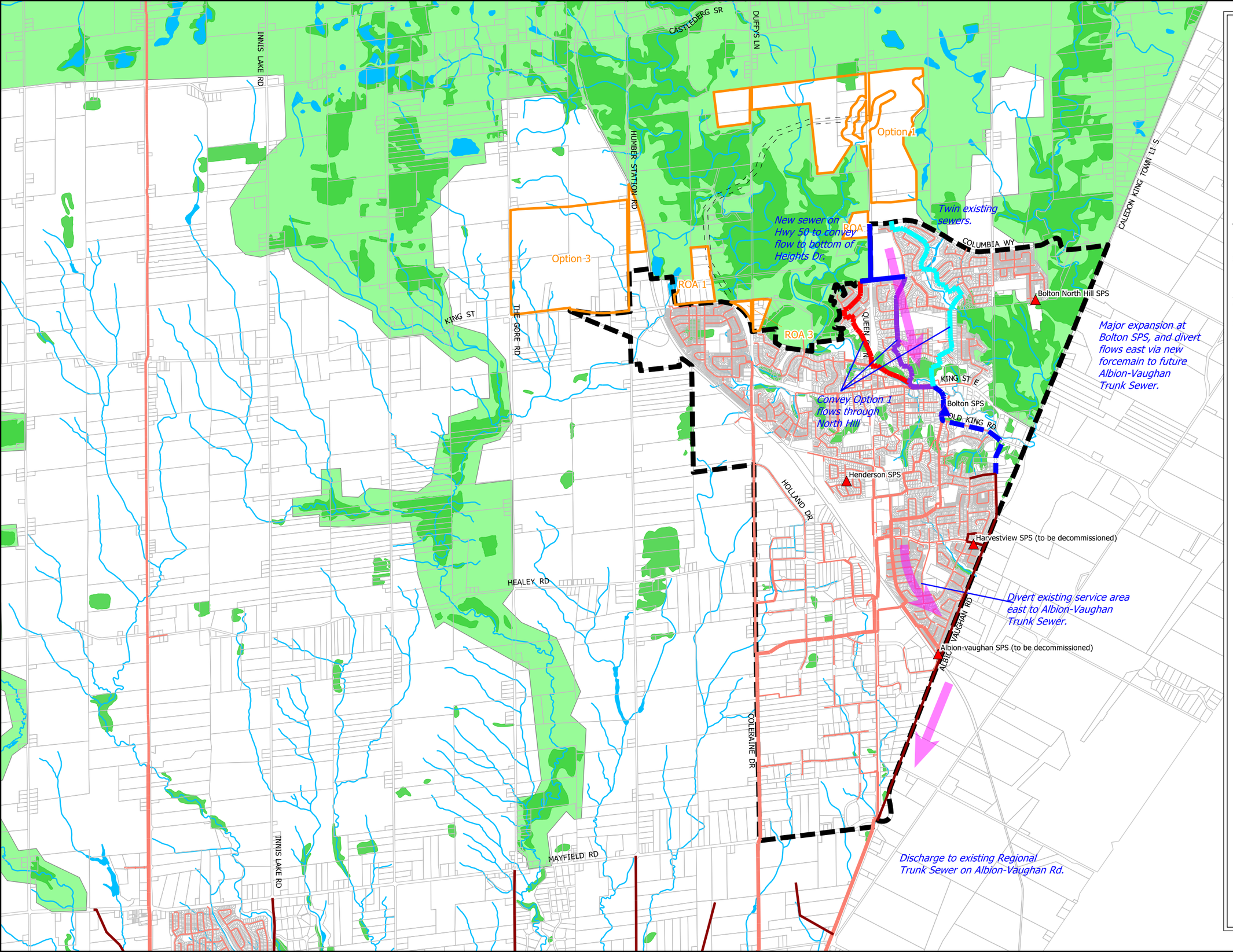

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Figure 16
Wastewater Servicing Strategy for Option 1 - Strategy 2
(Sewer Twinning Alternatives in the North Hill)

- Schematic Flow

Proposed Wastewater Facilities
- Proposed Sewage PS Upgrade
- Proposed Sanitary Forcemain
- Proposed Sewer
- Proposed Alt A
- Proposed Alt B
- Proposed Alt C

Existing Wastewater Facilities
- Existing Sewage Pumping Station
- Sanitary Forcemain
- Local Collector Sewer
- Local Trunk Sewer
- Regional Trunk Sewer
- Wastewater DC Project
- Bolton Arterial Road
- Road
- Study Area
- Parcel Fabric
- Woodland
- Greenbelt
- Water Course
- Water Bodies
- Urban Settlement Boundary

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Figure 17
Wastewater Servicing Strategy for Option 1 - Strategy 3

- Schematic Flow
- **Proposed Wastewater Facilities**
- Proposed Sewage PS Upgrade
- Proposed Sanitary Forcemain
- Proposed Sewer
- **Existing Wastewater Facilities**
- Existing Sewage Pumping Station
- Sanitary Forcemain
- Local Collector Sewer
- Local Trunk Sewer
- Regional Trunk Sewer
- Wastewater DC Project
- Bolton Arterial Road
- Road
- Study Area
- Parcel Fabric
- Woodland
- Greenbelt
- Water Course
- Water Bodies
- Urban Settlement Boundary

