1. Introduction

1.1 Background

Halton Region is one of a number of municipalities in the Greater Golden Horseshoe (GGH) area situated around the south-western end of Lake Ontario and is one of the fastest growing regions in North America. The Places to Grow Act identified growth from 2001 to 2031. Population in the GGH is forecasted to grow from 7.79 million people in 2001 to 11.50 million in 2031, which accounts for over 80 percent of Ontario's population growth. This new growth will require 1.75 million new homes and 1.7 million additional jobs.

In accordance with the Places to Grow Act, the population target for Halton Region is 780,000 people and 390,000 employees by 2031 representing nearly doubling in growth from 2001 to 2031.

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

In order to balance the needs of a growing Region with the protection and preservation of its natural, environmental, and heritage resources, Halton Region initiated the Sustainable Halton Plan. Under the Sustainable Halton Plan, the Region has developed goals that serve as a blueprint for building sustainable and healthy communities. This blueprint has helped guide several Regional initiatives including the Regional Official Plan review, the Transportation Master Plan, and the Water and Wastewater Master Plan.

Sustainable Halton is an integrated planning and engineering process designed to provide Halton Region with sustainable growth and servicing strategies to meet the population and employment needs to year 2031. As part of the Sustainable Halton process, a Water and Wastewater Master Plan has been completed which outlines the long range water and wastewater servicing strategies.

The Sustainable Halton Water and Wastewater Master Plan provides a Region-wide review, evaluation and development of water and wastewater servicing strategies for all urban service areas. The Master Plan has used updated planning population and employment estimates based on a 2031 planning horizon (Best Planning Estimate Data June 2011). The urban area under study includes the South Halton systems in Burlington, Oakville, Milton and Halton Hills 401 Corridor as well as the Georgetown and Acton systems. This Master Plan builds on previous work undertaken as part of the South Halton Master Plans and Updates, related studies for the North Halton systems and the Pumping Station Capital Needs Assessment and Master Plan Study for Oakville and Burlington. This Master Plan is a critical component in the integrated planning process of the Sustainable Halton program and provides the framework and vision for the water and wastewater servicing needs within the urban areas of Halton Region to 2031.

1.2 Master Plan Objectives

The Sustainable Halton Water and Wastewater Master Plan provides comprehensive documentation of the development, evaluation and selection of the preferred water and wastewater servicing strategies to meet the growth needs of Halton Region to year 2031.

Key aspects of the study objectives and work plan of the Sustainable Halton Water and Wastewater Master Plan are:

- Review best planning estimates provided by the Region as defined through ROPA 38 and determine impact on servicing needs
- Undertake a comprehensive review and analysis for both water and wastewater servicing requirements
- Address key servicing considerations as part of the development and evaluation of servicing strategies including:
  - Level of service to existing users and approved growth
  - Operational flexibility
  - Security of supply
  - Mitigation of impacts to natural, social and economic environments
  - Maintaining water balance within the watersheds
  - Opportunity to meet policy, policy statements, regulations and technical criteria
  - Opportunity to optimize existing infrastructure
  - Ensuring the strategies are cost-effective
- Consider and develop sustainable servicing solutions
- Utilize updated industry trends and more detailed information from relevant Region studies and projects to provide better capital cost estimates
- Utilize recently completed and on-going projects to update infrastructure status, capacity and cost estimates
- Utilize the water and wastewater models for the analysis of servicing alternatives
- Establish a complete and implementable water and wastewater capital program
- Extensive consultation with the public and other stakeholders

1.3 Master Plan Documentation Layout

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

The document has been organized into three (3) volumes, as shown in the figure on the right, and is described below:

Volume I – Master Plan Class EA Phase 1 and 2 Report

The Master Plan Class EA Phase 1 and 2 Report is the principal document summarizing the study objectives, approach, methodologies, technical analysis, evaluation and selection of the preferred water and wastewater servicing strategy. The report provides the context for the evaluation and decision-making processes undertaken to determine the preferred servicing strategy, while referring the reader to Volume II for further detailed project specific evaluation and technical supporting documentation.

This Report contains the following sections:

General
The General sections provide the overall master planning process background information with respect to the Master Plan process and methodologies used during the study.

Water
The Water section provides information on the analysis of the water systems and the development and evaluation of water servicing alternatives.

Wastewater
The Wastewater section provides information on the analysis of the water systems and the development and evaluation of wastewater servicing alternatives.

Preferred Servicing Strategies
The Preferred Servicing Strategies sections provide a summary of the strategies including project by project identification supported by mapping. This section also provides additional implementation and commitment requirements to successfully deliver the water and wastewater program.

Volume I – Master Plan Class EA Phase 1 and 2 Appendices
Technical background information critical in the development of the Master Plan is included in the appendices to Volume I. The technical appendices contain relevant project, implementation and technical analysis information, including:

- Water Demand and Supply Capacity Calculations
- Wastewater Flows and System Capacity Calculations
- Water and Wastewater Servicing Principles and Policy Paper
- Unit Costs
- Design Criteria
- Technical information related to key components of the Master Plan including intensification analysis, bulk water and septage receiving facilities, relevant environmental information and the capital programs

Volume II – Project File
The Project File volume provides detailed project information for select individual projects. The file includes technical and financial documentation, including project tracking sheets, evaluation tables, maps, and other technical supporting documentation for all Schedule B projects. The Master Plan provides systematic evaluation and documentation to support the Schedule B Class EA requirements along with any applicable review agency commitments prior to their respective implementation.

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

1.4 Related Studies

1.4.1 Historical Halton Region Water and Wastewater Master Plans

The Sustainable Halton Water and Wastewater Master Plan is the fourth generation of long term infrastructure planning reports for Halton Region dating back to 1995.

Following the 1995 work, the 2002 Halton Water and Wastewater Master Plan Review was completed. The 2002 Master Plan Review report established updated servicing strategies for South Halton only, to meet growth to 2016 with long term considerations for growth to build-out of the then identified urban service areas.

The Master Plan was further updated in 2008. The 2008 South Halton Water and Wastewater Master Plan Update was also only focused on infrastructure in Oakville, Burlington, Milton and Halton Hills 401 Corridor. At that time, the planning projections were updated to the year 2021. The servicing strategies established in the 2008 Master Plan Update addressed the servicing needs to year 2021 and also identified key infrastructure to support servicing to 2031.

The current Sustainable Halton Water and Wastewater Master Plan has considered analyses undertaken in the previous master planning processes. However, this Master Plan reflects the total servicing needs of an expanded urban area out to 2031, addressing the Places to Grow Act servicing requirements, and provides updated cost estimates and implementation programs. The servicing strategies have also been updated to reflect not only the South Halton systems, but also North Halton systems which include urban areas of Georgetown and Acton. The Sustainable Halton Water and Wastewater Master Plan has been scoped as a Region-wide study.

1.4.2 Halton Region Transportation Master Plan

Halton Region initiated a Transportation Master Plan (TMP) – The Road to Change in March 2010. The Transportation Master Plan provides the strategies, policies and tools for the development of a balanced and sustainable transportation system that supports the objectives of Sustainable Halton and meets the Region's transportation needs safely, effectively and cost efficiently to 2031. It will guide and support the development of the Regional Transportation system and help to define the Region's role in the establishment of the broader transportation system serving Halton. The study was led by Dillon Consulting Limited in association with GHD Inc. and was conducted in accordance with the Municipal Class EA process. A key outcome of the study is a list of transportation projects that the Region can incorporate in its 20-year Roads Capital Program.

The Sustainable Halton planning exercise has been an integrated approach between the Water and Wastewater Master Plan and the Transportation Master Plan, both running concurrently. The two Master Plan teams have worked closely together to ensure synergy in the development and selection of the preferred strategies. This synergy has resulted in a coordinated implementation program for future pipe alignments and road works to ensure efficiency, minimize social disturbance and to mitigate impact.

1.4.3 Wastewater Pumping Station Capital Needs Assessment and Master Plan Study for Oakville and Burlington

This study is an integrated approach to the planning and asset renewal of the pumping stations within the drainage areas of the Burlington Skyway, Oakville Southwest and Oakville Southeast Wastewater Treatment Plants. The study scope is as follows:

- To assess physical condition and renewal/replacement needs of 59 sewage pumping stations located in south Burlington and south Oakville
- To assess hydraulic capacity and expansion upgrade needs of the pumping stations to meet growth requirements
- To assess the overall efficiency in servicing the drainage areas and strategic alternatives in a Master Plan Class Environmental Assessment

The Sustainable Halton planning exercise has also been an integrated approach with the Wastewater Pumping Station Capital Needs Assessment and Master Plan Study with both studies running and completing concurrently.

The two Master Plan teams have worked closely together to ensure synergy in the development and selection of the preferred strategies with particular focus on the intensification areas of the south system. This synergy has resulted in a coordinated strategy to ensure efficiency, minimize social disturbance and to mitigate impacts.

1.4.4 Halton Tier 3 Groundwater Study for Halton Hills and Milton

The Ministry of Environment (MOE) and Ministry of Natural Resources (MNR) have developed a series of Guidance Modules to aid Source Protection Regions in the production of watershed assessment reports and source protection plans.

The Water Budget and Water Quantity Risk Assessment Guidance Module describes a 3-tiered approach for the assessment of water budgets for the Source Protection Region, with each tier providing more detail and a greater level of certainty than the previous tier. Progression from a Tier 1 study to Tier 3 study generally reflects greater level of detail.

The overall objectives of the Tier 3 risk assessment are:

- To evaluate the risk that a community may not be able to meet its current or future water demands
- To identify drinking water quantity threats contributing to potential water supply problems
- To explore and document potential alternative solutions for future water needs in this area.

The Tier Three Groundwater Study is a detailed hydrogeological analysis that is being completed as part of the Source Protection Planning process under Ontario's Clean Water Act (Government of Ontario, 2006). It is intended to address the sustainability of the Town of Halton Hill's municipal drinking water sources.

The Tier 3 study involves the use of complex numerical groundwater and surface water models to examine the current and future sustainability of Halton Hill's water supply. The scope also includes a water budget assessment to evaluate the risk to the water quantity of the well fields. It was initiated after a previous Tier 2 study completed for Credit Valley Conservation indicated that the area may be under a moderate drinking water stress, as defined by the Ministry of Environment. A tiered approach uses water budget models using a process of successively more detailed and focused level of technical complexity, more refined information derived from water budgeting work and refined geographical scale.

For this study, it was essential that the model be supported by field data and a detailed field program was conducted to physically improve the understanding of the local hydrogeological setting. The results of a habitat assessment survey conducted under this program are shown on a map in Appendix 1-13.

The field program developed for this study was comprehensive and multifaceted. Each component of the investigation was intended to address a particular aspect of the hydrogeological system. The field work included seismic studies, borehole drilling and core logging, downhole geophysics, baseflow survey, and a well field assessment. Based on the results of the field work and subsequent analyses, a revised conceptual model was developed that was significantly different than the pre-existing conceptual understanding.

1.4.5 Other Class EAs

There are numerous studies relevant to this Master Plan, including previous and ongoing studies. Review and coordination with these studies has been integral in the development and selection of the Master Plan preferred water and wastewater servicing strategies. These studies are summarized in Table 1.

Table 1 Summary of Related Class EA Studies

Class EA Study	Class EA Schedule
Wastewater Pumping Station Capital Needs Assessment & Master Plan Class Environmental Assessment Study	N/A
Acton Wastewater Treatment Plant Class EA Study	C
Burlington-Oakville Interconnecting Watermains Class EA Study	C
Lindsay Court Well Field Class EA Study	B
Acton Water Supply Master Plan Class EA Study	B
Cedarvale Well Field Expansion Class EA Study	B

1.4.6 Intensification Analysis

A typical Master Plan approach for intensification review does not sufficiently identify local infrastructure requirements. As such, a separate Halton Region Intensification Analysis was completed and included a review of potential impact to existing local and trunk level water and wastewater infrastructure due to intensification growth within the core areas of Burlington, Oakville, Milton, Georgetown, and Acton.

The full pipe hydraulic models were utilized to analyze the system capacity required to support potential intensification growth in each municipality. The results of this analysis have been incorporated into the Master Plan and are documented later in this report and summarized in Section 1. Additional documentation related to the Halton Region Intensification Analysis Report is provided in Appendix 1-7.

2. Master Planning Process

The Municipal Engineers Association (MEA) Class Environmental Assessment (EA) process clearly defines approaches for completion of Master Plans within the Class EA context. Halton Region has prepared this Master Plan based generally on Approach 2, which involves preparing a Master Plan document at the conclusion of Phases 1 and 2 in order to fulfill the requirements for Schedule A, A+ and B projects. Halton Region has identified Schedule C projects that will follow on with separate studies in order to provide greater pre-design detail. These studies would be completed separately to fulfill the requirements of Phases 3 and 4 of the Class EA process.

2.1 Class Environmental Assessment Process

This section describes the Class EA process and the specific requirements for the preparation of master plans.

2.1.1 Environmental Assessment Act

Ontario's Environmental Assessment Act (EA Act) was passed in 1975 and proclaimed in 1976. The EA Act requires proponents to examine and document the environmental effects that might result from major projects or activities and their alternatives. Municipal undertakings became subject to the Act in 1981.

The *Act* defines the environment broadly as:

- Air, land or water
- Plant and animal life, including man
- The social, economic and cultural conditions that influence the life of man or a community
- Any building, structure, machine or other device or thing made by man
- Any solid, liquid, gas odour, heat, sound, vibration or radiation resulting directly or indirect from activities of man
- Any part or combination of the foregoing and the interrelationships between any two or more of them.

The purpose of the EA Act is the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation and wise management of the environment in Ontario (RSO1990, c. 18, s.2).
As set out in Section 5(3) of the *EA Act*, an EA document must include the following:

- A description of:
  - The undertaking
  - The alternative methods of carrying out the undertaking
  - Alternatives to the undertaking
- A description of:
  - The environment that will be affected or that might reasonably be expected to be affected, directly or indirectly, by the undertaking or alternatives to the undertaking.
  - The effects that will be caused or that might reasonably be expected to be caused to the environment by the undertaking or alternatives to the undertaking.
  - The actions necessary or that may reasonably be expected to be necessary to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment by the undertaking or alternatives to the undertaking.
- An evaluation of the advantages and disadvantages to the environment of the undertaking, the alternative methods of carrying out the undertaking and the alternatives to the undertaking (RSO 1990, c. 18, s.2).

2.1.2 Principles of Environmental Planning

The Act sets a framework for a systematic, rational and replicable environmental planning process that is based on five key principles, as follows:

1. Consultation with affected parties. Consultation with the public and government review agencies is an integral part of the planning process. Consultation allows the proponent to identify and address concerns cooperatively before final decisions are made. Consultation should begin as early as possible in the planning process.
2. Consideration of a reasonable range of alternatives. Alternatives include functionally different solutions, "alternatives to" the proposed undertaking and "alternative methods" of implementing the preferred solution. The "do nothing" alternative must also be considered.
3. Identification and consideration of the effects of each alternative on all aspects of the environment. This includes the natural, social, cultural, technical, and economic environments.
4. Systematic evaluation of alternatives in terms of their advantages and disadvantages, to determine their net environmental effects. The evaluation shall increase in the level of detail as the study moves from the evaluation of "alternatives to" to the evaluation of "alternative methods".
5. Provision of clean and complete documentation of the planning process followed, to allow "traceability" of decision-making with respect to the project. The planning process must be documented in such a way that it may be repeated with similar results.

2.1.3 Class Environmental Assessment

"Class" Environmental Assessments were approved by the Minister of the Environment in 1987 for municipal projects having predictable and mitigable impacts. The municipal Class EAs were revised and updated in 1993, 2000 and again in 2007. The Class EA approach streamlines the planning and approvals process for municipal projects which have the following characteristics:

- Recurring
- Similar in nature
- Usually limited in scale
- Predictable range of environmental impacts
- Responsive to mitigation.

The Municipal Class Environmental Assessment, prepared by the Municipal Engineers Association (June 2000), outlines the procedures to be followed to satisfy EA requirements for water, wastewater and road projects. The process includes five phases:

Phase 1: Problem or Opportunity
Phase 2: Alternative Solutions
Phase 3: Alternative Design Concepts for the Preferred Solution
Phase 4: Environmental Study Report
Phase 5: Implementation.

Public and agency consultation are integral to the Class EA planning process. Projects subject to the Class EA process are classified into four possible "schedules", depending on the degree of expected impacts. Schedule A projects are minor, operational and maintenance activities and are pre-approved without the need for further assessment. Schedule A+ projects are also pre-approved; however, the public is to be advised prior to project

implementation. Schedule B projects require a screening of alternatives for their environmental impacts and fulfillment of Phases 1 and 2 of the planning process.

If outstanding issues remain after the public review period, any party may request that the Minister of the Environment consider a Part II Order, also known as "bumping-up" the project to an Individual EA. Provided no significant impacts are identified and no requests for a Part II Order to a Schedule C or Individual Environmental Assessment (IEA) are received, Schedule B projects are approved and may proceed directly to implementation.

