MILTON

Engineering and Parks Standards Manual

Part 4

2024 - September

Grading and Stormwater Management

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4.0 Table of Contents

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4.1 Introduction

4.1.1 Background

In a natural (un-developed) environment, stormwater infiltrates into the ground through pervious surfaces, such as grass. In urbanized (developed) areas, stormwater falls onto impermeable surfaces such as roads, driveways, and sidewalks and continues to flow overland without infiltrating. This decrease in infiltration results in an increase in the volume and rate of surface runoff. Without the proper implementation of stormwater management (SWM) practices, this decrease in infiltration, among other factors, may result in changes to the natural hydrologic cycle.

SWM practices are developed to maintain the health of the natural environment (streams, lakes, and aquatic life) and protect humans from risks of flooding due to the hydrologic impacts often associated with the increase in imperviousness resulting from urban development. Ultimately, SWM practices are used to maintain the natural hydrologic cycle, prevent an increased risk of flooding, prevent undesirable stream erosion, and protect water quality.

4.1.2 Document Purpose

Part 4 is intended to be used by proponents to aid in the planning, design, construction, maintenance and assumption of SWM infrastructure within the Town of Milton. The guidelines outlined in Part 4 align with Legislation, Provincial Policies, the Town's Official Plan and current SWM best practices.

Although SWM planning and design is influenced by the mandate of various Ministries and public agencies, the Town plays a central role in integrating the objectives of each policy into new development and associated SWM works, as well as, bearing ultimate responsibility for operation, ownership and maintenance of public SWM infrastructure. The Town's primary objectives must include ensuring public safety, the economic sustainability and functional effectiveness of SWM works within the Town.

The key objective of Part 4 is to guide practitioners in the design of SWM infrastructure within the Town of Milton, including a focus on:

- Complementary Federal and Provincial policies and legislation
- Town's policy, criteria and role in implementation of the foregoing policies
- Application of SWM techniques or practices unique to the Town

4.1.3 The Town's Drainage System

The Town of Milton falls under the jurisdictions of three Conservation Authorities, Grand River Conservation Authority (GRCA), Conservation Halton (CH), and Credit Valley Conservation (CVC). The watersheds that make up the Town's drainage system are illustrated on Figure 4.1.

Infrastructure located within or near a regulated area may require a permit or additional land considerations such as an environmental buffer. Proponents must engage in consultation with the respective Conservation Authority to determine any additional requirements prior to construction.

The Town is also located within a portion of the Niagara Escarpment, which is regulated under the Niagara Escarpment Planning and Development Act. Under the circumstance that development is occurring within an area regulated by the Niagara Escarpment Plan (NEP), a development permit may be required and the proponent is to obtain this permit through consultation with the Niagara Escarpment Commission (NEC).

4.1.4 Quantity and Quality Control Techniques

The Town, as well as current SWM best practices, advocate for the evaluation of suitable SWM controls on a hierarchical basis, whereby more pro-active techniques are considered first. The following techniques are grouped under the headings below in order of preferred application:

- Lot level techniques, source controls and alternative development standards
- Transport or conveyance controls
- End-of-pipe management techniques

The philosophy behind this hierarchy is that SWM techniques are usually more effective at mimicking the natural hydrologic cycle when applied at the source. The Town, consistent with current SWM best practices, requires proponents to apply a treatment train approach. The treatment train approach is when a series of practices are designed to meet SWM objectives. The treatment train approach combines lot-level, conveyance, and end-of-pipe controls to meet multiple objectives (e.g., water quality and quantity objectives). For instance, implementing lot level techniques upstream of an end-of-pipe management technique may comprise a treatment train.

Low Impact Development Facilities (LIDs), also commonly referred to as Green Infrastructure (GI), are the Town's preferred SWM technique, and are to be implemented as part of all SWM designs, unless determined not feasible or cost prohibitive through consultation with the Town. When LIDs are not included in a design, the proponent must provide the Town rationale as to why they are not included. The Town **does not** consider low percolation rate as a constraint that prevents the implementation of LIDs.

Table 4.1 constitutes a comprehensive list of currently available techniques associated with each of the foregoing categories. It is recognized that SWM remains an emerging science, hence this list may be updated over time. It will be the responsibility of the proponent to demonstrate that any technique, not currently approved by the Town, will address the intended function within expected maintenance and cost parameters, to the satisfaction of the Town. The Town currently endorses the Provincial Standards for SWM systems unless otherwise noted herein.

