March 2011

Regional Municipality of Halton

Acton Wastewater Treatment Plant Class Environmental Assessment

Submitted by:

DILLON
CONSULTING

Halton REGION

The Regional
Municipality of Halton
www.halton.ca

NOTICE OF COMPLETION

Acton Wastewater Treatment Plant
Municipal Class Environmental Assessment Study

Halton Region has completed the Schedule C Class Environmental Assessment study for the Acton Wastewater Treatment Plant located at 202 Churchill Drive, Halton Hills. The preferred strategy is to construct additional wastewater capacity at the existing plant.

Background

As part of the Environmental Assessment Study, Public Information Centre meetings were held on June 26, 2007 and November 16, 2010. The first Public Information Centre provided background information, a long list of alternatives to increase wastewater capacity and the proposed evaluation criteria. The second Public Information Centre presented the preferred strategy and recommended design concept for the proposed plant expansion. Input and comments received from key stakeholders such as residents, Credit Valley Conservation and the Ministry of the Environment were incorporated into the Environmental Study Report (ESR).

Environmental Study Report (ESR)

By this Notice, the ESR is being placed on the public record for review. The 30-day public review period begins on March 31, 2011 and ends May 4, 2011. The ESR is available on the project website: **www.halton.ca/EAs**.

A paper copy of the ESR is also available for public review at the following locations:

Town of Halton Hills
Clerk's Department
1 Halton Hills Drive,
Georgetown
Monday to Friday:
8:30 a.m. to 4:30 p.m.

Region of Halton
Citizen's Reference
Library
1151 Bronte Road, Oakville
Monday to Friday:
8:30 a.m. to 4:30 p.m.

Halton Hills Public Library
Acton Branch
17 River Street, Acton
Tuesday to Thursday:
9:30 a.m. to 8:30 p.m.
Friday to Saturday:
9:30 a.m. to 5:00 p.m.

Subject to additional comments received as a result of this Notice and the receipt of all necessary approvals, Halton Region intends to proceed with the design and construction as documented in the ESR.

Comments

During this 30-day review period, anyone who has any outstanding concerns with the project that cannot be resolved in discussion with Halton Region, may request that the Minister of the Environment make an order for the project to comply with Part II of the Environmental Assessment Act (referred to as a Part II Order). Written Part II Order requests must be submitted to the Minister of the Environment before May 4, 2011 at the following address:

Minister of the Environment
135 St. Clair Avenue West, 12th Floor
Toronto, ON M4V 1P5

Copies of Part II Order requests must also be sent to:

Magda Bielawski, P.Eng.
Project Manager, Halton Region
Phone: 905 825 6000 ext. 7426
Fax: 905 825 8822
E-mail: magda.bielawski@halton.ca

This Notice was first issued on March 31, 2011.

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1.0 INTRODUCTION

Acton is a community located within the upper-tier Regional Municipality of Halton with a 2009 residential population of 10,193. Acton is situated in the lower-tier municipality of the Town of Halton Hills, which also includes the communities of Ballinafad, the hamlet of Churchill, Georgetown, Hornby, Glen Williams, Limehouse, the village of Norval, Stewarttown, and Terra Cotta. Based on the provincial Growth Plan and the Halton Region Official Plan, it is anticipated that Acton's residential population will grow to approximately 14,709 over the next 20 years (2031). Acton's existing wastewater treatment system consists of a treatment plant located in the south east portion of the community. The treatment plant has a rated capacity of 4,545 m^3/day which is not sufficient to accommodate the residential and employment growth that is anticipated within the Acton urban area.

An increase in wastewater treatment capacity requires the completion of a Municipal Class Environmental Assessment (Municipal Engineers Association, 2007). The purpose of this Class EA is to document the process the Region has undertaken to identify a preferred solution for addressing immediate and long-term wastewater treatment servicing needs for the community of Acton, including the preferred design of new facilities or infrastructure that may be required.

This report includes the following Sections:

- Section 1 –introduces the project, the approach to the project and project study area.
- Section 2 – presents the project background and definition of the problem to be solved.
- Section 3 – provides information on the existing Acton WTTP and the natural, socio-economic and cultural environment.
- Section 4 – discusses the identification and evaluation of alternatives to address the need for additional treatment capacity (alternative solutions).
- Section 5 – discusses the identification and evaluation of alternative design concepts.
- Section 6 – provides an overview of the consultation undertaken for the project.
- Section 7 – presents the proposed undertaking for the Acton WWTP.
- Section 8 – presents the potential effects and proposed mitigation.
- Section 9 – presents future approval requirements.

1.1 Objectives of the ESR

The objectives of this Environmental Study Report (ESR) document are as follows:

- Provide background information relating to the Acton WWTP and need for additional wastewater treatment capacity.

- Present the alternative solutions to provide needed additional capacity and the rationale for selecting a preferred solution.
- Present the alternative design concepts for the preferred solution and the rationale for selecting the preferred design concepts.
- Provide a description of the potential environmental effects associated with construction and operation of the preferred design concept and proposed mitigating measures to minimize environmental effects.
- Document the consultation process with an explanation of how concerns raised by the public and review agencies have been addressed in developing this project.

1.2 Class Environmental Assessment Process

Major capital works for municipal sewage systems, such as expansions of wastewater treatment plants, are subject to the requirements of the Ontario *Environmental Assessment Act* (*EA Act*). These requirements are met by following the Municipal Class Environmental Assessment (Class EA) Process. The Municipal Class EA applies to a group or “class” of municipal water, wastewater and road projects which occur relatively frequently and have relatively minor and predictable impacts. These projects are approved under the *EA Act*, as long as they are planned, designed and constructed according to the requirements of the Class EA document.

Under the Class EA process, projects are subject to varying levels of environmental review depending on the extent of their potential impact. Projects fall into four schedules of undertakings including:

- Schedule A projects which are essentially pre-approved and exempt from the Class EA process.
- Schedule A+ projects which are also considered to be pre-approved but require that the public be advised prior to project implementation.
- Schedule B projects are those considered to potentially have some adverse environmental effects. In the case of Schedule B projects, proponents are required to undertake a screening process, involving mandatory contact with directly-affected public or relevant review agencies to make sure that they are aware of the project and that their concerns are addressed. If there are no outstanding concerns, the proponent may proceed to implementation. Schedule B projects generally include improvements such as upgrades to existing facilities.
- Schedule C projects are those that have the potential for significant environmental effects and must proceed through the full Municipal Class EA planning and documentation

process. Schedule C projects generally include the construction of new facilities and major expansions to existing facilities. Schedule C projects require that an ESR be prepared and filed for review by the public and review agencies. Provided that the approved Class EA planning process is followed and public and agency comments and concerns are resolved, the completed project is considered to have met the *EA Act* requirements.

As outlined in the Municipal Class EA, the expansion of an existing sewage treatment plant beyond its existing rated capacity is classified as a Schedule C project.

There are five phases of the Schedule C Class EA process as follows:

Phase 1 – Identify Problem or Opportunity

Work in this phase identifies the problem statement and provides a framework for evaluating future servicing options. Phase 1 is documented in Section 2 of this ESR.

Phase 2 – Identify and Evaluate Alternative Solutions

During this phase, alternative solutions to provide additional servicing are identified. The alternatives are evaluated based on a number of factors, including protection of the cultural and socio-economic environment, protection of the natural environment, technical performance, and cost. For this project, the alternative solutions encompass different ways to provide additional wastewater treatment capacity. The evaluation of alternative solutions includes consideration of input from outside agencies and the public, who were consulted through a Public Information Centre (PIC). The Phase 2 evaluation of alternative solutions is summarized in Section 4 of this ESR.

Phase 3 – Evaluation of Alternative Design Concepts

This phase consists of the identification and evaluation of a variety of technical design options to determine the preferred design concept. This includes collecting data and soliciting public and agency input to identify and evaluate alternative methods of implementing the preferred solution. Where possible, methods of minimizing negative impacts and maximizing positive effects are identified. The identification and evaluation of alternative design concepts and the discussion on potential effects of the project and mitigation to minimize effects is included in Sections Five and Eight of this ESR, respectively.

Phase 4 – Environmental Study Report (ESR)

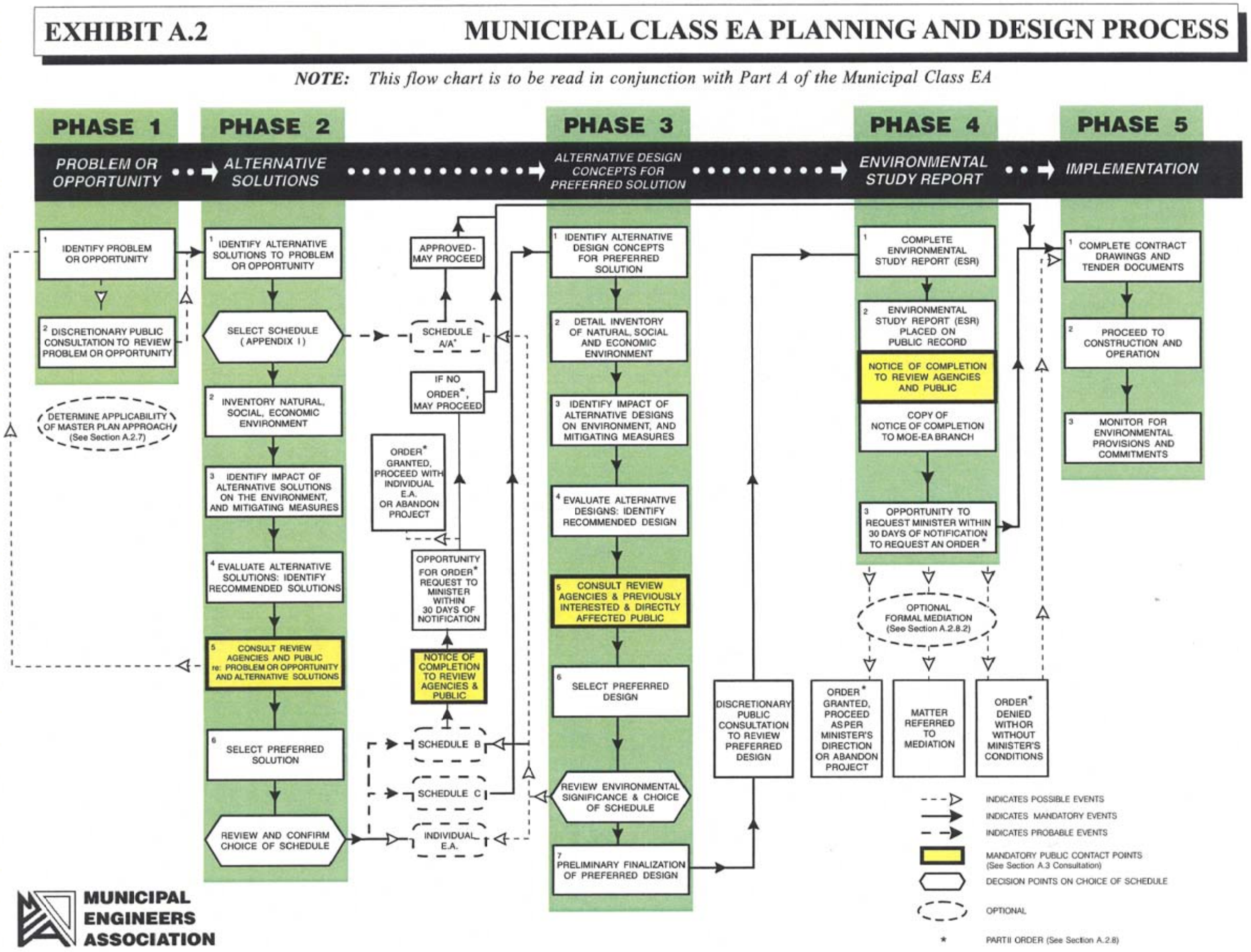
Phase 4 consists of the preparation of this ESR, including conceptual design. The ESR will be placed on the "public record" for a 30-day review period.

Phase 5 – Implementation

This phase includes the completion of the design phase and construction of the facility.

Figure 1.1 shows the Municipal Class EA process.

Figure 1.1 - Municipal Class EA Process



1.3 Canadian Environmental Assessment Act

Municipal projects may be subject to the requirements of the Canadian Environmental Assessment Act (CEAA). Potential CEAA triggers for a municipal project of this type could include:

- The provision of federal funding.
- The need for federal land.
- The need for federal approval (e.g. approval under the *Fisheries Act*, *Navigable Waters Protection Act* or other applicable Acts).

The proposed Acton WWTP expansion is located entirely within property owned by the Halton Region, and no federal funding or approvals are required. Thus, this project is not anticipated to trigger the need for a study under CEAA.

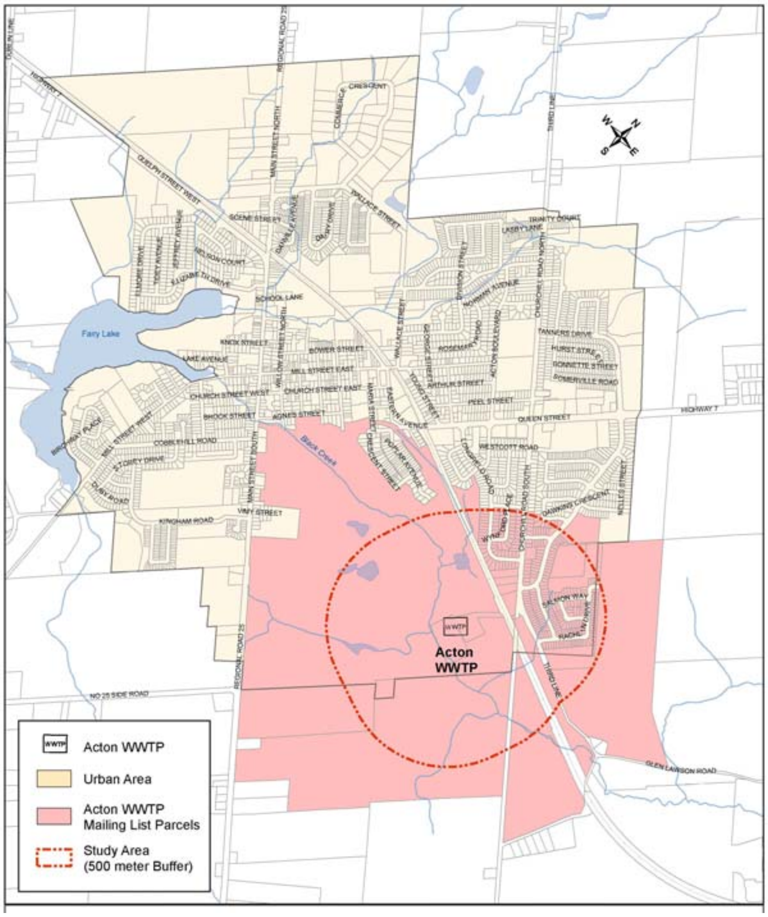


Figure 1.2 - Acton WWTP Class EA Study Area

1.4 Study Area

The study area for this project is the WWTP location and the environs in the immediate vicinity (0.5 km radius). The Study area is shown in ***Figure 1.2***. The study area was used as a basis for the description of existing conditions for the project. It is noted, however, that where appropriate, the existing conditions description is more focused on the WWTP site or more broadly covers the general Acton area.

The service area for the treatment plant is larger than the study area covering the existing urban area of Acton.

1.5 Environmental Assessment Project Team Members

The main team members involved with the Acton WWTP Class Environmental Assessment, including representatives from Halton Region, Dillon Consulting and sub-consultants are provided in ***Table 1.1*** below.

Table 1.1 - Key Project Team Members

Contact	Organization	Role
Magda Bielawski	Halton Region	Project Manager
John Duong	Halton Region	Advisor to the Project Team
Dave Andrews	Halton Region	Advisor to the Project Team
Louis Tasfi	Dillon Consulting	Consultant Project Manager
Marcy McKillop	Dillon Consulting	Project Coordinator
Don Weatherbe	Donald G Weatherbe Associates	Assimilative Capacity Specialist

2.0 BACKGROUND INFORMATION AND PROBLEM STATEMENT (PHASE 1)

2.1 Existing Wastewater Treatment Plant

The Acton Wastewater Treatment Plant (WWTP), located at 202 Churchill Road South, in the Town of Halton Hills, Halton Region, currently services the community of Acton. The Acton WWTP is a facility owned and operated by Halton Region. The related sanitary sewage collection system and water distribution systems are also Regional facilities, while the stormwater collection system is owned by the Town of Halton Hills.

The plant currently services an existing population of 10,193 and an industrial/commercial/institutional service area of approximately 100 ha. The plant has a rated capacity of 4,545 m^3/d and is currently operating near this rated capacity. Further details about the existing plant are included in Section 3 of this ESR.

2.2 Future Demands

The additional treatment capacity was estimated based on population and employment projections received from the Town of Halton Hills. Their projections were estimated for build-out of the Acton urban area which will occur beyond 2031. The Region has decided to fulfill the EA requirements for the ultimate WWTP capacity of 7,000 m^3/day as it is anticipated that this will be the last Acton WWTP expansion.

Lands within the current Acton urban area are expected to accommodate approximately 4,880 people and 50 ha of employment land. This growth translates into an increased wastewater flow of about 2,455 m^3/day. This increase combined with the existing flows results in the need for an ultimate wastewater treatment capacity of approximately 7,000m^3/day. It is proposed that the phasing-in of additional treatment capacity be coordinated with the availability of water servicing.

2.3 Problem/Opportunity Statement

As outlined above, the Acton WWTP is currently operating near its rated capacity and an additional treatment capacity of approximately 2,455 m^3/d is required to accommodate "build-out" of the Acton urban area, including south Acton (also known as the Maple Leaf lands). This Class EA addresses the need for additional treatment capacity. The following problem statement was presented to public and agencies through the Public Information Centres (refer to Section 6 for details).

Problem/Opportunity:
The Acton WWTP is currently operating near its rated capacity of 4,545 m^3/d. *Additional wastewater treatment capacity is required to accommodate build-out of the urban envelope, for a total ultimate capacity of 7,000* m^3/d.

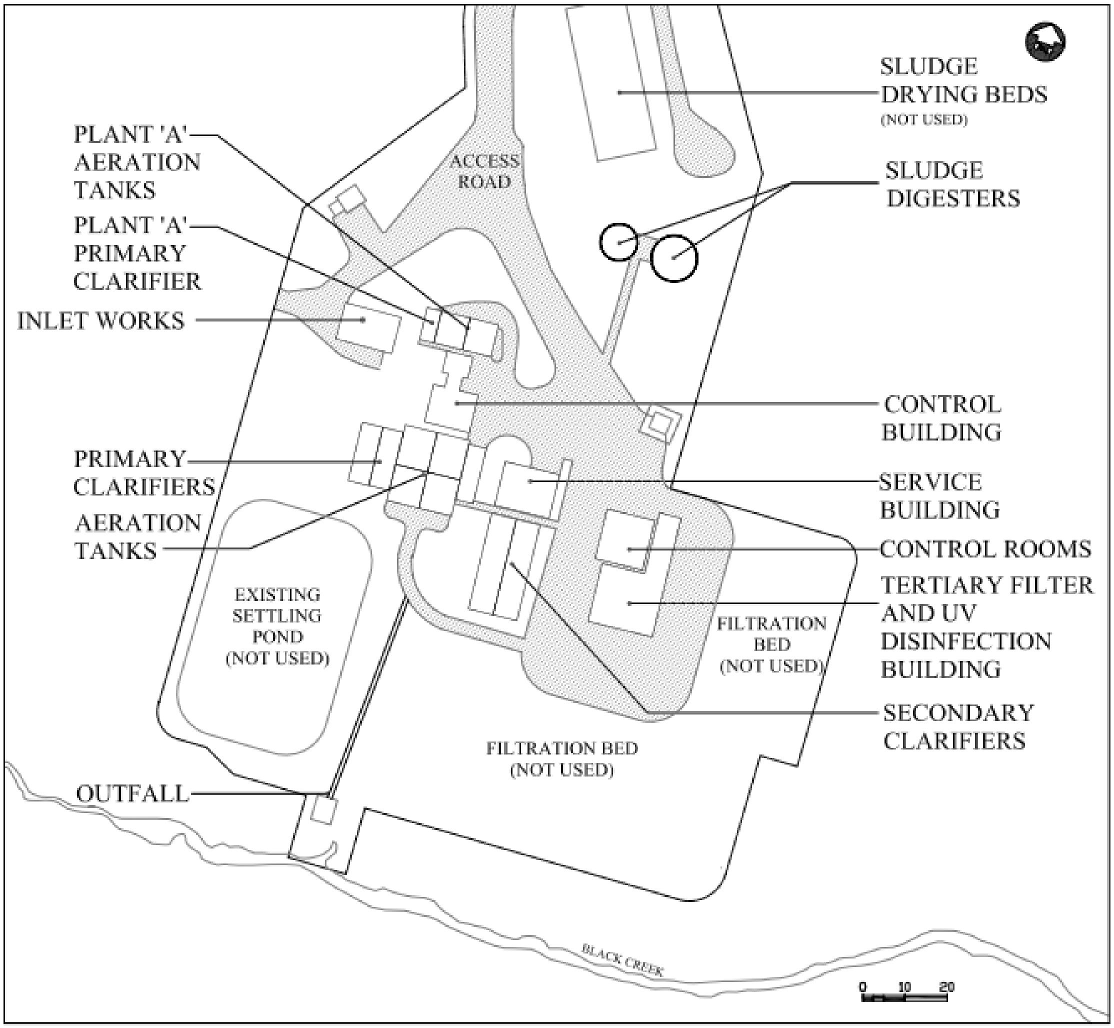
3.0 EXISTING CONDITIONS

3.1 Existing Treatment Plant

The Acton WWTP is located at 202 Churchill Road South, Halton Hills within Halton Region. The facility is located on the southeast edge of the community of Acton.

The current Acton WWTP employs an activated sludge treatment process with tertiary filtration and UV disinfection. Filtration beds and a settling lagoon which were formerly part of the treatment process are still located on the site. A layout of the current facility, with labels indicating the location of individual plant processes, is provided below in ***Figure 3.1***:

Figure 3.1 - Layout of existing works at Acton WWTP



The Acton WWTP treatment process consists of the following components:

- Inlet works.
- Sewage pumping.
- Primary clarification.
- Biological treatment (aeration tanks).
- Secondary clarification.
- Chemical dosing.
- Tertiary filtration.
- UV disinfection.
- Sludge digestion.

Primary clarifiers, secondary clarifiers and biological treatment are currently divided into two separately constructed process trains referred to as "Plant A" and "Plant B". Plant A was originally commissioned in 1951 and has a rated capacity of 1100 m^3/d. Plant B was commissioned in two stages in 1969 and 1978 and has a rated capacity of 3445 m^3/d (Earth Tech Canada, 2006). A brief overview of each of the components in the treatment process is provided below.

Inlet Works

Inlet works are required to screen and de-grit raw flows prior to biological treatment. Inlet works currently include one mechanically operated screen and one manually cleaned fine screen. The inlet works also include an aerated grit removal tank followed by flow splitting works to divide flows between Plant A and Plant B. A 2006 assessment of the inlet works indicated that they were in poor condition and unable to handle operational requirements (Dillon Consulting, 2006). A project to replace and upgrade the current inlet works is now underway and is separate from this Class Environmental Assessment.

Sewage Pumping Station

A pump station with a capacity of 1200m^3/d is currently required to pump flow from the inlet works into Plant A (MOE certificate of approval, 2007).

Primary Clarification

Primary clarification is required to remove excess solids upstream of biological treatment. Currently, this consists of one Plant A primary clarification tank and two Plant B primary clarification tanks.

Surface loading rates to Plant A and Plant B primary clarifiers are 37.6 $m^3/m^2 \cdot d$ and 26.1 $m^3/m^2 \cdot d$, respectively (Dillon Consulting, 2006). The 2008 MOE design guidelines for sewage works recommend a loading range of 25 to 30 $m^3/m^2 \cdot d$, indicating that Plant A primary clarification capacity is insufficient.

Plant B clarifiers are sized appropriately for rated flows (Dillon Consulting, 2006).

Biological Treatment

Biological treatment is required to remove dissolved organic components from wastewater. Currently, biological treatment consists of a conventional activated sludge process with nitrification.

Plant A has two square bottom aeration tanks with a total volume of 439 m^3. Plant B has four square-bottom aeration tanks with a combined volume of 892 m^3 (MOE certificate of approval, 2007). Both tanks are mixed and aerated by jet aeration. Plant A has one aeration blower. Plant B has two aeration blowers with one in duty and one on standby. Both Plant A and Plant B aeration tanks are operating within recommended guidelines (Dillon Consulting, 2006).

Plant A and Plant B currently operate with a food-to-biomass (F/M) ratio of 0.06 kg/kg·d and 0.075 kg/kg·d, respectively, falling within 2008 MOE design guidelines for conventional activated sludge processes with nitrification (Dillon Consulting, 2006). Hydraulic detention times for Plants A and B of 10.2 hours and 7.6 hours, respectively, also fall within MOE acceptable limits for the conventional activated sludge treatment. However, BOD loadings for both plants are slightly below MOE guidelines for conventional activated sludge treatment (Dillon Consulting, 2006).

Secondary Clarification

Secondary clarification is required to remove activated sludge biomass from treated wastewater following aeration. Currently, this treatment step consists of two Plant A secondary clarifiers and two Plant B secondary clarifiers. Plant A clarifiers are undersized and not operating within MOE design guidelines (Dillon Consulting, 2006).

Plant A secondary clarifiers currently operate at a hydraulic load of 37.6 $m^3/m^2 \cdot d$ and solids loading rate 6.4 $kg/m^2 \cdot h$, both of which exceed 2008 MOE design guidelines. Plant B clarifiers currently operate at a hydraulic load of 16.9 $m^3/m^2 \cdot d$ and a solids surface load of 2.6 $kg/m^2 \cdot h$, both of which fall within MOE guidelines (Dillon Consulting, 2006). It was noted in earlier facility assessments that Return Activated Sludge (RAS) pumping deficiencies have prevented Plant B secondary clarifiers from operating at recommended hydraulic retention times, resulting in poor settling performance and impacting efficiency of downstream tertiary filters. This issue has been addressed with recent upgrades of Plant B RAS pumping systems. RAS pumping is currently provided by four Plant A pumps and three Plant B pumps (MOE certificate of approval, 2007).

Chemical Dosing

Chemical treatment is required to improve primary settling performance and to precipitate dissolved phosphorous from treated sewage, allowing it to be captured by downstream tertiary filters. Currently, only alum dosing is performed. Alum is currently added to wastewater in the primary and secondary clarifiers (Earth Tech, 2006).

Dosing is provided by four metering pumps, each with a rated capacity of 100-500 L/h. Alum is currently stored in a 27.3 m^3 tank (MOE certificate of approval, 2007).

Tertiary Filtration

Tertiary filtration is required to remove precipitated phosphorous as well as residual suspended solids prior to discharge of treated sewage. Currently, filtration consists of two travelling bridge shallow-bed sand filters.

The peak filter loading rate is 1.5 $L/m^2 \cdot d$. However, with one filter unit out of service, the peak filter loading rate is 3.0 $L/m^2 \cdot d$, which exceeds the maximum 2008 MOE loading guideline for shallow bed filters of 2.4 $L/m^2/s$. Peak solids loading is 27.5 $mg/(m^2 \cdot s)$, which is below the maximum 2008 MOE loading guideline of 51 $mg/(m^2 \cdot s)$. Filter backwash is performed by two pumps with a capacity of 600 m^3/d and 3500 m^3/d, respectively. Backwash water is directed to primary clarifiers.