Schedule C projects must satisfy all five phases of the Class EA planning process. These projects have the potential for greater environmental impacts. Phase 3 involves the assessment of alternative methods of carrying out the project, as well as public consultation on the preferred conceptual design. Phase 4 normally includes the preparation of an Environmental Study Report (ESR) which is filed for public review. Provided no significant impacts are identified and no requests for a Part II Order or "bump-up" to an IEA are received, Schedule C projects are then approved and may proceed directly to implementation.

The Class EA process flowchart is provided in Figure 1.

2.1.4 Master Planning Process

Municipalities recognize the benefits of comprehensive, long-range planning exercises that examine problems and solutions for an overall system of municipal services. The Municipal Class EA for Water and Wastewater Projects recognizes the importance of master plans as the basis for sound environmental planning. The Class EA defines master plans as:

> "*Long range plans which integrate infrastructure requirements for existing and future land use with environmental assessment planning principles. These plans examine an infrastructure system(s) or group of related projects in order to outline a framework for planning for subsequent projects and/or developments."*

Master Plans have distinguishing features that set them apart from project specific studies, such as:

- Master Plans are broad in scope and focus on the analysis of a system for the purpose of outlining a framework for the provision of future works and developments.
- Specific projects recommended in a Master Plan are part of a larger management system and are distributed geographically throughout the study area. The implementation of specific projects may occur over an extended time frame.

According to the Class EA document, a Master Plan must <u>at least</u> satisfy the requirements of Phases 1 and 2 of the Class EA process and incorporate the five key principles of environmental planning, as identified in Section 2.1.2. The Master Plan must document public and agency consultation at each phase of the process and a reasonable range of alternative solutions must be identified and systematically evaluated.

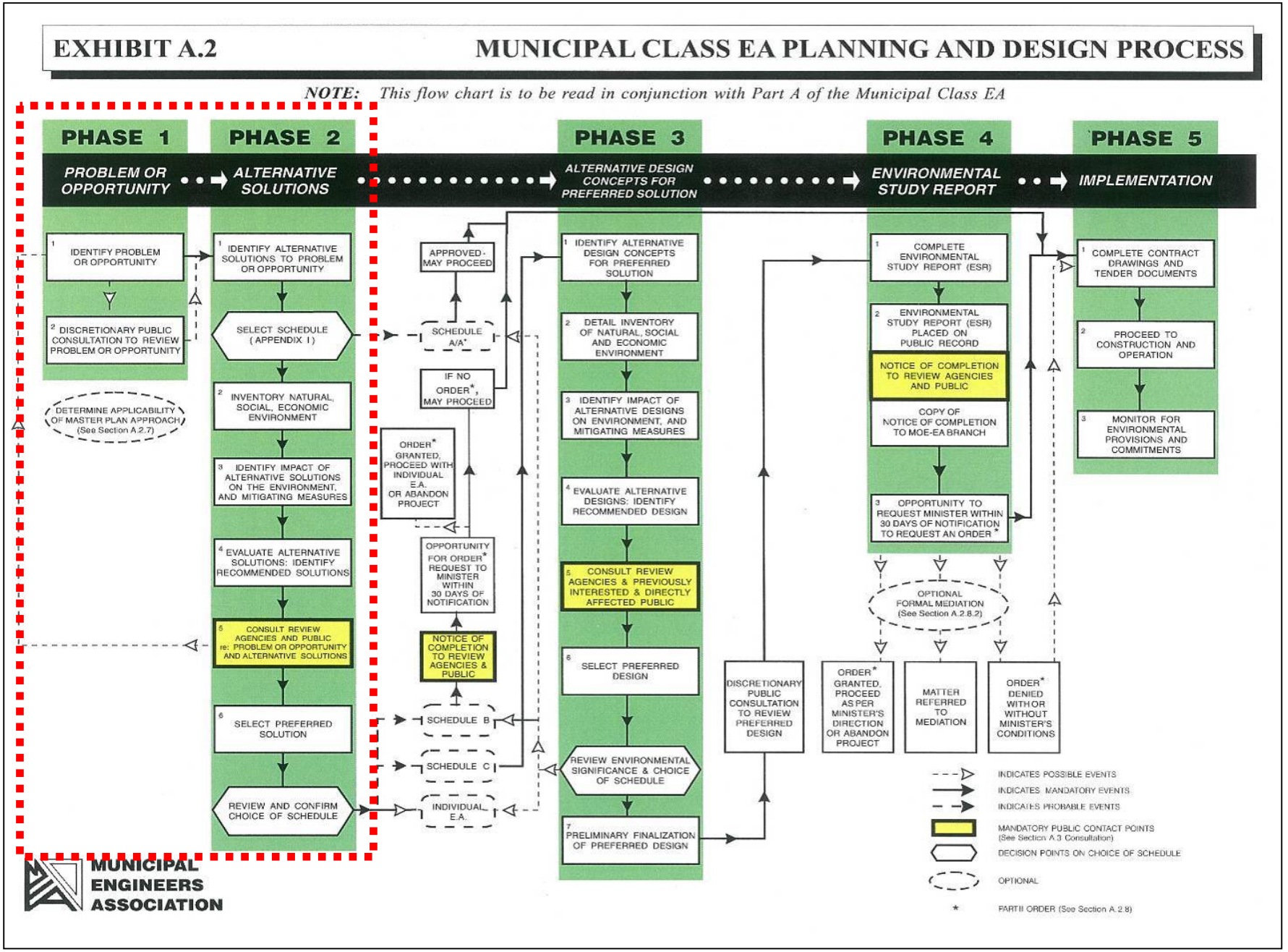


Figure 1 Municipal Class EA Planning and Design Process

The Sustainable Halton Water and Wastewater Master Plan is designed to build on the decision making completed in the previous Master Plan exercises and presents a refined strategy. The approach for the Master Plan is to confirm the existing projects and evaluate and develop any new components. This approach would also be scrutinized through a public and agency consultation process and be fully documented.

2.2 Public Consultation

Communication and consultation has been an important component of the Sustainable Halton Water and Wastewater Master Plan Class EA process. At the outset of the Master Plan process, a Public Consultation Plan was developed.

The primary goal of the plan was to carry out meaningful consultation with interested and affected stakeholders. The main goals and objectives were to:

- Present clear and concise information to stakeholders at key stages of the study process
- Solicit community, regulatory and Regional staff input
- Meet Municipal Class EA consultation requirements
- Ensure the general public, regional and municipal councillors, stakeholders, external agencies (including federal and provincial) and special interest groups have an opportunity to participate in the study process;
- Ensure that factual information is provided to interested and affected stakeholders as soon as reasonably possible; and
- Make contact with external agencies to obtain legislative or regulatory approvals, or to collect pertinent technical information.

Full documentation of the consultation and communication program is contained in *Volume III – Public Consultation*.

2.2.1 Study Communication and Public Consultation

A contact list of relevant and interested parties, including agencies, local area municipalities, and interested members of the community, was compiled. This contact list was continuously updated and used for mailing and e-mailing, where applicable, of Project Notices.

The following public consultation activities were undertaken as part of the Sustainable Halton Water and Wastewater Master Plan process.

Consultation during the Sustainable Halton Growth Conformity Exercise

- Participation at the Public Information Centres
  - September/October 2007
  - January 2008
  - September 2008
  - May/June 2009

Consultation during the Sustainable Halton Water and Wastewater Master Plan

The Notice of Commencement was published and distributed in May 2010.

Additional communications and consultation during the Master Plan are described in the following sections.

2.2.1.1 Public Information Centres #1

The first round of Master Plan Public Information Centres (PICs) was held during Phase 1 of the Class EA study process to present and receive feedback regarding the Problem and Opportunity Statement, Conceptual Servicing Alternatives and shortlisted Preliminary Preferred Conceptual Servicing Alternatives.

PIC#1 was held at the locations and dates shown below:

- Town of Milton – May 26, 2010 (Milton Sports Centre)
- Town of Burlington – May 27, 2010 (Assumption High School)
- Town of Oakville – May 3, 2010 (Halton Regional Centre)
- Town of Halton Hills – June 2, 2010 (Acton Arena and Community Centre).

Details on attendance, comments received, and display panels presented are provided in *Volume III – Public Consultation*.

2.2.1.2 Public Information Centres #2

The second round of PICs was held during Phase 2 of the Class EA study process to present the key water and wastewater issues, servicing alternatives, and preliminary preferred solutions.

PIC#2 was held at the locations and dates shown below:

- Town of Oakville – February 16, 2011 (Halton Regional Centre)
- Town of Burlington – February 17, 2011 (Assumption High School)
- Town of Milton – February 22, 2011 (Milton Sports Centre)
- Town of Halton Hills – February 24, 2011 (Christ the King High School).

Details on attendance, comments received, and display panels presented are provided in *Volume III – Public Consultation*.

The Notice of Completion was published and distributed in October 2011.

2.2.2 Public Access to Information

All project publications, presentation materials and other documentation has been made available to the general public through the Region's website (http://www.halton.ca). Information presented at both rounds of PICs was also posted on this website.

The Region also mailed project information to those who had expressed interest in the study but did not have access to the internet.

2.2.3 Stakeholder and Agency Consultation

In addition to the Public Information Centres held in Phases 1 and 2 of the study, technical workshops were also held with local non-governmental agencies, area municipalities, conservation authorities, and other approval agencies.

2.2.3.1 Technical Advisory Committee Meeting #1

The first Technical Advisory Committee Meeting (TAC #1) was held during Phase 1 of the study. Major discussion items included study objectives, planning projections and land use assumptions, preliminary servicing concepts, and intensification. TAC #1 was held on May 3rd, 2010.

2.2.3.2 Technical Advisory Committee Meeting #2

The second Technical Advisory Committee Meeting (TAC #2) was held during Phase 2 of the study. Major discussion items focused on key servicing issues, alternatives, and solutions as well as the preliminary preferred servicing strategy. TAC #2 was held on April 1st, 2011.

2.2.3.3 Review Agency Consultation

An independent review of the draft documentation and approval needs with Conservation Halton (CH), Credit Valley Conservation (CVC), and the Niagara Escarpment Commission (NEC) were coordinated in August/September 2011.

2.2.3.4 Development and Community Consultation and Co-ordination

Additional coordination meetings with the development community and representatives were held to review and discuss servicing strategies. These meetings were held as follows:

- Building, Industry and Land Development (BILD) – March 2011
- Halton Developers Liaison Committee (HDLC) – March 2011 and September 2011
- Milton / Georgetown Developers – March 2011
- Halton Area Planning Partners – March 2011
- Milton Realtors – June 2011
- Burlington Green/P.O.W.E.R. – October 2010 and June 2011.

3. Problem and Opportunity Statement

3.1 Study Area

Halton Region is situated in the west-central portion of the Greater Golden Horseshoe (please refer to Figure 2) and covers 959 square kilometres (370 square miles). The Region has a 25 kilometre frontage along Lake Ontario to the south and extends north of the Niagara Escarpment. The study area for the Sustainable Halton Water and Wastewater Master Plan covers all existing designated urban areas in the Region including, Town of Oakville, City of Burlington, Town of Milton, and the Town of Halton Hills (401 Corridor, Georgetown and Acton).

The study area is currently governed by the land use policies set forth in the Office Consolidation of the Halton Regional Official Plan (2006). In those areas covered by the Niagara Escarpment Plan and Parkway Belt West Plan, special Provincial plans are in effect and take precedence over the Regional Official Plan.

The study area is depicted in Figure 3.

3.2 Planning Context

In 2006, Halton Region launched the Sustainable Halton process to respond to the province's Places to Grow Plan, the Greenbelt Plan and the Provincial Policy Statement. The Sustainable Halton process helped develop Halton's growth management strategy to 2031. Starting in 2009, as part of Sustainable Halton, the Region initiated three amendments to the Regional Official Plan (2006). These amendments are Regional Official Plan Amendment No. 37 (ROPA 37), Regional Official Plan Amendment No. 38 (ROPA 38) and Regional Official Plan Amendment No. 39 (ROPA 39).

3.2.1 ROPA 37

On June 3, 2009, Regional Council adopted Regional Official Plan Amendment No. 37 (ROPA 37), *An Amendment to Incorporate the Basic Requirements of the Places to Grow Plan (Report LPS-64-09)*. ROPA 37 brought the Regional Official Plan into conformity with the Provincial Growth Plan by the June 16, 2009 deadline and, among other things, contained the density and intensity targets of the Provincial Growth Plan and provided for the protection of employment lands through more stringent criteria for conversion to other uses. The Minister of Municipal Affairs issued a Final Decision for ROPA 37 on November 27, 2009. With the Ontario Municipal Board's decision of November 29, 2010, ROPA 37 came into effect, save and except for three sections as outlined in the decision.

3.2.2 ROPA 38

Following Regional Council's approval of ROPA 37 and selection of a Preferred Growth Option for the period of 2021 to 2031 (Report LPS69-09), Regional staff began the 5 year statutory review of the Regional Official Plan. This process culminated with Council's unanimous approval of Regional Official Plan Amendment No. 38 (ROPA 38), *An Amendment to Incorporate the Results of Sustainable Halton, Official Plan Review Directions and Other Matters,* on December 16, 2009 (Reports LPS-114-09 and LPS-118-09). ROPA 38 brought the Regional Official Plan into conformity with the Provincial Growth Plan, the Greenbelt Plan and the Provincial Policy Statement (2005) and established a growth management strategy to guide development within the Region to 2031. It focused on delivering strong, vibrant and complete communities, an enhanced natural heritage system and a sustainable agricultural industry and land use decision making process within Halton.

On October 27, 2010, the Minister of Municipal Affairs and Housing issued a partial Draft Decision on ROPA 38. The Province's "Final Decision" for ROPA 38 is expected in late 2011 or early 2012.

3.2.3 ROPA 39

Regional Official Plan Amendment No. 39, *Regional Development Phasing to 2031,* was prepared following Regional Council's approval of ROPA 38 to implement the Regional Official Plan policies that require the Region to determine the phasing of growth in accordance with the new distribution of population and employment to 2031 in Table 1 of ROPA 38 and to show the phasing on Map 5 (Regional Phasing) of the Regional Official Plan.

As background to the Regional phasing, Regional staff updated the Region's Best Planning Estimates based on the employment and population distribution to 2031 in Table 1 and the new housing targets introduced through ROPA 38. Regional Council adopted ROPA 39 on July 13, 2011 (Report LPS-54-11).

The Region issued a Notice of Adoption for ROPA 39 on July 22, 2011. ROPA 39, along with appeals to the amendment, was forwarded to the Ontario Municipal Board, in August, 2011.

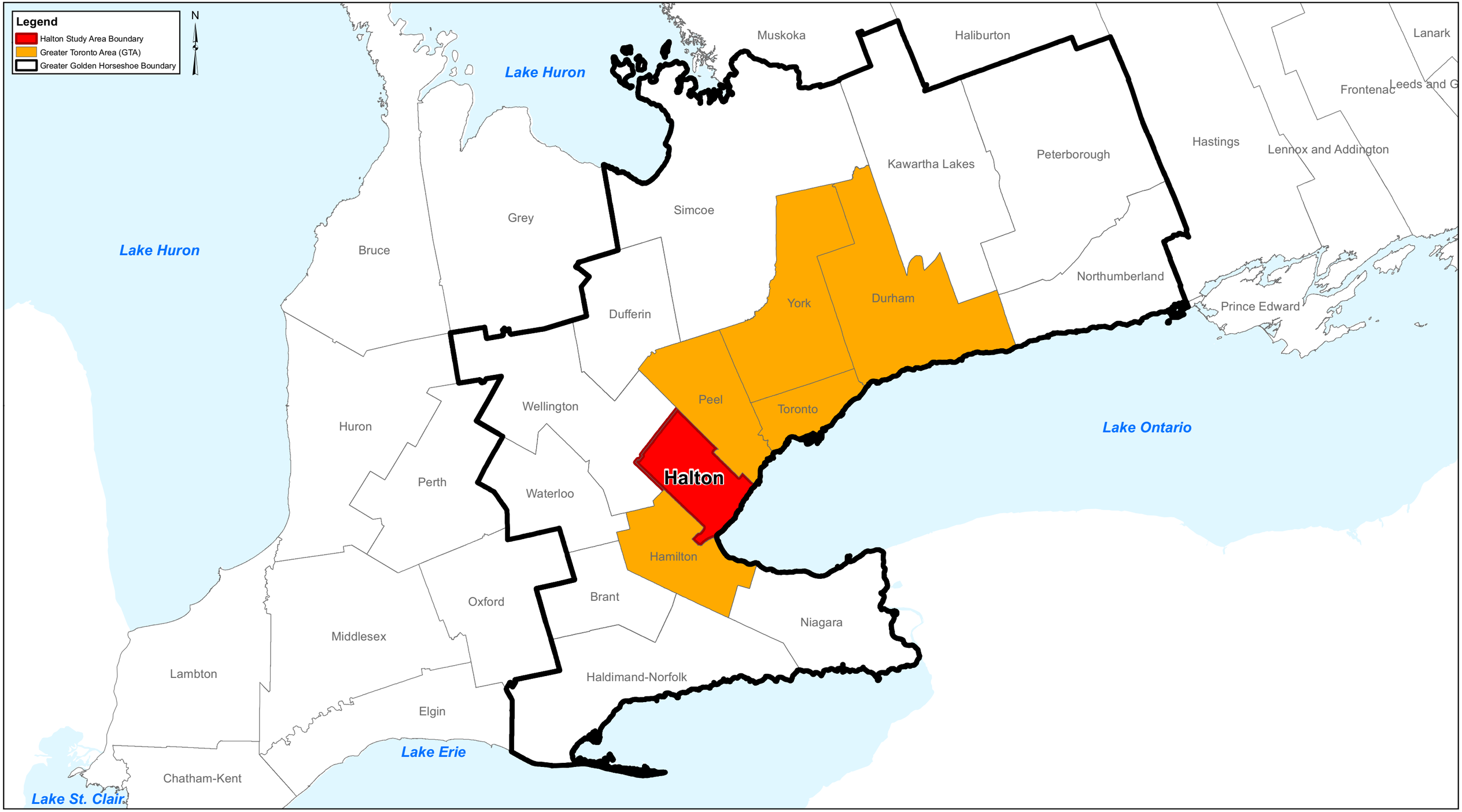
3.2.4 Provincial and National Legislation and Policy

This Master Plan is based on the Sustainable Halton planning process and meets Places to Grow Plan targets.