Table 4.1 Stormwater Management Techniques

Technique	Endorsement	Required Investigations and Documentation
Source Controls		
Reduced Lot Grades	Not currently endorsed	-
Roof Leader discharge to surface	Encouraged	Erosion Prevention, Address Winter Icing Concerns
Roof Leader and Sump Pump discharge to Soak Away Pits	Will be considered	Geotechnical Investigation, On-Site Soil Investigation
Rear Yard Ponding	Not currently endorsed	-
Rooftop Storage	Will be considered	SWM Report
Parking Lot Storage	Will be considered	SWM Report
Permeable Pavement	Encouraged where applicable	SWM Report, Operations & Maintenance Manual
Conveyance Controls		
Perforated Pipe Systems	Encouraged where applicable	SWM Report, Operations & Maintenance Manual, Geotechnical Investigation
Perforated Catchbasins	Not currently endorsed	-
Enhanced Grassed Swales	Encouraged where applicable	SWM Report, Operations & Maintenance Manual
Oversized Pipes (Superpipes)	Only appropriate in Redevelopment of existing urban areas	Demonstration that this is the only feasible technique
End-of-Pipe Facilities		
Wetlands	Applicable for water quality and quantity treatment	SWM Report, Operations & Maintenance Manual

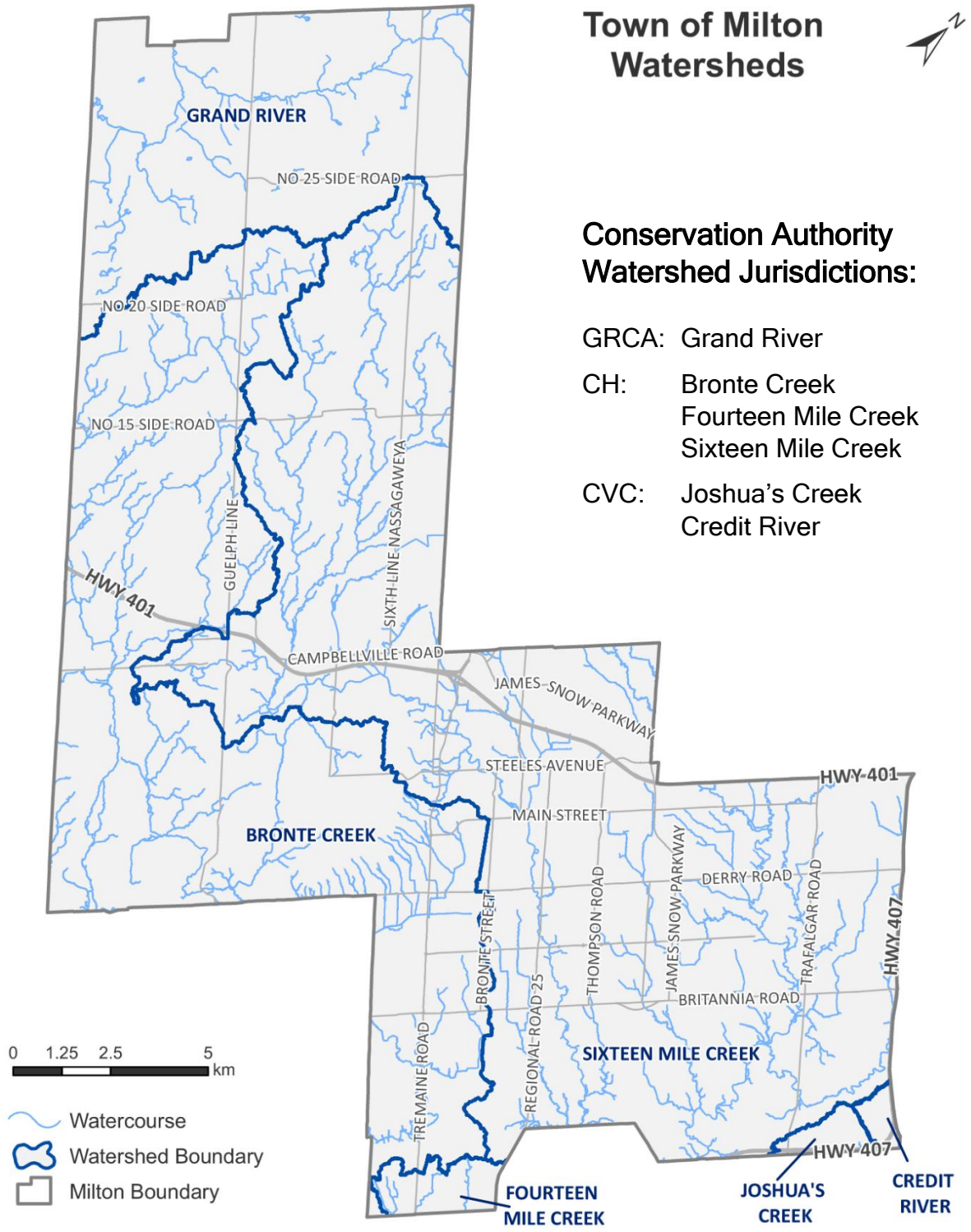
Hybrid (Wetland/Wet Pond)	Applicable for water quality and quantity treatment	SWM Report, Operations & Maintenance Manual
Wet Ponds	Applicable for water quality and quantity treatment	SWM Report, Operations & Maintenance Manual
Dry Ponds	Only applicable for water quantity control (unless used as part of a treatment train)	SWM Report, Operations & Maintenance Manual
Infiltration Facilities	Encouraged where applicable	Geotechnical Investigation, On-Site Soil Investigation, SWM Report, Operations & Maintenance Manual
Filter Strips	Will be considered as part of a Treatment Train	SWM Brief, Operations & Maintenance Manual (may be included in overall SWM Report)
Buffer Strips	Will be considered as part of a Treatment Train	SWM Brief, Operations & Maintenance Manual (may be included in overall SWM Report)
Sand Filters	Not currently endorsed	-
Oil/Grit Separators (or equivalent technology)	Applicable; Most appropriate for commercial/industrial land use	Technology software sizing output, SWM Brief, Operations & Maintenance Manual (may be included in overall SWM Report)