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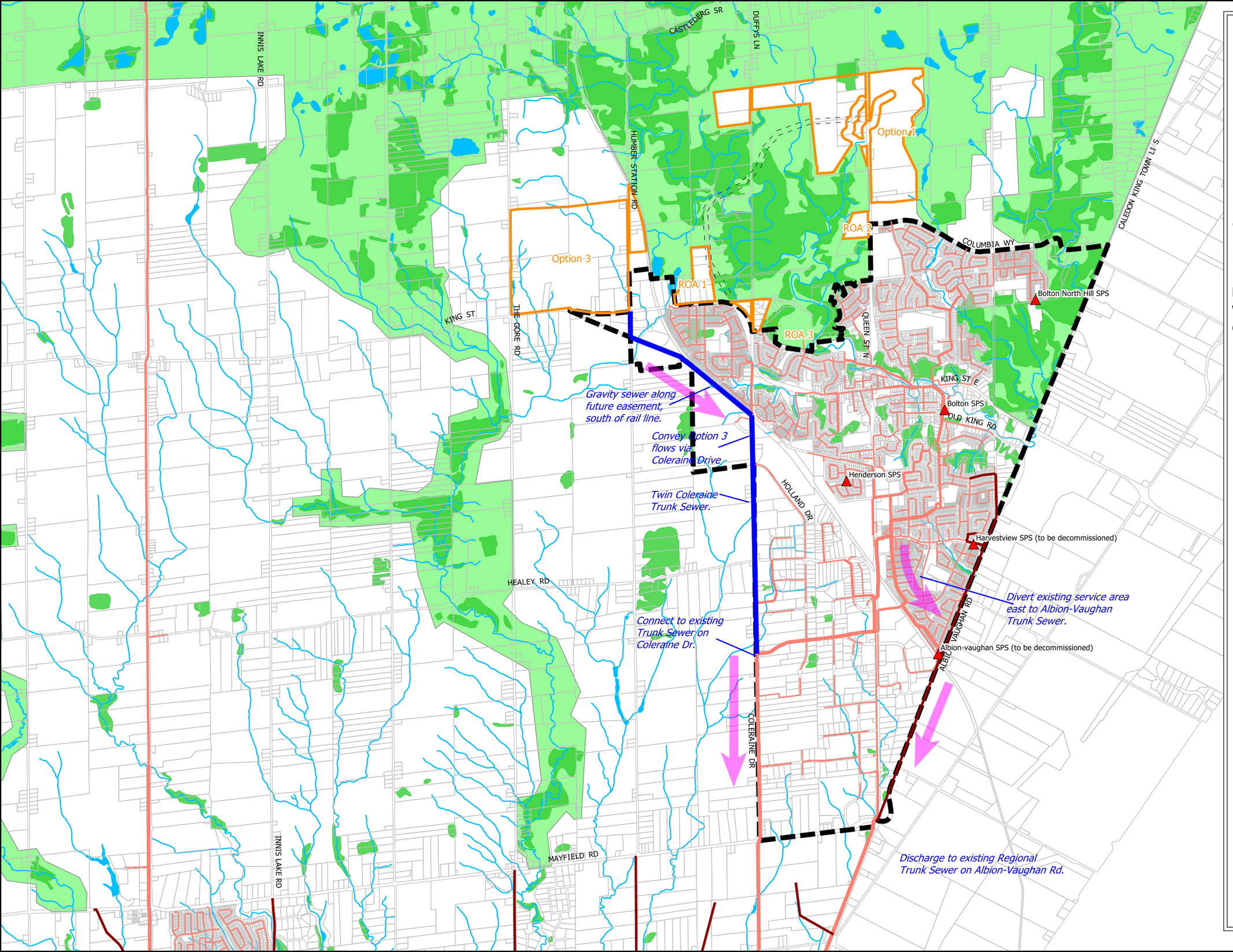

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Figure 18
Wastewater Servicing Strategy for Option 3 - Strategy 1

- Schematic Flow
- **Proposed Wastewater Facilities**
- Proposed Sewage PS Upgrade
- Proposed Sanitary Forcemain
- Proposed Sewer
- **Existing Wastewater Facilities**
- Existing Sewage Pumping Station
- Sanitary Forcemain
- Local Collector Sewer
- Local Trunk Sewer
- Regional Trunk Sewer
- Wastewater DC Project
- Bolton Arterial Road
- Road
- Study Area
- Parcel Fabric
- Woodland
- Greenbelt
- Water Course
- Water Bodies
- Urban Settlement Boundary

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Figure 19
Wastewater Servicing Strategy for Option 3 - Strategy 2

- Schematic Flow

Proposed Wastewater Facilities
- Proposed Sewage PS Upgrade
- Proposed Sanitary Forcemain
- Proposed Sewer

Existing Wastewater Facilities
- Existing Sewage Pumping Station
- Sanitary Forcemain
- Local Collector Sewer
- Local Trunk Sewer
- Regional Trunk Sewer
- Wastewater DC Project
- Bolton Arterial Road
- Road
- Study Area
- Parcel Fabric
- Woodland
- Greenbelt
- Water Course
- Water Bodies
- Urban Settlement Boundary

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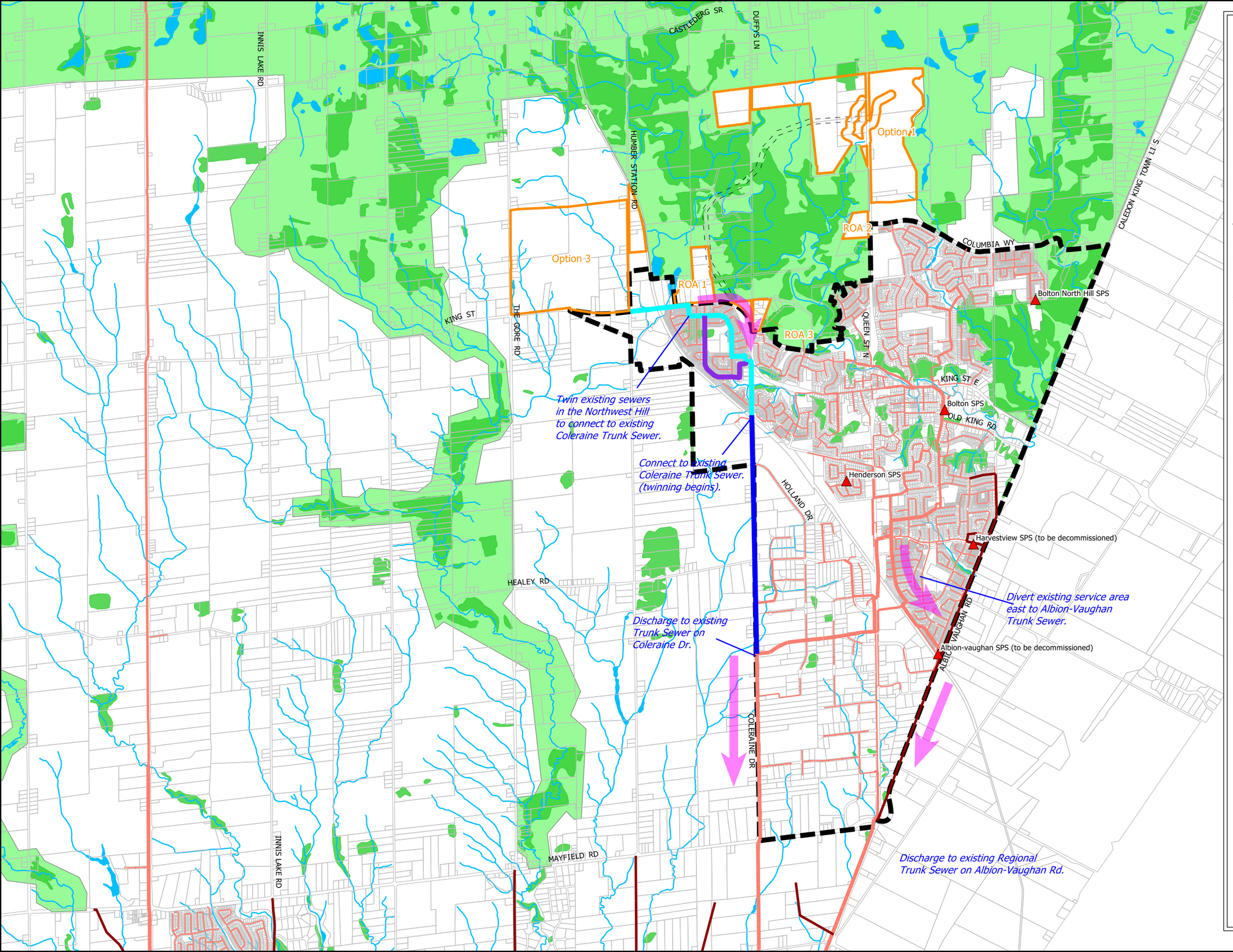