UV Disinfection

Currently, disinfection is provided by a UV system consisting of two modules. A 2006 capital needs assessment indicated that the UV system meets design objectives at average flows but is undersized for high flows (Earth Tech Canada, 2006).

Sludge Digestion

Sludge digestion is required to reduce the total volume of waste sludge produced by the treatment process, and to stabilize the material for subsequent offsite disposal. Currently, sludge digestion is performed by a 615 m^3 heated primary anaerobic digester and a 340 m^3 unheated secondary digester (MOE certificate of approval, 2007).

Gas produced during digestion is used to heat the primary digester and nearby process buildings.

Summary

The existing inlet works and Plant A concrete are in poor condition and replacement of these works has been recommended by prior condition assessment studies (Earth Tech Canada, 2006). Additionally, Plant A primary and secondary clarification tanks are undersized for current flows. Plant B tanks require minor repairs, but are otherwise in good condition. However, Plant B is currently operating near capacity, and future flow increases, or an increase in load to Plant B resulting from decommissioning of Plant A, will require the construction of additional treatment capacity. To accommodate future effluent quality, the existing plant needs to be re-configured, upgraded and expanded.

3.2 Cultural and Socio-Economic Existing Conditions

The community of Acton is located at the north end of Halton Region along Black Creek. It was amalgamated with Georgetown and Esquising townships in 1974 to create the Town of Halton Hills. Neighbouring towns and cities include Brampton, Milton, Erin, Rockwood, and Guelph. Between 1991 and 2001, the Town of Halton Hills increased in population by approximately 25%. (38,616 in 1991 compared to 48,414 in 2001).

3.2.1 Planning Policies, Acts and Regulations

A number of planning policies relate to providing wastewater treatment capacity to service the community of Acton:

- The Provincial Policy Statement (2005).
- The Greenbelt Plan (2005).
- Halton Regional Official Plan (2006).
- Halton Hills Official Plan (2008).
- MOE Guideline D-2: Compatibility between Sewage Treatment and Sensitive Land Use.

Provincial Policy Statement – The *Planning Act* requires that municipal decisions affecting a planning matter "shall be consistent with" the Provincial Policy Statement (PPS) issued in 2005.

As required by the PPS, municipalities shall ensure that sewage services are provided in a manner that:

- Directs and accommodates expected growth in a manner that promotes efficient use of existing services.
- Can be sustained by the water resources upon which such services rely.
- Is financially viable and complies with regulatory requirements.
- Protects human health and the environment.
- Promotes water conservation and water use efficiency.
- Integrates servicing and land use considerations in all stages of the planning process.

Infrastructure and public service facilities shall be provided in a coordinated, efficient and cost-effective manner to accommodate projected needs. The PPS also requires that planning for these facilities shall be integrated with planning for growth to meet current and projected needs.

The Greenbelt Plan – The Greenbelt Plan (2005) is a strategy that prescribes where urban growth within the Golden Horseshoe should be accommodated to provide permanent agricultural and environmental protection. The Greenbelt Plan consists of the lands protected by the Oak Ridges Moraine Conservation Plan, and the Niagara Escarpment Plan as well as additional lands referred to in the Plan as Protected Countryside. Within the Protected Countryside there are three key policy areas: Agricultural System, Natural System and Settlement Area. The Plan identifies Acton as a town/village within the Settlement Area. The Greenbelt Plan Protected Countryside polices doe not apply to lands within a designated town/village.

Halton Regional Official Plan (2006) – The goal of the Halton Region Official Plan is to provide broad policy direction on strategic matters within the Halton Region. The Halton Regional Official Plan (2006) addresses goals and objectives and fosters policies related to a wide range of topics including, but not limited to:

- The delineation of urban areas for the protection of farmlands.
- The designation of environmentally sensitive areas and promotion of land stewardship.
- The promotion of local economic development.
- The identification of urban services such as water supply and wastewater treatment, transportation, energy and utilities.
- The promotion and protection of human services and heritage resources.

Regarding water and wastewater infrastructure, the Regional Official Plan (Section 88) identifies the following objectives:

- Provide satisfactory levels of urban servicing in the urban area to meet existing and future requirements.
- Provide a staged approach for improvement and extension of urban services that:
    - Meets the financial capability of the Region.
    - Meets or exceeds provincial standards.
    - Is based on infrastructure plan.

The Halton Regional Official Plan identifies Acton as an "urban area". According to the Halton Regional Official Plan, urban areas are already serviced by municipal water and wastewater treatment services, or these services are planned to accommodate urban development and amenities.

The Halton Region Official Plan (Map 1 – The Regional Structure) identifies lands within the Acton WWTP study area as a combination of urban area, Greenlands A and B, Niagara Escarpment Area and Environmentally Sensitive Area.

Sustainable Halton, initiated in 2006, was a four phase process designed to bring the Regional Official Plan into conformity with the *Places to Grow Act (2005)*, the *Provincial Policy Statement (2005)* and the *Greenbelt Plan (2005).* Sustainable Halton identifies principles and priorities for future growth, land use concepts and preferred growth options. The goal of Sustainable Halton is to develop a sustainable growth management and land-use plan to accommodate the projected rapid growth in Halton. In 2009, with the culmination of Sustainable Halton, the Region completed the 5-year Official Plan review and Regional Council adopted Regional Official Plan Amendment (ROPA) 38 at the end of 2009. ROPA 38 incorporates the results of Sustainable Halton. In the fall of 2010, a partial draft decision on ROPA 38 was received by the Ministry of Municipal Affairs and Housing (MMAH). The approved 2006 Regional Official Plan is still in place until a complete decision is obtained from MMAH.

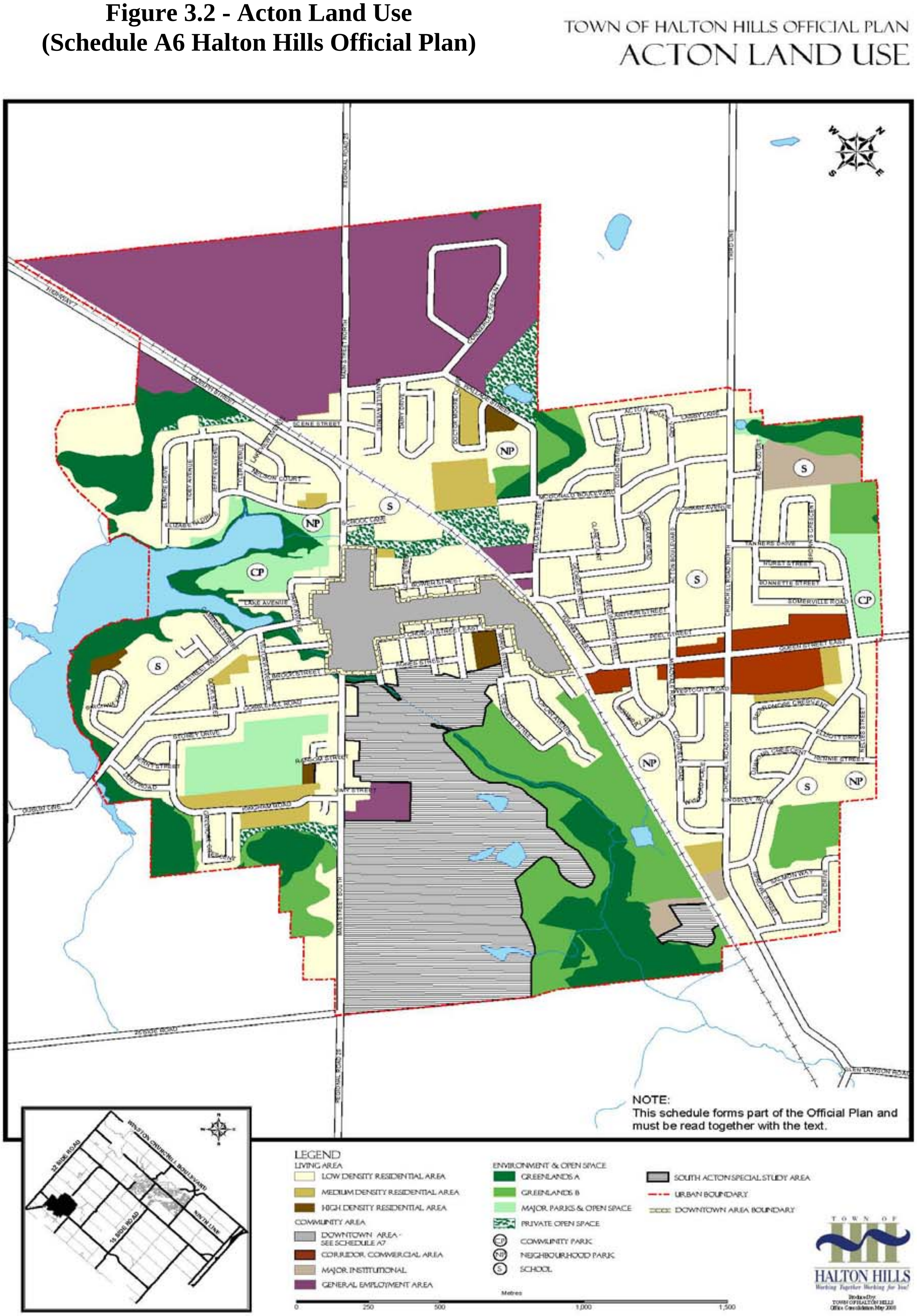
Halton Hills Official Plan – The Halton Hills Official Plan (May 2008) addresses lands within the Town of Halton Hills including the community of Acton. The Offical Plan clearly defines the urban area of Acton as well as land use within that urban area. ***Figure 3.2*** shows the Acton Urban Area and the land use in the vicinity of the Acton WWTP. As shown in the Figure, within Acton, the Halton Hills Official Plan (2008) identifies the following land use designations for the Acton WWTP study area: major institutional, Greenlands A and B, low and medium density residential and South Acton special policy area. The study area does extend south of the community of Acton where Schedule A1 of the Official Plan designates the lands as Niagara Escarpment Plan Area.

In December 2009, the Halton Hills Intensification Strategy proposed an Official Plan Amendment (OPA No. 9) that identifies the areas of South Acton and the Acton downtown areas as intensification or redevelopment corridors. OPA No. 9 was adopted in May 2010 and addresses the intensification policies of *Places to Grow*.

<u>MOE Guideline D-2: Compatibility between Sewage Treatment and Sensitive Land Use</u> – Guideline D-2 applies to all Certificate of Approval applications for new and expanding municipal and private sewage treatment facilities. The Guideline includes recommended separation distances and other control measures to minimize the impact of odours and noise on "sensitive land uses" adjacent to municipal and private sewage treatment facilities. "Sensitive land uses" are defined in Procedure D-1-3 and include residential, institutional, certain recreational uses and some agricultural operations, including cattle-raising, cash crops and orchards.

Guideline D-2 requires a minimum separation distance of 100 m from sensitive land uses (i.e. residential, institutional, certain recreational uses and some agricultural operations) for sewage treatment plants with a capacity of 500 m^3/d to 25,000 m^3/d, as applicable to the Acton WWTP. The separation distance is measured from the periphery of the noise/odour-producing source/structure, to the property/lot line of the sensitive land use. The closest sensitive land use to the Acton WWTP are the existing residences on Churchill Road South which are over 200 metres from the plant buildings.

Figure 3.2 - Acton Land Use (Schedule A6 Halton Hills Official Plan)



3.2.2 Existing Land Uses

The neighbourhoods located within Acton are primarily residential, dominated by low-density dwellings, although there are a handful of medium and higher density dwellings within the community. There are a number of recreation facilities in Acton including two golf courses and eight parks. Both golf courses are located on Dublin Line, with Acton Meadows Golf Club designated as a public course and Blue Springs Golf Club designated as a private course. There are multiple institutional properties including approximately nine churches, three schools and a library. Community and commercial/retail areas are located primarily along Mill Street and Main Street and along Queen Street East where a variety of businesses including restaurants, accounting services and electronic equipment suppliers are located.

The Acton Industrial Area is partly located along Main Street North and contains many long-established manufacturing and warehousing businesses. Some of the existing Acton industries are:

- Louisiana Pacific (ABTco).
- Geo-Foundations Contractors Inc.
- Galvcast Manufacturing Inc.
- Purity Life Health Products Ltd.
- Halton Hills Manufacturing.
- Halton Ready Mix.
- Halton Flour Mills Inc.
- Superior Glove Works Ltd.

Within the 500 metre study area for the Acton WWTP Class EA, most of the lands are designated low density residential or greenbelt. Lands within the low density designation are mostly built-out, there are approximately 300 residences within 500 metres of the Acton WWTP. Along Churchill Road neighbouring the WWTP, there is a smaller area designated as medium and high density residential, there are three apartment buildings on these lands (The Valleyview, Churchill Road Apartments, and the Winston). A neighbourhood park is nestled within the residential community in the study area. The Acton WWTP is separated from residential neighbourhoods by an existing rail line.

A significant portion of the lands within the Acton WWTP study area are identified as the South Acton Special Study Area which includes lands that were part of the former Beardmore Tannery.

Future development of these lands will likely include residential and mixed use development. Currently the lands are either vacant or are being farmed.

There are no businesses within the Acton WWTP 500 metre radius study area.

3.2.3 Stage 1 Archaeological Assessment

A Stage 1: Archaeological Background Research study was undertaken for the Acton WWTP. The Study area for this assessment is the section of the property comprising the WWTP facility, the gated and fenced area which includes all the existing structures.

Information about the archaeological potential of the site was gathered from various sources. The archaeological potential for Aboriginal presence has been assessed using the data gathered from the Ontario Sites Database (OSD), and from environmental data collected from geological, soils, National Topographic Series and Ontario maps. Pioneer (Euro-Canadian) site potential has been assessed using data from the OSD system, from historic maps, and from primary and secondary historic sources.

Environmental Setting

There are a number of environmental factors that would influence settlement and the archaeological potential of an area:

- Physiographic features – Acton lies on the eastern limb of the Horseshoe Moraine and is in proximity to the Niagara Escarpment, one of the most significant physiographic features in Southern Ontario.
- Soils – Soil on the northern portion of the site is comprised mainly of Font soil, a well drained sandy loam. Soil on the southern portion of the site is comprised of Colwood soil, a poorly drained silt loam.
- Water sources – The Historic Atlas of 1977 claims “the water power of this township [Esquesing] is unexcelled”. The Historic Atlas also depicts a creek, possibly Black Creek.
- Vegetation – The site falls within the Great Lakes – St. Lawrence forest region. The types of species that would have been found in this region include sugar maple, beech, white pine and yellow birch. These trees would have been a valuable resource to pioneers and early industrial pursuits.

Area History

Immigration to this region of Ontario by Euro-Canadian pioneers began in the mid 19th century. Prior to this, Aboriginal peoples inhabited the area for more than 8,000 years.

Based on a search of the Ontario Archaeological Sites Database, there is only one registered site within this zone. It is AjHa-23, a Euro-Canadian homestead site dating to the mid 19th century located on high ground between two tributaries of Black Creek.

The survey for the historic Township of Esquesing, Halton County, in the present-day Halton Region, was first conducted in 1819. By 1821, the Township had 425 residents and by 1871 a large number of mills were in operation along the Credit River. The first Crown Patent for land within the present day Town of Acton was for 100 acres issued in 1829. Situated on the Grand Trunk Railway line, Acton rapidly developed its own industry and trade and the first tannery was built in 1840.

The Acton WWTP property came into the Town of Acton through transaction with the Beardmore Tanning Co, in the mid 20th century. Available information suggests that the site remained undeveloped until the mid to late 1900s when the sewage treatment plant was established on site. More recent construction in 2000 identified the presence of a row of large logs surrounded by peat moss set below the frost line. The presence of these logs suggests that the ground surface was built up and that some development had occurred within the site prior to the WWTP. The logs may have been a former corduroy road.

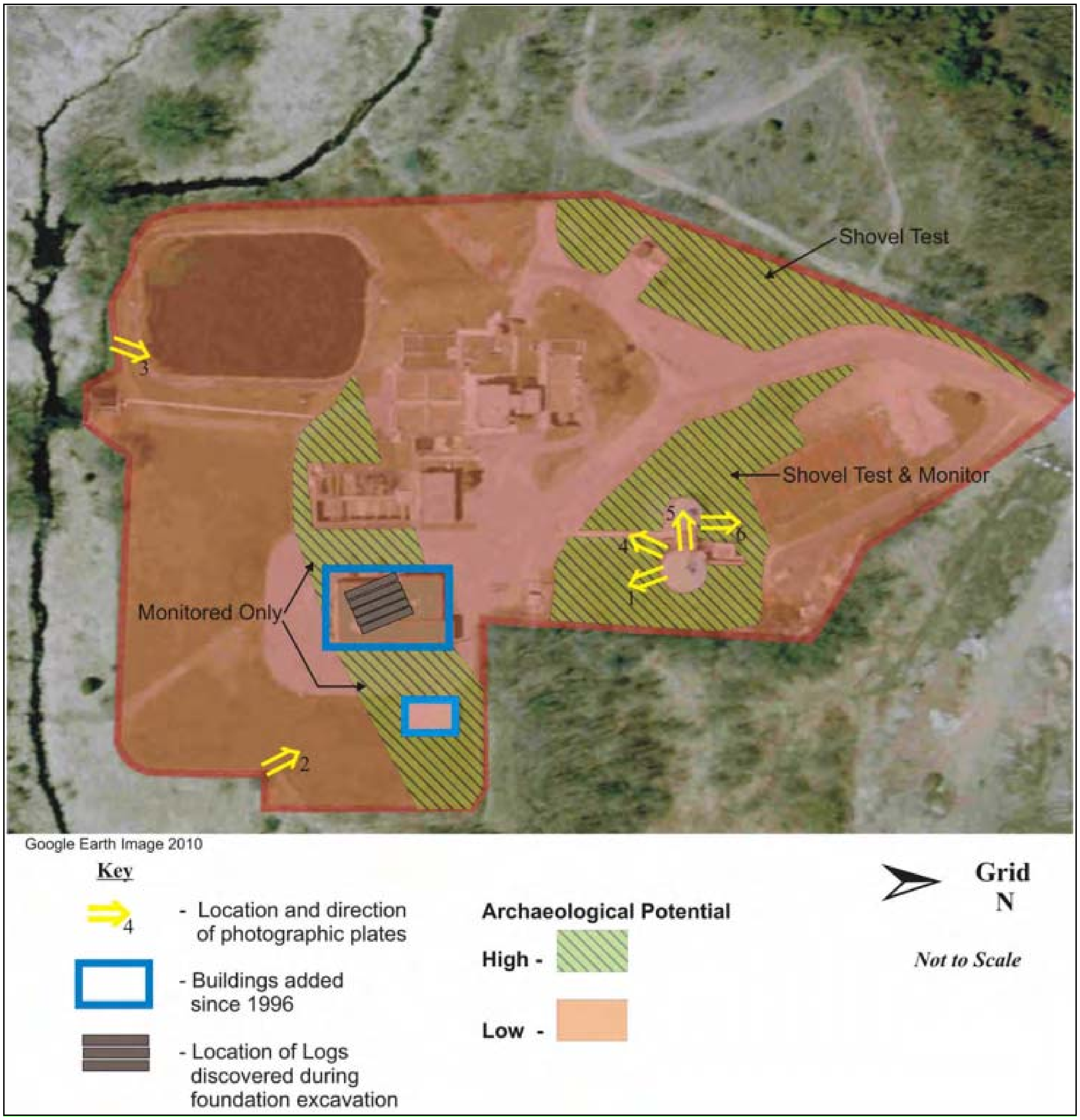
The results of the Stage 1 Archaeological Assessment are summarized as follows:

- The site is on Black Creek and this proximity to year round water is considered to indicate Aboriginal archaeological potential.
- Neither the CN railway nor Churchill Road South directly affects the archaeological potential of this site.
- The early 19th century survey and subsequent Euro-Canadian habitation of the Halton Region render the Euro-Canadian archaeological potential high.
- The hillock on which the digesters sit, though disturbed during construction and upgrading, appears to have maintained its natural topography and could still have sections of undisturbed soil and high archaeological potential.
- The level surface in the south half of the site appears to have been landscaped and raised above the surrounding natural marsh.

- The structures of the WWTP have created obvious disturbance in their immediate vicinities, reducing archaeological potential in those areas. Therefore there are only a few specific locations which may still retain archaeological potential.

Figure 3.3 shows the archaeological potential of the site. A Stage 2 Assessment is recommended for the areas identified as having high archaeological potential. In some areas monitoring of construction activities are recommended.

Figure 3.3 - Archaeological Potential



The complete Stage 1 Archaeological Assessment Report is included as ***Appendix A***.

3.3 Natural Environment Existing Conditions

3.3.1 Environmental Policy Context

The Halton Region Official Plan (2006) identifies key natural areas as part of their Greenlands system. The Greenlands system includes:

- Greenlands A - floodplain areas, provincially significant wetlands and species at risk habitat.
- Greenlands B – environmentally sensitive areas, regionally significant wetlands, provincially and regionally significant areas of natural and scientific interest, significant woodlands, etc.

Lands along Black Creek within the study area are identified as Greenlands A in the Halton Region Official Plan as well as the Halton Hills Official Plan. Lands to the north of the existing WWTP are designated as Greenlands B in both Official Plans.

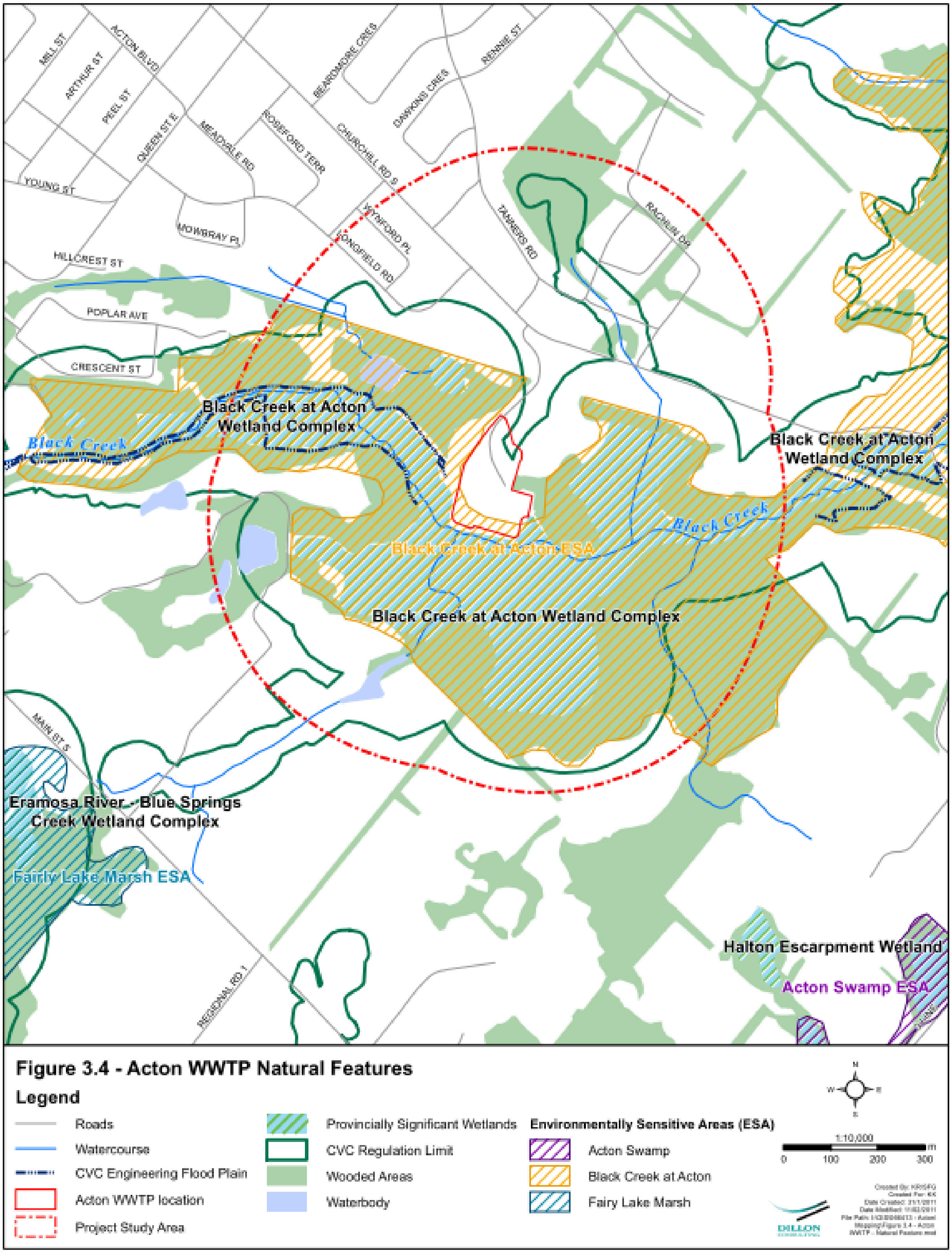
As per the policies of both Official Plans, it is permissible to locate essential utility facilities on land that is designated as Greenlands A, so long as the use of the land is in accordance with the objectives set out in other policies and the Conservation Authority Regulations.

The Halton Region Official Plan also identifies lands within the study area as Environmentally Sensitive Area. Section 119 of the Official Plan clarifies that mapping of the Environmentally Sensitive Areas in the Official Plan represents general boundaries and precise boundaries are to be established through an Environmental Impact Assessment. This is consisted with the policies of the Halton Hills Official Plan.

The Niagara Escarpment Plan Area is within the study area identified for this project. It is to the south of the existing treatment plant outside of the municipal boundary for Acton and thus it is not discussed further.

Environmental features within the study area are show in **Figure 3.4** and discussed in the sections below.

Figure 3.4 - Acton WWTP Natural Features



3.3.2 Aquatic Environment

3.3.2.1 Black Creek

The community of Acton is located in the Black Creek Subwatershed. Black Creek is a tributary of Silver Creek, and ultimately the Credit River. The subwatershed is located along the western section of the Credit River watershed. Credit Valley Conservation (CVC) manages aquatic resources in this watershed. Lands immediately adjacent to Black Creek consist of parkland, open space and wooded areas with medium dense cover.

Black Creek is classified as a cold-water fishery (sensitive to contaminant load and temperature increase), and provides habitat for important coldwater species such as brook trout (*Salvelinus fontinalis*) which rely on groundwater upwellings for spawning habitat and thermal refuge.

Historical fish community sampling indicates the presence of white sucker (*Catostomus commersoni*), pumpkinseed (*Lepomis gibbosus*), creek chub (*Semotilus atromaculatus*), eastern blacknose dace (*Rhinichthys atratulus*), brown bullhead (*Ameiurus nebulosus*), largemouth bass (*Micropterus salmoides*) and northern pike (*Esox lucius*). These species were reported in Background Documentation, Fisheries Habitat Assessment for Fairy Lake and Black Creek, prepared by Gartner Lee (1995) for the Halton Region and were based on captures from 1984 and 1971 as well as anecdotal information.

Brook trout have been captured by CVC in fish community sampling undertaken between 1999 and 2003 and from 2006 to 2008 at an established monitoring station downstream of Third Line (Bob Morris, CVC, personal communication; Black Creek Subwatershed Study, February 2009). Eight additional native species were represented in these catches and another three species were identified in the 2009 Black Creek Subwatershed Study (CVC, 2009) (BCSS). Species presence by year at this sampling station is summarized in ***Table 3.1***.