Halton Region, like all municipalities in Ontario, must operate within the administrative, legislative and financial framework established by senior levels of government. The key provincial initiatives that provided directives, and were considered under the Master Plan process, include the following:

- Provincial Policy Statement 2005
- Greenbelt Plan
- Niagara Escarpment Plan
- Parkway Belt West Plan
- Places to Grow Growth Plan for the Greater Golden Horseshoe
- Planning Act Reform
- Applicable Federal Legislation and Policy such as the Federal Fisheries Act.

The results of these initiatives directly affect future growth in Halton and the Region's policies to accommodate growth.

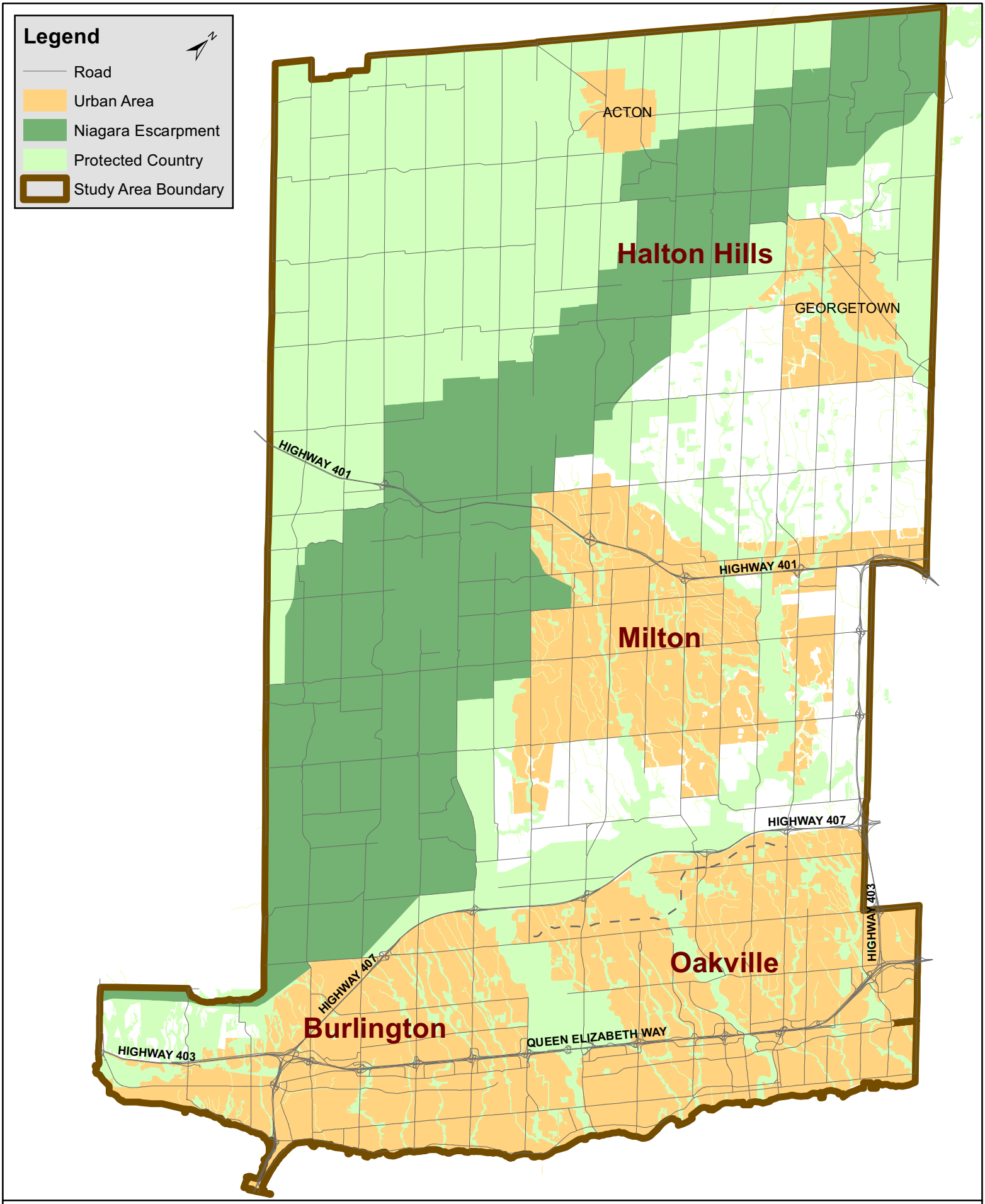


Sustainable Halton
Water and Wastewater Master Plan

Halton Region Boundary within Greater Golden Horseshoe

Figure 2

1:1,250,000
11 Oct 2011
File: 60114062-352-G



Halton Region
Sustainable Halton
Water and Wastewater Master Plan

Halton Region
Study Area
Figure 3

AECOM
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11 Oct 2011
File: 60114062-127-G

3.2.5.1 Provincial Policy Statement

The Provincial Policy Statement (PPS) (Ontario Ministry of Municipal Affairs and Housing, 2005) provides policy direction on matters of provincial interest related to land use planning and development. As a key part of Ontario's policy-led planning system, the PPS sets the policy foundation for regulating the development and use of land. It fosters appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural environment. Key policies relevant to water and wastewater services include the following:

- Infrastructure and public service facilities shall be provided in a coordinated, efficient and cost-effective manner to accommodate projected needs. Planning for infrastructure and public service facilities shall be integrated with planning for growth so that these are available to meet current and projected needs. (Policy 1.6.1)
- The use of existing infrastructure and public service facilities should be optimized, wherever feasible, before consideration is given to developing new infrastructure and public service facilities. (Policy 1.6.2)
- Planning for sewage and water services shall:
  - Direct and accommodate expected growth in a manner that promotes the efficient use of existing:
    - municipal sewage services and municipal water services; and
    - private communal sewage services and private communal water services, where municipal sewage services and municipal water services are not available
  - Ensure that these systems are provided in a manner that:
    - can be sustained by the water resources upon which such services rely
    - is financially viable and complies with all regulatory requirements; and
    - protects human health and the natural environment
  - Promote water conservation and water use efficiency
  - Integrate servicing and land use considerations at all stages of the planning process; and
  - Subject to the hierarchy of services provided in policies 1.6.4.2, 1.6.4.3 and 1.6.4.4, allow lot creation only if there is confirmation of sufficient reserve sewage system capacity and reserve water system capacity within municipal sewage services and municipal water services or private communal sewage services and private communal water services. (Policy 1.6.4.1)
  - Treatment capacity should be available for treatment of hauled sewage – that is, waste from septic tanks or other treatment units.

3.2.5.2 Greenbelt Plan

The Greenbelt is a broad band of permanently protected land which supports agriculture as the predominant land use, gives permanent protection to the natural heritage and water resource systems, and provides for a diverse range of economic and social activities. It includes lands within, and builds upon the ecological protections provided by, the Niagara Escarpment Plan (NEP) and the Oak Ridges Moraine Conservation Plan (ORMCP). The Greenbelt Plan identifies where urbanization should not occur in order to provide permanent protection to the agricultural land base and the ecological features and functions occurring on this landscape.

3.2.5.3 Niagara Escarpment Plan

The Niagara Escarpment is a provincially significant, 725 kilometre (450 mile) long geological feature, a portion of which runs through Halton. In 1990, the United Nations Educational, Scientific and Cultural Organization (UNESCO) named Ontario's Niagara Escarpment a *World Biosphere Reserve*. This designation recognizes the natural features and ecological importance of the Escarpment.

The *Niagara Escarpment Plan* is a large scale environmental land use plan with aims of balancing protection, conservation and sustainable development to ensure that the Escarpment remains mainly a natural environment.

The policies of the Niagara Escarpment Plan are the policies of the Greenbelt Plan for the Niagara Escarpment Plan Area.

Niagara Escarpment Plan policies were considered in the preparation of the Sustainable Halton Water and Wastewater Master Plan with specific objective compliance and factors considered as follows:

New Development Affecting Water Resources
The objective is to ensure that new development that might affect streams, watercourses, lakes, wetlands, and groundwater systems will have minimum, individual and cumulative effect on water quality and quantity, and on the Escarpment environment.

Transportation and Utilities
The objective is to design and locate new and expanded transportation and utility facilities so the least possible change occurs in the environment and the natural and cultural landscape.

All new and reconstructed transportation and utility facilities shall be designed and located to minimize the impact on the Escarpment environment and be consistent with the Plan.

New transportation and utilities facilities should avoid Escarpment Natural Areas. (*The Niagara Escarpment Plan, Niagara Escarpment Commission, Office Consolidation September 26, 2006)*

3.2.5.4 Places to Grow

Places to Grow is a growth plan for the Greater Golden Horseshoe. It is a 25-year plan, released in 2006, that has the following goals:

- Revitalize downtowns to become vibrant and convenient centres
- Create complete communities that offer more options for living, working, learning, shopping and playing
- Provide housing options to meet the needs of people at any age
- Curb sprawl and protect farmland and green spaces
- Reduce traffic gridlock by improving access to a greater range of transportation options
- Places to Grow sets population and employment targets that Halton Region must plan to achieve. Specifically, the Region needs to plan for a total 780,000 people and 390,000 jobs by 2031.

3.2.5.5 Federal Fisheries Act

The key national legislation for the protection of fish habitat is the Fisheries Act. The primary goal of this Act is to protect fish habitat from 1) biological 2) physical 3) or chemical alterations that are harmful or destructive. Fisheries and Oceans Canada (DFO) is responsible for the enforcement and management of fisheries resources according to the Fisheries Act. DFO works in conjunction with a variety of other agencies (Environment Canada, Ontario Ministry of Natural Resources (OMNR), Ontario Ministry of the Environment and Conservation Authorities) for administration of various portions of the Fisheries Act. The two significant components of this legislation in relation to watercourse crossings are briefly discussed below:

> *Section 35(1):*
>
> *No person shall carry on any work or undertaking that result in the harmful alteration, disruption or destruction of fish habitat.*

The guiding principle for Section 35(1) is "no net loss" of productive capacity of fish habitat in relation to project proposals. The DFO is ultimately responsible for the review and analysis process to identify the mitigation measures required to minimize or eliminate the adverse effects of projects on habitat or the compensation measures that apply in order to achieve no net loss in the productive capacity of fish habitat.

> *Section 36(3):*
>
> *No person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter such water.*

3.2.5.6 Species at Risk Act

- The federal Species at Risk Act (SARA) was created to prevent wildlife species from becoming extinct. The federal Act protects species at risk and their critical habitats. SARA also contains provisions to help manage species of special concern to prevent them from becoming endangered or extinct. The Act became law in June 2003. It includes prohibitions against killing, harming, harassing, capturing or taking species at risk, and makes it illegal to destroy their critical habitats and can impose restrictions on development and construction projects.
- The new *Ontario Endangered Species Act (2007)* covers public and private lands while the main limitation of SARA is that its legislative coverage extends only to federal lands. In Ontario, the SARA will take precedence for habitat protection and stewardship efforts for migratory birds and some aquatic species designated 'at risk'. The Ontario ESA (2007) takes precedence for most other species at risk.
- Species are designated 'at risk' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), an independent body of experts that assesses wildlife according to a broad range of scientific data. The committee meets annually to review status reports on species suspected of being at risk and provides assessments to government and the public. The federal Cabinet then decides whether those species should get legal protection under the Act. These decisions are made after consultations with affected stakeholders and other groups.
- Once a species is added to the list and protected officially under SARA, a recovery strategy must be developed. For endangered species, this strategy must be developed within a year of the listing; for threatened or extirpated (extinct in Canada) species, it must be developed within two years
- Recovery strategies and action plans for species listed as endangered or threatened will be developed in consultation with stakeholders. These recovery strategies and action plans will detail the specific steps that need to be taken to protect identified species.
- Action plans summarize the projects and activities required to meet recovery strategy objectives and goals. They include information on habitat, details of protection measures, and evaluation of socio-economic costs and benefits. Action plans are the second element of the Act's two-part recovery planning process, and are used to implement projects and activities to improve species status.
- Management plans differ from recovery strategies and action plans. Management plans set goals and objectives for maintaining sustainable population levels of one or more species that are particularly sensitive to environmental factors, but which are not yet considered in danger of becoming extinct. Whenever possible, management plans are prepared for multiple species on an ecosystem or landscape level.

SARA provides for a number of exceptions in a variety of circumstances. For example, activities that are undertaken in accordance with conservation measures for wildlife species under a land claims agreement are exempt from the application of SARA prohibitions. Activities related to public safety, health or national security may also be exempted. SARA also allows for permits to be issued or agreements to be entered into under certain conditions, to authorize certain activities that would otherwise contravene the Act.

Watersheds within the Master Plan study area contain watercourse segments that have been identified as having known distributions of fish designated as Extirpated, Endangered and/or Threatened that are not currently on Schedule 1 of the federal Species at Risk Act (SARA). Species in this category include Atlantic salmon, Lake Sturgeon and Redside Dace. Although the SARA prohibitions do not currently apply to these species, they could in the near future.

3.2.5.7 Endangered Species Act

Ontario's original Endangered Species Act was written in 1971. The new Endangered Species Act, 2007 (ESA 2007) received Royal Assent on May 17, 2007. With some minor exceptions, the Act came into force on June 30, 2008.

- The purposes of this Act are:
  - To identify species at risk based on the best available scientific information, including information obtained from community knowledge and aboriginal traditional knowledge.
  - To protect species that are at risk and their habitats, and to promote the recovery of species that are at risk.
  - To promote stewardship activities to assist in the protection and recovery of species that are at risk.
- The new legislation is the first in Canada to combine mandatory habitat protection with a science-based approach to listing species for protection. Species thought to be at risk are assessed by The Committee on the Status of Species at Risk in Ontario (COSSARO). COSSARO is an independent body that reviews species based on the best available science, including community knowledge, and Aboriginal Traditional Knowledge.
- Once species are classified "at risk", they are added to the Species at Risk in Ontario (SARO) list in one of four categories. Endangered, threatened and extirpated species on this list automatically receive legal protection under the ESA 2007. Providing legal protection to threatened species is a change from the original Act which only applied to endangered species.
- The new Act provides protection for species and their habitats. When a species is classified as endangered or threatened the habitat of that species is protected under a general definition. The Lieutenant Governor in Council may make regulations prescribing as area as habitat of a species that is listed as extirpated, endangered or threatened on the SARO list. A habitat regulation can prescribe an area as the habitat of a species through the description of boundaries or features of an area, or by describing that area in any other manner. Habitat will be regulated with the goal of protecting habitat that promotes the survival and recovery of endangered and threatened species.
- Species-specific habitat prescribed and protected under Regulation 242-08, that is considered likely to occur within the primary study area, will be assessed through detailed field investigations during subsequent phases of this study. Habitat protection for nine species that include American Badger, Barn Owl, Eastern prairie fringed-orchid, Engelmann's quillwort, Few-flowered club-rush, Jefferson salamander, Peregrine falcon, Western silvery aster and Wood turtle came into force on February 18, 2010. Preliminary screening has identified that only Jefferson salamander, Peregrine Falcon and Wood turtle are likely to occur within the Master Plan study area.
- The ESA 2007 calls for the creation of recovery strategies for endangered and threatened species, and management plans for special concern species. These documents provide advice to the government on steps to take to protect and recover species at risk to healthy population levels.
- Timelines and reporting requirements have been outlined in the Act to improve implementation. For example:
- Recovery strategies must be created within 1 year for newly listed endangered species.
- The government must also let the public know which actions will be taken for species recovery.

3.3 Population and Employment Planning Projections

3.3.1 BPE Data June 2011

The planning data set is based on the Halton Region June 2011 Best Planning Estimates (BPE) data. This planning data set contained population and employment projections that are geographically distributed by Traffic Survey Zone (TSZ) and subsequently more discretely to smaller areas identified as Small Geographic Units (SGUs) for master planning analyses. The BPE June 2011 Data are presented in Table 2 and Table 3.

It should be noted that the BPE data presented reflects the projections with residential Census undercount which has been identified by Halton Region Planning as approximately 4%. The BPE data projections have been utilized with Halton Region design criteria to ensure future demand and flow projections reflect actual future population. As such, the servicing strategies developed under the Sustainable Halton Water and Wastewater Master Plan will meet the Province of Ontario Places to Grow target for Halton Region of approximately 780,000 persons and 390,000 employees by 2031.