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Figure 20
Wastewater Servicing Strategy for Option 3 - Strategy 3
(Sewer Twinning Alternatives in the North Hill West)

Proposed Wastewater Facilities
- Proposed Sewage PS Upgrade
- Proposed Sanitary Forcemain
- Proposed Sewer
- Proposed Twinning Alt A
- Proposed Twinnign Alt B

Existing Wastewater Facilities
- Existing Sewage Pumping Station
- Sanitary Forcemain
- Local Collector Sewer
- Local Trunk Sewer
- Regional Trunk Sewer
- Wastewater DC Project
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Figure 21
Wastewater Servicing Strategy for Option 3 - Strategy 4

- Schematic Flow
- **Proposed Wastewater Facilities**
- Proposed Sewage PS Upgrade
- Proposed Sanitary Forcemain
- Proposed Sewer
- **Existing Wastewater Facilities**
- Existing Sewage Pumping Station
- Sanitary Forcemain
- Local Collector Sewer
- Local Trunk Sewer
- Regional Trunk Sewer
- Wastewater DC Project
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Figure 22
Wastewater Servicing Strategy for Option 3 - Strategy 5a

- Schematic Flow
- **Proposed Wastewater Facilities**
- Proposed Sewage PS Upgrade
- Proposed Sanitary Forcemain
- Proposed Sewer
- **Existing Wastewater Facilities**
- Existing Sewage Pumping Station
- Sanitary Forcemain
- Local Collector Sewer
- Local Trunk Sewer
- Regional Trunk Sewer
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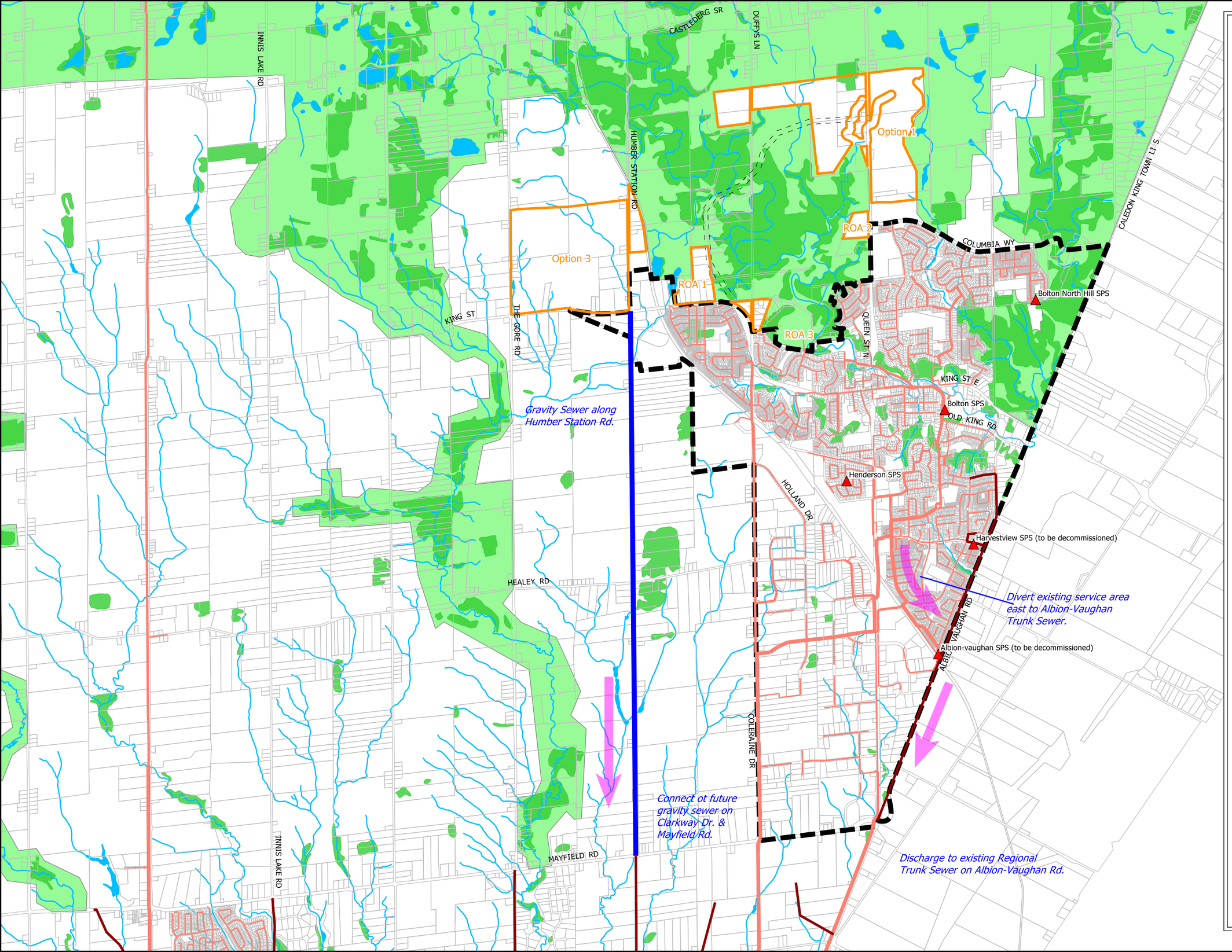

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Figure 23
Wastewater Servicing Strategy for Option 3 - Strategy 5b

- Schematic Flow
- **Proposed Wastewater Facilities**
- Proposed Sewage PS Upgrade
- Proposed Sanitary Forcemain
- Proposed Sewer
- **Existing Wastewater Facilities**
- Existing Sewage Pumping Station
- Sanitary Forcemain
- Local Collector Sewer
- Local Trunk Sewer
- Regional Trunk Sewer
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13 Alternative Stormwater Management Strategies

13.1 Alternatives for Option 1 and Option 3

As noted in Section 9.1, stormwater management will be implemented using a range of LID measures and stormwater ponds. Targets include:

- water balance: infiltration / evapotranspiration / re-use of stormwater to preserve the existing groundwater recharge and overall water balance;
- water quality control: Level 1 / Enhanced control;
- erosion control: provisional target - capture and release runoff from a 25mm storm event over 48 hours;
- flood control: post-to-pre control for all storms up to the Regional Strom event.