Table 3.1 - Summary of Fish Species Sampled by CVC at "Black Creek Downstream of Third Line" Station, 1999-2003, 2006-2009

Common name	**Scientific name**	**1999**	**2000**	**2001**	**2002**	**2003**	**2006**	**2007**	**2008**	**2009** (BCSS)
Eastern blacknose dace	*Rhinichthys atratulus*		✓	✓		✓	✓	✓	✓	
Brook stickleback	*Culaea inconstans*	✓	✓	✓	✓	✓		✓		✓
Brook trout	*Salvelinus fontinalis*	✓	✓	✓	✓	✓	✓	✓	✓	✓
Central mudminnow	*Umbra limi*	✓	✓	✓	✓	✓		✓		✓
Creek chub	*Semotilus atromaculatus*	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pumpkinseed	*Lepomis gibbosus*		✓							✓
Black crappie	*Pomoxis nigromaculatus*								✓	
Northern redbelly dace	*Phoxinus eos*						✓			
White sucker	*Catostomus commersoni*	✓	✓	✓	✓	✓	✓	✓	✓	✓
Brown bullhead	*Ameiurus nebulosus*									✓
Rock bass	*Ambloplites rupestris*									✓
Largemouth bass	*Micropterus salmoides*									✓
	Number of species:	5	7	6	5	6	5	6	5	

*Compiled from CVC's electrofishing station summaries and Adrienne Ockenden, CVC personal communication, September 16, 2008; and the Black Creek Subwatershed Study (February 2009).

CVC uses an Index of Biotic Integrity (IBI) scoring system to provide a measure of ecological health according to the biomass of a given species and its relative sensitivity or ecological importance. Based on calculated IBI scores in the BCSS, Black Creek downstream of the Fairy Lake station is considered to be in poor health; where as the station downstream of Third Line is considered to be in good ecological health mainly due to the influence of groundwater originating from the associated wetlands.

Beaver activity has been observed in Black Creek, immediately upstream of the Acton WWTP. The series of dams has resulted in slow-moving, flooded conditions with water depths over 1.0m. Throughout this area, bottom substrates are dominated by silt, and dense emergent vegetation is present along the stream margins. Dams pose barriers to fish passage at some of the locations.

3.3.2.2 Black Creek Assimilative Capacity Study

In January 2011, Dillon completed an assimilative capacity study for Black Creek based field work that was completed from June to August 2007. The study investigated the water quality and physical characteristics of Black Creek, and consisted of the installation of temperature loggers, a bi-weekly water quality sampling program, intensive diurnal surveys in June and August, measurements of water depth and velocity to estimate flow, and benthic invertebrate sampling. The following general conclusions were made based on the collected field data with regards the Acton WWTP:

- Elevated results of ammonia, Total Kjeldahl Nitrogen (TKN) and nitrate concentrations upstream and in the vicinity of the WWTP effluent suggested that a backwater movement near the treatment plant outfall, potentially caused by beaver dam activity, may exist. The upstream wetlands may also contribute as a potential source of ammonia, TKN and nitrate concentrations.
- Dissolved oxygen saturation levels are generally higher upstream of the WWTP than they are downstream, suggesting that the receiving waters are assimilating the organic oxygen demand from the WWTP.
- Water temperature data collected upstream and downstream of the WWTP indicated that effluent does not appear to be causing an increase in the temperature of Black Creek.
- Benthic invertebrate sampling upstream of the Acton WWTP suggested that water quality is slightly impaired along the upstream reach.
- Flow estimates indicated that the average flow rate increased significantly along Black Creek from the upstream monitoring station at the outlet from Fairy Lake to the downstream station near 8th Line (above the confluence with Silver Creek).

The Assimilative Capacity Study is included as ***Appendix B***.

3.3.2.3 Black Creek at Acton Wetland Complex

The Black Creek at Acton Wetland Complex extends from south of Crescent Street east to 5th Line and is located entirely within the larger Black Creek at Acton Environmental Sensitive Area (discussed in section 3.3.4.1). This wetland complex was evaluated by the Ontario Ministry of Natural Resources (MNR) in 1987. The evaluation was revisited in 2004 and the wetland was designated to be provincially significant (Emma Followes, MNR Aurora District, personal communication).

The wetland complex is largely comprised of floodplain associated with Black Creek. Generally, the complex is made up of seven individual wetlands, composed of two wetland types (44% swamp and 56% marsh, Source: MNR Natural Heritage Information Centre). There are large expanses of cattail marshes and other emergent vegetation throughout the wetland complex, interconnected by swamp and ponded wetlands. Beaver activity was found throughout the braided channels and floating vegetated mats of the wetland. The Black Creek at Acton Wetland complex is also an important groundwater discharge source atop the Niagara Escarpment.

As shown on Figure 3.4, current mapping includes portions of the Acton WWTP within the wetland complex. The section of the Acton WWTP property shown on the mapping as included within the wetland consists of manicured lawn and does not incorporate any wetland characteristics. Consultation with appropriate agencies during the design phase are planned to discuss adjustment of the wetland boundary to the Acton WWTP fenceline.

3.3.3 Terrestrial Features

3.3.3.1 Black Creek at Acton Environmentally Significant Area (ESA)

The Black Creek at Acton ESA, identified by Halton Region and the Town of Halton Hills, extends south of Crescent Street east to 5th Line and the Lime House Cliffs. The ESA surrounds the Acton WWTP site on three sides. The area is composed of woodlands, valley lands, wetlands (PSW), and floodplain of Black Creek. The uplands are composed of sugar maple (*Acer saccharum* ssp. *saccharum*) forests with white ash (*Fraxinus americana*) and white birch (*Betula papyrifera*) as well as old fields and shrub thickets. The valley slopes and higher portions of the floodplain contain lowland ash forest and poplar forest. The valley of the creek contains the following wetland communities that make up the PSW: reed canary grass (*Phalaris arundinacea*) marsh, cattail (*Typha* spp.) marsh, forb meadow marsh, willow (*Salix* spp.) swamp, poplar swamp and cedar (*Thuja occidentalis*) swamp.

Mapping of the ESA boundary currently shows it to be within the Acton WWTP fenceline. Based on the characteristics of the lands within the fenceline (which are primarily manicured grass) it is felt that this boundary should be refined. Consultation with appropriate agencies during the design phase will be planned to discuss adjustment of the ESA boundary to the Acton WWTP fenceline.

3.3.4 Species at Risk

Through correspondence with the MNR (Ms. Melinda Thompson-Black, MNR Species at Risk Biologist, personal communication, December 3, 2010) and a search of the NHIC database, no Species at Risk (SAR) occurrences were identified within or directly adjacent to the Acton WWTP site.

Several SAR element occurrences, however, were identified by MNR to be in the vicinity of the study area, including: Butternut (*Juglans cinerea*), Snapping turtle (*Chelydra serpentina*), Jefferson salamander (*Ambystoma jeffersonianum*), Milksnake (*Lamprepeltis triangulum triangulum*), Northern shrike (*Lanius excubitor*) and Redside dace (*Clinostomus elongates*). Many of these species and their habitat receive protection under the *Endangered Species Act, 2007*, and a permit may be required if the proposed Acton WWTP expansion could cause harm to either the species or their habitat. It is noted that the Acton WWTP site is generally manicured lawns and is not considered habitat for any of the SAR species listed above.

Of those species listed above, two are of interest due to the wetland and creek habitat types that are immediately adjacent to the WWTP site:

> Snapping turtle - The presence of Snapping turtles has not been confirmed by MNR records within the immediate WWTP reach or wetlands of Black Creek.
>
> Redside dace - While there are historical records of Redside dace in Black Creek downstream of 5th Line, several kilometers downstream of the Acton WWTP, there is no confirmed presence of Redside dace is in the immediate vicinity of the WWTP. There are several barriers to fish passage between the WWTP and 5th Line that have been described in the Spawning Redd Survey prepared by Dillon as Part I in the Black Creek Assimilative Study (2011); most notably, the perched culvert at the rail crossing directly upstream of 3rd Line.

3.3.5 Flooding and Erosion

The Acton WWTP is within the CVC Regulation Limit. Credit Valley Conservation approval is required for construction within this Regulation Limit and the Region will work with the CVC to obtain associated approvals. See Section 9.2 for further details. Credit Valley Conservation has delineated a floodplain for Black Creek. The current regulatory flood line covers much of the

Acton WWTP property including some of the existing facilities. It is understood that the flood forecasting model has been recently updated and a new flood elevation prepared. The new flood elevation removes much of the Acton WWTP from the regulated area. However, this new flood elevation is still to be adopted by Credit Valley Conservation. The Region will continue to consult with Credit Valley Conservation during the design phase to delineate the flood plain at this site and prepare a design that minimizes flooding effects.

Credit Valley Conservation has requested a fluvial geomophological /hazard assessment of the Black Creek in the vicinity of the Acton WWTP. The purpose of this assessment was to establish the hazard limits from a geomorphic perspective in order to establish any risk to the proposed expansion due to erosion and satisfy regulatory requirements.

The main objectives of this study were to:

- Complete channel mitigation analyses in order to determine 100 year erosion rates and identify the sensitivity of the reach(es); and
- Delineate the meander belt width on a reach basis in the vicinity of the subject development.

Refer to ***Appendix E*** for a copy of the Black Creek Geomorphic and Erosion Hazard Limit Assessment.

4.0 ALTERNATIVE SOLUTIONS (PHASE 2)

Phase 2 of the Class EA process requires consideration of alternative solutions or functionally different ways of solving the "problem" (as identified in Phase I). This section describes the alternative solutions considered, the evaluation criteria used to compare these alternatives and the process to select a preferred solution.

4.1 Alternative Solutions Considered

The following long list of alternative solutions was considered to provide additional wastewater treatment capacity for Acton. Many of these alternatives were presented at the Public Information Centre held on June 26, 2007:

- **Do nothing.** Leave the treatment plant 'as is' and doing nothing to provide additional wastewater treatment capacity.
- **Optimize the existing wastewater treatment plant.** Optimize and upgrade the existing treatment plant to improve process performance and provide some additional capacity. This alternative would be implemented within the existing treatment plant only and, thus, within the existing site footprint.
- **Inflow/infiltration reduction.** Implement an infiltration/inflow reduction program to repair and replace portions of the sanitary sewage collection system to reduce infiltration/inflow to the plant and regain system capacity.
- **Construct additional plant capacity at the existing site.** Construct new plant infrastructure including tankage at the existing wastewater treatment plant site, within the existing property boundary.
- **Construct a new wastewater treatment plant at a new site.** Construct a new off-site treatment plant to accommodate all flows. The existing wastewater treatment plant would be decommissioned and modifications to the existing collection system would be required.
- **Divert wastewater to an existing Halton Region wastewater treatment plant.** Divert all current and/or additional/future wastewater flows to the Milton, Mid-Halton (transfer of wastewater to another sewershed) or Georgetown wastewater treatment plants.
- **Divert wastewater to alternate end uses.** Divert all current and/or additional/future wastewater flows to alternative end uses such as subsurface disposal, irrigation on agricultural cropland, use for aquifer recharge, or discharge to a natural or constructed wetland. The treated effluent could be used as part of a water reuse system for various non-potable applications, such as toilet flushing, landscape irrigation or industrial process water.

Each of the alternatives must address the need to maintain water quality in the receiver, Black Creek and, if possible, improve water quality towards the Provincial Water Quality Objectives to improve the assimilative capacity of the receiver.

4.2 Evaluation Methodology and Criteria

A two-step evaluation process was used to identify a technically preferred solution for increasing wastewater treatment capacity in Acton considering potential impacts on the natural, social and cultural environments, as well as technical issues and cost.

- The key advantages and disadvantages of the long list of alternative solutions were documented to identify whether there are some alternatives that should be screened from further consideration based on their technical feasibility.
- The remaining alternatives were comparatively evaluated using a set of evaluation criteria. The criteria were developed to address the full definition of the environment as required in the Class EA process including: natural environment, socio-cultural environment, technical considerations and cost. The criteria were also developed to address both the evaluation of alternative solutions and alternative design concepts. Criteria groups and criteria for the evaluation of the alternative solutions and alternative design concepts are presented in ***Table 4.1***. Not all indicators will apply to both evaluations.

Table 4.1 - Acton WWTP Class Environmental Assessment: Evaluation Criteria

Criteria	**Indicator**
Protection of the Cultural and Socio-Economic Environment	
Consistency with provincial and local planning documents	Ability to meet needs for established growth targets
Compatibility with existing and planned land uses	Potential property required
Potential for cultural impacts	Displacement or disruption of archaeologically significant findings
	Displacement or disruption of cultural heritage features
Potential impact on residents/property owners	Potential visual-aesthetic impact associated with new construction (added footprint of new tankage and buildings, new building and tankage height)
	Potential short term disruption (noise, dust, odour, traffic) during construction
	Potential long term disruption (noise, dust, odour) during operation

Criteria	**Indicator**
Protection of the Natural Environment	
Impacts on receiving water quality	Potential of the alternative to minimize adverse impacts to the receiving water quality and aquatic systems
Impacts on natural environmental features	Potential for impact on terrestrial or aquatic habitat
Technical Performance	
Performance and experience	Ability of the technology to meet the Ministry of the Environment definition of 'proven technology'
Ease of construction and operation	Relative ease to implement/construct and maintain/operate the proposed technology within existing treatment plant
	Relative ease at which the plant could be expanded for the alternative, including new tankage and buildings or to meet more stringent effluent criteria
Reliability	Ability of the treatment process associated with the alternative to handle variable loadings and flows
Cost	
Capital cost	Relative capital cost
Operating and maintenance cost	Relative annual operating costs (including labour, energy, and ongoing routine operating and maintenance activities)
Lifecycle cost	The total relative cost estimate over a 20-year period considering inflation and the operating life of equipment and structures

4.3 Alternative Solutions Evaluation

As noted in Section 4.2, the first step in evaluating the Alternative Solutions was a review of the advantages and disadvantages to confirm the feasibility of the alternatives to meet the treatment servicing needs for Acton. ***Table 4.2*** provides the key advantages and disadvantages of each of the alternatives as well as commentary on whether the alternatives should be further considered. Conclusions of the evaluation are summarized as follows:

- **Do nothing.** This alternative cannot provide any additional treatment capacity to serve the approved growth within Acton, as outlined in the Regional Official Plan and the Town of Halton Hills Official Plan. Consideration of the 'do-nothing' alternative is a requirement of the Class EA process, as a way to test that proposed improvements are, on balance, preferred over the status quo.

- **Improve water quality in Black Creek.** An Assimilative Capacity Study for Black Creek has been completed to assess the water quality within the creek and its ability to assimilate additional discharge from the Acton WWTP. Improvements to water quality could be attained through effluent quality improvements to the discharge of the Acton WWTP and additional flows to Black Creek. This and other works to improve the water quality in Black Creek will be undertaken but it is not considered to be a stand-alone alternative.

- **Optimize the existing wastewater treatment plant.** Optimization and upgrade of the existing treatment plant processes are beneficial and could provide some additional capacity. These improvements, however, could not accommodate all of the approved growth. If an expansion of the existing plant is identified as the preferred solution, then upgrades within the existing plant would be incorporated into the staging/phasing of the plant expansion where appropriate.

- **Inflow/infiltration reduction.** An infiltration/inflow reduction program may reduce infiltration/inflow to the plant and, thus, provide some additional capacity. Improvements to the collection system will not provide a sufficient capacity gain at the plant to accommodate all of the approved growth. Rehabilitation of the existing collection system are proceeding regardless of the preferred alternative identified.

- **Construct additional plant capacity at existing site.** The construction of new plant infrastructure including tankage at the existing wastewater treatment plant site would accommodate approved growth within Acton.

- **Construct a new wastewater treatment plant at a new site.** The construction of a new off-site treatment plant would accommodate approved growth within Acton. It includes decommissioning of existing plant.

- **Divert wastewater to an existing Halton Region wastewater treatment plant.** The diversion of all current and/or additional/future wastewater flows to the Milton, Mid-Halton (transfer of wastewater to another sewershed) or Georgetown wastewater treatment plants would require upgrades to these treatment plants to accommodate flows from Acton. This alternative is likely cost prohibitive due to the new infrastructure required, which would include the routing of a forcemain through segments of the Greenbelt Greenlands and Niagara Escarpment Area.

- **Divert wastewater to alternate end uses.** The diversion of additional/future wastewater flows to alternative end uses such as subsurface disposal, irrigation on agricultural cropland, discharge to a natural or constructed wetland, or a water reuse system requires the location of appropriate sites, and likely further study to consider the environmental impacts. Based on the current regulatory environment this alternative would prove difficult to implement due to the potential for indirect environmental impacts.

- **Construct additional plant capacity at a new site.** This alternative involves the construction of a plant at a new site to address only the additional capacity that is needed for Acton. The existing Acton WWTP would remain in operation. This alternative would result in two plants to operate and two points of discharge.

Based on the information presented in ***Table 4.2*** and the discussion above, the following short-listed alternatives were considered for detailed evaluation:

- Alternative 1 - Construct additional plant capacity at the existing site
- Alternative 2 - Construct a new wastewater treatment plant at a new site.

Table 4.3 provides a comparison of the short listed alternative solutions for providing additional wastewater treatment capacity for Acton using the evaluation criteria and indicators previously discussed.

As shown on this table, Alternative 1 is equal to or preferred over Alternative 2 for all criteria groups with the exception of “ease of construction”. This criteria group recognizes that it would be easier to maintain existing treatment plant operations during construction if the new plant was in a different location. Given that the construction challenges can be mitigated and there are significant advantages to an expansion of the existing plant, ***Alternative 1 – Construct additional plant capacity at the existing site is identified as the preferred solution***.

	Table 4.2 - Screening of the Long List of Alternative Solutions
Alternative Solutions	**Advantages and Disadvantages**
Do Nothing	***Advantages:*** • No cost ***Disadvantages:*** • This alternative will result in the limiting of community growth • Does not allow for future growth in the Acton area, which is not consistent with the Regional Official Plan or the Official Plan for Town of Halton Hills ***Not recommended for further consideration as it can not provide required treatment capacity. As consideration of the "do-nothing" alternative is required in the Class EA process, this alternative will be compared to the preferred treatment alternative.***
Improve Water Quality in Black Creek	***Advantages:*** • Water quality improvements in Black Creek would benefit the long term health of the ecosystem. Water quality improvements would provide flexibility in the discharge levels associated with the WWTP ***Disadvantages:*** • The Region does not have control of all inputs to Black Creek • The level of improvement is difficult to quantify ***Measures to improve water quality in Black Creek will be put in place as appropriate but this is not considered to be a stand-alone alternative and will not be carried forward.***
Optimize the existing wastewater treatment plant	***Advantages:*** • Allows for some future growth through an interim capacity gain • Plant upgrade/optimization would reduce plant expansion requirements at the existing site, thereby reducing costs and impacts on the natural environment ***Disadvantages:*** • This alternative will not provide sufficient capacity for the approved build-out of the community • Must be carried out in combination with another alternative solution such as the construction of additional plant capacity ***Not considered as a stand-alone alternative. Upgrades within the existing plant could be incorporated into the staging/phasing of the plant expansion, if an expansion is identified as the preferred alternative.***

	Table 4.2 - Screening of the Long List of Alternative Solutions
Alternative Solutions	**Advantages and Disadvantages**
Inflow/Infiltration reduction	***Advantages:*** • Allows for some future growth through an interim capacity gain • Rehabilitation of the sanitary collection system may reduce plant expansion requirements at the existing site, thereby reducing costs and impacts on the natural environment ***Disadvantages:*** • This alternative will not provide sufficient capacity for the approved build-out of the community • Must be carried out in combination with another alternative solution such as the construction of additional plant capacity ***Not considered as a stand-alone alternative. Rehabilitation of the collection system is proceeding regardless of the preferred alternative identified.***
Construct additional plant capacity at existing site	***Advantages:*** • Allows for future growth • Can be combined with plant upgrade/optimization, as well as inflow/infiltration reduction to reduce plant expansion requirements • Maximizes existing infrastructure without requiring new property ***Disadvantages:*** • Large footprint required but could be accommodated within existing property boundary • Relatively expensive to construct and maintain ***To be considered further***
Construct new wastewater treatment plant at a new site	***Advantages:*** • Allows for future growth ***Disadvantages:*** • Large footprint required • Most expensive to construct • Would require changes to the collection system including the addition of a new pumping station • New potential sites in the Acton area have receivers that are equally or more sensitive than the current receiver (Black Creek) • Existing infrastructure is not reused, including the inlet works which is currently expanding • Requires property acquisition

	Table 4.2 - Screening of the Long List of Alternative Solutions
Alternative Solutions	**Advantages and Disadvantages**
	To be considered further
Divert wastewater to an existing Halton Region wastewater treatment plant (Georgetown, Milton or Mid-Halton wastewater treatment plants)	***Advantages:*** • Allows for future growth ***Disadvantages:*** • Sewage would be conveyed by a pumping station and forcemain to another Halton Region wastewater treatment plant. The required forcemain, pumping station, and offsite treatment cost would be high, thus making this alternative potentially cost-prohibitive. • Proposed forcemains from the Acton WWTP to these Halton Region wastewater treatment plants would have to pass through segments of the Greenbelt Greenlands and Niagara Escarpment Area • Georgetown wastewater treatment plant remaining capacity is allocated for growth within Georgetown • Milton wastewater treatment plant does not currently have additional capacity to accept Acton wastewater • Mid-Halton wastewater treatment plant has planned build-out capacity to provide servicing to Oakville, Milton and the Halton Hills 401 corridor only • The transfer of wastewater to another sewershed creates a potential unbalance of water on a subwatershed basis ***Not recommended for further consideration as forcemains to be constructed would require extensive environmental investigation and would be cost prohibitive, offering no advantages to the option of increased treatment in Acton***
Divert wastewater to alternate end uses (i.e., subsurface disposal, irrigation or discharge to a natural or constructed wetland)	***Advantages:*** • Allows for future growth ***Disadvantages:*** • It may prove difficult to locate sites for subsurface disposal, irrigation or discharge to a natural or constructed wetland. In addition, it may be difficult to prove and document that a minimum level of treatment is achieved through this type of discharge. This type of alternate disposal of municipal wastewater of this magnitude is unique to Ontario and may require further preliminary work before implementation is considered by regulatory agencies. • A water reuse system would require dual plumbing lines, which are not typically installed. Non-potable water is not generally recognized within the Ontario Building Code for water reuse applications. • These alternatives may have indirect impacts on the environment and it may prove difficult to obtain approvals from review agencies, or acceptance from the public

	Table 4.2 - Screening of the Long List of Alternative Solutions
Alternative Solutions	**Advantages and Disadvantages**
	Not recommended for further consideration due to regulatory environment and concerns regarding indirect environmental impacts that it may challenging to address
Construct additional plant capacity at a new site	***Advantages:*** • Could allow for future growth ***Disadvantages:*** • Would require the ongoing operation of two plants including two separate discharge points ***Not recommended for further consideration as the operation of two plants and two points of discharge is not practical.***

Table 4.3 - Evaluation of the Short List of Alternative Solutions

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Evaluation Criteria	**Alternative 1** **Expand the existing WWTP at the existing site**	**Alternative 2** **Construct a new WWTP at a new site** ***(includes decommissioning of existing plant)***
Protection of Cultural, Socio-Economic Environment		
Consistency with provincial and local planning documents	The existing treatment plant can be expanded to an ultimate capacity of 7,000 m^3/d to accommodate approved growth in Acton	A new treatment plant can be construction to provide an ultimate capacity of 7,000 m^3/d to accommodate approved growth in Acton
Compatibility with existing and planned land uses	Improvements would be contained on the existing property leaving an adequate buffer to adjacent land uses. Lands surrounding the existing site are zoned as Greenlands A and B based on its proximity to Black Creek and are generally considered unsuitable for development given their importance to the ecosystem, including protection of property from flooding. No recreational uses in the plant vicinity that will be impacted.	Additional land required to accommodate a new WWTP. WWTP may displace existing or future development depending on the location. The location may be limited to Black Creek or tributaries of this receiver with sufficient base flow to provide an acceptable dilution ratio. The potential to impact recreational facilities depends on the location of the new plant.
Potential for cultural impacts	Since no additional land will be required outside of the site fenceline and lands within the fence were likely disrupted during the original plant construction, the potential for impact on archaeological resources is minimal. There are no known cultural heritage features on-site.	Additional land is required which could result in potential to impact archaeological or cultural heritage resources.
Potential impact on residents/property owners	No private property will be required. There may be disruption including noise, dust, odour and visual impacts during construction and operation. Impacts will be mitigated, where possible.	Private property may be displaced for this site. There maybe disruption including noise, dust, odour and visual impacts during construction and operation. Impacts will be mitigated, where possible.

Table 4.3 - Evaluation of the Short List of Alternative Solutions

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Evaluation Criteria	**Alternative 1** **Expand the existing WWTP at the existing site**	**Alternative 2** **Construct a new WWTP at a new site** ***(includes decommissioning of existing plant)***
Protection of the Natural Environment		
Impacts on receiving water quality	🟩 Proposed WWTP effluent quality will meet the MOE Policy 2 requirements and not further degrade water quality.	🟩 New sites for the WWTP in the Acton area have the same receiver, Black Creek, or a receiver that is equally or more sensitive. Proposed WWTP effluent quality will meet the MOE Policy 2 requirements and not further degrade water quality.
Impacts on natural environmental features	🟩 No significant habitat will be displaced for the expansion. Loss of vegetation will be mitigated. A landscape plan will be prepared during the design phase.	🟧 A new site would be located to avoid significant habitat and significant habitat will be displaced for this expansion. A new site would likely result in greater removal of vegetation. Loss of vegetation will be mitigated where possible. A landscape plan will be prepared during the design phase.
Technical Performance		
Performance and experience	🟩 A proven and reliable treatment process with an established performance record will be employed for the WWTP expansion at the existing site.	🟩 A proven and reliable treatment process with an established performance record will be employed for the new WWTP at the new site.
Ease of construction and operation	🟩 An expansion of the existing plant and a new plant are likely to have similar processes, have similar training requirements, similar maintenance, and both will be relatively simple to operate.	🟩 An expansion of the existing plant and a new plant are likely to have similar processes, have similar training requirements, similar maintenance, and both be relatively straight forward to operate.
	🟧 Both alternatives involve standard construction practices. This alternative poses greater challenges for construction as it will be necessary to keep the existing plant operational while the expansion construction is underway.	🟩 Both alternatives involve standard construction practices. Maintaining treatment during construction will be more straight forward for an alternative with a new plant in a different location.

Table 4.3 - Evaluation of the Short List of Alternative Solutions

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Evaluation Criteria	**Alternative 1** **Expand the existing WWTP at the existing site**	**Alternative 2** **Construct a new WWTP at a new site** ***(includes decommissioning of existing plant)***
Reliability	A flexible process to accommodate variable flows and loads would be employed for both alternatives.	A flexible process to accommodate variable flows and loads would be employed for both alternatives.
Cost		
Capital cost	Moderate capital cost to provide WWTP expansion at existing site.	High capital cost to provide new infrastructure at a new site and the previous investment at the existing plan would be lost. Additional land is an added cost.
Operating & maintenance cost	An expansion of the existing plant and new plant are expected to have similar operating and maintenance costs, since a similar treatment process would be employed for either alternative.	An expansion of the existing plant and new plant are expected to have similar operating and maintenance costs, since a similar treatment process would be employed for either alternative.
Lifecycle cost	Lower lifecycle cost than Alternative 2 on account of the lower capital cost.	Higher lifecycle cost than Alternative 1 on account of the higher capital cost.
Overall evaluation	***Preferred***	***Not Preferred***

5.0 ALTERNATIVE DESIGN CONCEPTS FOR PREFERED SOLUTION (PHASE 3)

The purpose of this section of the ESR is to document the identification and evaluation of alternative design concepts for the Acton Wastewater Treatment Plant (WWTP) expansion to fulfill Phase 3 of the Municipal Class EA process. For this project, alternative design concepts are different ways to construct additional plant capacity at the existing site.