Halton Region's Places to Grow growth conformity exercise resulted in a Preferred Growth Option that ultimately led to the preparation and endorsement of the BPE data used in the preparation of this Master Plan. The preferred growth option with the new urban boundary is depicted in Figure 4, for reference. For further details please refer to Staff Report No. LPS 69-09 – Sustainable Halton – Preferred Growth Option and Official Plan Review Directions Report and No. LPS 54-11 – Adoption of ROPA 39 "Regional Development Phasing to 2031" and Endorsement of the "Best Planning Estimates of Population, Occupied Dwelling Units and Employment, 2011-2031".

Table 2 Halton Region Population Projections to 2031

Municipality	Population (Persons)					
	2006	2011	2016	2021	2026	2031
Oakville	165,529	174,780	197,702	221,826	234,122	246,399
Burlington	164,446	173,761	175,438	178,847	182,034	186,169
Milton	53,938	88,438	124,645	161,750	195,735	228,084
Halton Hills	54,978	56,066	57,922	61,672	77,003	91,885
TOTAL	438,891	493,045	555,707	624,094	688,895	752,537

Table 3 Halton Region Employment Projections to 2031

Municipality	Employment (Employees)					
	2006	2011	2016	2021	2026	2031
Oakville	82,089	90,969	106,485	120,796	122,578	128,359
Burlington	87,854	95,656	98,710	102,846	104,145	105,349
Milton	27,232	44,452	62,553	81,106	96,631	114,330
Halton Hills	19,228	19,856	20,744	22,936	32,356	41,962
TOTAL	216,403	250,932	288,493	327,684	355,710	390,000

3.3.2 Service Area Projections

The distribution of population and employment growth among the primary geographic regions of the Sustainable Halton study area up to year 2031 were prepared in partnership between the Halton Region and the Region's individual local municipalities.

The projections are summarized based on the potential service areas within the overall study area and are presented in Table 4 and Table 5.

Table 4 Service Area Population Projections to 2031

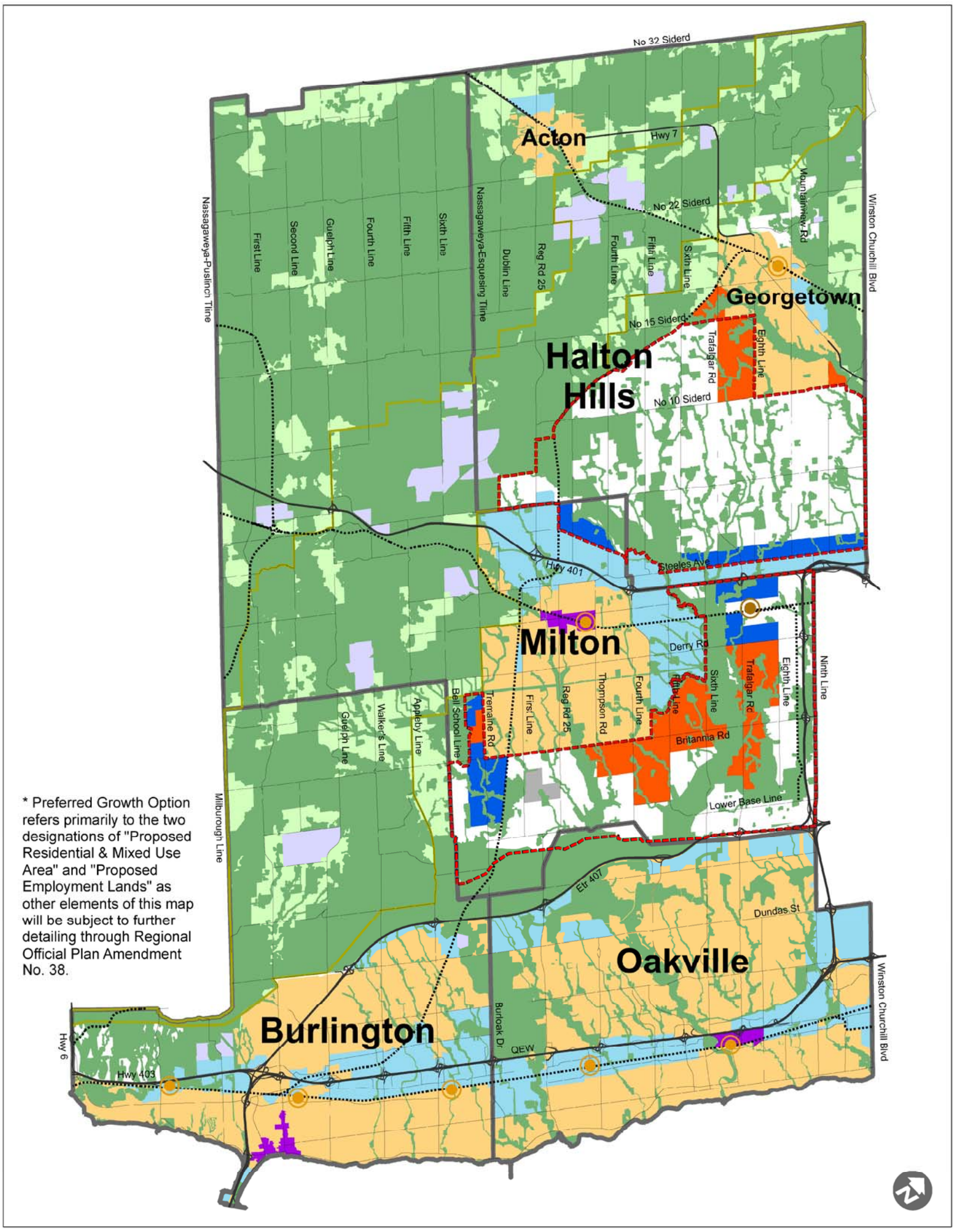
Service Area	Serviced Population (Persons)					
	2006	2011	2016	2021	2026	2031
Oakville	165,412	174,655	197,584	221,709	234,007	246,282
Burlington	160,833	170,176	171,919	175,393	178,648	182,834
Milton	48,332	82,752	118,931	155,945	189,587	221,450
Halton Hills 401 Corridor	0	0	0	0	0	0
Sub-Total South Halton	374,577	427,583	488,434	553,047	602,242	650,566
Acton	10,233	10,036	9,796	10,379	12,874	13,981
Georgetown	37,271	38,708	41,042	44,410	57,452	71,332
Note: Projections based on serviced area only and does not include rural population (BPE Data June 2011) Georgetown serviced population includes future servicing of Hamlets						

Table 5 Service Area Employment Projections to 2031

Service Area	Serviced Employment (Employees)					
	2006	2011	2016	2021	2026	2031
Oakville	82,089	90,969	106,485	120,796	122,578	128,359
Burlington	87,455	94,990	97,952	102,033	103,315	104,508
Milton	25,684	42,792	60,777	79,276	94,723	112,251
Halton Hills 401 Corridor	1,500	1,702	2,179	3,778	11,276	19,204
Sub-Total South Halton	196,728	230,453	267,393	305,883	331,892	364,322
Acton	3,642	3,791	4,085	4,354	4,744	5,071
Georgetown	12,663	12,902	13,017	13,341	14,868	16,206
Note: Projections based on serviced area only and does not include rural employment (BPE Data June 2011) Georgetown serviced employment includes future servicing of Hamlets						

Preferred Growth Option*

Attachment #1 (Amended)
To Report LPS69-09



* Preferred Growth Option refers primarily to the two designations of "Proposed Residential & Mixed Use Area" and "Proposed Employment Lands" as other elements of this map will be subject to further detailing through Regional Official Plan Amendment No. 38.

- GO Station
- Potential GO Station
- Rail Corridor
- Primary Study Area
- Provincial Greenbelt
- Natural Heritage System
- NEC Plan Area
- Urban Growth Centres
- Mineral Resource Extraction Area
- Waste Management Site
- Rural Area
- Municipal Boundary
- **Existing Urban Area**
- **Proposed Residential & Mixed Use Area**
- **Existing Local Official Plan Designated Employment Lands**
- **Proposed Employment Lands**

Date: 19.06.09

Halton REGION
Sustainable Halton
Water and Wastewater Master Plan

Preferred Growth Option
Figure 4

AECOM

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3.4 Inter-Regional Servicing

Currently, there are a few localized and isolated areas in Halton that are supplied through inter-regional connections, including the Bridgeview, Waterdown Road and Snake Road water service areas which are supplied by the City of Hamilton. There are also existing connections of the Oakville and Milton water system with the Region of Peel system along the Winston Churchill Boulevard corridor. The inter-Regional connections with Hamilton are a fundamental to providing water servicing for the isolated areas. The Peel connections are primarily implemented for emergency conditions.

Halton Region did undertake additional consultation with the neighbouring municipalities. It is understood that the existing connections will remain fundamental to the Region wide servicing strategy. Additional inter-connections for specific service areas will be considered under the Master Plan process. However, based on discussions with the municipalities, it has been identified that Halton-only solutions should be pursued and prioritized.

3.5 Problem/Opportunity Statement

The purpose of the Problem/Opportunity Statement is to define the principal starting point in the undertaking of the Master Plan Class EA and assist in defining the scope of the project.

As such, the Problem/Opportunity Statement has been defined as:

The 2008 Master Plan Update and the 2008 Development Charges Technical Report require review with respect to timing and costs for the water and wastewater infrastructure projects required to service growth within the existing designated urban area to 2031 reflecting the following factors:

- The Province, through its Places to Grow Act, has identified the need to accommodate growth to the year 2031 within Halton Region
- Update project schedule and costing based on revised population and employment planning estimates to 2031
- Recent intensification analyses undertaken for areas designated as Urban Growth Centres under Places to Grow
- Halton Region is required to conform with Provincial Planning Initiatives
- Water and wastewater infrastructure upgrades will be required to service areas already approved for development, as well as future residential and non-residential lands
- Satisfy Phases 1 & 2 of the Class EA process as per Section A.2.7 Master Plans, as defined in the Municipal Class Environmental Assessment document (October 2000, as amended in 2007)
- Need to integrate with other Regional master planning undertakings, such as the Transportation Master Plan
- Further strategic visioning post-2031 within the existing urban area boundary will be considered.

4. Master Plan Methodologies

4.1 Overview

The process of determining Halton Region's long term water and wastewater servicing needs involved a number of tasks and evaluation processes that were undertaken as part of the Master Plan process. The master planning approach undertaken follows the Municipal Class Environmental Assessment process and is in keeping with the "Sustainable Halton" approach. Some of the key tasks undertaken include:

- Establishing existing system conditions
- Identifying issues and constraints for each system
- Analyzing planning information
- Developing design criteria and projections of future water demands and wastewater flows
- Updating hydraulic models
- Assessing existing and future infrastructure capacity
- Identifying policy issues
- Identifying other considerations
- Developing evaluation criteria
- Developing alternative servicing concepts
- Evaluating alternative servicing strategies
- Determining implementation and scheduling.

4.2 Establishing Existing System Conditions

Baseline data relating to existing system conditions were provided by the Region at the outset of the study for water and wastewater treatment facilities, well water supply systems, pumping stations, reservoirs, and the full Regional water and wastewater pipe network. Infrastructure data included both physical and hydraulic information and was provided in a geodatabase. Specific system issues and constraints were also disseminated to the Project Team through discussions with Regional Operations staff.

Other information provided to help establish existing system conditions included:

- Annual water quality/wastewater system performance reports
- Plant/pumping station flow records
- As-built drawings
- Water pressure zones
- Wastewater drainage areas
- Halton Region water and wastewater design manuals
- Residential and ICI water billing and district metering data
- Inflow and infiltration flow monitoring reports.

Infrastructure baseline conditions for the water and wastewater systems are summarized in Sections 7 and 10 respectively.

Environmental baseline conditions were established through the Environmental and Hydro-geological Studies carried out as part of the Sustainable Halton Water and Wastewater Master Plan. These studies provided supporting information on existing groundwater extraction, available capacities, feature descriptions, inventory of existing environmental conditions, and detailed mapping of key features and functions of the natural environment.

4.3 Identifying Opportunities, Issues and Constraints

One of the first steps in the master planning process was identifying water and wastewater servicing issues and constraints in each system. This was achieved through discussion with Regional and local area municipal staff as well as through coordination with previous and ongoing related studies, such as the Intensification Analysis. Opportunities and constraints for each water and wastewater system are summarized in Sections 8.1 and 11.1 respectively.

4.4 Analysis of Planning Information

The Sustainable Halton Water and Wastewater Master Plan makes use of the planning information derived through the June 2011 Best Planning Estimates Data, provided in Section 3.3.1, in order to assess growth areas and allocate future water demands and wastewater flows.

The planning data was developed by Halton Region whereby Region-wide projections were geographically allocated by Traffic Survey Zones (TSZs) and subsequently more discrete areas identified as Small Geographic Units (SGUs) for master planning purposes. The data was provided to the Master Plan team in 5-year intervals: 2011, 2016, 2021, 2026, and 2031.

In applying the planning data for modelling purposes, additional GIS processing was completed to allocate the TSZ data to model node polygons using the land use (parcel fabric) layer.

4.5 Development of Design Criteria and Projection of Water Demands and Wastewater Flows

Estimating future water demands and wastewater flows is considered fundamental in the master planning process.

Water demands and wastewater flows were estimated based on the BPE June 2011 population and employment projections and applying the appropriate water consumption rate and wastewater generation rate respectively.

Water and wastewater design criteria used in the 2008 Master Plan Update was reviewed in order to establish appropriate residential and employment water demand consumptions and wastewater flow generations. This review helps to ensure that the projected water demands and wastewater flows are accurate and reflect new trends to support decision making for the sizing and timing of future infrastructure including pipes and facilities.

An overall guiding principle for the design criteria is to ensure that the flow projections are adequately predicted with an appropriate level of safety and risk management in order that the infrastructure has sufficient capacity to meet the servicing requirements and that the timing of key infrastructure and facilities does not compromise operation of the facilities or impede planned and approved growth. On this basis, for master planning purposes, the design criteria should reflect a total production need, which includes consumption plus non revenue water used.

The design criteria review undertaken in this Sustainable Halton Water and Wastewater Master Plan involved analysis of historical plant production/treatment data, historical consumption data, sample area water consumption data, district water metering areas (DMAs) and historical peaking factors at the plant. The design criteria review is

fully documented in the technical memorandum entitled “Sustainable Halton Water and Wastewater Design Criteria Review”, AECOM, December 2010. This technical memorandum is included in Appendix 1-6.

The unit rates used for estimating water consumption and wastewater flow generation as well as maximum day and peaking factor methodologies are provided in Section 6.1.

The design criteria were applied to the population and employment projections to 2031 to determine future water demands and wastewater flows for each system (see Section 3.3).

The approach undertaken as part of this study is based on establishing a yearly starting point, calculated from historical flows, and projecting growth flows from this starting point forward. The rationale and recommendation for this approach was documented in the inter-office memorandum entitled “Methodology for Determination of Water and Wastewater System Uncommitted Reserve Capacity”, Halton Region January 2010. This approach is being implemented in the Development Control Monitoring Report and will ensure continuity in projections as well will better serve reconciliation through the allocation processes. This technical memorandum is included in Appendix 1-6.

It was determined that future water demands and flows would be projected from existing demand/flow levels, adding incremental growth on top. The starting point is based on a five-year rolling average using historical production data and census data plus water meter installations where available.

4.6 Update of Hydraulic Models

The Regional hydraulic models were used to assess the base or current water and wastewater system capacity. Future scenarios were also added to the base model, including 2016, 2021, 2026, and 2031 as well as intensification growth areas. The hydraulic models helped support the analysis of infrastructure requirements in each municipality and helped justify some of the recommended projects.

4.6.1 Water Model

The water model utilized under this Master Plan evolved from the previous 2008 model. AECOM, with Halton Region, had updated to the full pipe model to reflect existing conditions which included calibration of 2010 data as provided by the Region. This hydraulic model is based in InfoWater (MWH Soft, now Innovyze) and was updated with new infrastructure facilities and project specific information to ensure completeness and accuracy. The Master Plan model was based on the full pipe water system network including major trunk feedermains and watermains, distribution watermains, valves, pumping stations, reservoirs, and elevated tanks with water supply points from the Water Purification Plants.

Water pressure zones servicing various areas were sub-divided into water node polygons. These geographic areas cover all existing serviced areas in the study area, as well as areas that were under development or that could potentially be developed by the year 2031. Water demands, in turn, were calculated for each water node polygon based on residential and employment projections and the respective design criteria.

4.6.2 Wastewater Model

Similarly, the wastewater model evolved from the previous 2008 model. This hydraulic model is based in InfoSewer (MWH Soft, now Innovyze) and was updated to reflect all wastewater system pipes including new infrastructure facilities and project specific information to ensure completeness and accuracy. The full pipe model comprises the full wastewater system network including trunk wastewater mains (sewers), collection system wastewater mains, forcemains and pumping stations with ultimate outlets at the wastewater treatment plants.