LID source and conveyance control measures would be used to meet the water balance targets. These would be relatively small-scaled measures incorporated into individual lots and/or within roadways. The same type or range of LID measures would be equally applicable within either of the Option 1 lands or Option 3 lands. Further planning and design for the LID measures is expected to be governed by the following:

- 2012 TRCA Stormwater Management Criteria document (general stormwater management targets and sizing requirements);
- 2010 TRCA Low Impact Development Stormwater Management Planning and Design Guide (detailed design and sizing for individual LID measures);
- Town of Caledon Standards (general drainage and grading requirements)

Stormwater management ponds would be used to meet the remaining water quality control erosion control, and flood control targets. Figure 24 and Figure 25 illustrate conceptual stormwater pond locations and corresponding drainage areas within the Option 1 and Option 3 expansion lands, respectively. The locations are based on a cursory review of the existing topography, drainage patterns, and environmental constraint areas. It is understood that the exact number of ponds, their locations and sizes are unknown at this point in time, and will ultimately depend on the finalized development limits, future road network, location and depth of suitable pond outlets, fragmentation of land ownership, and ability to co-ordinate the timing of the various development sites through future functional servicing studies.

Further planning and design for the stormwater ponds is expected to be governed by the following:

- 2012 TRCA Stormwater Management Criteria document (general stormwater management targets and sizing requirements);
- 2003 MOE Stormwater Management Planning and Design Manual (water quality and erosion control storage requirements, general design characteristics);
- Current TRCA Humber River Hydrology Update Study (flood control release rates and storage requirements);
- TRCA Stream and Valley Corridor Management Program (siting of the ponds and outlets relative to defined valleys);
- Town of Caledon Standards (general drainage, grading and pond design characteristics)

In terms of relative requirements, the flood control storage requirements for Regional Storm control are expected to be much larger than the erosion control and water quality control requirements. Therefore, the overall size and land requirements for the stormwater ponds will be defined largely by the flood control criteria.

The sizing of the conceptual ponds illustrated in Figure 24 and Figure 25 is not based on any modelling results, rather, a conservative estimate of 15% of the contributing drainage area has been assumed based on experience from the recent 2012 Bolton Employment Lands Expansion Study. This figure includes allowances for:

- permanent pool for water quality,
- extended detention for erosion control and flood (quantity) control of the Regional Storm;
- pond side slopes; and
- maintenance access roads.

13.2 Summary of Stormwater Pond Requirements for Option 1 vs 3

The general stormwater pond requirements for the Option 1 and Option 3 lands are compared in Table 21.

Table 21. Comparison of Stormwater Management Pond Requirements

	Option 1	Option 3
Number of SWM Ponds	5	3
Drainage Area served by SWM ponds	148 ha	131 ha
Estimated Land Requirements (assumed footprint of 15% of drainage area)	22.2 ha	19.7 ha
Estimated Storage Requirements (assumed 1,200 m^3/ha)	177,600 m^3	157,200 m^3
Estimated Pond Costs (assumed rate of $ 60/m^3)	$10.7 M	$9.4 M