5.1 Wastewater Treatment Alternative Design Concepts

A conventional municipal WWTP generally includes the following unit processes:

- Peak flow management: addresses the management of flows to or within the treatment plant, including the storage of excess wet weather flows.
- Preliminary treatment: includes inlet works or headworks processes such as screening to remove large solids and potentially a grit removal system.
- Primary treatment: may include primary clarification (settling) to achieve a primary treatment level removal of total suspended solids (TSS) and biochemical oxygen demand (BOD).
- Secondary treatment: biological process such as suspended growth, fixed film or hybrid process to achieve removal of organic material through oxidation of dissolved and particulate biodegradable constituents, and subsequent clarification/settling for further removal of Total Suspended Solids.
- Tertiary filtration: further treatment to provide removal of TSS, and total phosphorus (TP) that is associated with the TSS.
- Disinfection: removal of microbial contaminants before effluent is discharged to the receiver.
- Sludge management: handling and treatment of waste sludge generated as part of the treatment process.

Alternative design concepts were considered for each of these unit processes at the expanded Acton WWTP to fulfill Phase 3 of the Class EA process. Each design concept was evaluated based on its ability to provide adequate treatment and to handle an average daily flow of 7000 m^3/d. The alternatives are documented in the following subsections.

The following key assumptions were used in the development of alternative design concepts:

- The existing Acton WWTP consists of two plant sections, Plant A (approximately 25% of rated capacity, commissioned in 1951) and Plant B (approximately 75% of rated capacity, added in two phases in 1968 and 1978). It is understood that Plant A will be decommissioned as part of a plant expansion due to the poor structural condition of this treatment section. The existing tankage in Plant B will be reused as part of the plant expansion to maximize the use of existing infrastructure and reduce expansion requirements.
- It is understood that the design of the Acton WWTP expansion will provide nitrification, and potentially denitrification in the future. The denitrification process configuration would provide removal of nitrate-nitrogen and also enhances sludge settling and performance.
- Stringent effluent criteria for TP will be required for an expansion of the Acton WWTP. The identification and evaluation of tertiary filtration alternatives for TP removal will follow the evaluation of secondary treatment alternatives.

5.1.1 Peak Flow Management

The Acton WWTP does not currently have a flow equalization tank or peak flow management system to enhance operation for handling filter backwash or variable flows such as peak wet weather flows. An infiltration/inflow reduction study has been completed by XCG Consultants Ltd (XCG, 2007).

The new inlet works were designed to accommodate a maximum hourly wet weather flow of 26,000 m^3/d, which is 3.7 times the ultimate average day flow of 7,000 m^3/d. The maximum hourly wet weather flow to inlet works was derived from a 2008 capacity assessment performed by AECOM which estimated maximum hourly flow of 25,687 m^3/d, or peaking factor of 3.67, at ultimate build-out of the Acton urban area. This flow was used as the basis for the maximum hourly flow for the current Class EA

The current facility has a rated peak capacity of 13,410 m^3/d, which corresponds to a peaking factor of 2.95 above the design capacity of 4,545 m^3/d. It is assumed that as a minimum the upgraded facility must handle flows at a peaking factor of 2.95 above the rated plant capacity. Flows of 20,650m^3/d or a peaking factor of 2.95 above the ultimate average day flow of 7,000 m^3/d will be used as the maximum daily flow for the current Class EA. Peak flow management options may be considered for handling flows in excess of a peaking factor of 2.95, up to a peaking factor of 3.67.

A more detailed discussion of the basis for selecting peak design flows for the upgraded Acton WWTP is included in the peak flow management memo provided in ***Appendix C***.

The short list of alternatives for peak flow management alternatives at the Acton WWTP includes the following:

- Design the plant using 2.95 peaking factor and build a 420 m^3 offline equalization tank to accommodate peak instantaneous wet weather flow at a peaking factor of 3.67 for two hours.

- Design the plant using a peaking factor of 3.67 to accommodate estimated maximum hourly flows without the need for offline flow equalization (AECOM, 2008).

5.1.2 Preliminary Treatment

Preliminary treatment is currently provided in a centralized inlet works or headworks facility. The existing facilities are being replaced through an upgrade of the inlet works including screening and grit removal. The contract for this project was awarded in July of 2010.

Screening is the first unit operation in a wastewater treatment plant and is used to remove coarse materials from the influent wastewater that could damage downstream process equipment or reduce the effectiveness of the treatment processes. Grit removal systems are designed to remove grit which consists of sand, gravel, cinders, or other heavy materials that have specific gravities substantially greater than those of organic solids in wastewater.

The new inlet works will include two mechanical bar screens, each with a clear opening of 6 mm between the bars. Screenings will be collected in a screw conveyor and transferred to a washer/compactor. The new inlet works will also include a grit removal system consisting of a concrete vortex grit removal tank (3 m diameter, 3.860 m depth) and grit slurry pump. Grit will be transferred to a girt classifier to concentrate and dewater the grit. A screenings and grit bin will be provided to store these materials prior to collection and disposal.

It is important to note that the Membrane Bioreactor process requires upstream flows receive fine screening, from 1 to 3 mm based on the screen size.

No alternatives are considered for preliminary treatment since the upgrade of the inlet works is currently underway.

5.1.3 Primary Treatment

Primary treatment may include primary clarification and sedimentation and generally involves the removal of the readily settleable solids in wastewater.

Plant B includes two primary clarifiers. Waste activated sludge (WAS) is transferred from the secondary clarifiers to the primary clarifiers where this sludge is co-thickened. Primary clarifiers that do not receive WAS have a higher surface overflow rate at the design peak daily flow than clarifiers that receive WAS. As a result, if the WAS from the secondary clarifiers was instead transferred to a separate WAS thickening unit process, the capacity of the primary clarifiers could be enhanced through operation at a higher surface overflow rate of 60-80 $m^3/m^2\cdot d$ at the design peak daily flow, versus a rate of 50-60 $m^3/m^2\cdot d$ according to the design guidelines published by the MOE (2008).

Alternatives for primary clarification at the expanded Acton WWTP include the following:

- Construct new primary clarifiers and continue the practice of WAS co-thickening (based on a reduced surface overflow rate of 50-60 $m^3/m^2\cdot d$ at the design peak daily flow).
- Construct new primary clarifiers without WAS co-thickening (based on a surface overflow rate of 60-80 $m^3/m^2\cdot d$ at the design peak daily flow). WAS would be thickened in a separate sludge thickener unit prior to sludge digestion/treatment.
- Adopt chemically enhanced primary treatment and construct new primary clarifiers and chemical dosing systems.
- Adopt high rate clarification and construct /retrofit new high rate clarifiers.

5.1.4 Secondary Treatment

The secondary treatment process provides biological treatment and thus removal of organic material through aeration or the oxidation of dissolved and particulate biodegradable constituents. Typically, subsequent clarification/settling is provided for further removal of solids in the wastewater.

Secondary treatment at the Acton WWTP is provided through a conventional activated sludge process. The Plant B secondary treatment process includes four square bottom aeration tanks, equipped with jet aeration and two blowers, as well as two rectangular secondary clarifiers and associated return activated sludge/waste activated sludge pumps.

It is understood that the design of Acton WWTP expansion will provide full nitrification (conversion of ammonia to nitrite and nitrate), and potentially denitrification (conversion of nitrate to nitrogen gas) in the future. This will also enhance sludge settling and performance.

The long list of alternatives for secondary treatment at the expanded Acton WWTP includes the following:

- Suspended growth processes:
  - Conventional activated sludge process.
  - Modified activated sludge process to provide nitrification and denitrification.
  - Sequencing Batch Reactor (SBR).
  - Biological Nutrient Removal (BNR).
  - Membrane Bioreactor (MBR).
- Fixed Film Processes:
  - Rotating Biological Contactor (RBC).
  - Trickling Filter (TF).
  - Biological Aerated Filter (BAF).
  - Moving Bed Biofilm Reactor (MBBR).
  - Fluidized Bed Bioreactor (FBBR).
- Hybrid Processes:
  - Integrated Fixed-Film Activated Sludge (IFAS).
  - Trickling Filter (TF) / Solids Contactor (SC).

A description of each of the above secondary treatment processes is provided below.

Conventional Activated Sludge

The conventional activated sludge treatment process consists of an aeration basin followed by secondary clarifiers. The aeration basin maintains microorganisms in suspension through aeration by diffusers or an alternate aeration system, such as a jet aeration system. The microorganisms consume and remove organic material. Effluent from the aeration basin passes into a secondary clarifier where solids and microorganisms are settled out. A portion of the activated sludge from the secondary clarifier is recycled and returned to the aeration basin to maintain the microorganisms. The remainder of the activated sludge is wasted and requires further processing including thickening prior to treatment such as digestion.

There are various modifications of the conventional activated sludge process such as the high-rate activated sludge process and step-feed process. The conventional activated sludge process may be configured to provide nitrification.

The conventional activated sludge process does not achieve full nitrification and denitrification without process modifications to include the following zones: pre-anoxic, aerobic, anoxic, and post aerobic.

Design guidelines published by the MOE (2008) recommend a number of design considerations which should be taken into account when sizing conventional activated sludge systems with nitrification, including:

- Organic loading rates of 0.31 to 0.72 kg $BOD_5/(m^3 \cdot d)$.
- Food to biomass (F/M) ratio of 0.05 to $0.25d^{-1}$.
- Minimum hydraulic retention time at average daily flow of 6h.
- Mixed liquor suspended solids (MLSS) concentrations of 3000 to 5000 mg/L.

Consideration should also be given to aeration system design to ensure that oxygen demand and mixing conditions are satisfied.

Modified Activated Sludge Process

The modified activated sludge process is similar to the conventional activated sludge process described in Section 1.4.1 except that separate zones are provided to achieve nitrification and denitrification. These zones include: pre-anoxic zone, aerobic zone, anoxic zone, and post aerobic zone. These modifications resemble some of the biological nutrient removal process components but the main intent of this modification of the activated sludge process is to achieve full nitrification and potentially denitrification.

Design guidelines published by the MOE (2008) recommend a number of design considerations which should be taken into account when sizing modified activated sludge systems. Recommended hydraulic retention times and recycle rates for zones within the process are similar to the biological nutrient removal (BNR) process. For reference, hydraulic retention times and recycle ratios for a BNR process providing nitrogen and phosphorous removal are as follows:

    - Anaerobic zone – 0.5 to 2 h.
    - Anoxic zone – 0.5 to 10 h.
    - Aerobic zone – 4-12 h.
- RAS return of 25 to 100% of influent flow.
- Internal (inter-zone) recycle ratio of 100- 600% of influent flow if required.

The following design standards for extended aeration systems providing nitrification are also relevant to the modified activated sludge process:

- Food to biomass ratio of 0.05 to 0.15 $d^{-1.}$
- Minimum total hydraulic retention time at average day flow of 15h.
- Organic loading rates of 0.17 to 0.24 kg $BOD_5/(m^3 \cdot d)$.

Hydraulic retention times for modified activated sludge processes providing nitrogen removal only may vary from the above values. Consideration must also be given to aeration system design to meet maximum day oxygen demands. Anoxic and anaerobic zones may require mechanical mixing in the absence of aeration.

Sequencing Batch Reactor

The sequencing batch reactor (SBR) process operates using a ‘batch’ activated sludge process with complete mixing. The SBR process includes the following sequential phases of operation in a single tank: fill, react (aeration), settle, and draw (decant). The SBR process achieves aeration, waste stabilization and solids separation through the sequential phases of operation. This process can be modified to achieve nitrification and potentially denitrification.

The use of the SBR process presents an advantage for the design of new treatment systems but offers less of a benefit for the retrofit of existing activated sludge treatment systems.
Design guidelines published by the MOE recommend a number of design considerations which should be taken into account when sizing SBR systems. Including:

- Providing more than two SBR tanks. The system should be designed to handle at least 75% of peak design flows with one unit out of service, without altering cycle times.

- Sizing all downstream processes to accommodate peak liquid decant rates from SBR basins.

Biological loading to the SBR basin should be of less than 0.24kg $BOD_5/(m^3/d)$. Food to biomass (F/M) ratios should be maintained between 0.05 and 0.1 d^{-1}. Design loadings and solids concentrations should be calculated at the minimum water level during each cycle.

Biological Nutrient Removal

The biological nutrient removal (BNR) process is designed to provide removal of biodegradable organics, suspended solids and also nutrients, including phosphorus and/or nitrogen, through a combination of anaerobic, anoxic, and aerobic zones and different recycle streams. The use of this process for biological phosphorus removal may reduce the need for chemical dosage for removal of phosphorus. Chemical phosphorus precipitation is required to meet stringent effluent TP quality criteria.

Since most of the phosphorus is biologically removed by the sludge wasted from the BNR process, consideration must be given to the waste sludge processing methods and the potential to recycle and return excessive amounts of phosphorus back to the head of the plant. In the case of biological phosphorus removal, anaerobic conditions in sludge thickening and/or digestion can result in the release of significant amounts of phosphorus that was biologically removed. Sludge treatment/digestion is currently achieved through anaerobic digestion at the Acton WWTP. The digester supernatant that is returned to the treatment process, typically at the head of the plant, would consequently have a high concentration of phosphorus. This supernatant return stream would have to be pre-treated, before introducing it with the plant inflow, to minimize the phosphorus load to the treatment system.

The BNR process presents an advantage for the design of new treatment systems that require stringent nitrogen and phosphorus effluent limits, but offers less of a benefit for a plant that must be retrofitted to meet stringent phosphorus effluent criteria which uses anaerobic sludge digestion.

Design guidelines published by the MOE include design criteria for the sizing of a combined nitrogen and phosphorous BNR process (MOE, 2008), as provided below:
- F/M ratio of 0.1 to 0.25 d^{-1}.
- Solids retention time (SRT) of 10 to 40 d.

- Mixed liquor suspended solids (MLSS) of 2000 to 5000 mg/L.
- Hydraulic retention times for each process zone:
    - Anaerobic zone – 0.5 to 2 h.
    - Anoxic zone – 0.5 to 10 h.
    - Aerobic zone – 4-12 h.
- RAS return of 25 to 100% of influent flow.
- Internal (inter-zone) recycle ratio of 100- 600% of influent flow is required.

Design criteria vary depending on the specific BNR process variant selected. BNR systems designed for nitrogen or phosphorous removal only may have different sizing requirements.

Membrane Bioreactor

The membrane bioreactor (MBR) process is an advanced activated sludge wastewater treatment process that achieves aeration, secondary clarification, and tertiary filtration in a single process configuration. The most common MBR process configuration for wastewater treatment consists of a bioreactor followed by membrane filtration tanks that provide in-situ filtration of the mixed-liquor using either microfiltration or ultrafiltration membranes. It is also possible for MBR systems to operate at much higher MLSS concentrations than other suspended growth processes such as conventional activated sludge or BNR. The use of these membranes may eliminate the need for external clarification and tertiary filtration, once sufficient field experience is gained to validate process performance. Chemical phosphorus precipitation is required to meet stringent effluent Total Phosphorus quality criteria.

The MBR process requires fine screening of upstream flows (from 1 to 3 mm based on the screen size). Primary clarification is not typically required upstream of the MBR process due to the fine screening provided.

The bioreactor of the MBR process may be arranged into zones to achieve nitrification and potentially denitrification including: pre-anoxic zone, aerobic zone, anoxic zone, and post aerobic zone. MBR systems may operate with MLSS concentrations of 10,000 mg/L or greater to achieve denitrification. High MLSS concentrations allow anoxic conditions to be formed rapidly in the absence of aeration and also ensure a large quantity of denitrifying bacteria.

Design guidelines published by the MOE include a number of design considerations to take into account when sizing MBR systems (MOE 2008), including:

- Ensuring that appropriate air scouring is provided for membrane units submerged directly into bioreactor tanks. Scouring may be provided by locating air diffusers directly below membrane modules.
- Providing adequate scouring through aeration or liquid turbulence for membrane units installed in a flow-through tank separate from the main bioreactor.
- Providing adequate fine screening to remove large solids or fibrous material that may clog membrane modules.

Design of MBR processes may depend on the specific membrane unit selected and the desired installation configuration. Selection of appropriate design parameters may require pilot testing or appropriate data from similar full-scale installations.

Rotating Biological Contactor

Rotating biological contactor (RBC) systems consists of a series of closely spaced circular discs that are mounted on rotating shafts and partially submerged in wastewater. Wastewater flows through the disks providing attached bacteria with access to nutrients, while rotation out of the liquid allows for passive oxygen uptake without the need for an aeration system. Sloughing of biomass occurs as a result of wastewater flow down the disks during rotation. RBC systems require pretreatment, primary clarification or fine screening and subsequent secondary clarification for solid/liquid separation. In early RBC installations, structural failure of the RBC shafts, disks and disk support systems has occurred. This was addressed in later modifications.

The RBC process does not provide the capability for denitrification. This process is more commonly used for providing treatment in smaller plants or as a side-stream treatment process only for larger plants. This process cannot be easily adopted for a retrofit of an existing activated sludge treatment system, as tank dimensions required for RBC may be much different than those of existing aeration basins.

Design guidelines published by the MOE recommend a number of design considerations which should be taken into account when sizing RBC systems (MOE, 2008). The following design parameters are recommended:

- Organic loadings to stage one of the treatment process of less than 0.04 kg $BOD_5/(m^2/d)$ and 0.02 kg BOD_5 soluble/(m^2/d).

- Hydraulic loading of 75 to 155 L/(m^2/d) without nitrification or 30 to 80 L/(m^2/d) with nitrification.
- Tank volumes of approximately 0.042 L/m^2 of biological support media area.
- Hydraulic retention time of 40 to 120 minutes per-stage.
- 40% media submergence.

Operating RBC systems in series orientation may improve treatment performance. It is recommended that each RBC system be constructed with at least four stages, separated either by internal baffle walls or located in separate tanks.

Trickling Filter/Solids Contactor

Trickling filters (TF) are a non-submerged fixed-film biological reactor using rock or plastic packing. Treatment occurs as the wastewater flows continuously over the attached plastic packing or biofilm.

Trickling filters were a popular form of secondary treatment during the 1940s. The activated sludge process then became more popular due to the trickling filter's higher initial capital cost and need for more stringent effluent requirements. A number of advances have occurred since the introduction of the TF, including the development of improved media and application of new combined processes.

Combined processes have improved effluent quality from the TF. The trickling filter (TF)/solids contactor (SC) process is a hybrid system that combines the simple operation of a TF with the settling characteristics of a suspended growth system. The aeration component is referred to as a solids contact tank based on the low retention time.

Although nitrification can be accomplished in a TF and TF/SC operated at low organic loadings, the TF and TF/SC processes do not provide the capability for consistent full nitrification and denitrification.

Design guidelines published by the MOE recommend a number of design considerations which should be taken into account when sizing trickling filter systems (MOE, 2008). The following design parameters are recommended:

- Wetting rate (per unit area of filter media) of 40 to 60 $m^3/(m^2 \cdot d)$.

- Organic loading rate (per unit of filter bed volume) of 0.4 to 1.8 kg/(m^3/d).
- Solids contact chamber contact time of 30 to 60 minutes.

Recommended filter depths may vary depending on the type of media chosen. Media must be inert and resistant to chemical, biological and UV degradation. The structural integrity of the media must be considered to determine if walkways are needed to allow maintenance of wastewater distributor heads.

Biological Aerated Filter

The biological aerated filter (BAF) process combines filtration and aerobic/anoxic treatment using a fixed-film process. The fixed-film biomass is developed on an inert granular media bed submerged in a single compact aerated reactor. Periodically, the reactor is backwashed to remove solids from suspended growth media. The process is more commonly used in Europe and Asia, but is emerging in North America. A single BAF reactor operates with a concentrated biomass and achieves biological treatment and solids separation. To meet stringent TP effluent criteria, the BAF process must be modified to provide a chemical dosage point without impacting the treatment system.

The use of this innovative and compact process offers an advantage for the design of new treatment systems, but offers less of a benefit for the retrofit of existing activated sludge treatment systems.

Design guidelines published by the MOE recommend a number of design considerations which should be taken into account when sizing BAF systems (MOE, 2008). Typical design parameters are provided as follows:

- Media bed depths of 3 to 4 m.
- Specific media surface areas or 500 to 2000 m^2/m^3.
- Backwash cycles of 20 to 40 min every 24 to 48 hours.
- Maximum organic loading rates for nitrification of 1.5 kg $BOD_5/(m^3 \cdot d)$.

Due to their compact footprint, BAF systems are typically tall above-ground structures which often require inlet pumping. Aeration energy demands are also high.

Moving Bed Biofilm Reactor

The patented moving bed biofilm reactor (MBBR) is a high rate process that relies on the development of biofilm on small, lightweight, rigid, plastic carrier media in the aeration tank that are kept in suspension by coarse bubble aeration and/or mixing. Biofilm reactors can be constructed without suspended growth, thus eliminating the need for sludge return streams. Existing aeration tanks can be modified or retrofitted to accommodate the media. This process is typically more suitable for deep aeration tanks to provide a higher level of oxygen transfer for coarse bubble aeration. Secondary clarification is required following the MBBR system.

Successful full-scale installations have been reported for municipal and industrial wastewater treatment plants in Europe. There are not currently any full scale installations in Canada of the AnoxKaldnes patented MBBR process. Specific Ontario design guidelines are unavailable as this is a proprietary process that is not common in North America.

Fluidized Bed Bioreactor

The fluidized bed bioreactor (FBBR) is a fixed film process in which wastewater is fed upward to a bed of sand or activated carbon. For municipal wastewater treatment applications, FBBRs have mainly been used for post-denitrification.

They are not currently any full scale installations of the FBBR system in Canada for municipal wastewater secondary treatment applications. This process could not be easily adopted for a retrofit of an existing activated sludge treatment system. Specific Ontario design guidelines are unavailable as this is a process that is not common in North America.

Integrated Fixed-Film Activated Sludge (IFAS)

The patented integrated fixed-Film activated sludge (IFAS) process was also developed by AnoxKaldnes. Similarly to the moving bed biofilm reactor (MBBR) process, the IFAS process relies on the development of biofilm on small, lightweight, rigid, plastic carrier media in the aeration tank that are kept in suspension by coarse bubble aeration and/or mixing. The IFAS is a hybrid system that relies of suspended growth and thus makes use of the sludge recycle stream. The IFAS systems allows for retrofit of existing basins with media to achieve nitrification. Secondary clarification is required following the IFAS system. A simpler version of the IFAS process, integrated fixed-film (IFS) operates without solids recycle and is a simple flow-through bioreactor.

Successful full-scale installations have been reported for municipal and wastewater treatment plants in Europe and the United States. There are not currently any full scale installations of the AnoxKaldnes patented IFAS process in Canada.

Design guidelines published by the MOE recommend a number of design considerations which should be taken into account when sizing IFS and IFAS systems (MOE, 2008). Typical design parameters are provided as follows:

- Organic loading rates of less than 3.5 g BOD_5/m^2 of support media are recommended for nitrification.
- Design of IFAS systems should be based on recommended mixed liquor suspended solids (MLSS) concentrations and the necessary mixing and aeration required to maintain this biomass.

Selection of specific design parameters should be made in consultation with equipment manufacturers.

5.1.5 Tertiary Filtration and Total Phosphorus Removal

The Acton WWTP consists of two travelling bridge shallow bed sand filters. An alum dosing system includes a storage tank and four metering pumps. Alum is added to the influent of the primary or secondary clarifiers and the tertiary filter for phosphorus removal.

The stringent TP effluent criteria required in the case of an expansion of the Acton WWTP requires careful review and evaluation of the alternate design concepts for the removal of TP. The proposed effluent criteria for TP in the case of an expansion of the Acton WWTP are:

- TP effluent objective concentration of 0.1 mg/L.
- TP effluent non-compliance limit of 0.2 mg/L.

Compliance with the effluent limit would be based on the monthly average of data. The effluent objective of 0.1 mg/L represents the limit of technology for “proven technologies” capable of TP removal. The plant will be designed to reduce the release of TP to the extent practical. The Region will also be required to maintain the current TP loading to the receiver. If additional TP reductions are required in the future, other off-site controls for TP will be implemented. A final strategy for TP management could include:

- Further optimization of plant performance for TP removal.
- Ongoing monitoring of TP levels in Black Creek and the WWTP effluent.
- Implementation of other ways to reduce TP when necessary to achieve the targets agreed to by the Region, CVC and MOE.

The long list of alternatives for tertiary filtration for the expanded Acton WWTP includes:

- Existing filters combined with granular filtration.
- Existing filters combined with new membrane filtration.
- Stand-alone granular filtration with existing filters decommissioned.
- Stand-alone membrane filtration with existing filters decommissioned.
- Physical-chemical treatment provided by the Actiflo or AquaDAF process upstream of the existing expanded shallow bed sand filters or as a stand-alone treatment step.

The above alternatives would be combined with an upstream alum or iron salt dosing system to achieve sufficient removal of TP.

A description of each of the above tertiary filtration technologies is provided below:

Granular Filtration

Granular filtration is a process which allows high efficiency removal of phosphorous and total suspended solids by filtration though a granular media bed. This process may be operated with or without chemical addition upstream of the treatment system. Chemical pre-treatment such as coagulation may allow effluent concentrations of 5 mg/L TSS and 0.1 mg/L TP to be achieved. Granular filtration systems typically operate in a continuously backwashed configuration. Filtration backwash water may be directed to plant inlet works.

Guidelines published by the MOE recommend a number of design considerations which should be taken into account when sizing granular filtration systems (MOE, 2008). Typical design parameters are as follows:

- Filter hydraulic loading rates should not exceed 3.3 L/(m^2·d).
- Peak solids loading rates should not exceed 83 mg/(m^2·s).

- Filter media should have a depth of 1.2 to 1.8 m.

Filter units should be designed to accommodate maximum hourly flow rates. Peak flows should be accommodated with one filter unit out of service.

Membrane Filtration

Membrane filtration is a process by which solids are removed from wastewater streams by fine-pore membranes. Membrane filtration may be referred to as microfiltration (with pore sizes of 0.1 to 2 microns) or ultrafiltration (with pore sizes of 0.002 to 0.2 microns).

Filtration is pressure-driven and may include aeration to provide scouring and prevent pore clogging. Membrane filtration does not naturally remove TP or other dissolved chemical components smaller than membrane pore sizes, and is typically not recommended for use as a stand-alone technology without additional sand filtration. However, chemical pre-treatment to provide coagulation may allow TP to be captured in the form of solid precipitate, allowing membrane filtration to meet effluent objectives. Due to their small pore size, ultrafiltration units may decrease residual BOD and levels of microbiological contaminants.

Design guidelines published by the MOE recommend a number of design considerations which should be taken into account when sizing microfiltration and ultrafiltration units (MOE, 2008). Typical design parameters are as follows:

- Typical pressure differential is 140 to 690 kPa for ultrafiltration and 35 to 210 kPa for microfiltration.
- Ultrafiltration systems should be designed with minimum initial and final flux values of 0.73 $m^3/(m^2 \cdot d)$ and 0.2 $m^3/(m^2 \cdot d)$, respectively.
- Upstream pre-treatment may be required to reduce influent TSS. Influent TSS concentrations of 15 mg/L or less are preferred.

Selection of specific membranes may require pilot-scale testing. It is recommended that filter units be sized to accommodate design loads while allowing for filter unit backwash cycles or membrane replacement.

Actiflo and AquaDAF process

The Actiflo process is a proprietary physical-chemical treatment process marketed by Veolia Water. This process consists of a high-rate clarification unit which offers ballasted coagulation/flocculation and lamella settling in a small process footprint. It may be used to provide high rate clarification of peak wet weather flows in addition to tertiary treatment applications. Design guidelines published by the MOE indicate that ballasted clarifiers may be operated at surface overflow rates of 815 to 3260 L/(m^2·min) (MOE, 2008). Solids removal efficiencies may range from 80 to 95%.