Drainage areas by wastewater treatment plant (WWTP) were sub-divided into individual sewer catchments, or wastewater node polygons. These catchments cover all existing serviced areas of the study area, as well as areas that are currently under development or that could potentially be developed by the year 2031. Wastewater flows, in turn, were calculated for each wastewater node polygon based on residential and employment projections and the respective design criteria. The model development included system calibration using data provided by the Region.

4.7 Assessment of Existing and Future Infrastructure Capacity

Utilizing the water demand and wastewater flow projections, a Region wide baseline analysis and future needs assessment was conducted to determine existing and future shortfalls in system capacity. Results from the hydraulic models under different operating conditions were used to supplement the pipe network analysis.

Results from this capacity assessment for the water and wastewater systems are provided in 8.3 and 0, respectively.

4.8 Policy Issues

4.8.1 Residential Servicing

The Sustainable Halton Water and Wastewater Master Plan has reviewed the specific servicing needs for the existing and future residential areas.

Residential servicing strategies were developed based on the overall water and wastewater policies and guidelines, Regional servicing standards and guidelines, and servicing needs calculated from planning projections and design criteria.

Key considerations for residential servicing are related to providing water supply from the trunk infrastructure, ensuring adequate trunk infrastructure extend servicing to the residential areas, providing for extension of local servicing from the trunk infrastructure, allowing for system redundancy, increasing security of supply, and meeting adequate levels of service for residential servicing including pressures and fire flows.

The Sustainable Halton Water and Wastewater Master Plan focused the analysis on the trunk infrastructure. As such, the trunk infrastructure must provide sufficient level of service to account for future extension of local servicing.

4.8.2 Employment Servicing

Similar to residential servicing, the Sustainable Halton Water and Wastewater Master Plan has reviewed the specific servicing needs for the existing and future employment areas. Employment strategies and considerations are similar to those for residential servicing. Of note, the fire flow requirements in employment areas can have greater needs.

4.8.3 System Security

In addition to the traditional growth related needs evaluated under the Master Plan, review was undertaken of the existing systems and the ability to continue to convey flows and provide adequate level of service to support growth. Critical areas of the trunk water system were identified as requiring improved transmission capacity. The new projects addressed concerns such as isolated service areas, single feeds across significant features such as major highways, support for emergency shutdown conditions, and overall capacity for future growth flows.

4.8.4 Intensification

Given the focus of intensification for future growth in Halton Region, as per conformity with the Places to Grow Act, Sustainable Halton Master Plan undertook a specific analysis for the impact of intensification on the water and wastewater systems. This analysis investigated the impacts of intensification on the core areas of Burlington, Oakville, Milton, Georgetown and Acton. These areas are illustrated in Figure 5 and Figure 6. The orange shading represents the areas where intensification will occur and areas bounded in red are the major urban centres.

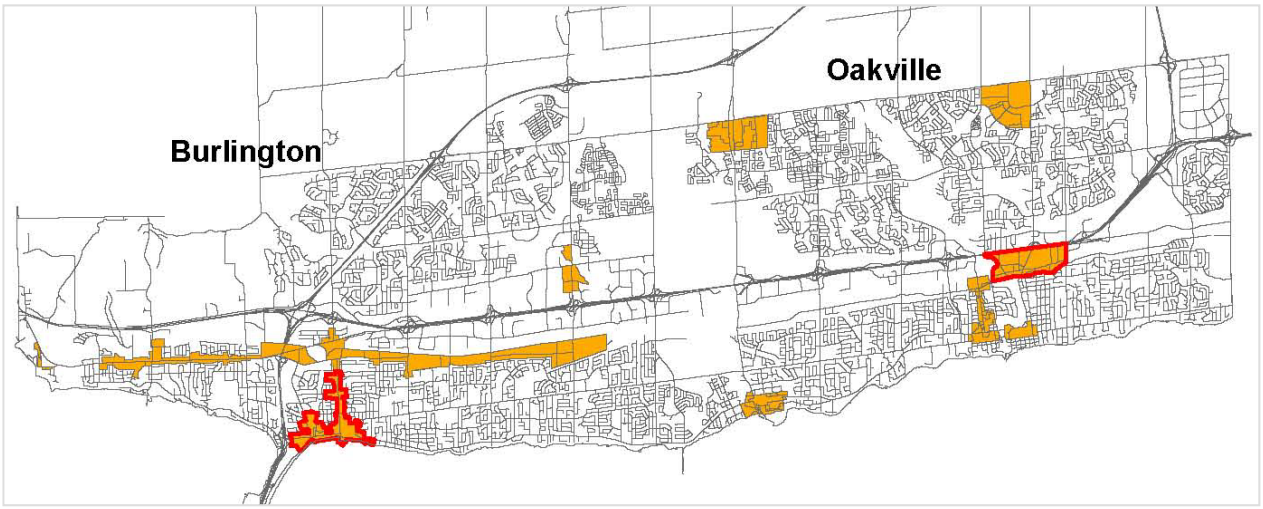


Figure 5 Intensification Areas in Burlington and Oakville

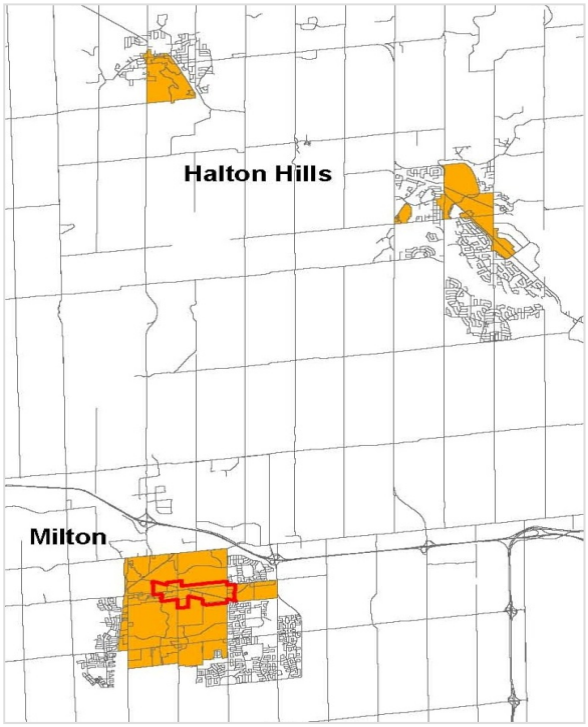


Figure 6 Intensification Areas in Milton, Acton and Georgetown

4.8.5 Principles and Policy Paper

The Principles and Policy Paper was created to provide direction and guidelines for development and evaluation of servicing alternatives for the Sustainable Halton Water and Wastewater Master Plan. While the objective was to develop a set of policies that will stand the test of time, it is anticipated that best practices and criteria can be updated over time while the context and intent of the policy should remain valid without requiring revisions.

The range of servicing policy concepts considered includes:

- Harmonize planning and servicing policies
- Recognize potential for growth beyond current planning horizons
- Maximize use of available existing capacity in infrastructure
- Maintain reserve capacity in infrastructure
- Minimize property requirements for infrastructure
- Provide reliability and security in the systems
- Optimize pumping and storage infrastructure to maintain level of service under emergency conditions
- Recognize water conservation and efficiency measures

The Policy Paper developed as part of the Sustainable Halton Water and Wastewater Master Plan is provided in Appendix 1-5. The content of the general, water, and wastewater servicing policies is summarized below:

General Policies

- G.01. Municipal Servicing
- G.02. Planning Horizon
- G.03. Reserve Capacity
- G.04. System Reliability and Security
- G.05. Location of Municipal Services and Facilities
- G.06. Design and Costing Criteria
- G.07. Climate Change
- G.08. Energy Efficiency
- G.09. Inter-Regional Partnerships
- G.10. Level of Service
- G.11. Intensification and Greenfield Growth Analysis

Water Policies

- W.01. Raw Water Source
- W.02. Treatment and Distribution Water Quality
- W.03. Distribution Requirements
- W.04. Fire Flow Requirements
- W.05. Storage Requirements
- W.06. Water Efficiency and Consumption Trends
- W.07. Bulk Water Facilities

Wastewater Policies

- WW.01. Sewer Use Criteria
- WW.02. Wastewater Treatment and Collection Requirements
- WW.03. Overstrength – Surcharge Agreements
- WW.04. Septage Receiving Facilities

4.9 Other Considerations

4.9.1 Sustainability Principles

The Master Plan has reviewed guiding sustainability principles during the planning, servicing alternative evaluation and recommendation stages of the study. Key objectives included:

- Make best use of existing infrastructure
- Minimize the cost of new hard infrastructure
- Consider operating and maintenance costs to ensure financial sustainability
- Ensure the long-term reliability and security of the water and wastewater systems
- Perform financial evaluation including lifecycle costing

The Master Plan process also ensured policy compliance with relevant planning legislation and their sustainable objectives including the Clean Water Act, Great Lakes Charter and Annex, Safe Drinking Water Act, Provincial Policy Statement, Greenbelt Plan, Growth Plan, Oak Ridges Conservation Plan and Planning Act Reform.

Specifically with respect to criteria used for the Master Plan, areas such as the design criteria, consumption and flow projections, and recent historical data, guided the update of the criteria which would allow for consideration of recent water conservation initiatives and climate conditions.

4.9.2 Source Water Protection

Protecting water at the source is the first step to a multi-barrier approach and an important part of ensuring the health of people, ecosystems and economies. Provincial laws, such as the *Safe Drinking Water Act* and the *Ontario Water Resources Act*, are in place to regulate other key elements of the multi-barrier approach including effective water treatment, adequate testing, rigorous monitoring, operator training, permits to take water and to regulate industrial pollution.

Halton Region's municipal water comes from two major supply sources: surface water (Lake Ontario) and groundwater (underground aquifers). Issues with respect to source water protection are relevant as it relates to the location of water purification plants/intakes, well supplies and wastewater treatment plants/outfalls. Although Source Water Protection implications were considered in the Master Plan, Source Water Protection Plans (under the *Clean Water Act*) are currently being developed as part of separate program in order to minimize the impact that human and natural activities have on the quality and supply of our water resources.

4.9.3 Groundwater Sustainability

Groundwater supply is part of the existing servicing strategy and anticipated to remain integral to the servicing strategies moving forward.
Safe sustainable use of the groundwater well fields in the long term servicing strategy can be ensured through protection of the well fields and influence/recharge areas.

In order to sustain these vital resources, the Region has taken various initiatives in collaboration with the Province such at the Tier 3 Water Budget and Water Quantity Risk Assessment and Source Water Protection Program. All groundwater protection information has been documented through the Halton Region Wellhead Protection Area Studies.

4.9.4 Drinking Water Legislation

The *Clean Water Act* is part of the Ontario government's commitment to implement all of the recommendations of the Walkerton Inquiry. The legislation directly addresses 12 and supports the implementation of 22 recommendations of the Walkerton Inquiry on protecting drinking water at its source.

The legislative, regulatory and policy framework applicable to water resources in the Province of Ontario is summarized by Justice Dennis O'Connor in Chapter 13 of the Part One Report of the Walkerton Inquiry. Within Ontario, the legal framework for protection and management of water resources falls mainly within the following statues:

- Ministry of the Environment Act
- Ontario Water Resources Act and Regulation 435/93
- Environmental Protection Act
- Environmental Bill of Rights
- Health Promotion and Protection Act
- Public Utilities Act
- Conservation Authorities Act
- The Planning Act and Provincial Policy Statement
- Oak Ridges Moraine Act and Oak Ridges Moraine Conservation Plan

As part of the many recommendations in the Walkerton Inquiry, four key pieces of legislation envisioned by Justice O'Connor included:

- The Safe Drinking Water Act (Bill 195 passed December 2002)
- The Nutrient Management Act (Bill 81 passed June 2002)
- The Sustainable Water and Sewage Systems Act (Bill 175 passed December 2002)
- The Clean Water Act (2006) , including Watershed Based Municipal Drinking Water Source Protection (currently in draft legislation)

4.9.5 Water Efficiency

Halton Region continues to implement and support water efficiency efforts through its ongoing toilet rebate program, rain barrel sales, residential and commercial irrigation system optimization, pilot program, distribution system leak detection , summer outdoor water use reduction program, and education and outreach including the annual Halton Children's Water Festival.

Halton's water efficiency program is integral to the long term planning of the water and wastewater systems. This current water efficiency program employs the following four-pronged approach:

- Technical measures such as water distribution system leak detection, and residential and commercial irrigation system optimization,
- Regulatory measures such as waterworks by-law to address summer outdoor water use peak demands,
- Financial measures including high efficiency toilet rebates and a consumption-based water rate structure,
- Marketing, community outreach and education such as rain barrel sales events to promote capture and storage of rain water for use in gardens, encouraging use of drought-tolerant plantings and avoiding excessive lawn watering, and co-hosting the annual Halton Children's Water Festival.

Through analysis of the Region's water efficiency program and design criteria, a 5% reduction (average day demand reduction of ~ 16 litres per capita per day) in residential growth water use for the Region moving forward was utilized as a foundation in the Master Plan. This target was based on savings achieved through anticipated use of high efficiency front loading clothes washers in new homes and anticipated changes to the building code for low flush toilets (6.0 L to 4.8 L toilets).

It is anticipated that the base water demand may be further decreased as existing residents continue to retrofit their homes by replacing old fixtures such as washing machines, shower heads and whole-home humidifiers with high efficiency models. As well, the Region continues to target summer peak demand through promotion of the Outdoor Water Use Strategy and by encouraging residential and commercial property owners to reduce overwatering of landscapes through irrigation system optimization.

Halton continues to annually monitor the Regional water system supply capacity/demand and compare actual growth uptake with the theoretical growth projections. In addition, the overall water servicing strategy will be reviewed every five years in accordance with updated population and employment estimates. In doing so, the water efficiency strategy can be revised to respond to changes in residential and employment water use with Halton Region.

4.10 Development of Evaluation Criteria

The Master Plan evaluation approach followed typical evaluation of impacts under Class EA evaluation criteria including:

- Physical and Natural Environment:
  - Impact on vegetation, fish and wildlife; surface drainage and groundwater; soil and geology
  - Impact on areas of natural and scientific interest, and environmentally-sensitive areas
  - Disruption of topographical features.

- Social, Economic, and Cultural Environment:
  - Impact on existing and proposed development

- Impact on archaeological and historic sites
- Impact on agricultural resources
- Impact on recreational areas
- Impact on other utilities
- Coordination with proposed roadway development.

- Financial Factors:
  - Construction, operation and maintenance (life-cycle) costs
  - Best use of existing infrastructure
  - Flexibility for scheduling works.

- Technical Factors:
  - Level of service
  - Security and reliability
  - Impact on existing infrastructure
  - Constructability
  - Impact on operations and maintenance
  - Meeting legislated criteria and regulations.

A high level 12 Point Evaluation Criteria was generated and used to evaluate preliminary servicing concepts and a further refined, 5 Point Evaluation Criteria was generated to evaluate subsequent service alternatives. These evaluation criteria are provided in Table 6 and Table 7.

Table 6 12 Point Criteria for Water and Wastewater Servicing Concepts Evaluation

Criteria	Criteria Description
Environmental Impact	• Describes the potential impacts of the option on the natural environment, proximity to existing natural features and designations including but not limited to Greenbelt, Niagara Escarpment, ESAs, ANSIs, vegetation, woodlands, wildlife, aquatic resources and fisheries • Highlights requirement for major environmental crossings, deep sewers, development through environmental designated areas, and requirements for mitigative action
Socio-Economic Impact	• Describes potential impact socio-economic factors such as impact on residents, archaeological/heritage resources, aesthetics, noise, dust, vibrations, traffic disruptions during construction, etc.
Regional Policies and Guidelines	• Compliance with Regional Guidelines and Policies
Legal/Jurisdictional Impact	• Highlights any land requirement issues and agency concerns that may arise from servicing option related to project alignments, land acquisition, planning permits, crossings, etc.
Technical Impact	• Describes any overall technical advantage/disadvantage to an option related to: o Capacity requirements and level of service o Performance under power outage conditions o Alignments that can maximize a service area o Utilization of existing infrastructure • Describes difficulty of construction (construction in limited areas and/or with limited access, crossings, protection of utilities, trees or structures) o Are existing infrastructure upgrades required? o What level of security of water supply/transmission does the option provide? o Does the option require pumping stations / deep sewers?
Phasing Impact	• Describes ability for staged growth • Describes ability to maximize use of existing available or planned infrastructure • Describes ability of incremental extensions of infrastructure as growth progresses • High level comment on ability to balance infrastructure costs with staged level of growth • Do early phases of growth require large up-front costs?
Sizing Impact	• Describes impact on the sizing of planned and existing infrastructure • Highlights trunk infrastructure that potentially should be oversized to benefit future growth • Makes comment on whether growth areas will need to be serviced by existing infrastructure, 2021 Master Plan infrastructure or new • Highlights sizing difference of common projects
Constructability Impact	• Describes technical level required for construction of projects • Highlights potential need for deep pipe construction, creek/railway/highway crossings, alignment challenges, potential challenges during construction through existing built-up areas • Construction of projects that can be coordinated with road construction
Build out Impact	• Highlights potential opportunities/constraints to servicing build out • Projects and strategies that offer flexibility of servicing the mature state growth (post 2031)
Implementation and Operability Impact	• Describes post-construction impacts such as operation and maintenance costs and requirements
Servicing Integration	• Describes potential impacts related to opportunity or requirement for integrated planning, design, construction with other servicing such as bridge construction, road improvements, etc.
Financial Impact	• Describes the capital cost and O&M costs relative to other options • Considers construction costs for new infrastructure and for upgrades to existing system • Highlights major projects that differ from other options that significantly contribute to the capital cost

Table 7 5 Point Criteria for Water and Wastewater Servicing Alternatives Evaluation

Category	Criteria	Indicator
Natural	Terrestrial Impacts	Potential effects on terrestrial features (e.g., vegetation and wildlife habitat) Proximity to environmentally sensitive features (e.g., wetlands, Environmentally Significant Areas (ESAs), Areas of Natural and Scientific Interest (ANSIs) and other designated Natural Areas) Potential effects on habitat for sensitive species (e.g., proximity to vulnerable/threatened/endangered or locally/regionally rare amphibians, birds and other wildlife)
	Aquatic Impacts	Potential effects on water resources (e.g., surface water quality and quantity, and groundwater)
	Land Use Impacts	Compliance with planning policies (e.g., Provincial/Regional Growth Plans, Region/Local Official Plans) Compatibility with existing and designated land uses
Social	Property Impacts	Potential land requirements
	Nuisance Impacts	Potential effects on sensitive receptors (e.g., dust, noise, vibration impacts on residential land uses) Temporary impacts during construction
Cultural	Archaeological and Heritage Impacts	Potential disruption to archaeological resources Potential disruption to built /cultural landscape heritage resources
Technical	Compliance	Compliance with Provincial Water Quality Objectives Compliance with Provincial Wastewater Treatment Requirements
	Reliability	Ability to meet future servicing needs based on projections to 2031 Ability to maintain existing services during and following construction Ability to secure supply during construction and/or operational failure
	Constructability	Construction Constraints Operation and Maintenance Constraints
Economic	Cost Implications	Capital Costs Operation and Maintenance Costs

4.11 Development of Alternative Servicing Concepts

The preferred servicing strategy identified in the previous 2008 Water and Wastewater Master Plan Update was validated, given the latest Best Planning Estimates. Once baseline system conditions and system constraints were established, a long list of high level servicing concepts was developed. These concepts were evaluated against the criteria agreed by the Project team, presented in Table 6, and ranked to determine a preferred servicing concept. This formed the basis for identifying alternative servicing strategies for the water and wastewater systems.