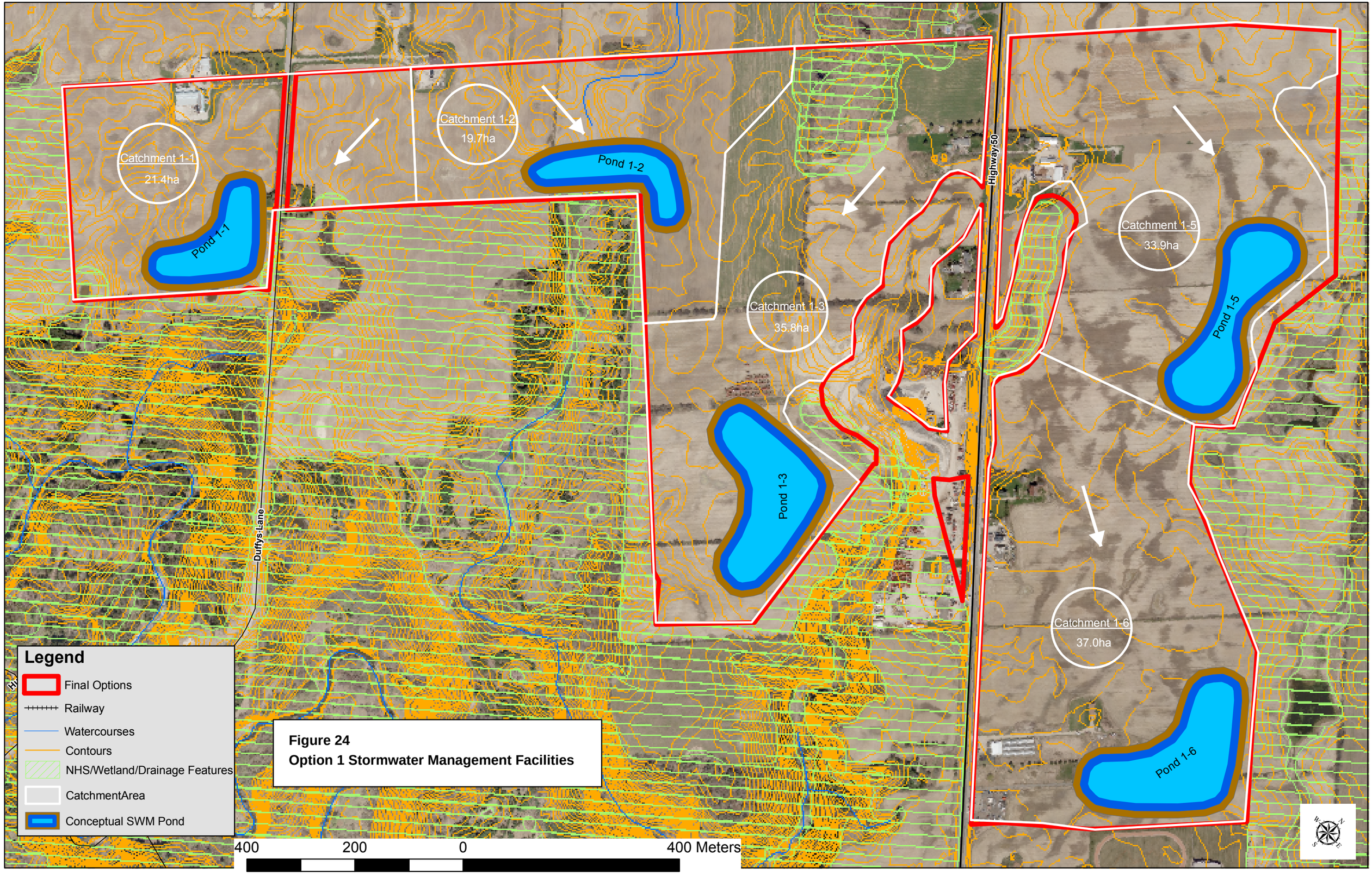
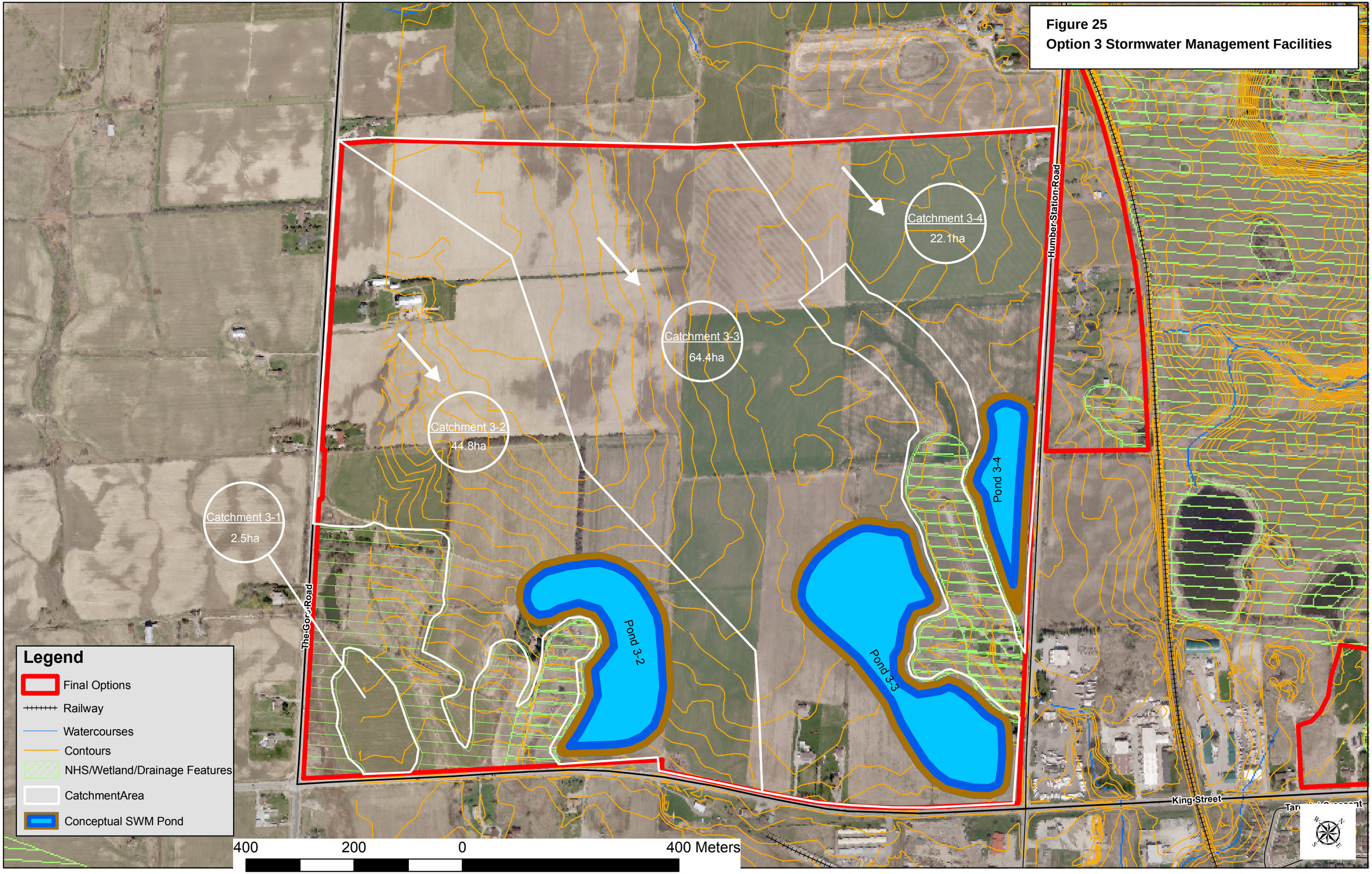


Figure 24
Option 1 Stormwater Management Facilities

Figure 25
Option 3 Stormwater Management Facilities



14 Recommendations for Preferred Option

14.1 Evaluation Process for Option 1 vs 3

The detailed evaluation undertaken identified a preferred water and wastewater servicing strategy for Option 1 and Option 3. The preferred water and wastewater servicing maps for Option 1 are provided in Figure 26 and Figure 27, respectively. The preferred water and wastewater servicing maps for Option 3 are provided in Figure 28 and Figure 29, respectively. The following sections summarize the high level comparison of Option 1 servicing vs Option 3 servicing.

Table 22. Preliminary Preferred Water Servicing Strategies for Option 1 vs Option 3

Option 1 – Strategy 1	Option 3 – Strategy 1
Creation of a new local pressure zone (Zone 6A/7 based on topography)	Can be serviced within future pressure zone 7
Opportunity to enhance existing level of service for residents in North Hill and northwest Bolton	Opportunity to enhance existing level of service for residential and industrial customers in northwest Bolton
Provides flexibility to support future potential growth areas to the east, and to some extent to the west, by virtue of the location of the booster pumping station	Provides greater flexibility to support future potential growth areas to the west, south, and north of Option 3 growth area by virtue of the location of the elevated tank
Ability to oversize elevated tank to service future potential growth areas within new local pressure zone (Zone 6A/7)	Ability to oversize elevated tank to service future potential growth areas within pressure zone 7
Additional feedermain and cost compared to Option 3	Lower feedermain length and lower cost compared to Option 1
Greater complexity of water infrastructure upgrades due to watermain construction along Bolton Arterial Road	Less complexity of water infrastructure upgrades than Option 1

Table 23. Preliminary Preferred Wastewater Servicing Strategies for Option 1 vs Option 3