The AquaDAF is a proprietary high-rate clarification system marketed by Degremont technologies. This process is a high rate clarification system making use of dissolved air flotation to separate solids from wastewater. Air introduced to the untreated wastewater is used to float solids to the top of a clarification tank where they are separated from the clarified liquid which flows out of the bottom of the basin.

Selection of specific design parameters should be confirmed in consultation with equipment manufacturers. A pilot study may also be necessary to confirm design parameters and performance of the treatment process.

5.1.6 Disinfection

Disinfection is provided at the Acton WWTP with an ultraviolet (UV) disinfection system. The system consists of low pressure, high intensity UV bulbs which disinfect the effluent prior to discharge to Black Creek.

The disinfection alternatives considered for the Acton WWTP expansion include:
- Chlorination/dechlorination.
- Ozonation.
- Ultraviolet disinfection.

A description of each of the above disinfection alternatives is provided below:

Chlorination/Dechlorination

Chlorination is a chemical treatment technology that is one of the most common methods of disinfection at Ontario sewage treatment facilities. Design of systems using this technology must consider the ability to provide appropriate contact time for disinfection, while meeting effluent microbiological guidelines and ensuring that residual chlorine in effluent does not impact the receiving body. A variety of forms of chlorine for disinfection are available, including:

- Pure gaseous chlorine.
- Liquid hypochlorite solution.
- Solid hypochlorite tablets.

Design guidelines published by the MOE recommend a number of design considerations which should be taken into account when sizing chlorination units units (MOE, 2008).

- Total chlorine residual should be 0.5mg/L after 30 minutes to achieve 200 organisms/ 100mL.
- Minimum contact time of 30 minutes at average daily flow and 15 minutes at maximum hourly flow.

Dimensions of the chlorine contact chamber must also be considered to provide appropriate contact time.

Dechlorination is a secondary chemical treatment following chlorination which may be required in situations where it is necessary to reduce residual chlorine concentrations. Dechlorination is typically performed by dosing with sulphur dioxide and may also be performed with liquid solutions of sulphite or bisulphite. Dosing of sulphur compounds must be monitored to ensure appropriate concentrations are provided. Excess dosage may decrease dissolved oxygen concentrations in the final effluent.

Ozonation

Ozonation is a chemical treatment method that makes use of ozone gas to provide disinfection. Benefits of ozone treatment include a lack of disinfection by-products such as those produced by chlorination, increased oxygen content in final effluent and lower process sensitivity to effluent pH and ammonia fluctuations.

Ozone is produced onsite, eliminating concerns associated with transport of toxic chemicals. However, ozonation systems have higher capital cost and operational complexity than chlorination.

Design guidelines published by the MOE recommend basing design of ozonation systems on similar full-scale or pilot testing data relevant to the specific wastewater application (MOE, 2008). Typical dosing concentrations to achieve monthly geometric mean microbial concentrations of 200 organisms per 100mL are:

- 12 to 15 mg/L ozone for non-nitrified tertiary treated effluent.
- 3 to 5 mg./L ozone for nitrified tertiary treated effluent.

Ultraviolet Disinfection

Ultraviolet (UV) radiation is a common technique of achieving effluent disinfection without the need for chemical addition. Disinfection systems are typically proprietary designs and sizing of these systems should be based off of similar full scale applications and experience from equipment vendors.

Light for disinfection is produced by mercury vapour lamps. Design guidelines published by the MOE describe three types of UV lamps, including:

- Low pressure/low intensity.
- Low pressure/high intensity.
- Medium pressure/high intensity.

Lamp selection depends on the specific disinfection application. Higher intensity lamps provide greater power output and disinfection efficiency but may experience difficulties with scaling due to high operating temperatures. Disinfection reactors may consist of closed or open channels and typically consist of modules of lamps arranged either horizontally or vertically in the reactor channel.

5.1.7 Sludge Handling, Digestion and Biosolids Management

Following thickening in the primary clarifiers, anaerobic digestion is used for the treatment/stabilization of sludge at the Acton WWTP.

Halton's Biosolids Management Master Plan is currently being developed. The preferred sludge management system for the Acton WWTP will be evaluated and identified during the design phase, following the Class EA. Additional anaerobic digestion capacity could be achieved by adding a second primary digestion tank and a second secondary digestion tank.

The potential for separate thickening of waste activated sludge (WAS) will be considered as indicated in **Section 5.1.3**.

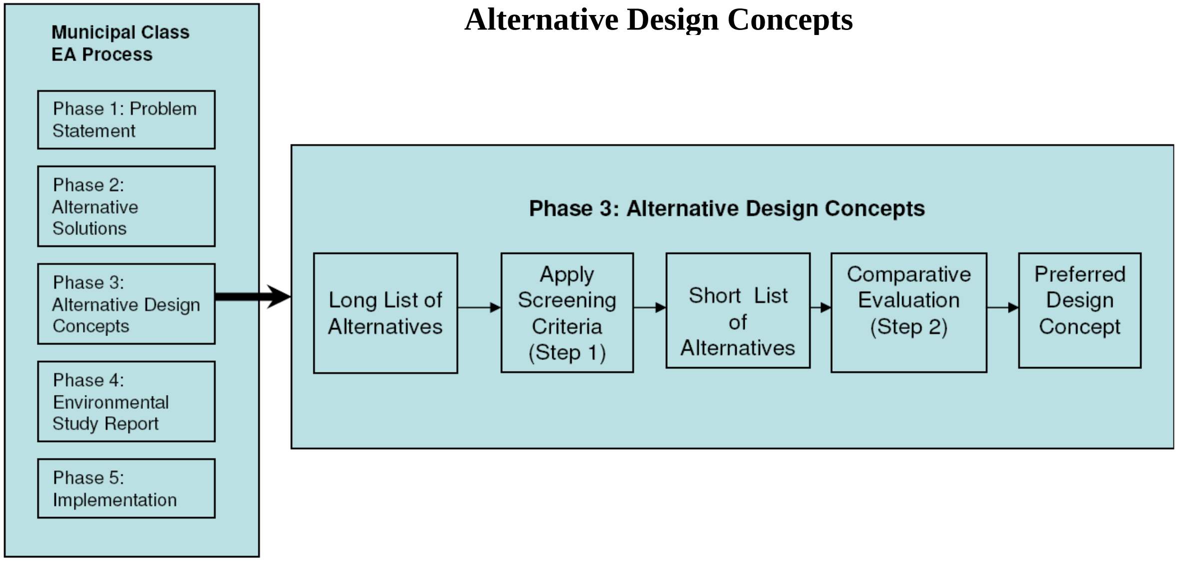
5.2 Evaluation Methodology

The objective of Phase 3 of the Class EA process is to identify the technically preferred design concept for constructing additional wastewater treatment plant capacity at the existing Acton WWTP site considering potential impacts on the natural, social and cultural environments, as well as technical issues and cost. To accomplish this, a two-step evaluation process was used.

- Step 1: A set of "must meet" criteria were developed. The long list of alternative design concepts for each of the WWTP unit processes was reviewed based on these criteria. Those alternatives that did not meet all of the criteria were screened from further consideration. The resulting short list of alternative design concepts proceeded to the second evaluation step.
- Step 2: The short list of alternative design concepts for each of the WWTP unit processes was comparatively evaluated using a set of evaluation criteria to select a preferred design concept. The criteria were developed to cover the full definition of the environment as required in the Class EA process including: natural environment, socio-cultural environment, technical considerations and cost. The result of the evaluation for each of the unit processes was combined to develop the overall preferred design concept for constructing additional WWTP capacity at the existing site.

Figure 5.1 shows the approach taken for the identification and evaluation of alternative design concepts.

Figure 5.1 - Evaluation Approach for Alternative Design Concepts



5.3 Screening of the Long-List of Treatment Alternatives

5.3.1 Long List Screening Criteria

The screening criteria were developed to identify those treatment alternatives and process options that would not be applicable, feasible or practical for the Acton WWTP expansion. To be considered feasible or practical, alternatives must meet all screening criteria.

The following screening criteria were used to identify the short list of alternative design concepts:

- **Operational and Performance Objectives:** The alternative must satisfy hydraulic requirements and meet effluent objectives and limits by accommodating design flows through the various treatment components. The alternative must not pose any unreasonable operational controls or schemes. Secondary treatment alternatives must provide nitrification and the potential for denitrification in the future.
- **Experience and Implementation**: The alternative must have successful full-scale municipal wastewater installations under similar operating conditions and environments.
- **Expandability**: The alternative can be implemented within the existing site property to retrofit the existing plant by using all or at least a portion of existing Plant B aeration and secondary clarifier tankage, to allow for a planned expansion to an ultimate capacity of 7,000 m^3/d.

5.3.2 Long List Screening Results

This section describes the application of the screening criteria to the long list of alternatives for each of the unit processes. The screening results are summarized in ***Table 5.1***. Alternatives that met or passed the screening are highlighted in blue and will form the short list of alternative solutions.

Table 5.1
Application of Screening Criteria to the Long List of Alternative Design Concepts
(**Fail** indicates that the alternative does not meet the criteria and is screened out)

Alternative	Operational and Performance Objectives	Experience and Implementation	Expandability
Peak Flow Management			
Increase overall hydraulic capacity	Pass	Pass	Pass
Add flow equalization tank	Pass	Pass	Pass
Primary Treatment			
PC with WAS co-thickening	Pass	Pass	Pass
PC without WAS co-thickening	Pass	Pass	Pass
Chemically Enhanced PC	*Fail*	Pass	Pass
High Rate Clarification	*Fail*	Pass	Pass
Secondary Treatment			
Conventional Activated Sludge	*Fail*	Pass	Pass
Modified Activated Sludge with nitrification and denitrification	Pass	Pass	Pass
SBR	Pass	Pass	*Fail*
BNR	*Fail*	Pass	Pass
MBR	Pass	Pass	Pass
RBC	*Fail*	Pass	*Fail*
TF	*Fail*	Pass	Pass
TF/SC	*Fail*	Pass	Pass
BAF	Pass	Pass	*Fail*
MBBR	Pass	*Fail*	*Fail*
FBBR	Pass	*Fail*	*Fail*
IFAS	Pass	*Fail*	*Fail*
Tertiary Filtration			
Maintain existing filters and add granular filtration	Pass	Pass	Pass
Maintain existing filters and add membrane filtration	Pass	Pass	Pass
New stand-alone granular filtration	Pass	Pass	Pass
New stand-alone membrane filtration	Pass	Pass	Pass
Add high-rate chemical-physical treatment	Pass	Pass	Pass
Disinfection			
Ultraviolet disinfection	Pass	Pass	Pass
Chlorination/dechlorination	*Fail*	Pass	Pass
Ozonation	*Fail*	Pass	Pass

Peak Flow Management

Both of the long listed alternatives for peak flow management will be further evaluated using the short list evaluation criteria. Further details on peak flow management are provided in ***Appendix C***.

Primary Treatment

The following alternatives can be screened out on the basis of operational and performance objectives:

- Adopt chemically enhanced primary treatment and construct new primary clarifiers and chemical dosing systems.
- Adopt high rate clarification and construct/retrofit for new high rate clarifiers.

The alternatives above would unreasonably increase operational controls and requirements associated with primary treatment, in order to provide a higher level of solids removal upstream of secondary treatment. These primary treatment alternatives would not reduce the treatment requirements for subsequent secondary treatment and tertiary filtration, to provide nitrification and meet stringent TP effluent criteria, respectively.

Secondary Treatment

The following alternatives are screened out since they do not meet the operational and performance objectives, as described below:

- Conventional Activated Sludge – does not provide the potential for nitrification and denitrification without process modifications.
- Biological Nutrient Removal – creates an unreasonable operational concern associated with the release of phosphorus during anaerobic digestion and the recycle of a digester supernatant with a high TP loading.
- Rotating Biological Contactor (RBC) – does not provide denitrification capability.
- Trickling Filter (TF) – does not provide denitrification capability.
- Trickling Filter (TF)/Solids Contactor (SC) – does not provide denitrification capability.

The following alternatives are screened out since they do not meet Experience and Implementation criterion, as described below:

- Moving Bed Bioreactor (MBBR) – no full scale installations in Canada of the AnoxKaldnes patented MBBR process.
- Fluidized Bed Bioreactor (FBBR) – no full scale installations in Canada for municipal wastewater secondary treatment applications.
- Integrated Fixed-Film Activated Sludge (IFAS) – no full scale installations in Canada of the AnoxKaldnes patented IFAS process.

The following alternatives are screened out on the basis of Expandability, as indicated below:

- Sequencing Batch Reactor (SBR) – does not allow for use of existing Plant B tankage, provides no advantage for retrofitting an existing WWTP.
- Rotating Biological Contactor (RBC) – does not allow for use of existing Plant B tankage, provides no advantage for retrofitting an existing WWTP.
- Biological Aerated Filter (BAF) – does not allow for use of existing Plant B tankage, provides no advantage for retrofitting an existing WWTP.
- Moving Bed Bioreactor (MBBR) – existing Plant B aeration tanks could not be easily retrofitted to accommodate media due to tank geometry.
- Fluidized Bed Bioreactor (FBBR) – does not allow for use of Plant B tankage, provides no advantage for retrofitting an existing WWTP.
- Integrated Fixed-Film Activated Sludge (IFAS) – existing Plant B aeration tanks could not be easily retrofitted to accommodate media due to tank geometry.

Tertiary Filtration and Total Phosphorus Removal

It is not possible to screen out any of the tertiary filtration alternatives. All five of the long listed alternatives will be further evaluated using the short list evaluation criteria.

Disinfection

The following alternatives are screened out since they do not meet the operational and performance objectives:

- Chlorination/dechlorination.
- Ozonation.

Due to the sensitivity of the receiver, Black Creek, chlorination/dechlorination can not be further considered due to the potential impacts of chlorine dosage, including acute and chronic toxicity. The ozonation process lacks full scale applications and would not be further considered based on the lack of full scale operating data. The Acton WWTP currently has an ultraviolet (UV) disinfection process that could be expanded to provide additional capacity. The UV disinfection alternative is thus the preferred disinfection solution for the Acton WWTP expansion.

5.4 Evaluation of the Short List of Treatment Alternatives

5.4.1 Short List Evaluation Criteria

The evaluation criteria to be used to comparatively evaluate the short-listed alternatives (following the initial screening) are shown in ***Table 5.2.***

Table 5.2 - Short List Evaluation Criteria

Criteria	**Indicator**
Protection of the Cultural and Socio-Economic Environment	
Potential for Cultural Impacts	Displacement or disruption of any archaeologically significant findings
	Displacement or disruption of cultural heritage features
Potential Impact on Residents/Property Owners	Potential visual-aesthetic impact associated with new construction (added footprint of new tankage and buildings, new building and tankage height)
	Potential short term disruption (noise, dust, odour, traffic) during construction
	Potential long term disruption (noise, dust, odour) during operation
Protection of the Natural Environment	
Impacts on Receiving Water Quality	Potential of the alternative to minimize adverse impacts to the receiving water quality and aquatic systems
Impacts on Natural Environmental Features	Potential for impact on terrestrial or aquatic habitat
Technical Performance	
Performance and Experience	Ability of the technology to meet the Ministry of the Environment (MOE) definition of 'proven technology': • a minimum of three separate installations, operated at near design capacity • a minimum of three years of operating record at three separate locations • a minimum of three years operating record showing reliable consistent compliance with the design performance criteria without major failure of either the process or equipment

Table 5.2 - Short List Evaluation Criteria	
Criteria	**Indicator**
Ease of Construction and Operation	Relative ease to implement/construct and maintain/operate the proposed technology within existing treatment plant
Expandability	Relative ease at which the plant could be expanded for the alternative, including new tankage and buildings or to meet more stringent effluent criteria
Reliability	Ability of the treatment process associated with the alternative to handle variable loadings and flows
Cost	
Capital Cost	Estimated capital cost associated with the alternative only (excluding costs that common among the alternatives being compared)
Operating and Maintenance Cost	Estimated annual operating costs, including non-common costs only such as energy and chemical consumption to provide an incremental cost
Lifecycle Cost	The total estimated cost estimate over a 20-year period considering inflation (5.57%/yr, NRBCI 1999-2009 for Quarter 2 for Toronto area), and the above capital cost and operating and maintenance costs associated with the alternative only

It is noted that the construction footprint for all alternative design concepts is entirely within the existing property and all the alternatives will have similar potential for impact on the natural environment, socio-economic and cultural environments. This is reflected in the evaluation results presented in the Section below.

5.4.2 Short List Evaluation Results

Following the screening step, the preferred design concept for some of the unit processes was confirmed. For the primary treatment, secondary treatment and tertiary filtration unit processes, the screening step resulted in a short list that had to be further evaluated. The criteria documented in ***Table 5.2*** above were used for these evaluations. This section describes the evaluation for short listed alternatives. For the comparative evaluation the impact is considered for each alternative in order to present the technically preferred alternative for each criterion/indicator.

Peak Flow Management

Both long-listed flow alternatives were short listed for closer evaluation. The alternatives considered included:

- Design the plant using 2.95 peaking factor and build 420 m^3 of offline equalization tank capacity. The purpose of the equalization tank would be to accommodate the differences in flow between the peak wet weather flow of 25,687 m^3/d (or peaking factor of 3.67) identified in the *Town of Acton Hydraulic Analysis and Capacity Assessment (AECOM, 2008)*, and the design peaking factor of 2.95.

  The AECOM study considered a hypothetical 25 year design storm with a short, intense rainfall peak. Peak wet weather flows into the plant under these conditions would be expected to be relatively short in duration. Two hours of equalization tank storage capacity (420m^3) was estimated to be sufficient under these peak flow conditions. The availability of space within the existing fenceline for an equalization tank has not been confirmed.
- Design the plant using a peaking factor of 3.67 to accommodate all flows.

An evaluation of the peak flow management alternatives is provided in ***Table 5.3***.

Table 5.3 - Evaluation Peak Flow Management Alternatives

Evaluation of Peak Flow Management Alternatives

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Criteria/Indicator	**Increase plant capacity**	**Construct flow equalization tank**
Protection of the Cultural and Socio-Economic Environment		
Displacement or disruption of any archaeologically significant findings	Minimal since within property boundary	Minimal, provided space available on property
Displacement or disruption of cultural heritage features	None	None
Potential visual-aesthetic impact associated with new construction (added footprint of new tankage and buildings, new building and tankage height)	Limited visibility of new tankage	Limited visibility of additional tankage
Potential short term disruption (noise, dust, odour, traffic) during construction	Both have similar construction impacts which could be mitigated	Both have similar construction impacts which could be mitigated
Potential long term disruption (noise, dust, odour) during operation	Minimal impacts associated with operation that could be mitigated	Some potential for odour impacts
Protection of the Natural Environment		
Potential of the alternative to minimize adverse impacts to the receiving water quality and aquatic systems	Minimal	Minimal
Potential for impact on terrestrial or aquatic habitat	Minimal	Minimal
Technical Performance		
Ability of the technology to meet the MOE definition of 'proven technology'	Both proven, well established treatment processes	Both proven, well established treatment processes
Relative ease to implement/construct and maintain/operate proposed technology within existing treatment plant	Does not present additional concern	Some concern with solids accumulation within tank
Relative ease at which the plant could be expanded for the alternative, (including new tankage and buildings and to meet more stringent effluent criteria)	Does not present additional concern	Potential expandability concerns due to land requirements
Ability of the treatment process to handle variable loadings and flows	Both provide a reliable form of treatment	Both provide a reliable form of treatment

Evaluation of Peak Flow Management Alternatives

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Criteria/Indicator	**Increase plant capacity**	**Construct flow equalization tank**
Cost		
Estimated capital cost (excluding common costs)	$5.7 M	$5.3 M
Estimated or relative annual operating and maintenance costs (excluding common costs to provide an incremental cost)	--	$2000 /yr
Estimated lifecycle cost (over a 20-year period) based on above costs	$5.7 M	$5.4 M
Overall Evaluation	***Recommended***	***NOT Recommended***

Both of the above alternatives address the need to manage peak hourly flows to the treatment process.

Additional plant capacity will provide several advantages. Odour and operational issues related to storage of sewage in an offline tank, will be minimized. An expanded capacity option will also have greater flexibility to handle high flows, particularly for long-duration high flow events which may overload an offline equalization tank.

Peak flow management through capacity increases also minimizes land requirements. Installation of an offline equalization tank would require allocation of existing land on the property, potentially affecting future facility modifications. Increases to treatment capacity to provide peak flow management without an offline tank do not require increasing the size of process tanks as both primary and secondary clarification are sized to accept maximum day flow, which would be accommodated by both alternatives. Costs associated with peak flow management through increased plant capacity primarily result from increases to the size of tertiary filtration and disinfection processes.

Increasing plant capacity to handle peak flows is slightly more expensive than an off-line tank. However, construction of additional plant capacity is the preferred alternative due to its other benefits as noted above.

Primary Treatment

The short-listed alternatives for primary treatment include the following:

- Construct new primary clarifiers (PCs) and continue the practice of WAS co-thickening (based on a reduced surface overflow rate of 50-60 $m^3/m^{2}\cdot d$ at the design peak daily flow).
- Construct new primary clarifiers (PCs) without WAS co-thickening (based on a surface overflow rate of 60-80 $m^3/m^{2}\cdot d$ at the design peak daily flow). WAS would be thickened in a separate sludge thickener unit, prior to sludge digestion/treatment.

An evaluation of the primary treatment alternatives is provided in ***Table 5.4.***

Table 5.4 - Evaluation of Short Listed Primary Treatment Alternatives

Evaluation of Short Listed Primary Treatment Alternatives

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Criteria/Indicator	**PCs with WAS co-thickening**	**PCs without WAS co-thickening**
Protection of the Cultural and Socio-Economic Environment		
Displacement or disruption of any archaeologically significant findings	Minimal since within property boundary	Minimal since within property boundary
Displacement or disruption of cultural heritage features	None	None
Potential visual-aesthetic impact associated with new construction (added footprint of new tankage and buildings, new building and tankage height)	Limited visibility of new tankage	Limited visibility of new tankage and new sludge thickening building
Potential short term disruption (noise, dust, odour, traffic) during construction	Both have similar construction impacts which could be mitigated	Both have similar construction impacts which could be mitigated
Potential long term disruption (noise, dust, odour) during operation	Minimal impacts associated with operation that could be mitigated	Minimal impacts associated with operation that could be mitigated
Protection of the Natural Environment		
Potential of the alternative to minimize adverse impacts to the receiving water quality and aquatic systems	Minimal	Minimal
Potential for impact on terrestrial or aquatic habitat	Minimal	Minimal

Evaluation of Short Listed Primary Treatment Alternatives

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Criteria/Indicator	**PCs with WAS co-thickening**	**PCs without WAS co-thickening**
Technical Performance		
Ability of the technology to meet the MOE definition of 'proven technology'	Well established treatment process; Both proven	Well established treatment process; Both proven
Relative ease to implement/construct and maintain/operate proposed technology within existing treatment plant	Easier to construct as Existing PCs remain in operation Co-thickening of WAS in PCs is maintained	More difficult to construct as new, separate WAS co-thickening process arrangement must be configured Existing practice of co-thickening of WAS in PCs is discontinued; Presents new operational requirements for new WAS thickening process
Relative ease at which the plant could be expanded for the alternative, (including new tankage and buildings and to meet more stringent effluent criteria)	Both can be expanded	Both can be expanded
Ability of the treatment process to handle variable loadings and flows	Both provide a reliable form of treatment	Both provide a reliable form of treatment
Cost		
Estimated capital cost (excluding common costs)	$1.9 M	$2.7 M
Estimated or relative annual operating and maintenance costs (excluding common costs to provide an incremental cost)	--	$13,000 / yr
Estimated lifecycle cost (over a 20-year period) based on above costs	$1.9 M	$3.2 M
Overall Evaluation	***Recommended***	***NOT Recommended***

As shown in the above table, both primary treatment alternatives are well established treatment processes that provide a reliable form of treatment. Although the alternative "construct new primary clarifiers and continue the practice of WAS co-thickening" will require a larger area for new primary clarifier tankage, this alternative is preferred from the perspective of cost and ease of implementation and maintenance. For the remainder of the criteria, the alternatives were considered to have the same potential for impact.

Secondary Treatment

The short-listed alternatives for secondary treatment include the following:

- Modified activated sludge process with nitrification and denitrification.
- Membrane Bioreactor (MBR).

An evaluation of the secondary treatment alternatives is provided in ***Table 5.5.***

Table 5.5 - Evaluation of Short Listed Secondary Treatment Alternatives

Evaluation of Short Listed Secondary Treatment Alternatives

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Criteria/Indicator	Modified Activated Sludge	MBR
Protection of the Cultural and Socio-Economic Environment		
Displacement or disruption of any archaeologically significant findings	Minimal since within property boundary	Minimal since within property boundary
Displacement or disruption of cultural heritage features	None	None
Potential visual-aesthetic impact associated with new construction (added footprint of new tankage and buildings, new building and tankage height)	Limited visibility of new tankage	Limited visibility of new tankage and new building
Potential short term disruption (noise, dust, odour, traffic) during construction	Both have similar construction impacts which could be mitigated	Both have similar construction impacts which could be mitigated
Potential long term disruption (noise, dust, odour) during operation	Minimal impacts associated with operation that could be mitigated	Minimal impacts associated with operation that could be mitigated
Protection of the Natural Environment		
Potential of the alternative to minimize adverse impacts to the receiving water quality and aquatic systems	Minimal	Minimal
Potential for impact on terrestrial or aquatic habitat	Minimal	Minimal
Technical Performance		
Ability of the technology to meet the MOE definition of 'proven technology'	Well established treatment process	May not be considered a 'proven' technology based on limited number of installations and length of operation in Ontario
Relative ease to implement/construct and maintain/operate proposed technology within existing treatment plant	Conventional system that could be more easily integrated into the existing plant; Existing activated sludge treatment process remains in operation	Integration of Bioreactor component of the MBR into existing Plant B tankage is similar to Modified Activated Sludge; Screening of all flows to 1-3 mm is required which complicates commissioning and implementation of the treatment process

Evaluation of Short Listed Secondary Treatment Alternatives

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Criteria/Indicator	**Modified Activated Sludge**	**MBR**
Relative ease at which the plant could be expanded for the alternative, (including new tankage and buildings and to meet more stringent effluent criteria)	Can be expanded	Can be expanded and may reduce footprint for future plant expansion requirements
Ability of the treatment process to handle variable loadings and flows	Both provide a reliable form of treatment	Both provide a reliable form of treatment
Cost		
Estimated capital cost (excluding common costs)	$9.9 M	$19.7 M
Estimated or relative annual operating and maintenance costs (excluding common costs to provide an incremental cost)	--	$53,540 / yr
Estimated lifecycle cost (over a 20-year period) based on above costs	$9.9 M	$25.6 M
Overall Evaluation	***Recommended***	***NOT Recommended***

The Membrane Bioreactor (MBR) process has some significant disadvantages compared to the Modified Activated Sludge process including:

- The MBR process is currently not considered a "proven technology" according to the MOE definition since it lacks a minimum of three separate installations (operated at near design capacity) and a minimum of three years of operating data (at three separate locations) to demonstrate reliable performance within Ontario.
- Both alternatives can handle variable flows and loads, but the MBR process is a more complex system to operate and capacity for treating peak flows may be limited.
- Both alternatives could accommodate a phased expansion, but the MBR process would present more challenges to maintain operation during construction, since existing tankage must be modified and flows must receive fine screening.
- The MBR process has significantly higher energy demands which results in a higher annual operating and maintenance cost.