Alternative water and wastewater servicing concepts and strategies considered under the Sustainable Halton Water and Wastewater Master Plan are provided in Sections 9 and 12.

4.12 Evaluation of Alternative Servicing Strategies

4.12.1 Overview

The process undertaken to evaluate the alternative servicing concepts and strategies was more extensive and detailed than with previous Regional Servicing Master Plans. The evaluation and decision-making process was based on a triple bottom line approach (i.e. evaluating against the three fundamental criteria of: i) natural environment, ii) social/cultural, and iii) technical/financial) and Class Environmental Assessment evaluation. The evaluation progressed from high level concepts, to servicing alternatives, to a preferred servicing strategy with individual servicing components that required their own evaluation.

The general approach can be described as follows:

1. Using the preferred growth option identified in the Growth Plan Conformity exercise, water and wastewater servicing concepts were generated for lake-based, groundwater-based and stream-based systems
2. Using predetermined evaluation criteria, these servicing concepts were evaluated to determine the preferred servicing concepts
3. From the preferred servicing concepts, servicing alternatives were generated and evaluated by undertaking a Triple Bottom Line Class EA evaluation
4. Following this Triple Bottom Line Class EA Evaluation, a preferred servicing strategy was identified
5. Having identified a preferred servicing strategy, individual servicing components were evaluated for alternative sites and alignments, in order to satisfy Schedule B requirements

Extensive documentation is provided in Volume II – Project File for all Schedule B projects to be satisfied under the Master Plan and other select projects that required additional supporting documentation. The evaluation and decision making process used in short listing alternative solutions and identifying the preferred strategy is depicted in Figure 7.

Water and wastewater-specific technical evaluation criteria are provided in Section 4.12.2 and Section 4.12.3.

4.12.2 Water Strategies Evaluation

Based on the approved planning estimates, average day, maximum day, and peak hour demands and supplies were determined for each water system by SGU and by pressure zone. These demands, and recognizing current operation conditions, were used as the basis for assessing the adequacy of current levels of service and MOE requirements, such as pressure and flows for domestic use and firefighting. System security and redundancy were also considered in identifying alternative water servicing strategies.

Hydraulic model runs were utilized to assess impact of new growth demands (based on projected BPEs) on system infrastructure, including:

- Capacity
- Pressure
- Fire flow

Service areas were analyzed on a zone by zone basis and existing pressure zones were analyzed to determine whether or not they needed adjustment.

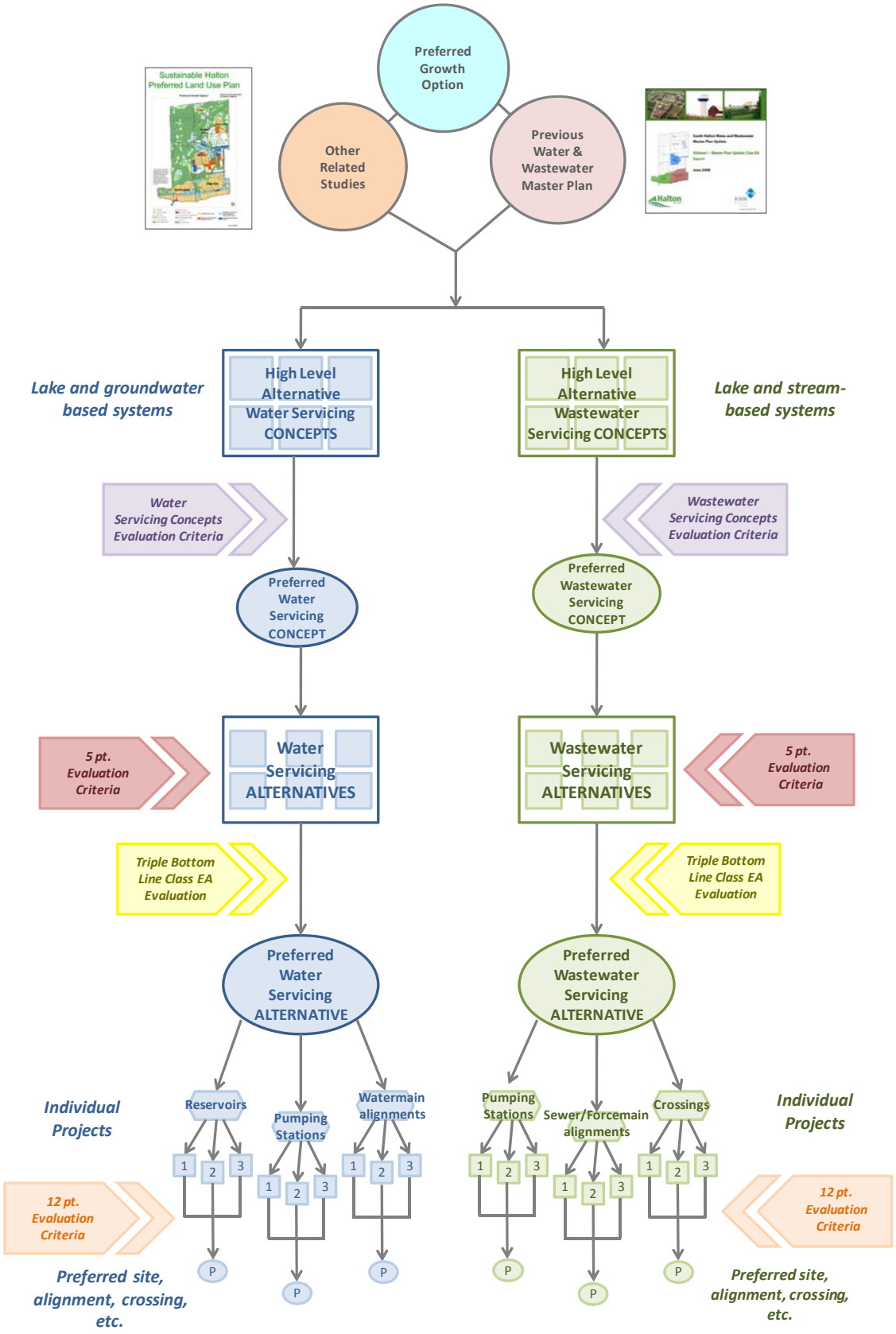


Figure 7 Evaluation and Decision Making Process

4.12.3 Wastewater Strategies Evaluation

Based on the approved planning estimates, average day flows were determined by SGU and by treatment plant drainage area. Average day flows were used as the basis for calculating peak flows using the Harmon Formula and were utilized to assess the adequacy of current levels of service and MOE requirements, such as pipe flows and velocities. Effluent quality standards and assimilative capacities were also considered in identifying alternative wastewater servicing strategies.

- Hydraulic model runs were utilized to assess impact of new growth demands (based on projected BPEs) on system infrastructure, including:
- Capacity
- d/D (depth of flow relative to full pipe diameter).

The findings concluded through the data collected by the Region's inflow and infiltration monitoring program were considered into the issues and constraints identified at the outset of the study. Specific I/I response rates, where available, were also incorporated into the hydraulic model to better simulate existing conditions and better gauge future scenarios.

4.13 Determining Implementation and Scheduling

It has been determined during this project, that scheduling of infrastructure upgrades should be based on, where possible, not exceeding approximately 90% of full capacity. This approach should coincide with scheduling the future upgrades before flow projections meet available capacity.

This concept is more easily achieved for the projects further out in the planning horizon. Given that many upgrades are required in the short term (i.e., before 10 years), some projects have been identified with accelerated schedules and in-service dates as soon as feasible.

It is also good engineering practice to provide sufficient capacity to meet servicing requirements beyond the planning horizon, particularly for larger diameter trunk piping and major structural components of major supply facilities. In addition, the sizing and capacity determined for 2031 needs must also provide a sufficient level of service to the new growth areas, ensure efficient integration with existing infrastructure, and not negatively impact current operations of the systems. Even after making this latter allowance, some infrastructure has been sized to meet needs beyond the planning horizon.

Under this Master Plan, the strategies identified under previous studies, including the 2008 Master Plan Update (2021 growth horizon), have been reviewed and updated. New projects were developed based on the 2031 service area. The scope of each project and the timing was updated from the previous servicing strategy and determined for new projects based on the BPE June 2011 data and status of the current implementation program.

The service area was reviewed for each project. Based on the projections for water demand or wastewater flow requirements of the service area developed from the BPE June 2011 data, the project timing requirements were determined.

This process took into consideration a logical extension of growth from the existing development. The evaluation of timing also took into consideration the availability of and need to maximize the use of existing infrastructure and best judgement on reasonable timing of subsequent expansions.

For the major facility expansions, such as the Burloak WPP and Mid-Halton WWTP, larger expansions have been considered to minimize the construction periods at the site and to avoid scheduling subsequent work immediately following completion of the previous project.

Project timing was also integrated with the results of recent studies, Class Environmental Assessments and reports, and where possible with the 2011 Transportation Master Plan Update to ensure that underground infrastructure was not scheduled after completion of road improvements. This did result in several projects being accelerated. Total project scheduling has been based on total project delivery requirements including identifying all project components such as additional studies, Class EA studies, design, construction and RFP requirements.

5. Existing Conditions

Existing environmental conditions were established as part of the baseline component of this study and provided supporting information for evaluating water and wastewater servicing alternatives.

The Baseline Environmental and Groundwater Studies conducted as part of the Sustainable Halton Water and Wastewater Master Plan helped establish a technical baseline for assessing opportunities/constraints, generating water and wastewater servicing concepts, and evaluating alternatives. Information gathered through these studies is summarized in this section.

This section summarizes the baseline environmental conditions in Halton Region, such as:

- Watersheds
- Natural environment
- Bio-physical environment
- Socio-economic and cultural environment
- Approved servicing strategy.

5.1 Conservation Authorities and Niagara Escarpment Commission

In the province of Ontario, there is a network of 36 Conservation Authorities that exist to deliver services and programs that protect and manage water and other natural resources in partnership with government, landowners and other organizations. These agencies are organized by watershed and promote an integrated watershed approach balancing human, environmental and economic needs.

Conservation Authorities play an important role in the master planning and consultation process. Infrastructure projects located within or in near proximity to areas protected under the jurisdiction of a Conservation Authority may require further consultation to obtain the necessary approvals and/or permits.

Figure 8 shows a map of the watersheds across Halton Region.

5.1.1 Conservation Halton

The majority of Halton Region falls under the jurisdiction of Conservation Halton (CH), who is responsible for three major watersheds and 18 smaller watersheds within Halton Region. Each of these watersheds ultimately drains into Lake Ontario.

The Bronte Creek watershed covers the west end of Burlington, Oakville and Milton and is comprised mainly of rural lands and residents on groundwater supply.

The Sixteen Mile Creek watershed covers approximately 357 square kilometres of land and includes portions of Milton, Halton Hills, and Oakville within the Region. The creek drains into Lake Ontario in the Town of Oakville.

The Grindstone Creek watershed covers approximately 99 square kilometres of land and includes the urban districts of Waterdown, Aldershot and Bayview, as well as the largely rural western area of Halton Region.

5.1.2 Credit Valley Conservation

The Credit Valley Conservation (CVC) is responsible for the Credit Valley watershed, generally located in the north eastern part of Halton Region. The communities of Acton and Georgetown are subject to CVC regulations, as they both fall within what is considered the middle watershed of the Credit River.

5.1.3 Grand River Conservation Authority

The Grand River Conservation Authority (GRCA) covers the northwest end of Halton Region. There are no urban areas or hamlets serviced by municipal water or wastewater systems within this watershed, and as such this jurisdiction was not considered to be within the scope of this Master Plan.

5.1.4 Niagara Escarpment Commission

The Niagara Escarpment Commission is part of the Ministry of Natural Resources and was a key review agency throughout the process. The Niagara Escarpment is a very prominent topographical feature that extends from Niagara Falls to the Bruce Peninsula and Manitoulin Island. The Niagara Escarpment's designation as a World Biosphere Reserve by UNESCO in 1990 gives it international prominence. In the Halton Hills, Milton and Burlington areas, the Niagara Escarpment trends in a northeast - southwest direction and sharply divides the area into an upland area to the west and a lower-lying area to the east. The Niagara Escarpment is a working countryside and a cornerstone of Ontario's Greenbelt. It is a protected area, recognized provincially and internationally as a significant landform with a system of development control in place to guide development in its area. To ensure that the Escarpment's natural resources, health and ecosystems are protected, Niagara Escarpment landowners are required to obtain an Escarpment Development Permit for certain types of development. Provincial objectives and land use control for the Niagara Escarpment are achieved through the *Niagara Escarpment Plan*.

5.2 Natural Environment

In Halton Region there exists a system of natural areas of varying significance. These interdependent areas are described as the Regional Natural Heritage System and are the focus of resource protection policies.

Halton Region's diverse natural features perform numerous ecological functions, essential to life processes including the conservation of biological diversity. These functions include:

- Maintaining and improving air and water quality
- Controlling and mitigating the effects of erosion, sedimentation and flooding
- Providing habitat for a wide variety of plant and animal species. Natural features also provide many recreational, aesthetic and economic benefits to our human communities.

The Region's natural areas include such major landscape features as the Niagara Escarpment, Lake Ontario, as well as a network of streams, wetlands, water bodies, forests, woodlots and other identified areas of natural and scientific interest.

Findings from the Environmental Baseline Study carried out under the Sustainable Halton Water and Wastewater Master Plan are referenced in this section.

There are 48 Environmentally Significant Areas identified in Halton Region (including the Escarpment and other areas of provincial level significance). Figure 9 shows a map of the Region's Environmental Features. Additional mapping and environmental surveys are provided in Appendix 1-12 and Appendix 1-13.

5.2.1 Environmentally Significant Areas

Environmentally Significant Areas (ESAs) are natural areas that have been identified as significant and worthy of protection on three criteria – ecology, hydrology and geology. The Provincial Government, through the Planning Act and the Provincial Policy Statement, requires that municipalities develop policies to protect natural heritage features. Halton Region uses ESAs as a means to protect natural areas like wetlands, fish habitat, woodlands, habitat of rare species, groundwater recharge and discharge areas, and Areas of Natural and Scientific Interest. The location of the Region's 46 ESAs were considered in the preparation of this Master Plan with the specific objective of avoiding negative impact.

5.2.2 Areas of Natural and Scientific Interest

In addition to wetlands and woodland, the Ontario Ministry of Natural Resources identifies Areas of Natural and Scientific Interest (ANSIs) throughout the province. The principle behind the recognition of ANSIs is that protecting the most significant features is crucial to maintaining biodiversity, and the conservation of natural heritage. There are two types of ANSIs – Life Science and Earth Science.

The MNR has confirmed ANSI status for 35 locations in Halton Region. Twenty-three sites are identified as Life Science ANSIs and the 12 remaining ANSIs in Halton are classified as Earth Science ANSIs.

The location of the Region's 35 ANSIs were considered in the preparation of the Master Plan with the specific objective of avoiding negative impact.