Option 1 – Strategy 2a	Option 3 – Strategy 1
Internal servicing requires one local pumping station and forcemain	Can be fully serviced by gravity wastewater system
External servicing requires major expansion at Bolton SPS and new forcemain to divert flow east to Albion-Vaughan Rd	Can be fully serviced by gravity wastewater system
Makes use of capacity in future Albion-Vaughan Trunk Sewer	Maximizes use of available capacity in wastewater system (Albion-Vaughan & Coleraine Trunk Sewers)
Greater complexity of wastewater infrastructure upgrades due to extensive twinning through North Hill	Lower complexity of wastewater infrastructure upgrades, compared to Option 1
Greater potential for impacts / disruption due to construction, compared to Option 3	Less potential for impacts / disruption due to construction, compared to Option 1

Option 1 – Strategy 2a	Option 3 – Strategy 1
Greater cost than Option 3	Lower cost compared to Option 1
Less opportunity for infrastructure deferral	Greater opportunity for infrastructure deferral (Coleraine Trunk Sewer twinning)

These preferred servicing strategies for each growth option were then evaluated and a preferred growth option was identified.

14.2 Preferred Option

From a servicing standpoint, Option 3 is recommended as the preferred option to accommodate growth in Bolton post 2021.

Key benefits of Option 3 include:

- Ability to augment existing service areas in the local northwest Zone 6 area, to Zone 7
- Provides post period servicing flexibility by virtue of the location of the Zone 7 booster pumping station
- Greater flexibility to support post-period servicing with the potential location of the elevated tank northwest of the Option 3 lands
- Maximizes use of existing feedermains as it builds off existing distribution infrastructure
- Greater opportunity to service existing land uses, and specifically, industrial lands adjacent to Option 3 area given that lands would need Zone 7 servicing
- Opportunity to oversize elevated storage tank to service future potential growth areas in Caledon, to the west and south of Option 3 growth area
- Servicing solution does not require any sewage pumping station upgrades
- Opportunity to leverage the existing wastewater servicing strategy with optimization of system hydraulics
- Greater flexibility to coordinate with post-period wastewater servicing needs
- Opportunity to defer Coleraine Trunk Twinning project
- Minimizes environmental crossings

Key water projects to service Option 3 growth area include:

1. Zone 6 Coleraine Feedermain Extension
2. Zone 7 Booster Pumping Station
3. Zone 7 King/Gore Watermain
4. Zone 7 Elevated Tank
5. Zone 7 Trunk Distribution Watermain

Key wastewater projects to service Option 3 growth area include:

1. King/Coleraine Sewer
2. Coleraine Trunk Sewer Twinning

The cost breakdown for servicing Option 3 growth area is as follows:

- Water Servicing Cost ~ $36.56M
- Wastewater Servicing Cost ~ $18.70M

Final cost estimates will need be refined during detailed design stage, following the selection of the preferred growth option.

Appendix G contains the full costing and implementation plan for the preferred servicing strategy for Option 3.

From a stormwater management standpoint, both of the future residential expansion land options would be required to incorporate a range of LID measures and stormwater ponds to mitigate the hydrologic impacts of the proposed future urban development. As outlined in Section 9.1, the water balance, water quality, erosion and flood control targets are anticipated to be similar for both Option 1 and Option 3, and therefore the types and scale of stormwater measures to be implemented are also expected to be similar.

Both options will require LID source and conveyance control measures to meet the water balance targets, and the same type or range of LID measures would be equally applicable within either of the Option 1 lands or Option 3 lands. Both options will also require stormwater management ponds for water quality, erosion and flood control. In both options, the stormwater ponds will require up to roughly 15% of the serviced drainage area.

Conceptual stormwater pond locations are depicted in Figure 24 and Figure 25. The relative stormwater storage and land requirements are anticipated to be similar between options. However, due to the existing topography, drainage patterns and shape of the lands, Option 3 may be served by only 3 ponds, compared to Option 1 which would require 5 ponds. Therefore, the long-term costs associated with Option 3 are anticipated to be lower due to less operation and maintenance requirements and general economies of scale.

Based on the above, from a stormwater management perspective, Option 3 is preferred.

It is important to note that the infrastructure servicing components carried forward in the BRES costs pertain to infrastructure external or trunk required to service the BRES expansion area. Internal or local servicing costs would be additional. The costs do not include Regional trunk infrastructure related to the 2031 Master Plan Capital Program and Development Charges programs. The infrastructure requirements are not currently carried in the Regional Capital Plan. As such, alternative financing methods will need to be utilized, which will likely require front end financing by the development community.