Based on the evaluation of alternative treatment plant alternate design options, Modified Activated Sludge was identified as the preferred secondary treatment alternative. The Modified Activated Sludge process is preferred for the following reasons:

- conventional system that can be more easily operated and maintained and phased in during construction, and
- lower energy consumption and reduced frequency of equipment replacement in comparison to the Membrane Bioreactor.

Tertiary Filtration and Total Phosphorus Removal

The long and short-listed alternatives for tertiary filtration include the following:

- Existing filters combined with new granular filtration.
- Existing filters combined with new membrane filtration.
- Stand-alone granular filtration with existing filters decommissioned.
- Stand-alone membrane filtration with existing filters decommissioned.
- Physical-chemical treatment provided by the Actiflo or AquaDAF process upstream of existing expanded shallow bed sand filters or as a stand-alone treatment step.

An evaluation of the tertiary filtration alternatives is provided in ***Table 5.6***. The evaluation of tertiary filtration alternatives is based on technical performance and cost as all alternatives are relatively similar for the criteria under the Protection of the Cultural and Socio-Economic Environmental and the Protection of the Natural Environment criteria groups

In summary membrane filtration has the following disadvantages:

- The membrane filtration process is currently not considered a “proven technology” according to the MOE definition since it lacks a minimum of three separate installations (operated at near design capacity) and a minimum of three years of operating data (at three separate locations) to demonstrate reliable performance within Ontario.
- All alternatives can handle variable flows and loads, but the membrane filtration process is a more complex system to operate.
- The membrane filtration process has significantly higher energy demands which results in a higher annual operating and maintenance cost. It also has the high capital cost.

Table 5.6 - Evaluation of Short Listed Tertiary Treatment Alternatives

Evaluation of Short Listed Tertiary Treatment Alternatives

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Criteria/Indicator	**Maintain Existing Filters and Add Granular Filtration**	**Maintain Existing Filters and Add Membrane Filtration**	**New Standalone Granular Filtration**	**New Standalone Membrane Filtration**	**New High-Rate Physical-Chemical Treatment**
Protection of the Cultural and Socio-Economic Environment					
Displacement or disruption of any archaeologically significant findings	Minimal since within property boundary	Minimal since within property boundary	Minimal since within property boundary	Minimal since within property boundary	Minimal since within property boundary
Displacement or disruption of cultural heritage features	None	None	None	None	None
Potential visual-aesthetic impact associated with new construction (added footprint of new tankage and buildings, new building and tankage height)	Limited visibility of new building	Limited visibility of new building	Limited visibility of new building	Limited visibility of new building	Limited visibility of new building
Potential short term disruption (noise, dust, odour, traffic) during construction	All have similar construction impacts which could be mitigated	All have similar construction impacts which could be mitigated	All have similar construction impacts which could be mitigated	All have similar construction impacts which could be mitigated	All have similar construction impacts which could be mitigated
Potential long term disruption (noise, dust, odour) during operation	Minimal impacts associated with operation that could be mitigated	Minimal impacts associated with operation that could be mitigated	Minimal impacts associated with operation that could be mitigated	Minimal impacts associated with operation that could be mitigated	Minimal impacts associated with operation that could be mitigated
Protection of the Natural Environment					
Potential of the alternative to minimize adverse impacts to the receiving water quality and aquatic systems	Minimal	Minimal	Minimal	Minimal	Minimal

Evaluation of Short Listed Tertiary Treatment Alternatives

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Criteria/Indicator	**Maintain Existing Filters and Add Granular Filtration**	**Maintain Existing Filters and Add Membrane Filtration**	**New Standalone Granular Filtration**	**New Standalone Membrane Filtration**	**New High-Rate Physical-Chemical Treatment**
Potential for impact on terrestrial or aquatic habitat	Minimal	Minimal	Minimal	Minimal	Minimal
Technical Performance					
Ability of the technology to meet the MOE definition of 'proven technology'	Existing filters and new sand filters considered a 'proven technology' (48 installations of DynaSand Filter in Canada which have been in operation for 0-18 years	May not be considered a 'proven' technology based on limited number of installations and length of operation in Ontario	New sand filters considered a 'proven technology' (48 installations of DynaSand Filter in Canada which have been in operation for 0-18 years)	May not be considered a 'proven' technology based on limited number of installations and length of operation in Ontario	High-rate physical-chemical process (ACTIFLO or AquaDAF) may not be considered a 'proven' technology' based on limited number of installations in Ontario and Canada
Relative ease to implement/construct and maintain/operate proposed technology within existing treatment plant	Relatively easy to construct and operate	Relatively easy to construct and operate	Moderately more challenging as existing filters must be decommissioned and flows diverted to new filters	More challenging as existing filters must be decommissioned and flows diverted to new filters	Relatively easy to construct and operate
Relative ease at which the plant could be expanded for the alternative, (including new tankage and buildings and to meet more stringent effluent criteria)	All can be expanded	All can be expanded	All can be expanded	All can be expanded	All can be expanded
Ability of the treatment process to handle variable loadings and flows	All provide a reliable form of treatment	All provide a reliable form of treatment	All provide a reliable form of treatment	All provide a reliable form of treatment	All provide a reliable form of treatment

Evaluation of Short Listed Tertiary Treatment Alternatives

🟩	Minimal to no impact/technically preferred
🟧	Some impact/technically less preferred

Criteria/Indicator	**Maintain Existing Filters and Add Granular Filtration**	**Maintain Existing Filters and Add Membrane Filtration**	**New Standalone Granular Filtration**	**New Standalone Membrane Filtration**	**New High-Rate Physical-Chemical Treatment**
Cost					
Estimated capital cost (excluding common costs)	🟧 $5.3 M*	🟧 $ 11.5 M*	🟩 $4.1 M	🟧 $10.3 M	🟧 $8.0 M
Estimated or relative annual operating and maintenance costs (excluding common costs to provide an incremental cost)	🟩 $15,300 / yr	🟧 $80,000 / yr	🟩 $15,300 / yr	🟧 $80,000 / yr	🟩 $15,100 / yr
Estimated lifecycle cost (over a 20-year period) based on above costs	🟧 $5.9 M	🟧 $18.4 M	🟩 $4.7 M	🟧 $17.2 M	🟧 $8.6 M
Overall Evaluation	🟧 ***NOT Recommended***	🟧 ***NOT Recommended***	🟩 ***Recommended***	🟧 ***NOT Recommended***	🟧 ***NOT Recommended***

*based on series configuration

It is possible that continued operation of the existing filters could be maintained and additional granular filtration added to accommodate additional flows. This option was not selected for the following reasons:

- It is expected that operation of two parallel/series systems would be more complex and labour intensive than operation of a single unit. This option would also result in higher capital costs, removing any potential for cost savings by maintaining the existing filter unit.
- Maintaining existing filters in series with new granular filters would require existing filters to be expanded to handle increased flows.
- Maintaining existing filters in parallel with new granular filtration units would require high-quality effluent from the new system to allow for blended effluent to meet discharge criteria.

A new high rate physical-chemical treatment process has the following disadvantages:

- High-rate physical-chemical processes (e.g. ACTIFLO or AquaDAF) may not be considered a “proven technology” based on the MOE definition since there are a limited number of installations in Ontario and Canada.
- This option has a relatively high capital cost when compared to granular filtration.

Based on the above evaluation, the preferred tertiary filtration alternative is a new stand alone granular filtration to address the full plant capacity with the decommissioning of the existing filters. This alternative meets the MOE definition of proven technology and is the least expensive with a lifecycle cost of approximately $4.7 million.

5.5 Recommended Design Concept

Based on the evaluation of alternative design concepts the recommended design concept for the expansion of the Action WWTP includes:

- Peak flow management – provide adequate flow equalization through an increase in peak plant hydraulic capacity to accommodate flows at a peaking factor of 3.67.
- Preliminary treatment – new inlet works (currently underway).
- Primary treatment – new primary clarifiers with co-thickening of waste activated sludge.
- Secondary treatment – modified activated sludge treatment process including nitrification, and potentially full denitrification in the future.
- Tertiary filtration – new stand alone granular filtration system.
- Disinfection – ultraviolet disinfection.

6.0 PUBLIC AND AGENCY CONSULTATION

This section summarizes consultation activities undertaken by Halton Region and Dillon Consulting during the Class EA process for the Acton Wastewater Treatment Plant. Consultation with the public, agencies, aboriginal communities and other stakeholders was undertaken in accordance with the requirements of a Municipal Class EA for a Schedule C project. The Class EA specifies three mandatory points of contact for Schedule C projects:

- An invitation for the public, aboriginal communities, agencies and other stakeholders to review and comment on the alternative solutions under consideration.
- An invitation for the public, aboriginal communities, agencies and other stakeholders to review and comment on the alternative design concepts for the preferred solution.
- A Notice of Completion for the project and an opportunity for the public, Aboriginal communities, agencies and other stakeholders to review the Environmental Study Report.

The following subsections document how Halton Region has met these requirements. All consultation materials are provided in ***Appendix D***.

6.1 Notice of Commencement

Contact lists for this project were created for landowners within 500m of the project location, aboriginal communities, municipal staff and elected officials, provincial and federal agencies, interest groups and other stakeholders. These lists have been maintained and updated throughout the study based on communication with these individuals/organizations. The contact lists are provided in ***Appendix D1***.

A Notice of Commencement was published August 11 and 12, 2006, in the following local papers: Georgetown Independent & Free Press, Acton Tanner and the Halton Compass, to introduce the project to the public. A copy of this notice, along with a comment sheet, was mailed to those on the contact list. A copy of the notice and comment form can be found in ***Appendix D1***.

6.2 Project Website

A link to the project website (www.halton.ca) was provided in all of the notices that were sent out. Notices, Public Information Centre materials (including blank comment sheets), relevant reports and a copy of this draft ESR have been posted on the site.

6.3 Public Information Centres

Two Public Information Centres (PICs) were held for this project. PIC 1 was held on June 26, 2007 from 6:00 to 9:00 p.m. at the Acton Royal Canadian Legion (Branch 197) and PIC 2 was held on November 16, 2010 from 6:30 to 8:30 p.m. at the Acton District High School (cafeteria). Notices for PIC 1 were published June 14 and June 21, 2007 and notices for PIC 2 were published November 4 and 11. The notices were published in the same local papers as the Notice of Commencement. Copies are provided in ***Appendix D1***.

The purpose of PIC 1 was to provide background information on the project and Municipal Class Environmental Assessment process, the existing conditions, long list of potential solutions, and proposed evaluation criteria. A total of 21 people attended PIC 1, where information was presented on both the Acton Water Supply Master Plan Class EA and the Acton Wastewater Treatment Plant Class EA. Two comment forms were completed onsite but neither pertained to the Wastewater Treatment Plant Class EA.

PIC 2 provided additional and detailed information on the evaluation process, the preferred solution, recommended design concept, information on background studies completed and next steps. Construction of additional wastewater capacity at the existing plant was presented as the preferred solution. A total of eleven people attended PIC 2 and three comment forms were completed.

The PICs fulfilled the requirements of two mandatory points of contact as outlined in the Municipal Class EA process (opportunity to comment on alternative solutions and opportunity to comment on alternative design concepts). PIC materials, including sign-in sheets and panels, are provided in ***Appendix D2***.

6.4 Public Comments Received

A number of questions and comments were received from the public over the lifetime of the project, including: requests to be added to the mailing list; questions/comments; and completed comment forms. ***Table 6.1*** summarizes the comments and questions received and associated responses and ***Appendix D3*** provides copies of emails and comment forms.

Table 6.1 - Public Comments Received and Associated Responses

Comment	***Response***
Satisfied with the project as presented at PIC 2 and with the screening and evaluation criteria. Concerned about maintaining the quality of the receiving stream and the cold water fishery.	Comment noted. The Region has been working with Credit Valley Conservation and the Ministry of the Environment to ensure minimal to no impacts on Black Creek as a result of the Acton WWTP expansion.
Has the Town ever considered reducing wastewater flows via implementing a water efficiency program? An estimate has been completed for the Region regarding the potential to reduce water demands in Halton Hills and this analysis included the potential savings in Acton. One factor to consider is that the average per capita indoor residential water demand is reducing by a minimum of approximately 4 litres per day per year across North America.	Water conservation is an important part of the overall municipal water and wastewater process. Halton Region currently has a water efficiency program that addresses indoor and outdoor water use and provides a Household Guide to Water Efficiency. We anticipate that water conservation will play an increasing role in reducing wastewater flows; however, increased capacity will still be necessary at the Acton WWTP.
Provided suggestions to meet effluent requirements and discussed new technologies for wastewater treatment.	Thank you for the information. The Region is well aware of all the technologies listed in the attached brochure.
Requested information on the type of growth and development for which the Acton WWTP project is needed.	The Acton urban area is not expanding; however, there are vacant lands within the urban area that could potentially be developed or existing lands that could be redeveloped or intensified. Additionally, the existing wastewater treatment plant (WWTP) is currently operating near its rated capacity. A review of the WWTP through the Environmental Assessment process is prudent at this time to accommodate existing and future wastewater capacity requirements.

6.5 Agency Consultation

An important part of the Class EA process is to consult with agencies to gather information they may have and obtain their input on alternative solutions and design concepts for the preferred solution. A Technical Advisory Committee (TAC) was formed including Credit Valley Conservation and the Halton Region. The Ministry of the Environment and Ministry of Natural Resources were also contacted to be part of the committee. The TAC met 4 times to discuss and review technical and environmental issues, the status of the Class EA, and to provide guidance for the project. The following agencies were contacted as part of this Class EA:

- Canadian Environmental Assessment Agency.
- Fisheries and Oceans Canada.
- Environment Canada.
- Ministry of Agriculture and Food.
- Ministry of Energy and Infrastructure.
- Ministry of Culture.
- The Ministry of Natural Resources, Aurora District.
- The Niagara Escarpment Commission.
- Ontario Realty Corporation.
- Various Utilities – Hydro One, Bell Canada, Enbridge Gas Distribution Inc., Cogeco Cable Systems Inc. Trans Canada Pipeline, Union Gas Limited, CP Rail, Canadian National Railway.
- Credit Valley Conservation*.
- Ministry of Environment*.

*The MOE and Credit Valley Conservation have actively participated in this project as described in the following subsections. Comments received from other agencies include the following:

<u>Niagara Escarpment Commission</u> – Noted that the Niagara Escarpment Plan Area is in proximity to the east and south-easterly limits of the Acton Urban Boundary and that discharges to Black Creek and any impacts associated with increased discharge may be of concern to the NEC. Pleased that the existing site will be used and that there will be no impact to lands in the Niagara Escarpment Plan. These comments were received via comment form in 2006 and 2010.

<u>Canadian Environmental Assessment Agency</u> – In response to the Notice of PIC 2 mailing this agency responded by letter requesting a full project description if information on whether the Canadian Environment Assessment Act applies to this project was desired.

Ministry of Municipal Affairs and Housing – Request to be added to mailing list after attending PIC 2.

Copies of agency letters and emails, as well as TAC minutes are provided in ***Appendix D3***.

6.5.1 Ontario Ministry of the Environment (MOE)

Extensive consultation occurred between Halton Region, the MOE and CVC via in-person meetings, emails, letters and phone calls. Issues of concern to the MOE were similar to those of the CVC (see below). It was suggested in 2006 that a number of additional studies would be prudent. The MOE was particularly interested in minimum dilution ratios for municipal wastewater discharges, effluent limits and TP loadings. They also provided input on the assimilative capacity study for Black Creek.

Meetings with the MOE took place on the following dates: June 15, 2007; November 14, 2007; September 23, 2008 and July 9, 2010. Minutes of these meetings as well as emails and letters discussing issues of concern to the MOE are provided in ***Appendix D3.***

6.5.2 Credit Valley Conservation (CVC)

Extensive consultation occurred between Halton Region, CVC and the MOE via in person meetings, emails, letters and phone calls. Issues of concern to Credit Valley Conservation were similar to those of the MOE and centered around water quality and the assimilative capacity of the receiving water body, including: phosphorous offsets in the urban and rural areas; nitrate concentrations; dilution rations; impacts from low flow regimes on water quality; dissolved oxygen impacts; erosion management; backwater impacts; elevated levels of chloride and un-ionized ammonia; and water temperature and chemistry. Also of importance were mitigation measures, the accuracy of background data, biological monitoring, accurate modelling of best management practices, fisheries, wetlands and habitat mapping.

Copies of the following studies were provided to CVC for review and comment:

- Black Creek Assimilative Capacity Study Report
- Spawning Redd Survey.
- Assimilative Capacity Field Study Report.
- Assimilative Capacity Modelling Report.
- Acton Total Phosphorus Management Study.

- Rural Total Phosphorus Management Study.
- Fluvial Geomorpological/Hazard Assessment.

Meetings with the CVC took place on the following dates: August 11, 2006; March 23, 2007; November 14, 2007; September 23, 2008; and July 12, 2010. Minutes of these meetings are available in ***Appendix D3*** along with emails and letters discussing issues of concern to the CVC.

6.6 Aboriginal Consultation

The initial Notice of Commencement for this project was sent to Indian and Northern Affairs Canada (INAC) and the Ontario Secretariat for Aboriginal Affairs in June 2007. INAC responded to the notice with a letter requesting that contact with aboriginal communities that may have an interest in the project begin as early as possible and provided a list of resources and websites for generating a list of such communities.

Since this time, the Region has added the following agency and aboriginal contacts to the mailing list for this project:

- Huron-Wendat Nation.
- Mississauga’s of New Credit First Nation.
- Six Nations of the Grand River First Nation.
- Haudenosaunee Confederacy Chiefs Council.
- Métis Nation of Ontario.
- Grand River Community Métis Council.
- Hamilton/Wentworth Métis Council.
- Niagara region Métis Council.
- Windsor-Essex Métis Council.
- Ministry of Aboriginal Affairs (MAA).
- Ministry of the Attorney General.
- Indian Claims Commission.

A letter was mailed to aboriginal communities and organizations on November 1, 2010 to notify them of PIC 2 and to provide an update on the Class EA process. The letter included a request that any concerns or questions be addressed to Halton Region. No communication was received in response to this letter.

A letter was mailed to INAC and MAA requesting information on aboriginal communities and land claims, to which both agencies responded with information about active litigation within the vicinity of the project location by the Six Nations of the Grand River. Consultation has been ongoing with the Six Nations of the Grand River. No concerns about the project in relation to land claims have been raised. In addition, MAA provided contact information for the Haudenosaunee Confederacy Chiefs Council. An updated copy of the November 1, 2010 letter was mailed to the Council and a follow up phone call was made. No response has been received.

Between December 10, 2010 and January 15, 2011, phone calls were placed to the Huron-Wendat Nation, Mississaugas of New Credit First Nation and Six Nations of the Grand River. The purpose of these calls was to follow-up on correspondence sent, provide information on the status of the project and to identify any outstanding questions, concerns or comments aboriginal communities may have about the Class EA process and/or Acton Wastewater Treatment Plant. A concern was raised by the Mississauga's of New Credit about whether an archaeological assessment had been completed. Information was provided on the status and conclusions of the Phase I study. Subsequently an email was sent to Ontario contacts for the Huron-Wendat Nation. No response was received.

In January 2011 a request was made of the Métis Nation of Ontario to provide a list of local councils and councilors who should be contacted. This list was received and letters were mailed February 9th, 2011 with information on the project. Follow up calls were made to the Métis. No response has been received.

A copy of the Notice of Completion was mailed on March 28, 2011 to all agencies, First Nations and Métis communities on the mailing list.

All correspondence received is available in ***Appendix D3*** and mailed notices and letters are provided in ***Appendix D1***.

6.7 Notice of Completion

A Notice of Completion was published March 31, 2011 in the three local newspapers identified above to notify the public that this ESR was being placed on the "public record" for the required 30-day public and agency review period. This notice satisfies the final consultation point of contact in the Municipal Class EA process. A copy of this notice was mailed to individuals and organizations on the most recent mailing list. A copy of the notice and mailed letters are provided in ***Appendix D1***.

During the review period, the Class EA entitles any person who has significant concerns, which cannot be resolved, to request the Minister of Environment to change the status of the project from a Class EA to an Individual EA by issuing a Part II Order under the *EA Act*.

If there are no Part II Order requests, and following the receipt of other required approvals, the proposed wastewater treatment plant expansion may proceed to design and construction.

7.0 PREFERRED DESIGN CONCEPT

7.1 Description of Preferred Design

The preferred design concept for the expanded Acton WWTP includes decommissioning of existing Plant A along with modification and expansion of the existing Plant B works. The design criteria for the preferred concept and individual process stages are described in the following sections. The full design summary for the Acton WWTP expansion is included as ***Appendix C***.

7.1.1 Design Criteria

Upgrades to the Acton WWTP are designed to satisfy the need for expanded treatment capacity of 2,455 m^3/d. Future treatment needs were assessed by forecasting residential, industrial, commercial and institutional growth for full build-out of the existing urban area of Acton.

An ultimate capacity for the upgraded Acton WWTP was estimated at 7000 m^3/d. The basis for determining ultimate treatment capacity, as provided by Halton Region, is outlined in ***Table 7.1.***

Table 7.1 - Ultimate Capacity Design Parameters

Estimated Residential Population Growth (2009 – Mature State)	4880 persons
Estimated Institutional/Commercial/Industrial (ICI) growth (2009 – Mature State)	50 ha
Per Capita Sewage Flow [l/(person*day[1])]	365

[1] *Per capita sewage flow provided by Halton Region*

Peak Flow Requirement

The expanded Acton WWTP will have a capacity of 7000 m^3/d. The facility will be designed to accommodate maximum day and maximum hour flows that exceed the average day capacity. Discussion of factors considered in determining peak design flows to the expanded Acton WWTP is included in the peak flow management memo, provided in ***Appendix C***.

Design flows for the upgraded Acton WWTP are summarized in ***Table 7.2.***

Table 7.2 - Design flow rates for the upgraded Acton WWTP

Flow Condition	Flow Rate	Peaking Factor
Average day	7000 m^3/d	1.0
Maximum day	20650 m^3/d	2.95
Maximum hour	25687 m^3/d	3.67

Biological Loading

Biological loadings to the treatment facility were determined by examining current Acton WWTP raw sewage quality. Future loads were determined by applying accepted per capita biological generation rates to account for future wastewater generation and biological loading above the current loadings to the facility. Expected raw sewage quality and biological loading rates for the Acton WWTP are provided below in ***Table 7.3***. A full description of process specifications is provided in the design summary included in ***Appendix D***.

Table 7.3 - Design Biological Loading for the Expanded Acton WWTP

	Sewage Load		
Parameters	**Design Loading[1] (g/cap/d)**	**Mass Load at 7000 m^3/d flow (kg/d)**	**Concentration at 7000 m^3/d flow (mg/L)**
Q (l/cap/d)	365[2]		
BOD_5	85	1245.5	177
Suspended Solids	95	1460.7	208
TKN	13.3	252.5	36.6
NH_3-N	7.8	160.6	22.9
Total Phosphorus	3.28	44.1	6.3

[1] Residential per-capita loading rates obtained from Metcalf and Eddy 3rd edition (2003).
[2] Per capita wastewater generation rate (Halton Region Master Plan as referenced by AECOM, 2008)

7.1.2 Treatment Process

Process alternatives were evaluated following a number of socio-economic, environmental and financial criteria during Phase 3 of the Class EA process. The preferred design was determined by individually evaluating each process component. A description of the preferred design is provided in this section. More detailed descriptions of process design parameters and equipment specifications are included in the design summary (***Appendix C***).

The preferred design concept consists of decommissioning Plant A and incorporation of existing Plant B primary clarifiers, aeration tanks and secondary clarifiers into an expanded process. Additional capacity to offset the decommissioning of Plant A and allow for future flow increases will be provided through the construction of new primary clarification, secondary clarification and aeration tankage. New tertiary treatment and disinfection process units will also be provided. Sludge digestion will be expanded to account for expected load increases.

A description of the preferred design for each process component is provided below.

Preliminary Treatment

Preliminary treatment needs are presently being addressed as part of a separate facility upgrade. They were not considered as part of the Class EA process.

Peak Flow Management

Peak flow management is provided to mitigate bypass events caused by high flows to the expanded Acton WWTP. Peak flow management needs will be met by designing plant upgrades to accommodate peak hour flows of 25687 m^3/d, or a peaking factor of 3.67 above the average day flow capacity of 7000 m^3/d. Sizing of the plant to a peaking factor of 3.67 will provide necessary equalization capacity without the need to construct a separate, offline equalization tank.

Primary Treatment

Primary treatment at the expanded Acton WWTP will be performed by primary clarifier tanks employing waste activated sludge (WAS) co-thickening. This process involves directing WAS from the biological treatment process to primary clarifiers, where it is thickened along with primary sludge.

The proposed primary treatment upgrades will employ existing Plant B primary clarifiers and include an additional three primary clarifier tanks, each 24m long and 5m wide. This will offset losses in treatment capacity resulting from the planned decommissioning of Plant A and will provide sufficient capacity to handle expected peak wet weather flows at the ultimate design capacity of the expanded facility. A design summary is provided in ***Table 7.4***.

Table 7.4 - Design Summary for Proposed Primary Clarifier Upgrades

Design Parameter	Value
Design flow basis (maximum day flow)	20,650 m^3/d
Number of tanks	5 (2 existing, 3 new)
New tank dimensions (LxWxH in metres)	24 m x 5m x 4m
Total surface area (including existing tanks)	480.8 m^2
Maximum surface hydraulic load	42.9 $m^3/(m^2 \cdot d)$
(MOE surface loading guideline)	$\leq 60\ m^3/(m^2 \cdot d)$

Biological Process

Biological treatment at the expanded Acton WWTP will employ a modified activated sludge process. The proposed modified activated sludge process consists of pre-aeration anoxic tanks and aeration tanks containing aeration, swing anoxic-aerobic and re-aeration zones. The treatment process is described briefly below.

Flow enters the treatment system through a mechanically mixed pre-anoxic zone, occupying the former Plant B aeration tanks. Following the pre-anoxic zone, flow enters the aeration zone where biological material (BOD) is consumed and ammonia is converted into nitrate. A portion of the wastewater flow from the aeration zone is recycled to the pre-anoxic zone where nitrate is denitrified to nitrogen gas. Raw sewage entering the pre-anoxic zone provides a carbon source for the denitrification process to occur. Following the aeration zone, flow enters a swing anoxic-aerobic zone, which converts the remaining nitrate to nitrogen. If complete denitrification is desired, methanol can be added as a supplemental carbon source, as most organic material is removed in the aeration zone. The final re-aeration zone is necessary to increase dissolved oxygen content in the final effluent directed to secondary clarification. This zone will also remove any remaining BOD as a result of methanol addition. A simplified process schematic is provided below in ***Figure 7.1.***

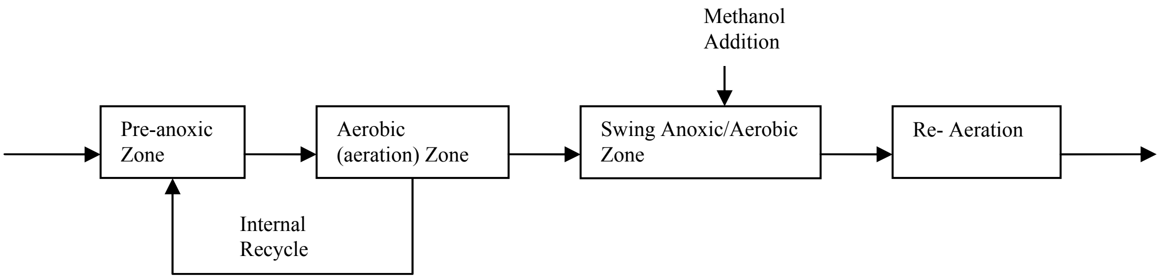


Figure 7.1 - Biological Process Flow Schematic

The upgraded Acton WWTP will re-use current Plant B aeration tanks to provide pre-anoxic zones in the expanded biological process. Aerobic, swing and re-aeration zones will be located in new biological process tanks.