5.2.3 Niagara Escarpment

The Niagara Escarpment, as described in Section 5.1.4, is a provincially significant, 725 kilometre (450 mile) long geological feature, a portion of which runs through Halton and a key component of Halton's natural environment.

5.2.4 Parkway Belt

The Parkway Belt West Plan provides a system of linked natural areas and protected utility corridors that originates in Dundas and runs through the Regions of Halton, Peel and York. The Secondary Plan was reviewed and taken into consideration during the preparation of the Master Plan.

5.2.5 Significant Woodlands

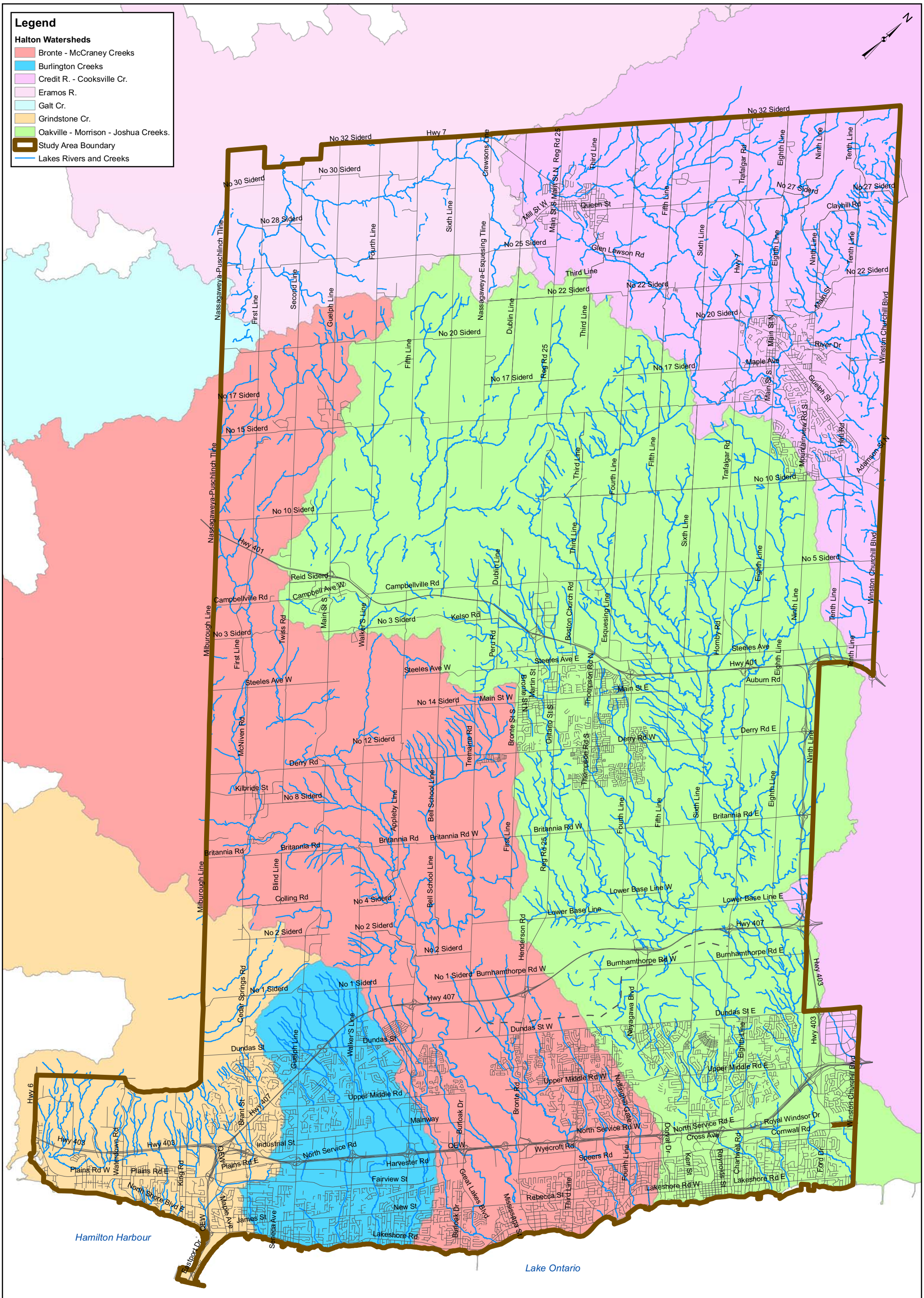
Halton Region recognizes the importance of woodlands and trees to the health and quality of life in the community. The Region's policies encourage the protection and restoration of forests, including trees, hedge rows, wooded areas, significant woodlands. Where the Region is undertaking infrastructure work, the Region will, where feasible, protect and preserve existing woodland resources.

5.2.6 Archaeological Resources

Halton recognizes the importance of the Region's archaeological resources. During Phase 3 of the Sustainable Halton planning process a *Master Plan of Archaeological Resources of the Regional Municipality of Halton 2008 Update* was completed. This Master Plan was used to help guide the planning process in determining areas of constraint and areas of opportunity for growth.

The Sustainable Halton Water and Wastewater Master Plan has used this document and mapping to provide high level screening in order to avoid historical features and cemeteries. Individual preferred sites determined through the Master Plan process will also be required to undertake an Archaeological Stage 1 Study as a minimum during the pre-design stages of implementation.

A historical features map and cemeteries map extracted from the *Master Plan of Archaeological Resources* can be reviewed in Appendix 1-13



Sustainable Halton
Water and Wastewater Master Plan

Watersheds within Halton Region
Figure 8

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August 2011
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Legend

- Greenbelt
- Greenland
- Regional Wetlands
- Provincial Wetlands
- ANSI
- ESA
- Escarpment Natural Area
- Escarpment Rural Area
- Escarpment Protected Area
- Study Area Boundary
- Lakes Rivers and Creeks

N

Hamilton Harbour

Lake Ontario

Environmental Features within Halton Region
Figure 9

Halton Region

Sustainable Halton
Water and Wastewater Master Plan

AECOM

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5.3 BioPhysical Environment of Halton Region

The shorelines of Lake Ontario and Burlington Bay have ecological, economic, aesthetic, recreational, historical and cultural importance. Many of these features must be protected to ensure that impacts are minimized upon the natural ecosystems and protect the shoreline, water quality and aquatic ecosystems.

Findings from the Groundwater Study carried out under the Sustainable Halton Water and Wastewater Master Plan are referenced in this section.

The following description of the biophysical environment of the Region is taken directly from the 1995 Environmentally Sensitive Area Study prepared by Geomatics International Inc.

5.3.1 Physical Environment

The physical environment is expressed in the bedrock, landform soils and waters of the Region.

Halton's physiographic character is dominated by the Niagara Escarpment. The Escarpment bisects the Region on a north-south axis. It is an erosional landform, also referred to as a cuesta, which was created by glaciers and water. Physical and chemical forces associated with these elements have differentially eroded the rock strata comprising the escarpment.

Relatively hard dolomites cap the escarpment and underlie the western portion of the Region. Softer shales and siltstones form the lower face of the escarpment underlie the eastern and southern portions of the Region. As a result, the topographic expression, surficial materials, soil types, surface drainage and groundwater flow regimes are significantly different above and below the escarpment.

5.3.2 Bedrock Geology

Within Halton Region, there is a major transition in many of the rock formations, which make up the Niagara Escarpment. This generally reflects a northward deepening in the salt water seas into which the original sediments were deposited during the Palaeozoic Era (approximately 400 to 500 million years ago).

The Lockport-Amabel Formation forms the upper scarp face and underlies all of the Region located above the escarpment. From the Niagara Peninsula to approximately Waterdown (near the boundary between Halton and Hamilton) this is known as the Lockport Formation. To the east and north, it becomes more massively bedded, and is referenced as the Amabel Formation. Although often referred to as limestone, this formation is actually a dolomite. Both limestone and dolomite are types of carbonate rocks.

Below the Lockport-Amabel is a sequence of rocks known as the Clinton and Cataract Groups. These are exposed in the face of the escarpment, particularly in river valleys which have eroded into the scarp face.

5.3.3 Surficial Geology

The surficial geology of Halton is mostly represented by glacier and glacial lake sediments although more recent alluvial (stream) and organic deposits are also common.

Below the escarpment, the rolling plains overlying the Queenston Formation consist primarily of thick silty to sandy clay till referred to as the Halton Till. Above the escarpment is a discontinuous to thick sandy till known as the Wentworth Till.

5.3.4 Hydrology

The hydrology and hydrogeology of the Region is closely linked to the landform characteristics. Many streams originate on or immediately below the escarpment and flow southerly or south-easterly towards Lake Ontario. These include, from west to east, Grindstone, Bronte (also known as Twelve Mile Creek) and Oakville (Sixteen Mile Creek).

5.3.5 Groundwater Supply

As part of the Groundwater Study carried out under the Sustainable Halton Water and Wastewater Master Plan, a groundwater technical baseline was established for the existing groundwater supplies in Acton, Georgetown, and Milton. The study identified and assessed opportunities for additional long term sustainable groundwater supplies in Acton, Georgetown, and Milton. These results were used to support the evaluation of servicing alternatives to meet the increased projected water demands for the three service areas.

Some of the key tasks carried out under the Groundwater study included:

1. Evaluating historical data and reports
2. Reviewing draft results from ongoing projects on the various well fields
3. Utilizing a detailed groundwater model to assess long term sustainability of the proposed water takings, including the cumulative effects of all the well fields

Mapping of the groundwater service areas together with underlying physiographic, bedrock geology, and bedrock topography conditions are provided in Appendix 1-12.

5.4 Socio-Economic and Cultural Environment

5.4.1 Cultural Heritage

Halton Region and area municipalities encourage and support heritage preservation. Criteria and guidelines established by the Ministry of Culture, Tourism and Recreation are used to identify, preserve and interpret the cultural heritage features, structures, archaeological resources, and cultural heritage landscapes.

Cultural heritage policies established by the Region include the need for appropriate assessment, preservation, interpretation and/or rescue excavation of cultural heritage and archaeological resources including mitigation measures as prescribed by the Province. Provincial and Regional cultural heritage policies and objectives were considered in the preparation of the Master Plan.

5.4.2 Aggregates Resources Areas

The planning responsibility for aggregate resources is shared between the Province and Halton Region. The Provincial interest is to protect the aggregate resources for long term use and ensure that as much as possible is made available to the aggregate industry. The task of Halton Region is to establish comprehensive mineral aggregate policies for the protection and use of mineral aggregate resources.

5.4.3 Prime Agricultural Area

Halton's rural area comprises two distinct parts. One area, the Protected Countryside, is covered by the Greenbelt Plan and includes lands within and beyond the Niagara Escarpment Plan Area. The other rural portion is for the most part below the escarpment, and is recognized in the Regional Official Plan as Halton's Prime Agricultural Area. Halton has long established policies that recognize agriculture as a vital component of the Region. The preservation and enhancement of farming and agricultural land is a key objective in the Regional Official Plan and was considered in the preparation of the Master Plan.

5.4.4 Open Space and Recreation

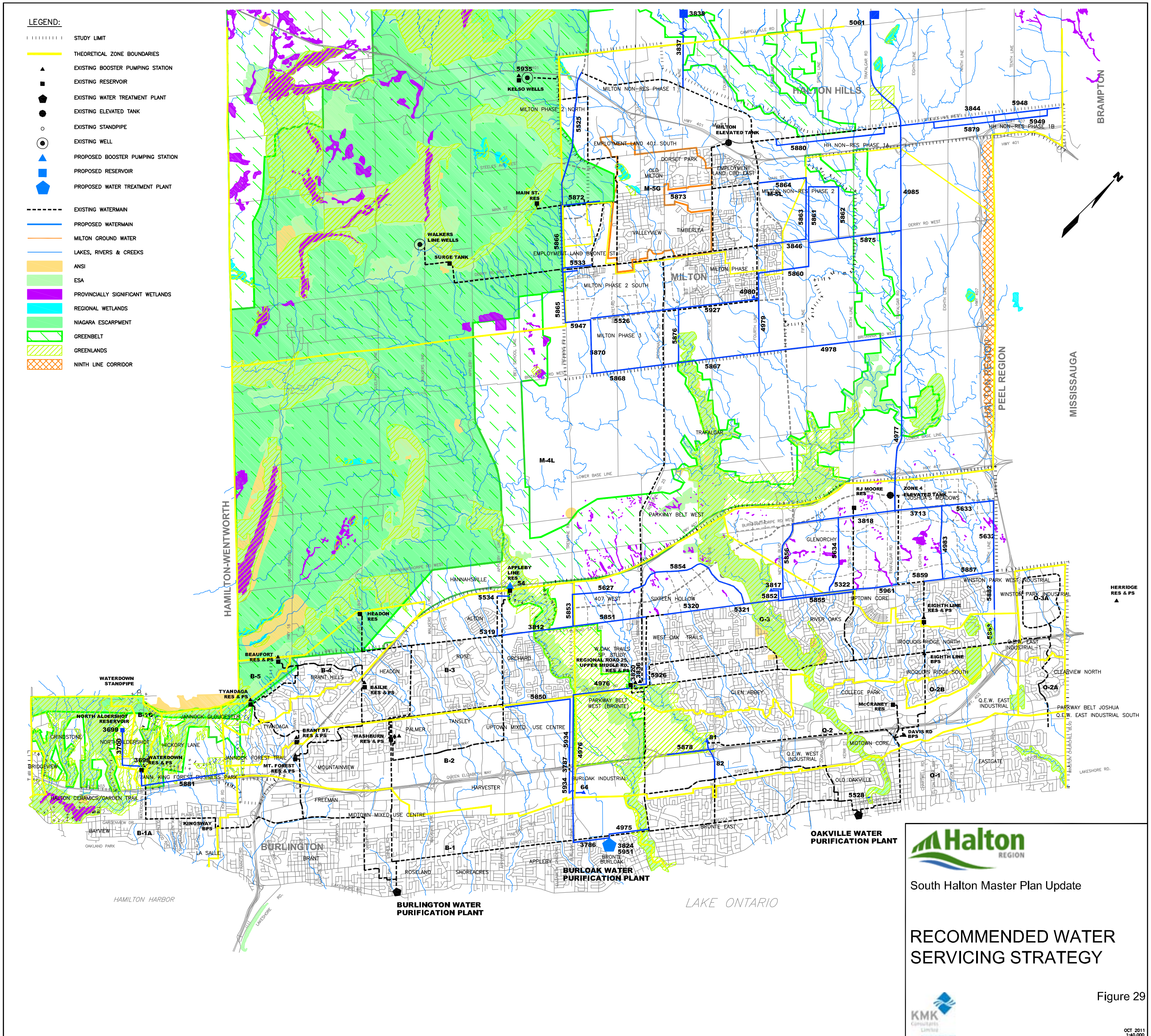
Recreational opportunities are vast and varied within the study area due to the presence of natural features, open spaces and parklands. Active recreation is accommodated by the many municipal parks, while passive recreation is supported by the river valleys and trail systems of Grindstone Creek, Bronte Creek, 16 Mile Creek and the Lake Ontario Waterfront.

Halton Region supports passive recreational opportunities through regional cooperation and partnership with provincial agencies, conservation authorities and area municipalities. The preservation and enhancement of open space and recreational opportunities are vital components of the sustainable future envisioned for Halton Region, and were considered in the preparation of the Master Plan.

5.5 Approved Servicing Strategies

The existing approved servicing strategies under the 2008 South Halton Water and Wastewater Master Plan Update are depicted in Figure 10 and Figure 11. These strategies formed the basis for the 2008 DC Bylaw process.

The 2008 strategies were used as the baseline analysis for the servicing review under this Sustainable Halton Water and Wastewater Master Plan.