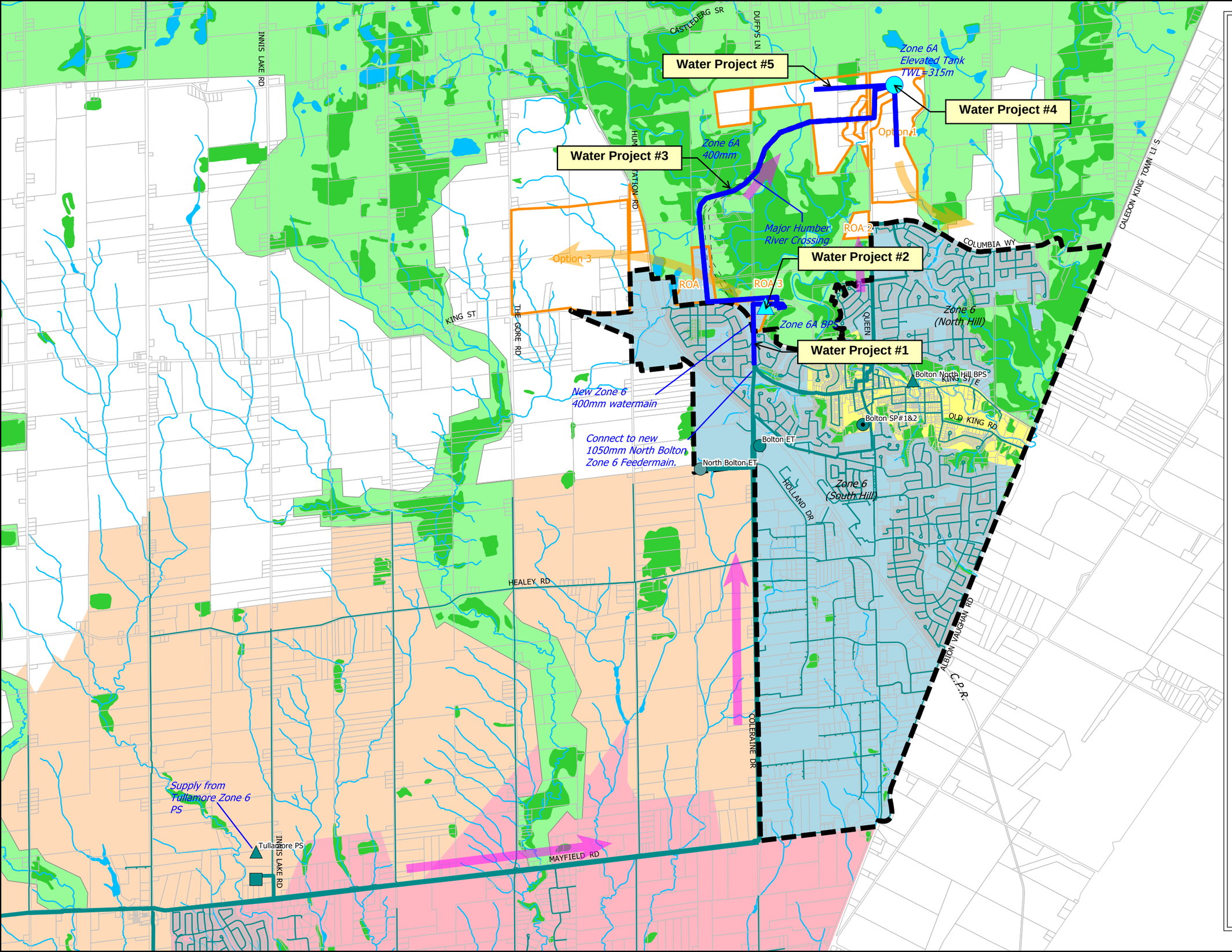


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Figure 26
Preferred Water Servicing Strategy for Option 1 *(Strategy 1)*

- Schematic Flow
- Future Schematic Flow

Proposed Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Proposed Watermain

Existing Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Standpipe
- Minor Local Watermain
- Major Local Water Main
- Transmission Main
- Bolton Arterial Road
- Roads
- Pressure Zone 5B
- Pressure Zone 5E
- Pressure Zone 6B
- Pressure Zone 6E
- Study Area
- Parcel Fabric
- Woodlands
- Greenbelt
- Water Course
- Water Bodies
- Urban Settlement Boundary

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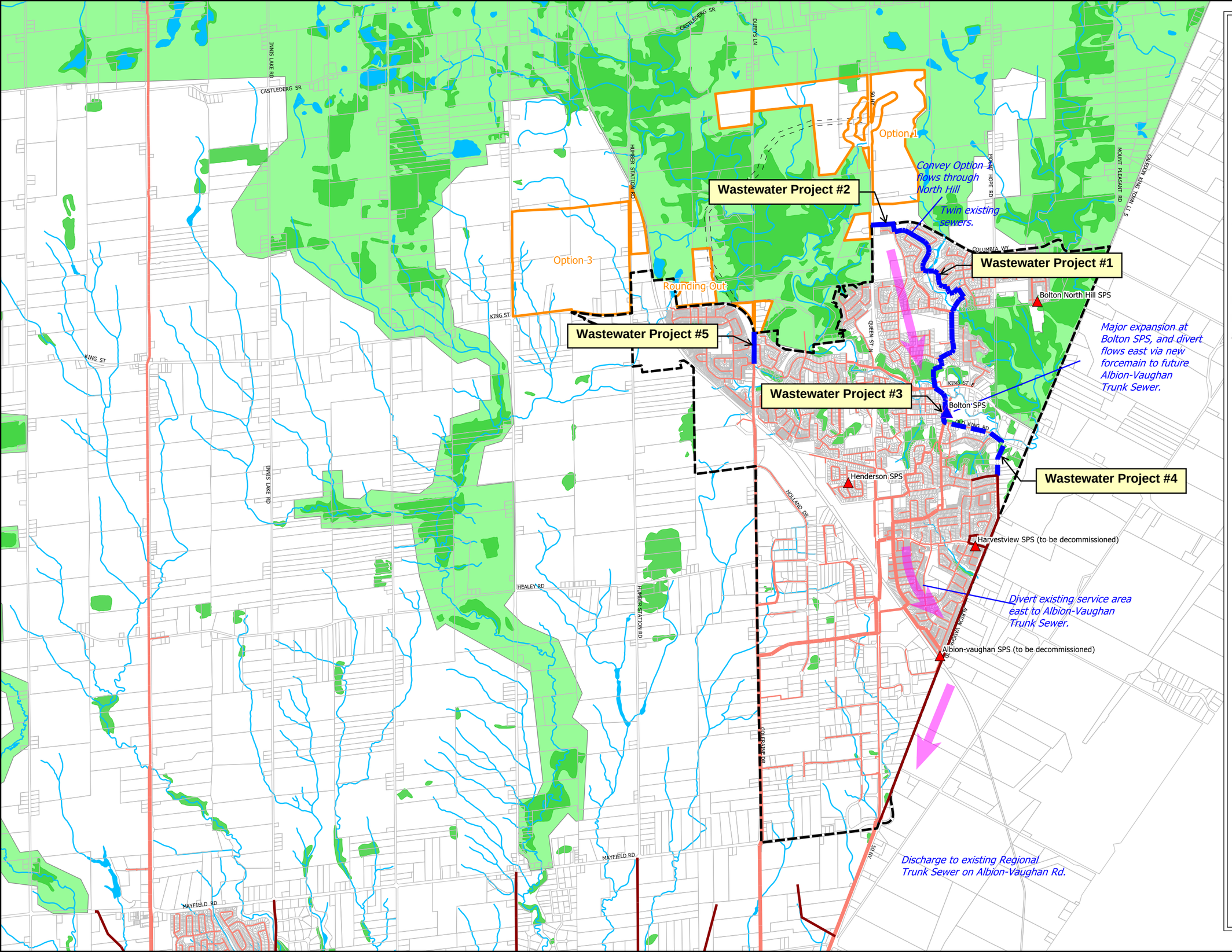

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Figure 27
Preferred Wastewater Servicing Strategy for Option 1 *(Strategy 2A)*

- Schematic Flow

Proposed Wastewater Facilities
- Proposed Sewage PS Upgrade
- Proposed Sanitary Forcemain
- Proposed Sewer