Aeration demands for the biological process will be supplied by two additional process air blowers.

A design summary is provided below in ***Table 7.5***:

Table 7.5 - Design Summary for Proposed Secondary Treatment Process Upgrades

Design Parameter	**Value**
Design flow basis (maximum day flow)	20,650 m^3/d
Design BOD load	85 kg/d
Design TKN load	13.3 kg/d
Number of tanks	7 (4 existing, 3 new)
New tank dimensions (LxWxH in metres)	34 m x 8.5m x 5.5m
Total volume of new tanks	4843 m^3
Pre-anoxic zone volume	988 m^3
Swing anoxic-aerobic zone volume	290 m^3
Re-aeration zone volume	290 m^3
Total volume including existing tanks	5834 m^3
Total HRT at average day flow	16.6h
(MOE HRT guideline)	15h
Mixed liquor suspended solids (MLSS)	4 kg/m^3
Food to Biomass (F/M) ratio	0.08
(MOE F/M guideline)	0.05 to 0.15 kg/kg*d
Sludge age	21.6 d
Maximum aeration requirement at a biological peaking factor of 2.0 above average day loads	132696 m^3/d

Secondary clarification at the expanded Acton WWTP will be performed by the existing Plant B secondary clarifiers and includes three additional rectangular secondary clarification tanks. Secondary clarifiers are required to settle solids from mixed liquor. Rectangular tanks were selected due to their compact footprint and ability to be efficiently located on available land.

Secondary clarifiers will be sized to treat maximum hourly flows and solids at the mixed liquor suspended solids concentration of 4kg/m^3. Secondary clarifiers will be sized to produce treated effluent with TSS concentrations of 10 mg/L or less, which is appropriate for discharge to the preferred tertiary treatment process.

New return activated sludge pumps will be installed to accommodate the additional pumping requirements of the new clarifier basins.

A design summary is provided below in ***Table 7.6***

Table 7.6 - Design Summary for Proposed Secondary Clarifier Upgrades

Design Parameter	Value
Design flow basis (maximum hour flow)	25,687 m^3/d
Inlet MLSS solids concentration	4 kg/m^3
Effluent solids concentration	10 mg/L
Number of tanks	5 (2 existing, 3 new)
Existing tank surface area	308 m^2
New tank surface area	629 m^2
New tank dimensions (LxWxH in metres)	29m x 7.24m x 3.6m
Total surface area	937 m^2
Total clarifier volume	3373 m^3
Surface hydraulic load at design flow basis	27.41 m^3/m^2*d
(MOE maximum surface loading guideline)	$\leq$40 m^3/m^2*d
Surface solids loading at design flow basis	167.5 kg/m^2*d
(MOE maximum solids loading guideline)	$\leq$170 kg/m^2*d
Hydraulic retention time at average day flow	11.6h

Tertiary Treatment

Tertiary treatment at the expanded Acton WWTP will be performed by a new stand-alone granular continuously backwashed filtration unit. Existing shallow-bed sand filters will be decommissioned.

The filtration system will be arranged into six cells, each containing four separate filter modules. Filters will be sized to accommodate maximum hourly flow rates with one filter cell out of service. Loads will not exceed the MOE maximum loading rate of 3.3 $L/(m^2\cdot sec)$ under these conditions (MOE, 2008). The filter unit will be housed in the new tertiary treatment and disinfection building.

Granular filtration operates by filtering remaining TSS from treated effluent following secondary clarifiers using a granular media and provides phosphorous removal by capturing phosphorous precipitate produced by upstream chemical dosing. Continuous backwashing is provided during operation to remove captured solids from the filter bed. Backwash water will be directed to primary clarifiers.

A design summary is provided below in ***Table 7.7.***

Table 7.7 - Design Summary of Proposed Tertiary Treatment Upgrades

Design Parameter	Value
Design flow basis (maximum hour flow)	25,687 m^3/d
Inlet TSS concentration	10 mg/L
Inlet TP	1 mg/L
Effluent TSS	5 mg/L
Effluent TP	0.1 mg/L
Number of filter modules	24
Overall filtration unit dimensions (L x W x H in metres)	7.22m x 19.41m x 7.17m
Total filtration area	111.5 m^2
Hydraulic loading at max hour flow	2.66 L/m^2/sec
Hydraulic loading at max hour flow with one cell offline	3.2 L/m^2/sec
(MOE maximum hydraulic loading guideline)	3.3 L/m^2/sec
Solids loading at max hour flow	26.6 mg/(m^2·s)
(MOE maximum solids loading guideline)	83 mg/(m^2·s)
Reject water flow rate	38.16 m^3/d to 76.32 m^3/d

Disinfection

Disinfection at the expanded Acton WWTP will be performed by a new UV treatment system. The existing UV disinfection system will be decommissioned. The new unit will consist of two banks, each containing five lamp modules. The disinfection system will be sized to treat maximum hourly flows. During early operation, when average and peak flows are expected to be lower, one disinfection module per bank may be turned off to reduce power consumption.

A design summary is provided in ***Table 7.8*** below:

Table 7.8 - Design Summary of Proposed Disinfection Upgrades

Design Parameter	Value
Design flow basis (maximum hour flow)	25,687 m^3/d
Design effluent quality	100 organisms per 100mL
Number of banks	2
Number of modules per bank	5
Minimum UV transmittance	65%

Sludge Digestion

Sludge digestion at the expanded Acton WWTP will be performed by providing additional digestion capacity to supplement the primary and secondary digester units presently in operation. Expansion of sludge digestion capacity will minimize sludge disposal requirements and allow Acton WWTP to maintain its current biosolids management practices.

The expanded sludge digestion system will include two heated primary digesters and two unheated secondary digesters. This system includes the two existing digesters (one primary digester and one secondary digester) and two new digesters (one primary digester and one secondary digester). New digesters will be provided with jet mixing. The digester system will be sized to accommodate co-thickened primary and secondary sludge collected in primary clarification tanks. Sludge digestion will provide appropriate solids retention and stabilization time as recommended by the MOE to remove pathogenic organisms and will reduce final sludge volumes (MOE, 2008). Gas produced during digestion will continue to be used to provide heat to primary digesters and nearby process buildings.

A design summary is provided in ***Table7.9*** below:

Table 7.9 - Design Summary of Proposed Digestion Upgrades

Design Parameter	Value
Design loading (primary sludge, chemical sludge and WAS)	1754 kg waste sludge/d
Volatile solids loading	1221 kg/d
Number of tanks	2 primary digesters, 2 secondary digesters
New tanks	1 primary digester, 1 secondary digester
Primary digester volume	615 m^3 each
Total primary digester volume	1230 m^3
Secondary digester volume	340 m^3 each
Total secondary digester volume	680 m^3
Primary digester solids retention time	24.6 d

Effluent Pumping (provisional)

Discharge of treated effluent at Acton WWTP is currently performed by a gravity sewer leading from the existing tertiary treatment system. Currently, the flood line is under review by the CVC. In the event that the current floodplain elevation does not change, the preferred design concept includes a provisional effluent pump to allow flow to be discharged properly during periods of flooding in Black Creek. This provisional effluent pump is described in detail below.

Under normal operating conditions, effluent from the expanded Acton WWTP will be discharged by gravity through the existing Black Creek outfall. However, during periods of flooding or high water levels in Black Creek, discharge of treated effluent may not be possible under gravity flow. Under these conditions, provisional effluent pumping is necessary to ensure that all flows may be discharged properly and to prevent flooding in the upstream treatment processes.

Effluent pumping will be performed by a provisional pump station located near the existing outfall to Black Creek. Discharge will occur by gravity flow through the provisional pump station to the outfall under normal operating conditions. Pumping will only occur if required by high water levels in Black Creek. The provisional effluent pump station will be sized to discharge maximum hourly flows during flood conditions. A reference flood water elevation in Black Creek of 332.08 m was selected, based on drawings for the 2001 Acton WWTP upgrade (Earth Tech Canada, 2001). During periods of high water level in Black Creek, effluent will be raised to a surcharge chamber located adjacent to the provisional pump station. Effluent pumped into the surcharge chamber will drain by gravity and connect to the effluent sewer upstream of the Black Creek outfall.

A design summary is provided in ***Table 7.10*** below:

Table 7.10 - Design Summary of Proposed Provisional Effluent Pumping Upgrades

Design Parameter	Value
Sump dimensions (L x W x H in metres)	3.6m x 2.4m x 4.0m
Surcharge chamber dimensions (dia x H in metres)	1.5m x 5m
Number of pumps	4 (3 duty, 1 standby)
Maximum flow per pump	8588 m^3/d
Total capacity	25764 m^3/d

Outfall

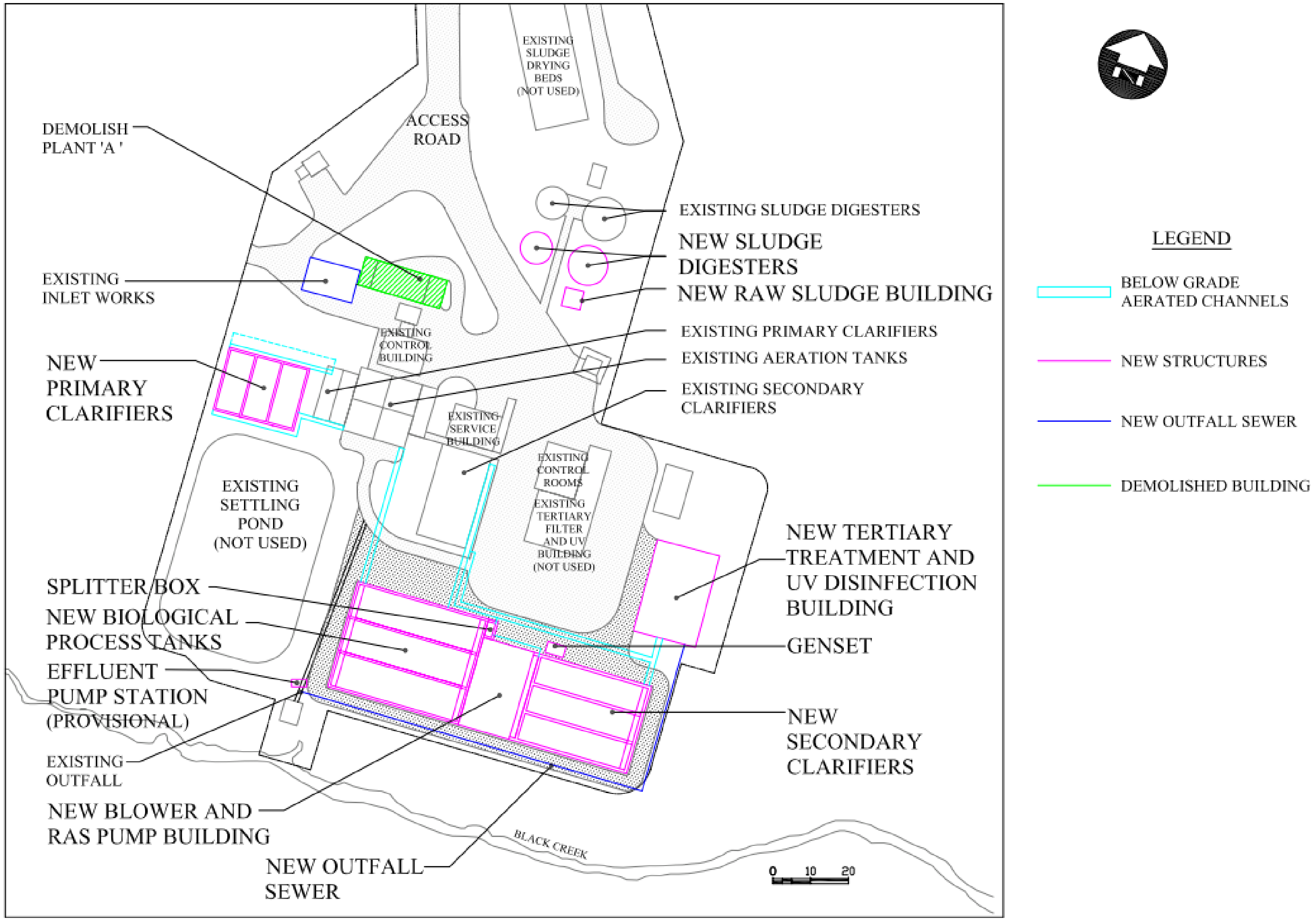
Discharge of treated wastewater will occur through the existing outfall to Black Creek. This will avoid potential impacts associated with construction of a new outlet structure. Treated effluent will be re-aerated to achieve a final dissolved oxygen concentration of 5mg/L. Aeration may be provided through flow cascading at the outfall to Black Creek. If necessary, additional re-aeration will be provided in a new chamber upstream of the existing outfall structure. This will ensure that dissolved oxygen concentrations meet discharge objectives.

7.1.3 Plant Expansion Footprint and Construction

Additional works to be constructed as part of the proposed upgrade will be arranged efficiently within the existing property boundaries. New biological process and secondary clarification tanks, as well as the new blower and RAS pump building, will be constructed on the location of the former slow sand filter beds. The new tertiary treatment and UV disinfection building, will be constructed on available land near the east boundary of the site. Additional primary clarifiers will be constructed on available land near the west property boundary. Care should be taken to maintain roadway allowance for truck access within the plant. A conceptual layout of specific facility upgrades is provided in ***Figure 7.2***. It is noted that during detailed design, the layout of the Acton WWTP expansion may be revised as a result of additional geotechnical and other information.

The proposed conceptual layout will be confirmed during detailed design when additional geotechnical and other information becomes available.

Figure 7.2 - Layout of New and Existing Works for Preferred Design Concept



Construction of Acton WWTP will require additional buildings, wastewater conveyance channels and process tanks. Flows will be directed between process components by way of aerated channels designed to maintain dissolved oxygen levels and minimize hydraulic headloss. Below is a description of the layout of new buildings and process works.

Primary Clarifiers

Flows will be directed from the new inlet works to primary clarifiers. A new conveyance channel will be constructed to split flows between the two existing primary clarifiers and three newly constructed primary clarifiers. New primary clarifiers will be located adjacent to existing primary clarifiers, north of the existing lagoon. Primary sludge pumping will be installed for new and existing clarifiers. A new collection channel will be constructed to collect clarified wastewater from primary clarifiers and direct flows to the biological process.

Biological Process Tanks

Flows from the new primary clarifier effluent channel will be directed to existing Plant B aeration tanks. These tanks will be modified to provide a pre-anoxic zone upstream of the new modified activated sludge process. Following pre-anoxic zone tanks, flows will be directed through a new conveyance channel to the new aeration tanks.

New biological process tanks will contain the aeration, swing anoxic-aerobic and re-aeration zones of the modified activated sludge process. Treated flows will be collected in a channel following the re-aeration zone, and directed to a new splitter box which will divide flow between new and existing secondary clarifiers.

New Blower and RAS Pump Building

The new blower and RAS pump building will be constructed between the new biological process tanks and secondary clarifiers. This building will house the following process equipment:

- Blowers for new biological process tanks.
- Return activated sludge (RAS) pumps.
- Waste activated sludge (WAS) pumps.

A new genset to provide standby generation in the event of a power failure will be located outside this building.

Secondary Clarifiers

Secondary clarification will be provided by two existing Plant B secondary clarifiers, located adjacent to the existing service building and three new secondary clarifiers located adjacent to the new blower and RAS pump building. Flow will be conveyed to clarifiers from the effluent splitter box located downstream of the biological process through new aerated channels. New aerated channels will be constructed to collect and combine clarified effluent, which will then be directed to tertiary filters.

Tertiary Treatment and UV Disinfection Building

The new tertiary treatment and UV disinfection building will be constructed to house new tertiary treatment process equipment, including:

- New granular filtration system.
- Ultraviolet (UV) disinfection equipment.
- Chemical dosing tanks and metering pumps.

Backwash air compressors associated with tertiary filters will also be located in this building. Following UV disinfection, flows will enter a new outfall sewer which will follow the east and south property fence line and will discharge to new floodwater pump station and existing outfall.

Geotechnical Considerations

During the selection of the preferred design alternative, available geotechnical information for the Acton WWTP site was reviewed. A 2010 report, titled *Geotechnical Investigation: Acton WWTP Expansion* was prepared by Peto MacCallum Ltd. As part of this work, additional bore holes were drilled to provide information about the soil conditions on the property. The report found generally poor soil quality for constructability within the studied area. Groundwater elevations within the study area at the time of the investigation were approximately 330 m. This corresponds to the approximate maximum Black Creek water level used in design of the 2001 plant upgrade (Earth Tech, 2001).

Further geotechnical work is required during the pre-design phase of the project. The geotechnical work that will be undertaken will include examination of the subsurface for the presence of any contaminants. This work will also address specific issues related to the construction of tanks and buildings at the location of the proposed upgrades. The conceptual layout of the WWTP may be revised once further geotechnical information is known.

Methods of Construction

Construction of the proposed upgrades to Acton WWTP will be performed in a method that minimizes potential impacts to neighbouring residents and the environment. During construction, water retention sheeting will be employed to reduce excavation areas and minimize dewatering requirements. Reduced dewatering requirements will minimize effects on groundwater levels and avoid impacts on groundwater inflow to Black Creek.

Specific construction methods and scheduling will be determined during the design phase.

7.2 Capital Cost of Preferred Design

An opinion of probable capital cost was prepared for the preferred design concept. Based on information available during the conceptual design of the proposed upgrade, the probable capital cost is $21,000,000 (in 2010 dollars). This cost opinion was based on conceptual level design of process components. Costs will be further refined during the design phase. A breakdown of capital costs by unit process component is provided in ***Table 7.11.***

Table 7.11 - Probable opinion of capital cost for upgrades to Acton WWTP

No.	Item description	Estimated cost*
	PRIMARY: Design Basis = Maximum Day Flow (20650 m3/d)	
1.	Equipment	406,917
2.	Construction	643,652
	Subtotal	$1,050,569
	BIOLOGICAL: Design Basis = Peak Hourly Flow (25687 m3/d)	
3.	Equipment	889,279
4.	Construction (inlcuding channels)	3,510,150
	Subtotal	$4,399,429
	SECONDARY: Design Basis = 4kg/m3 MLSS at Maximum Day Flow (20650 m3/d)	
5.	Equipment	530,665
6.	Construction	768,254
	Subtotal	$1,298,919
	CHEMICAL: Design Basis = Peak Hourly Flow (25687 m3/d)	
7.	Equipment	114,053
8.	Construction	0
	Subtotal	$114,053
	DIGESTION: Design Basis = WAS+Primary Sludge generation at Maximum Day Flow	
9.	Equipment	789,349
10.	Construction	107,195
	Subtotal	$896,544
	TERTIARY: Design Basis = Peak Hourly Flow (20650 m3/d)	
11.	Equipment	1,322,125
12.	Construction	1,113,000
	Subtotal	$2,435,125
	DISINFECTION: Design Basis = Peak Hourly Flow (25687 m3/d)	
13.	Equipment	463,449
14.	Construction (Channel)	39,106
	Subtotal	$502,556
	EFFLUENT PUMPING: Design Basis = Peak Hourly Flow (25687 m3/d)	
15.	Equipment	$130,094
16.	Construction	$105,000
	Subtotal	$235,094
	SITE WORKS	
17.	Yard & Plant Piping, Landscaping, Outfall	1,077,617
18.	Architectural	966,785
19.	Electrical - Power Distribution, I&C, Genset	630,000
	Subtotal	$2,674,402
Total Direct Costs		**$13,606,690**
	INDIRECT COSTS	
20.	Mobilization, Demobilization, 3%	408,210
21.	Insurance, Bonds, 3.5%	476,234
22.	Contingency - Estimating, 30%	4,082,007
23.	Start-up and trial operation	200,000
24.	Project Management, 2%	272,140
25.	Engineering Design/Contract Administration, 15%	2,041,004
Total Indirect Costs		**$7,480,000**
Total including indirect costs (nearest $100,000)		**$21,100,000**

*Note: This opinion of probable costs is based on an assumed scope of work only. Actual costs can only be established following further investigation, detailed design, and tendering. Costs do not include taxes.

Direct costs include the following markup rates:

Installation - 5 to 20% per equipment item
Sub-Contractor Markup - 10% per equipment item
General Contractor Markup - 5%

7.3 Anticipated Project Implementation

It is anticipated that construction will start in 2012 and will last approximately two years.

It is proposed that the plant expansion be constructed in two phases. Most likely, Phase I will be a plant expansion of 1,055 m^3/d, increasing plant capacity to 5,600 m^3/d; and Phase II will be a plant expansion of 1,400 m^3/d, increasing plant capacity to 7,000 m^3/d.

Specific capacity to be constructed in each phase, as well as construction schedules, will be determined during the design phase.

8.0 SUMMARY OF EFFECTS AND MITIGATION MEASURES

This section of the Environmental Study Report documents the potential effect of the natural socio-economic environment from the construction and operation of the Acton WWTP expansion and provides proposed mitigation measures to minimize/eliminate identified impacts. The following subsections provide a detailed discussion of potential effects and mitigation measures associated with of the following:

- Potential visual impact.
- Noise and air quality.
- Transportation and truck traffic.
- Dust.
- Archaeological resources.
- Stormwater management/sediment control.
- Groundwater/dewatering during construction.
- Loss of vegetation.
- Environmentally Sensitive Areas.
- Water quality in Black Creek.
- Species at Risk.
- Drainage and flooding.
- Erosion.
- Integration with existing operations.

Table 8.1 provides a summary of potential effects, mitigation measures and net effects (effects remaining after mitigation measures are implemented).

Table 8.1 - Summary of Potential Effects and Proposed Mitigation

Activity/Potential Effect	Proposed Mitigation and Monitoring	Net Effect
Protection of the Cultural and Socio-Economic Environment		
Potential visual impact	The Acton WWTP property is set back from residences along Churchill Road South and the proposed new structures are not likely to be visible or intrusive. The expansion will be within lands already associated with the treatment plant and no mitigation of visual impacts is necessary as neighbours already have a screened view of the plant, due to the plant being situated in a valley.	No net effect anticipated
Noise and Air Quality	The results of baseline modelling showed no odour impact is expected in the surrounding community. During detailed design phase, once the size and layout of the new unit processes will be confirmed, a noise and air quality assessment will be completed to demonstrate compliance with applicable regulations (O.Reg. 419/05 and NPC 205 and 232). The Town of Halton Hills noise by-law will be enforced during construction.	No net effect anticipated
Transportation and truck traffic	Minimal construction truck traffic will occur on local roads around the site. Neighbouring residences/landowners will be notified prior to initiating plant construction and during construction as needed. Construction information and contact information to log any complaints will be provided. Complaints made to Halton Region regarding truck traffic will be addressed as they arise.	No net effect anticipated
Dust	Dust is expected to be limited and contained within the WWTP site and effects are associated with construction only. Best management practices for dust management will be implemented. Measures to minimize dust will be implemented and may include using covers on fill piles and watering techniques on roadways to minimize fugitive dust from trucks.	No net effect anticipated

Table 8.1 - Summary of Potential Effects and Proposed Mitigation

Activity/Potential Effect	**Proposed Mitigation and Monitoring**	**Net Effect**
Archaeological resources	Prior to construction, a Stage 2 archaeological assessment will be completed for the areas identified as high potential and clearance will be obtained from the Ministry of Culture. As per the Stage 1 archaeological assessment some monitoring during construction will occur. Should unknown archaeological resources be uncovered during construction all work will cease immediately and a licensed archaeologist will be engaged to carry out further archaeological fieldwork as appropriate in compliance with Section 48(1) of the Ontario Heritage Act. Should human remains be discovered, all work will cease immediately and the police will be contacted.	No net effect anticipated
Protection of the Natural Environment		
Stormwater management/sediment control	A detailed sediment control plan and a spills response plan will be prepared prior to construction and reviewed with CVC. It will contain best management practices to control stormwater runoff including: • The size of soil stockpiles will be minimized and they will be located away from Black Creek. • Silt fences will be installed prior to construction to prevent deleterious substances from entering the creek and will remain in place until soil stabilization is achieved. • Refuelling and maintenance of equipment will be undertaken in confined areas away from Black Creek. • Sediment-laden water and runoff from the construction site will be treated using appropriate methods (e.g., swale) before it is permitted to enter Black Creek. • Disturbed areas will be replanted immediately upon completion of construction.	No net effect anticipated

Table 8.1 - Summary of Potential Effects and Proposed Mitigation

Activity/Potential Effect	Proposed Mitigation and Monitoring	Net Effect
Groundwater/dewatering during construction	Dewatering requirements will be assessed during the design phase once geotechnical and hydrogeological information is available. The geotechnical work that will be undertaken will include examination of the subsurface for the presence of any contaminants. Depth of excavation and appropriate construction methods will be used to minimize any dewatering requirements. Appropriate dewatering methods will be identified to minimize impact on the groundwater table and water supply to the creek. For example, a temporary metal coffer dam may be installed to prevent inflow from the surrounding soil, significantly reducing the need to continue to dewater the excavation pits during construction. Dewatering requirements and proposed dewatering methods will be reviewed with CVC. A program to monitor potential impacts to water levels of Black Creek will be developed and implemented. In addition, Halton Region will undertake a well monitoring program for nearby domestic water wells prior to, during and post construction.	No net effect anticipated
Loss of vegetation	Direct impacts will be minimal as the site is already disturbed (landscaped/manicured). There will be no tree-cutting or removal of significant habitat. The following measures will minimize potential impacts: • A detailed sediment control plan will be prepared. • Dust and noise control measures will be implemented. • Disturbed areas will be replanted immediately upon completion of construction. • Staging areas and soil stockpiles will be located appropriately to avoid natural areas. • Tree hoarding and fencing will be provided to protect against damage to trees or sensitive vegetation immediately adjacent to the construction zone. • Site access will be confined to the existing access road to prevent disturbance to the natural areas adjacent to the current WWTP driveway.	No net effect anticipated

Table 8.1 - Summary of Potential Effects and Proposed Mitigation

Activity/Potential Effect	**Proposed Mitigation and Monitoring**	**Net Effect**
Environmentally Sensitive Area	The current mapping of the Black Creek at Acton ESA shows the boundary of this on the Acton WWTP property. Lands within the WWTP fence are mowed lawn and do not exhibit the characteristics of an ESA and the proposed WWTP expansion is not anticipated to result in a negative impact to sensitive environmental features or the wetland. As such, further discussion with appropriate agencies is proposed during the design phase to confirm the feature boundaries.	No net effect anticipated
Water quality in Black Creek	The plant expansion will be designed to meet effluent criteria set by MOE. During the design phase, the Region will develop a monitoring program in consultation with CVC and MOE for monitoring effluent objectives and limits, as well as water quality in Black Creek. The plant expansion will be designed to reduce the release of TP to the extent practical. If additional TP reductions are required in the future, other off-site controls for TP will be implemented. A final strategy for TP management could include: • Further optimization of the plant performance for TP removal. • Ongoing monitoring of TP levels in Black Creek and the WWTP effluent. • Implementation of other ways to reduce TP when necessary to achieve the targets agreed to by the Region, CVC and MOE.	Monitoring program will be implemented to determine if any net effect will occur
Species at risk	The footprint of the plant expansion will be contained within the existing manicured area and thus no impact to Species at Risk habitat is expected. The Region will continue to work with MOE and CVC to design and operate the expanded Acton WWTP so that it meets appropriate effluent quality criteria and minimize phosphorus loading to Black Creek, thus no impact on aquatic SAR is anticipated.	No net effect anticipated

Table 8.1 - Summary of Potential Effects and Proposed Mitigation

Activity/Potential Effect	**Proposed Mitigation and Monitoring**	**Net Effect**
Drainage and flooding	Work is currently underway to confirm the floodplain in the area of the Acton WWTP. The Region will work with CVC to incorporate the results of this work into the design of the Acton WWTP expansion.	No net effect anticipated
Erosion	A portion of the Acton WWTP property is located within the meander belt, however it was determined that the actual risk to the property was likely minimal. The Region will continue to work with CVC to ensure that mitigation measures selected will be satisfactory.	
Technical Considerations		
Integration with existing operations	The construction of new tanks and filters will not impact existing plant operation. Once new tanks are operational, the existing tanks can be taken out of service and re-fitted and upgraded to meet the technical requirements of the expanded plant.	No net effect anticipated

8.1 Potential Visual Impact

The Acton WWTP expansion will be within the existing manicured lawn on property owned by the Region and already associated with the treatment plant. The plant is set back from Churchill Road South where the closest neighbouring residences are located, thus minimizing the potential for visual impacts associated with construction or operation. No mitigation of visual impacts is necessary as neighbours already have a screened view of the plant.