Halton REGION

Sustainable Halton
Water and Wastewater Master Plan

2008 Water and Wastewater Master Plan Update
Water Servicing Strategy
Figure 10

AECOM

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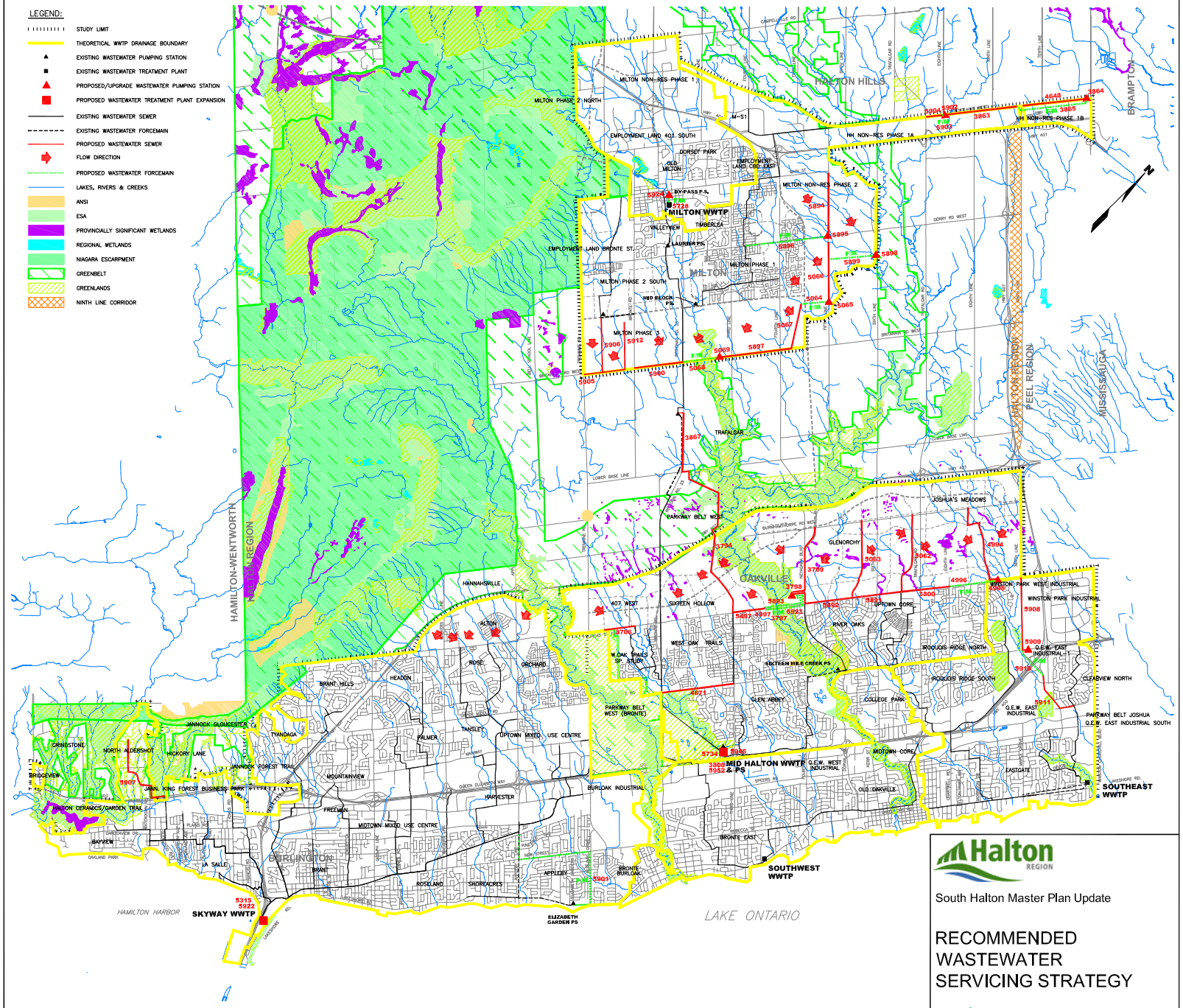

Halton REGION

South Halton Master Plan Update

RECOMMENDED WASTEWATER SERVICING STRATEGY

Figure 30

KMK Consultants Limited

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6. Design Criteria

6.1 Design Criteria

The design criteria used for the Sustainable Halton Water and Wastewater Master Plan is based on data used in previous studies, historical records, Halton Design Standards and updated information developed through the servicing review process with Region staff. Master planning requires the use of design criteria to support planning of trunk infrastructure. These criteria are used to evaluate system capacities, predict the flows that each system will see in future years and determine the scheduling and implementation plan.

A technical memorandum providing further details and context to the design criteria review undertaken under the Sustainable Halton Water and Wastewater Master Plan is included in Appendix 1-6.

Sizing of facilities and pipes is based on existing servicing (taking into account existing demands outside the urban boundary), as well as predicted future growth within the urban boundary only. Should future growth outside the urban boundary be serviced by Regional infrastructure, the effect of this growth on the infrastructure should be assessed and any changes to the projects determined.

6.1.1 Water

The water demand criteria for the Sustainable Halton Water and Wastewater Master Plan study is summarized in Table 8.

Table 8 Water Design Criteria

Land Use	Average Day Water Design Criteria
Residential	314 L/person/day [1]
Industrial	302 L/employee/day
Commercial	213 L/employee/day
Institutional	72 L/employee/day
Note: [1] A 5% reduction in rate was applied to the residential consumption rate of 330 L/cap/d to reflect water use trends. This equates to a water consumption rate of 314 L/cap/d.	

A 5% reduction rate was applied to the water consumption rate for residential growth only. This 5% reduction in rate is intended to reflect recent factors that have led to a decline in household water consumption. The 5% reduction target was based on savings achieved through anticipated changes to the building code for low flush toilets (6.0 L to 4.8 L toilets). Refer to Section 4.9.5 regarding Halton Region's water efficiency program.

As per the MOE Guidelines, the water system should be designed based on maximum day demand as well as recognize requirements for fire flows and peak hour demands. The maximum day demand is typically referenced as a maximum day factor above the average day demand.

Maximum day factors were historically derived and were found to differ based on the source of supply. Lake-based service areas were found to be higher than groundwater service areas, as shown in Table 9.

Table 9 Max Day and Peaking Factors

Water Design Criteria		Max Day Factor	Peak Hour Factor
Lake-Based	Oakville, Burlington, Milton, Georgetown	1.9	3
Groundwater-Based	Milton	1.6	
	Georgetown		
	Acton		

For the peak hour peaking factor (Peak PF), a factor of 3 for Residential and Employment areas as per Halton Region standards. The same criteria for growth have been applied throughout the Region, as it is assumed that new development will have similar characteristics wherever it occurs.

Projecting Water Demands

Future water demands will be determined using the best planning estimate data for residential and non-residential users and applying the design criteria.

As a basis for projecting future demands at the treatment facilities, a baseline 2009 maximum day demand was calculated at each plant using historical demands. Equivalent per capita consumption was calculated for every year by dividing the year's max day demand production by the year's population based on the planning data.

An average per capita consumption was calculated for the last five years. This represents the "5-year Rolling Average" and will be updated every year moving forward.

The 2009 Max Day Starting Point was defined as the 2009 Serviced Population multiplied by the 5-year Rolling Average. Residential and employment growth was then added to this baseline using the water design criteria presented in Table 8.

Sizing of the water system components is presented in the following sections and summarized in Table 10.

6.1.1.1 Water Treatment Facilities

Water treatment capacity is based on meeting maximum day water demand requirements.

The following criteria will be used to assess when water treatment facilities will require expansion:

- When flows reach 80% of plant capacity, the planning process for plant expansion will be triggered.
- When 90% of plant capacity has been reached, expansions should be completed.

If the criteria are triggered, further analysis should be carried out to confirm if and when a plant expansion project is required. The age and condition of the plant should be considered, as well as the amount of storage in the system that can be used to supply maximum day demands.

6.1.1.2 Water Mains

Feedermain sizing was based on flow demands and pressure requirements which include maintaining pressures in the system between 40 and 100 psi. Regional watermains require pressures higher than 40 psi to account for hydraulic losses in local system.

Velocities in the pipe should be maintained within acceptable ranges as defined in the MOE design guidelines. Head losses in the system will be observed when evaluating the existing and future water system. Hydraulic models were utilized to assess the network and to run four main scenarios (min hour, max day, peak hour, and max day plus fire) to confirm feedermain requirements.

Feedermain capacity expansions were based on service level (pressure, velocity, headloss). Oversizing may be considered in areas where future potential growth and build-out may occur.

Watermains making up the local distribution system were sized for the greater of maximum day demands plus fire flow or peak hour demands.

6.1.1.3 Pumping Stations

Pumping stations were rated on their firm capacity to supply water demands, which is defined as the total capacity of the pumping station with the largest pump out of service.

Where there is sufficient storage in a zone, pumping stations should be able to provide maximum day demands. When storage in the zone is not adequately available, the recommended requirement is for the higher of peak hour demand or maximum day demand plus fire flow for all subsequent zones.

Capacity expansions were triggered once the station's firm capacity reaches the required max day demand or peak hour demand dependant on storage availability. Site capacity was evaluated where expansions were required. When proposing a new site for a pumping station, an allowance in the facility building was considered to facilitate future expansion and staging of works.

6.1.1.4 Storage

The capacity of the required storage was dictated by the ability to provide the required equalization storage, fire flows, and emergency supply to maintain a satisfactory level of service. Storage calculations are based on the MOE Design Guidelines for Drinking Water Systems, which is summarized as follows:

- Fire storage (in accordance with the MOE Guidelines for the Design of Water Distribution Systems) and is dependent on equivalent population
- Equalization storage at 25% of the maximum day demand for the lower pressure zone at the reservoir's hydraulic grade line
- Emergency storage at 25% of the equalization plus fire storage for the lower pressure zone at the reservoir's hydraulic grade line (25% of A+B)

Therefore, it follows that the total treated water storage requirement is the sum of the above three components.

As there is no other data to suggest otherwise, MOE guidelines are considered to be appropriate.

Table 10 Design Criteria for Water Servicing System Components

Pumping Stations	With adequate zone storage available	Maximum day flow to zone and all subsequent zones
	Without adequate storage available	Greater of Peak hour flow to zone or Max Day plus Fire and maximum day flow to all subsequent zones
Storage	A - Equalization	25% of maximum day demand
	B - Fire	Largest expected fire in zone (based on land use)
	C - Emergency	Minimum of 25% of (A+B)
	Total	= A+B+C
Fire flow	Minimum flow (residential)	5,500 L/min for 2 hours @ minimum 140 kPa (20 psi)
	Minimum flow (industrial/ commercial/institutional)	15,000 L/min for 3 hours @ minimum 140 Pa (20 psi)
System pressure	Normal operating conditions	280 kPa (40 psi) to 700 kPa (100 psi)

6.1.2 Wastewater

The Regional average day wastewater flow criteria utilized for the Sustainable Halton Water and Wastewater Master Plan is summarized in Table 11.

Table 11 Sustainable Halton Average Day Wastewater Flow Design Criteria

Design Criteria		**Average Flows**
Lpcd	Residential	365/275
L/emp/d	Industrial	410
	Commercial	260
	Institutional	135
The 365 Lpcd residential average flow criteria includes a flow component for average level of extraneous flow allowance (90 Lpcd). This criteria is used to estimate flows at a WWTP catchment level. A residential dry weather flow criteria of 275 Lpcd is used for calculation of peak flows at a collection system level.		

Peak wastewater flow criteria, including inflow and infiltration (I/I) allowances, are summarized in Table 12.

Table 12 Sustainable Halton Peak Wastewater Flow Design Criteria

Area	Halton Inflow and Infiltration Design Allowance (L/s/ha)
All existing and new wastewater treatment plant service areas (except those identified below).	0.286[1]
Milton WWTP	0.24 to 1.0
Oakville Southwest WWTP	0.40 to 3.0
Skyway WWTP existing service area	0.35 to 0.65
Notes: [1] *Regional design criteria. This is being applied to new growth areas throughout the Region for evaluating wastewater collection system capacity. Residential flows are calculated using average dry weather flow criteria of 275 Lpcd. ICI flows are calculated using the values contained in Table 11. Total peak flows are calculated using the total dry weather flows peaked using the Halton standard modified Harmon formula plus the extraneous flows.*	

Peak flows are calculated using the average dry weather flow criteria listed in Table 11 multiplied by the Halton standard modified Harmon formula, which is based on equivalent population, plus extraneous flows.

Projecting Wastewater Demands

Future wastewater flows will be determined using the best planning estimate data for residential and non-residential users and applying the appropriate design criteria.

As a basis for projecting future flows at the treatment facilities, a baseline 2009 average day flow was calculated at each plant using historical flows from 2005 to 2009. These calculations are provided in Appendix 1-3. Residential and employment growth was then added to this baseline using the design criteria presented in Table 11.

Sizing of the wastewater system components is presented in the following sections.

6.1.2.1 Wastewater Treatment Facilities

Wastewater treatment capacity requirements are based on average day loadings and flows, including average level of extraneous flow allowance. Although the plant's physical components including tankage must accommodate the peak flows, historical convention has been to rate wastewater treatment plants at average day flows.

The same criteria for growth have been applied throughout the Region, as it is assumed that new development will have similar characteristics wherever it occurs. New development is likely to use modern construction techniques which should minimize the amount of inflow and infiltration seen in the wastewater system.

It should be noted that the average daily flows at the treatment facilities are highly affected by the amount of wet weather that reaches the plants. Should the amount of wet weather reaching the plants in the future be greater than that predicted in this Master Plan, planned plant expansions may be triggered earlier. For this reason, it is important that I/I reduction programs be continued.

Wastewater treatment plant expansions were triggered when projected average day wastewater flows approached the plant's rated treatment capacity. When flows reach 80% of plant capacity, the planning process for plant expansion will be triggered (i.e. Class EA) and when 90% of plant capacity has been reached, expansions should be completed.

6.1.2.2 Trunk Sewers

Conveyance capacity requirements in the sanitary sewers making up the collection system are based on the peak flows, comprising peak dry weather flows and inflow and infiltration design allowance.

Trunk sanitary sewer capacity is based on the pipe area (function of diameter) and slope. The design of sanitary sewer pipes is based on maintaining a minimum cleansing velocity and a maximum scouring velocity in the pipe through a combination of diameter and slope.

The InfoSewer wastewater models are used as the basis for assessing future wastewater flows in the regional pipe network. These models are calibrated to 2009 conditions and simulate dry weather, average flow and peak wet weather flow conditions. The trunk sewers are analyzed against peak flow conditions. Peak flow conditions are estimated using dry weather flow of 275 L/cap/d is applied for population growth (residential and employment equivalent) based on the Region's technical specifications (Halton Design Criteria for Wastewater Systems, 2001), peaked using the Harmon's formula (function of population) and to account for additional wet weather flows, a wet weather inflow/infiltration allowance is applied to all catchments.

The following criteria was used as a guideline to assess when regional sanitary sewer pipes require capacity upgrades:

- When Peak Flow exceeds 85% of pipe full (by depth), a possible capacity expansion project will be triggered.

The wet weather flag should be treated as indicative only. When determining whether there is a need for improvement works to address wet weather flows in each area, the depth of the pipe with respect to the local system and the elevation of basements should be considered. Each of the expansion projects will require field verification of the issue.

6.1.2.3 Pumping Stations

Pumping station capacity requirements were based on the peak flows, comprising peak dry weather flows and inflow and infiltration design allowance.

Pumping stations are rated on their firm capacity, which is based on the total capacity of the pumping station, with the largest pump out of service. Each pumping station must have sufficient firm capacity to meet peak dry weather flows for its respective catchment, as well as an allowance for extraneous flows.

Wastewater pumping station upgrades were triggered when projected peak wastewater flows approached firm capacity of the pumping station.

For the majority of pumping stations, the Region has supplied flow gauging and pump test data with the current peak flows. This is used as the baseline for projections.

6.2 Costing Criteria

The approach to developing cost estimates for the respective projects was based on an updated approach from the previous 2008 Water and Wastewater Master Plan Update and Development Charge process.

Base construction costs were developed using a unit cost approach. These unit costs have been updated from the previous 2008 Water and Wastewater Master Plan Update and reflect current 2012 market conditions. They have been inflated using a value of 9.6% which is based on the Statistics Canada Quarterly Construction Price Statistics (Catalogue number 62-007). The update to the unit costs has considered trends in materials, labour, other market conditions and recent tendered projects within the Greater Toronto and Golden Horseshoe areas.

Based on a similar approach undertaken during the previous Master Plan and Development Charges processes, the unit costs were developed for linear infrastructure including watermains, forcemains and for sewers with more shallow installations (5m depth) and maximum depth for open cut installations (10m depth). Additional trenchless installation (including tunneling) unit rates were developed.

These unit cost rates are provided in Appendix 1-4.

For each linear project, a review of potential additional costs was undertaken. Unique conditions such as additional rock excavation, property, natural feature crossings, tunneling (resulting from infrastructure depth or crossings), etc. were estimated separately. Also, for the vertical projects, specific preliminary cost estimates were developed to reflect current tendered construction conditions. Where available, more detailed construction cost estimates from studies or preliminary designs were utilized.

Based on the information available for the major facilities, including water treatment plant expansions, wastewater treatment plant expansions, water pumping stations, wastewater pumping stations, and reservoirs, the cost estimates for these projects referenced either recent project estimates or recent tender prices within the Greater Toronto and Golden Horseshoe Area. Many of these projects had undergone recent Class EA studies or preliminary/detailed design phases and had construction estimates available.

For all projects, a sub-total construction cost was established for each project based on the base unit cost and additional costs. These master planning (conceptual) level cost estimates are reflective of cost estimates which typically range between levels of +100% / -50%.

To account for total project engineering costs and contingency, 35% of the construction cost was added to each project.

In general, the project cost estimating process as described above can be summarized as follows:

+ $ generated from construction base unit costs
+ $ for additional unique construction requirements (crossings, others, …)
= $ subtotal for construction

+ $ subtotal for construction * 1.35 for engineering (internal and external costs) and contingency= $ total cost for project

Due to the program uniquely identified for intensification within the Built Boundary, different unit cost estimates were developed for project within the existing urban areas. These unit costs were higher than Greenfield unit costs due to:

- Urban construction area impacts
- Utility coordination, mitigation and diversion
- Urban reinstatement
- Small project mobilization
- Other contingencies

The construction cost and engineering/contingency cost make up the total project costs in 2012 dollars only and do not reflect inflated costs at the time of implementation.

The capital programs developed through this cost estimating approach will be utilized as high level baseline estimates for the Regional capital budgets. These costs will be further developed and refined during the implementation phases as more detailed information becomes available.