Existing Wastewater Facilities
- Existing Sewage Pumping Station
- Sanitary Forcemain
- Local Collector Sewer
- Local Trunk Sewer
- Regional Trunk Sewer
- Wastewater DC Project
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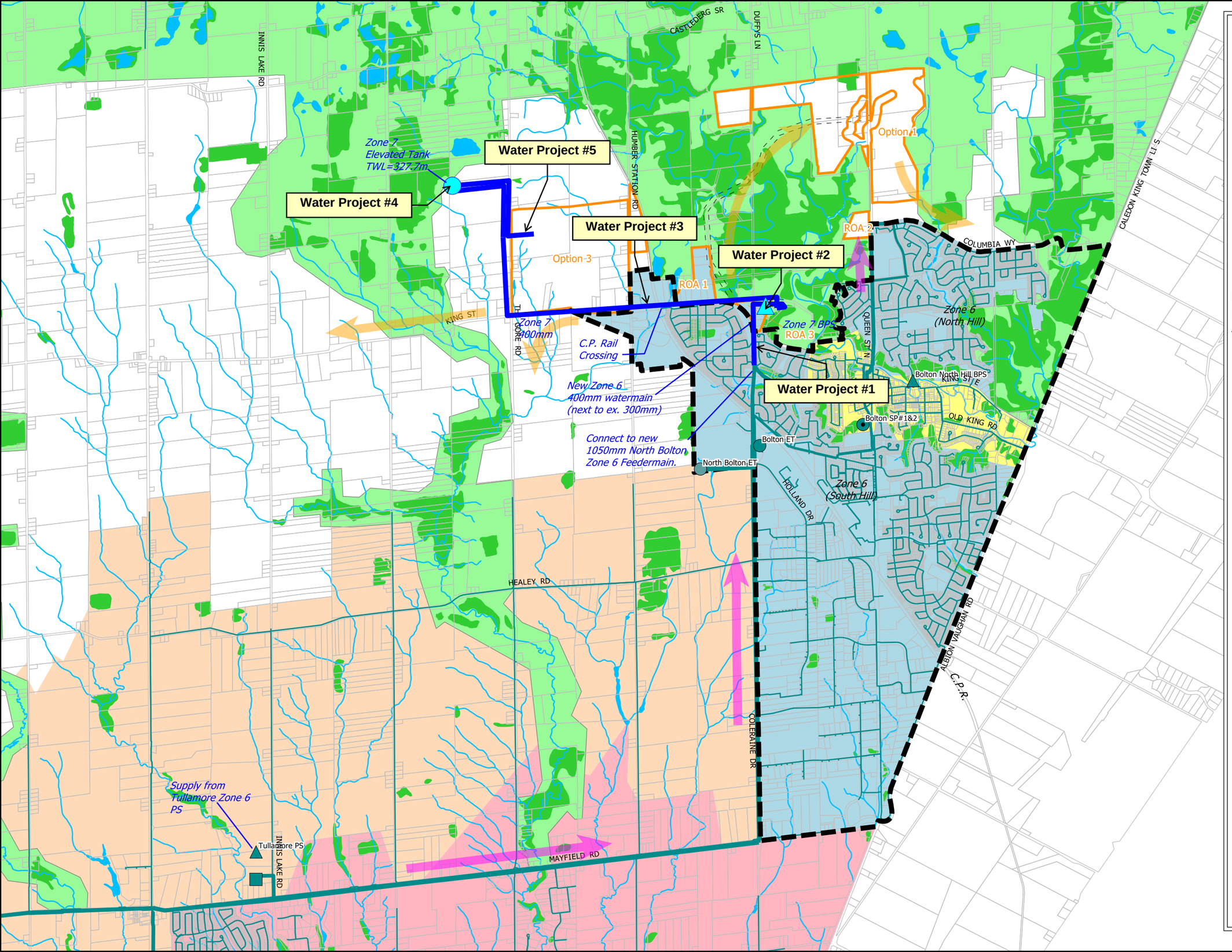

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Figure 28
Preferred Water Servicing Strategy for Option 3 *(Strategy 1)*

- Schematic Flow
- Future Schematic Flow

Proposed Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Proposed Watermain

Existing Water Facilities
- Pumping Station
- Elevated Tank
- Reservoir
- Standpipe
- Minor Local Watermain
- Major Local Water Main
- Transmission Main
- Bolton Arterial Road
- Roads
- Pressure Zone 5B
- Pressure Zone 5E
- Pressure Zone 6B
- Pressure Zone 6E
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Figure 29
Preferred Wastewater Servicing Strategy for Option 3 *(Strategy 2)*

- Schematic Flow
- **Proposed Wastewater Facilities**
- Proposed Sewage PS Upgrade
- Proposed Sanitary Forcemain
- Proposed Sewer
- **Existing Wastewater Facilities**
- Existing Sewage Pumping Station
- Sanitary Forcemain
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15 Summary

This report provides a review of the approach undertaken to develop, evaluate and select a preferred option from an infrastructure servicing perspective. The focus of this report is on Phase 3 of the BRES, the detailed analysis and evaluation of the alternative servicing strategies for Option 1 and Option 3. The analysis leverages the preliminary servicing review undertaken in Phase 1 and Phase 2.

The evaluation carried out in Phase 3 was based on identifying and assessing individual water and wastewater servicing strategies for Option 1 and Option3, such that they represent two comprehensive analyses. Based on the merits of each servicing strategy, a preferred water and wastewater servicing strategy was carried forward for Option 1 and Option 3. Based on the preferred water and wastewater servicing strategies for each growth option, Option 1 and Option 3 were evaluated and a preferred growth option was selected. From a servicing standpoint, Option 3 was considered more favourable from a servicing standpoint, as it generally:

- Involves logical extension of infrastructure;
- Requires less water infrastructure than Option 1;
- Provides opportunity to augment existing service areas in the local northwest Zone 6 area to Zone 7, by virtue of the location of the Zone 7 booster pumping station;
- Provides opportunity to service existing land uses and specifically industrial lands adjacent to Option 3
- Provides ability to oversize elevated tank to service potential growth areas to the south, west, and north of the Option 3 area within Zone 7;
- Is less complex than Option 1 wastewater servicing;
- Provides an all gravity wastewater servicing solution;
- Requires less complex (fewer SWM ponds) stormwater management strategy than Option 1;
- Could be staged to support servicing of Option 1 at a later time; and,
- Is less costly than Option 1 for all infrastructure.

Following internal and agency review of this report, the recommendations contained herein and in the component studies will be presented to Town Council. The next steps in the BRES will move toward Phases 4 and 5 of the BRES, where the servicing strategies for the preferred option further be refined, and will feed into an overall Comprehensive Environmental Impact Study and Management Plan (CEISMP). This CEISMP will follow an approach that is consistent with the Provincial Policy Statement (PPS), the Town of Caledon Official Plan, the Region of Peel Official Plan, and applicable Official Plan Amendment policies.

16 References