8.2 Noise and Air Quality

Halton Region takes a very proactive approach when dealing with air emissions associated with the provision of wastewater treatment services. There are occasions when environmental conditions and/or operational issues may result in odour and/or noise being detected beyond the property line of the treatment plant. These events are typically brief and infrequent. Halton Region continues to direct efforts towards a better understanding and potential mitigation measures to manage the potential for emissions associated with the wastewater treatment process.

Between 2005 and 2007 Halton Region undertook a Region-Wide Odour Assessment project. The project's purpose was to create a Region-Wide Odour Management Strategy (OMS) for Halton's wastewater treatment plants to be used as a proactive tool to aid in responsible management of the Region's WWTPs. Halton recognizes that emissions from some of its treatment facilities have the potential of generating odours and odour complaints from the surrounding community and therefore Halton has undertaken the development of the Region-Wide OMS.

The scope of this project included: identification of the WWTP's odour sources and quantification of odour emission rates using field measurements, olfactometry evaluations and chemical analysis as well as modeling the impacts on surrounding neighbourhoods using these measured results. Appendix C of this report contains pages from the Region-Wide Odour Management Strategy report which are relevant to the Acton WWTP.

Results of the baseline modeling completed for Acton WWTP did not identify odour impacts to the surrounding community. Hydrogen sulphide modeling also predicted concentrations of less than 0.5 µg/m3 at the property line, which is well below the Ontario standard of 30 µg/m3. Based on the environmental management system used to record and follow up on potential issues, there have been no complaints received related to odour in the last eight years. In summary, the report recommended that no new remedial odour control measures were required for the Acton WWTP.

Although no odour control measures were recommended, Halton Region continues to take a proactive approach when dealing with air emission. Recent inlet works consisting of mechanical bar screens and vortex grit removal system were designed with an enclosed headworks building. Inside the headworks building, the vortex grit removal unit and the wastewater channels will also be covered with checkerplate further to minimize odour generation. Lastly, space has been set aside in the headworks building to permit future installation of an odour control system if necessary.

Halton Region is committed to maintaining the high level of managing odour and noise emissions for the expanded Acton WWTP. The Acton WWTP facility will undergo an emission and dispersion modeling exercise along with an acoustical assessment (noise and vibration) as part of the detailed design phase. Once the size and location of the new sources are confirmed with the detail design, emissions from the proposed expansion can be appropriately estimated. Noise and Air quality impact assessments will be completed to demonstrate compliance with applicable regulations established to mange facility air emissions including potential odourants, combustion by-products, and noise (i.e. Reg. 419/05 and NPC 205 and 232). Halton Region will develop and implement appropriate levels of control odour control plan for the proposed expanded facility.

8.3 Transportation and Truck Traffic

Construction-related traffic will need access to the site during the construction period. The amount of traffic is expected to be minimal. Access to the site will be from Churchill Road South. Construction traffic is not anticipated to cause disruption in the neighbourhood. Appropriate communication with neighbouring landowners/residences along Churchill Road South, immediately prior to and during construction, will promote awareness of construction timing and potential construction-related disruption such as traffic impacts. A phone number will be provided for landowners to lodge complaints and the Region will address any issues raised on a case-by-case basis.

8.4 Dust

During the construction of the plant expansion there is the potential for dust associated with construction activities and traffic accessing the site. Impacts from dust are expected to be limited and contained within the WWTP site.

Appropriate construction best management practices will be applied to minimize dust during construction including: minimizing the extent of exposed soils (covers on fill piles), washing of trucks; and use of dust suppressants (water) on roadways where appropriate.

8.5 Archaeological Resources

The Stage 1: Background Research and Windshield Survey of the site indicates varied archaeological potential for both Aboriginal and Euro-Canadian material. The conclusions of the Stage 1: Background Research are as follows:

- A Stage 2 Assessment should be conducted in all areas indicated as having high archaeological potential as presented on page 113.
- Monitoring is recommended for any construction activities on the hill containing the digesters and the area to the southwest of the control building. These areas are indicated in Figure 3.3 (page 22).
- No further archaeological work needs to be conducted for areas identified as being of low archaeological potential.
- The Stage 1 report was submitted to the Minister of Culture as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c0.18. The report is to be reviewed to ensure that the licensed consultant archaeologist has met the terms and conditions of their archaeological licence, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario.
- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with sec.48(1) of the *Ontario Heritage Act*.
- The *Cemeteries Act*. requires that any person discovering human remains must notify the police or coroner and the Registrar of cemeteries, Ministry of Small Business and Consumer Services (416-326-8406)

The construction of the Acton WWTP expansion is not expected to impact cultural heritage features.

8.6 Stormwater Management/Sediment Control

Excavation and stockpiling of soil material will be required for plant expansion construction. During the design phase, the Region will prepare a sediment control plan and an emergency/spills management plan. These plans will be reviewed with Credit Valley Conservation Authority. It is anticipated that the plans will include measures such as:

- Minimizing the size of soil stockpiles and the length of time they are exposed as well as locating them away from Black Creek to minimize the potential of runoff from the stockpiles entering the creek.
- Installation of silt fences and/or other means prior to construction to prevent deleterious substances including sediment from entering the creek. These measures will be installed prior to construction and will remain in place until soil stabilization is achieved.
- Treatment of sediment-laden water and runoff from the construction site using appropriate methods such as swales or biobags before it is permitted to enter Black Creek.
- Re-vegetation of disturbed areas immediately upon completion of construction to reduce the extent of erosion.
- Identification of a confined area for the refuelling and maintenance of equipment. This area will be removed from Black Creek, and containment and clean-up measures will be implemented in the event of an unexpected spill of fuel or other substances.

8.7 Groundwater/Dewatering During Construction

During the design phase, geotechnical and hydrogeological work will be undertaken to provide required information for the design of the plant expansion and to develop construction technical specifications. Effort will be made to design the expansion to minimize the extent of excavation required. It is anticipated that groundwater will be encountered during construction and a permit to take water will be needed. Construction methods will be selected to minimize the amount of water that needs to be managed during construction. For example, a temporary metal coffer dam may be installed during the construction of buildings and process tanks. This structure would consist of metal sheet piles which would be driven into the ground surrounding the excavation pit. The coffer dam would be designed to prevent water inflow from the surrounding soil, and would be expected to significantly reduce the need to continuously dewater excavation pits during construction. The duration and the allowable period for dewatering will be assessed during the design phase to minimize the impact of this activity on groundwater levels and on the creek.

A program to monitor potential impacts to water levels of Black Creek will be developed and implemented. The Region will review the monitoring program with CVC.

In addition, a proposed hydrological study will be completed during detailed to address the potential dewatering requirements due to proposed construction. The study will also include a domestic water well survey to determine which wells should be included in the well monitoring program. The well monitoring program will be developed during detailed design and will be implemented pre, during- and post construction. The monitoring program will consist of the collection of water samples for quality testing and recording water well static levels.

8.8 Loss of Vegetation

Direct impacts due to infrastructure construction are defined as those that cause an immediate effect on the wildlife community in and immediately adjacent to the development footprint. Typically, the adverse effects of direct impacts are most evident during the construction phase of the development, but may persist through the operational and maintenance phases. The Acton WWTP expansion will be constructed in areas that are already disturbed and currently maintained as manicured lawn thus avoiding direct impacts to natural features and habitats.

There are no anticipated adverse impacts on adjacent vegetation from the operation and maintenance of the proposed expansion and impacts to wildlife and their habitats have been reduced to the extent possible by avoiding intrusion into natural areas.

Disturbance to local wildlife habitat could occur during the construction period due to noise and the physical disruption associated with construction (i.e., equipment movement, earthworks, dust, etc.).

Indirect impacts are defined as those that do not manifest in the core development area associated with the project, but in the lands adjacent to the development. Indirect impacts can begin in the construction phase, however, they are typically most pronounced in the operational/maintenance phases of development. The magnitude of indirect impacts is difficult to predict because of variability in species tolerance to disturbance and/or changes in habitat quality. Indirect impacts to wildlife due to operation and maintenance of the plant expansion should be minimal, as the plant is currently operating and other than the increased footprint size within the existing fenceline, there will be little change when compared to the current situation.

Overall, potential impacts on the natural environment are anticipated to be minimal and can generally be mitigated by the implementation of reasonable mitigation measures:

- To prevent the possible sedimentation of adjacent lands, a detailed sediment control plan will be required. This effectiveness of this plan will be monitored during construction, and modified as necessary.
- Staging areas and soil stockpiles will be located to avoid natural areas.
- Dust and noise control measures will be implemented to reduce negative short-term impacts during construction.
- Areas that are disturbed during construction will be stabilized by seeding and/or planting.
- Tree hoarding and fencing should be provided to protect against damage to trees and other sensitive vegetation close to the construction zone.
- Access will be limited to the existing plant driveway to prevent disturbing more vegetation than is necessary.
- The replanting plan should include opportunities to re-naturalize areas around the plant expansion where possible.

8.9 Environmentally Sensitive Area

The current mapping of the Black Creek at Acton ESA shows the boundary of this feature on the Acton WWTP property. Lands within the WWTP fence are mowed lawn and do not exhibit the characteristics of an ESA and the proposed WWTP expansion is not anticipated to result in a negative impact to sensitive environmental features. As such, further discussion with appropriate agencies is proposed during the design phase to confirm the feature boundary.

8.10 Water Quality in Black Creek

Black Creek is a cold-water fishery tributary to the Credit River. To determine the potential for impacts to the creek as a result of expansion to the Acton WWTP, an assimilative capacity study was completed by the Region with review and input from Credit Valley Conservation. The study included a desk top analysis, field work and a spawning redd survey. The following sections document the potential effects and proposed mitigation measures identified through this work. The complete Assimilative Capacity Study Report can be found in ***Appendix A***.

8.10.1 Low Flow Conditions

A significant portion of the Black Creek flow is provided by the Acton WWTP and the Acton Quarry located downstream of the WWTP. Concern has been expressed from Credit Valley Conservation that the continued flow from Acton Quarry is uncertain and could be discontinued. The assimilative capacity study calculations were based on the potential for impact to Black Creek at the point of WWTP discharge and are not affected by downstream dilution afforded by the flow to Black Creek from the Acton Quarry. The analysis shows that the worst impacts are at the point of discharge, with the quality improving downstream with assimilation and dilution. No problems were noted downstream of monitoring Station B3, which is above the point where water is pumped from the Acton Quarry. As such, no problems are anticipated with reduced flow from the quarry. The flow gauge at station B3 will continue to operate to provide advanced warning of reduced flow conditions.

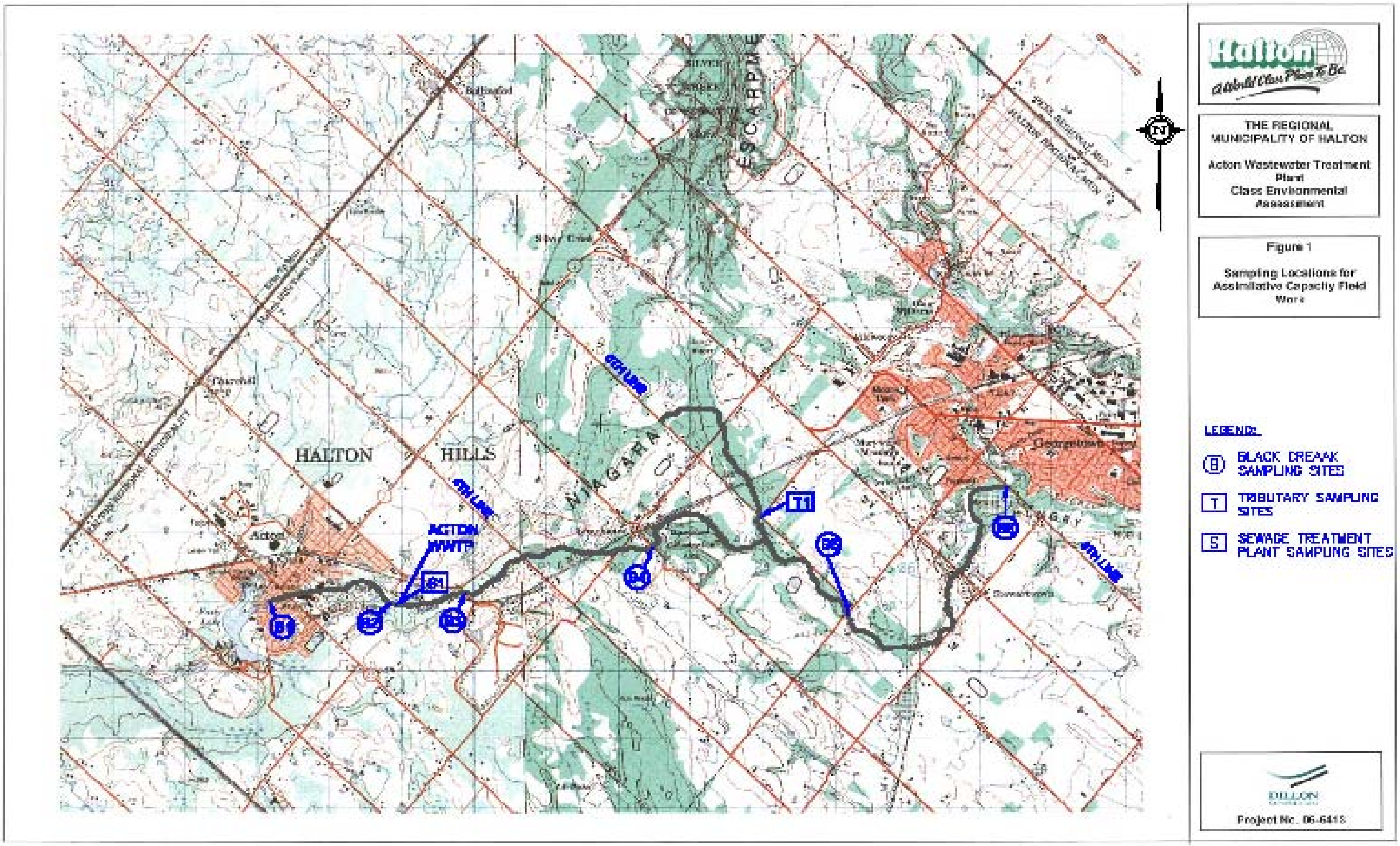
Monitoring stations for the assimilative capacity field study are shown in **Figure 8.1.**

8.10.2 Water Temperature

Water sampling upstream and downstream of the treatment plant indicates that the Acton WWTP effluent may not be causing an increase in the temperature of Black Creek. As noted below, continuous monitoring (likely at station B3) for temperature and dissolved oxygen is recommended.

8.10.3 Peak Flow Management

To minimize by-pass events and provide buffering capacity in the event of high flows the Region proposes to construct the system for an increased peak flow capacity. Refer to Section 5.1.1 for more details.


HALTON
HILLS
NIAGARA
ESCARPMENT
Acton
Georgetown
Silver Creek
ACTON WWTP
6TH LINE
4TH LINE
B1
B2
B3
B4
B5
B6
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THE REGIONAL MUNICIPALITY OF HALTON
Acton Wastewater Treatment Plant
Class Environmental Assessment
Figure 1
Sampling Locations for Assimilative Capacity Field Work
LEGEND:
B BLACK CREAAK SAMPLING SITES
T TRIBUTARY SAMPLING SITES
S SEWAGE TREATMENT PLANT SAMPLING SITES
DILLON
Project No. 06-6413

8.10.4 Water Chemistry

Background water quality for Black Creek shows evidence of elevated phosphorus, nitrate and *E.Coli* in excess of the provincial water quality and/or Canadian water quality standards. It will be important that the expansion of the Acton WWTP effluent meets appropriate water quality standards and does not result in increased loadings to the creek.

Based on the analysis of the assimilative capacity of Black Creek, the effluent objectives and limits proposed for the expansion of the Acton WWTP are shown in ***Table 8.2.***

Table 8.2 - Proposed Effluent Objectives and Limits

Parameter	**Effluent Objective**	**Effluent Limit**
BOD$_5$	2 mg/L	5 mg/L
TSS	3 mg/L	5 mg/L
Total Phosphorus *		
Phase 1 (5,600 m^3/d)	0.1 mg/L (204 kg/yr)	0.2 mg/L (409 kg/yr)
Phase 2 (7,000 m^3/d)	0.1 mg/L (255 kg.yr)	0.2 mg/L (511 kg/yr)
(Ammonia + Ammonium) Nitrogen**		
Non-freezing period (May 1 – Nov 31):	0.5 mg/L as N	2.0 mg/L as N
Freezing period (Dec 1 – April 30):	1.0 mg/L as N	4.0 mg/L as N
Escherichia Coli (monthly geometric mean density)	100 organisms/100mL	150 organisms/100mL

* It is understood that the total phosphorus loading objective to the receiver will be maintained at its current loading of 156kg/yr. Refer to section 8.10.4.3 for a description of the approach to total phosphorus management.

** The corresponding un-ionized ammonia values (based on effluent pH and temperature) are as follows:

- ammonia objective always meets the PWQO for unionized ammonia of 0.016 mg/L (or 0.02 mg/L as NH_3)
- ammonia limit always meets the acute target value for un-ionized ammonia of 0.08 mg/L as N (or the current single sample compliance limit of 0.1 mg/L as unionized NH_3).

During the design phase, the Region will work with CVC and MOE to develop an appropriate program for monitoring the effluent objectives and limits. The monitoring program will incorporate Acton WWTP effluent monitoring as well as monitoring of Black Creek both upstream and downstream of the plant. It is anticipated that the following could be incorporated into the monitoring program:

- Quarterly monitoring of Acton WWTP effluent quality to establish background levels of metals.
- Quarterly monitoring of Acton WWTP effluent toxicity to indicate acute toxicity.
- Addition of chlorides to the routine monitoring program.
- Continuous monitoring of Black Creek water quality downstream of Acton WWTP for in-stream dissolved oxygen, temperature, and conductivity.
- Monitoring of nitrate concentration in the effluent, as well as upstream and downstream of the Acton WWTP outfall.
- Annual monitoring of Black Creek for in-stream macroinvertebrates and fisheries.
- Investigation of Black Creek background water quality upstream of the Acton WWTP outfall. The marshy area between Fairy Lake and the Acton WWTP will be considered to determine if a natural source can explain the high levels of nitrogen compounds and the low dissolved oxygen observed immediately upstream of the Acton WWTP outfall. The impact of beaver activity on these parameters should also be considered, along with the potential impact of man-induced sources produced from the surrounding urban area.

8.10.4.1 Dissolved Oxygen

The dissolved oxygen content in the creek downstream of the WWTP is generally above the Provincial Water Quality Objectives. During the design phase, the Region will monitor the current Acton WWTP effluent DO concentration to assess the need for aeration of the effluent for the expansion. The need for mechanical mixing and/or aeration of the effluent would be incorporated into the design, if required. The current effluent objective and limit for BOD will be maintained for the expanded WWTP.

8.10.4.2 Total Suspended Solids

The current effluent objective and limit for TSS will be maintained for the expanded WWTP. No effect on TSS is anticipated and mitigation is not required.

8.10.4.3 Phosphorus

Black Creek is considered a “Policy 2” receiver with respect to total phosphorus (TP) since the background water quality in Black Creek exceeds the Provincial Water Quality Objective (PWQO) for TP of 0.030mg/L. Policy 2 of the MOE’s Water Management Policies Guidelines, and Provincial Water Quality Objectives state:

> "Water quality which presently does not meet the PWQOs shall not be further degraded and all practical measures shall be undertaken to upgrade the water quality to the objectives… Where new or expanded discharges are proposed, no further degradation will be permitted and all practical measures shall be undertaken to upgrade water quality." (MOE, 1994)

The plant will be designed to meet effluent criteria set by MOE. The current measured loading of phosphorus (approx. 156 kg/yr) to the Black Creek will also be maintained. The Region is working to develop a comprehensive TP management program. A final strategy for TP management could include:

- Further optimization of the plant performance for TP removal.
- Ongoing monitoring of TP levels in Black Creek and the Acton WWTP effluent.
- Implementation of other ways to reduce TP when necessary to achieve the targets agreed to by the Region, CVC and MOE. The Region will continue to work with CVC and MOE to confirm appropriate offsets and the point at which these offsets need to be brought on line to manage the overall TP loading to Black Creek.

8.10.4.4 Ammonia

The current effluent objective and limit for ammonia will be maintained for the expanded WWTP. No effect on ammonia is anticipated and mitigation is not required.

8.10.4.5 Nitrites and Nitrates

The current concentration of nitrite in the Acton WWTP effluent is not significantly different from the other monitoring stations in Black Creek, and is, therefore, not the likely source of elevated nitrite. Although an effluent nitrite or nitrate concentration is not proposed for the expansion of the Acton WWTP, a denitrification treatment process may be provided to reduce or at least maintain the current loading of nitrate-nitrogen to the receiver.

8.10.4.6 E. coli

The current effluent objective and limit for *E. coli* will be maintained for the expanded WWTP. No effect on *E. coli* is anticipated and mitigation is not required.

8.10.4.7 Chloride

Concerns about high levels of chloride in the Acton WWTP effluent have been raised. To mitigate this, the Halton Region and the Town of Halton Hills will require new developments to install high efficiency water softeners. In addition, existing water softener users will be encouraged through incentives to replace their current models with more efficient ones.

8.11 Species At Risk

The Acton WWTP expansion is not expected to cause harm to the SAR listed by MNR or their habitat as a result of the construction of new facilities. The expansion plans are limited to the existing WWTP property boundaries where no SAR habitat exists.

Further, the Acton WWTP expansion does not anticipate causing harm to the aquatic SAR listed by MNR or their habitat as a result of the proposed Action WWTP expansion. There are historical records of Redside dace in Black Creek downstream of 5th Line, several kilometers downstream of the Acton WWTP. However, the presence of Redside dace has not been confirmed within the immediate WWTP reach of Black Creek. There are several barriers to fish passage between the WWTP and 5th Line that have been described in the Spawning Redd Survey prepared by Dillon as Part I in the Black Creek Assimilative Study (2011); most notably, the perched culvert at the rail crossing directly upstream of 3rd Line. The presence of Snapping turtles has also not been confirmed by MNR records within the immediate WWTP reach or the wetlands of Black Creek.

The potential for impact on the aquatic SAR and their habitat relates to the discharge from the expanded Acton WWTP. Discussions with CVC and MOE related to the sensitivities of Black Creek and the effluent from an expanded Acton WWTP have been ongoing. The assimilative capacity study for Black Creek was completed to provide information to better determine appropriate effluent quality parameters for the treatment plant. Based on this study the Region has established appropriate effluent quality criteria in concert with MOE and CVC. The Region has also initiated a Total Phosphorus Offset Study to identify other sources of phosphorus in Acton that could be controlled to minimize phosphorous loading to Black Creek.

8.12 Drainage and Flooding

The Acton WWTP is located within the currently delineated floodplain for Black Creek. It is understood that the flood forecasting model has been recently updated and that the Acton WWTP is no longer located within the floodplain. However, a new floodplain delineation is still to be adopted by CVC. During the design phase, the Region will work with CVC to confirm the floodplain and prepare a design that minimizes potential impact on natural hazard areas. We have identified some preliminary engineering solutions to facilitate plant operation at the proposed site such as selecting the top of tank elevation and floor elevation of buildings to be above the flood line to prevent flooding of tanks and buildings. In addition, an effluent pump station could also be proposed to maintain discharge at high water level in Black Creek, when normal gravity discharge may not be possible. The Region will continue to work with CVC to confirm the floodplain at this site and prepare a design that minimizes potential flood effects.

8.13 Erosion

A Geomorphic and Erosion Hazard Limit Assessment was undertaken in support of the proposed plant expansion. A portion of the Acton WWTP property was identified as being within the meander belt width, however, a sensitivity analysis based on the desktop evaluation determined that actual risk to the property was likely minimal.

A field investigation to confirm findings of the desktop assessment was also completed. During the site visit Rapid Geomorphic Assessment and Rapid Stream Assessment Technique was completed.

8.14 Integration with Existing Operations

Construction of the plant expansion must be completed without impacting the ability of the current plant processes to treat wastewater. The proposed plant expansion is removed from the existing treatment plant, thereby the construction of new tanks and filters will not impact existing plant operation. Once new tanks are operational, the existing tanks can be taken out of service and re-fitted and upgraded to meet the technical requirements of the expanded plant.

9.0 FUTURE APPROVAL REQUIREMENTS

9.1 Municipal Approvals

Site plan approval and a building permit from the Town of Halton Hills will be required.

9.2 Credit Valley Conservation Approvals

As noted, the final location of buildings and the determination of the floodplain will be confirmed during the design phase. CVC approval will be required for any and all works proposed within lands regulated pursuant to Ontario Regulation 160/06 (Credit Valley Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses). Halton Region will work with CVC during the design phase to fulfill their requirements.

9.3 Ministry of the Environment Approvals

Prior to construction, a Certificate of Approval under Section 53 of the Ontario Water Resources Act (OWRA) is required from the Ministry of Environment. Under the Transfer of Review Program, the Halton Region is a designated municipality authorized to review the application and supporting documentation on behalf of MOE. Halton then submits their recommendations to MOE for final approval. The local MOE District Office will also review the application and supporting documentation.

Water takings in Ontario are governed by the OWRA and the Water Taking Regulation (O.Reg. 387/04). A Permit to Take Water (PTTW) is required for construction dewatering, for water volumes greater than 50,000 litres per day. Based on the current regulation, a Category 2 application requiring a technical review of the proposed water taking by a qualified person will be needed for the PTTW. Further information and specific details will be determined during the design phase.

A Certificate of Approval (Air and Noise) will be required under Section 9 of the Environmental Protection Act. During detailed design phase, Noise and Air Quality impact assessments will be completed to demonstrate compliance with applicable regulations established to manage facility air emissions including potential odourants, combustion by-products, and noise (i.e. O.Reg. 419/05 and NPC 205 and 232).

9.4 Ministry of Culture Clearance

Prior to construction, a Stage 2 Archaeological Assessment will be completed for the areas identified as having high archaeological potential. Clearance from the Ministry of Culture will be sought based on the completion of the Stage 1 and Stage 2 Archaeological Assessments. Should the Stage 2 Archaeological assessment identify something of archaeological significance, a Stage 3 Assessment will need to be undertaken and clearance will not be granted until satisfactory completion of the Stage 3 work.

9.5 Ministry of Natural Resources Species at Risk

Based on the work completed to date, no impact on SAR or their habitat is anticipated. Should discussions with MOE, CVC or MNR during the design phase reveal otherwise, a permit will be required.

9.6 Utilities

Detailed plans and specifications will be submitted to Halton Hills Hydro and other utilities for review and approval.

10.0 REFERENCES

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