Notes for Table 4.1:

i. The use of any of the forgoing techniques is subject to approval by the Town.

ii. The Town requires standard signage at all SWM Facilities. Refer to TMSDs 16-07.01 and 16-07.02.

Figure 4.1 Town of Milton Watersheds



Prepared by: GIS Services - IT Division - Corporate Services Department, Town of Milton, Ontario, 2023
Watershed Boundary: Grand River Conservation Authority 2023, Credit Valley Conservation 2023, Conservation Halton 2023
This map has been produced from a variety of sources. The Town of Milton does not make any representations concerning the accuracy, likely results, or reliability of the use of the materials. The Town hereby disclaims all representations and warranties.

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4.2 Legislative Framework

The Town, Region, and Province, as well as Conservation Authorities, have published various legislation, regulations, studies, and guidance to support the planning and design of SWM practices. The following list is a summary of the currently available documents, but is not meant to be an exhaustive list. It is the responsibility of the proponent to review the applicable documents, and to consult the Town and applicable agencies to ensure that the most relevant information is reviewed.

There is a wide range of legislation that may apply to the planning, design, construction and operation of stormwater works. While the Town has made an attempt at referencing all relevant information in this document, the design practitioner is advised that this document may not be complete and should determine for themselves the applicable statues, regulations, guidelines and procedures for the proposed stormwater works and ensure familiarity with the treatment, design and approvals requirements.

4.2.1 Town of Milton

- Town of Milton Official Plan
- Secondary Plans
- Tertiary Plans
- Subwatershed Studies
- Functional Stormwater and Environmental Management Strategy (FSEMS)
- Master Environmental Servicing Studies (MESP)
- Subwatershed Impact Studies (SIS)/Development Area Environmental and Functional Servicing Study (DAEFSS)
- Municipal Environmental Assessments (MEA)
- Town of Milton Municipal SWM Infrastructure By-Law No. 095-2022

4.2.2 Halton Region

- Halton Region Official Plan
- The Regional Municipality of Halton Sewer Use By-Law No. 02-03
- Halton-Hamilton Source Protection Plan
- Hydrogeological Studies & Best Management Practices for Groundwater Protection Guidelines
- Halton Region's Engineering Design Guides & Manuals

4.2.3 Conservation Authorities

- Conservation Halton Guidelines for Stormwater Management Engineering Submissions (February, 2024)
- Conservation Halton Guidelines for Slope Stability Assessments for Valleys

(February 2024)
- Low Impact Development Stormwater Management Planning and Design Guide (STEP)

4.2.4 Provincial

- Ontario Water Resources Act (1990 and as amended)
- Conservation Authorities Act (1990 and as amended)
- Environmental Assessment Act (1990 and as amended)
- Ontario Environmental Protection Act (1990 and as amended)
- Water Management: Policies, Guidelines, Provincial Water Quality Objectives (1994)
- Planning Act (1996)
- Municipal Act (2001)
- Ministry of Transportation (MTO) Drainage Management Manual (1997)
- Technical Guide, River & Stream Systems: Flooding Hazard Limit (MNR, 2002)
- Stormwater Management Planning and Design Manual (MOE, 2003)
- Greenbelt Act/Greenbelt Plan (2005 as amended)
- Clean Water Act (2006 and as amended)
- Endangered Species Act (2007 and as amended)
- Highway Drainage Design Standards (MTO, 2008)
- Water Opportunities Act (2010)
- Interpretation Bulletin, Ontario Ministry of Environment and Climate Change, Expectations re: Stormwater Management (MOECC, 2015)
- Guidance for Development Activities in Redside Dace Protected Habitat (2016)
- Ontario Regulation 41/24 Prohibited Activities, Exemptions, and Permits
- Ontario Regulation 162/06 Halton Region Conservation Authority: Regulation of Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses (2013 and as amended)
- Ontario Regulation 406/19 On-Site and Excess Soil Management (2019 and as amended)
- Provincial Policy Statement (2020 and as amended)
- DRAFT Low Impact Development SWM Guidance Manual (2022)
- DRAFT Subwatershed Planning Guide (2022)
- Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under an Environmental Compliance Approval, MECP (May 31, 2023)
- Design Guidelines for Sewage Works, MECP (2019 and as amended)

4.2.5 Federal

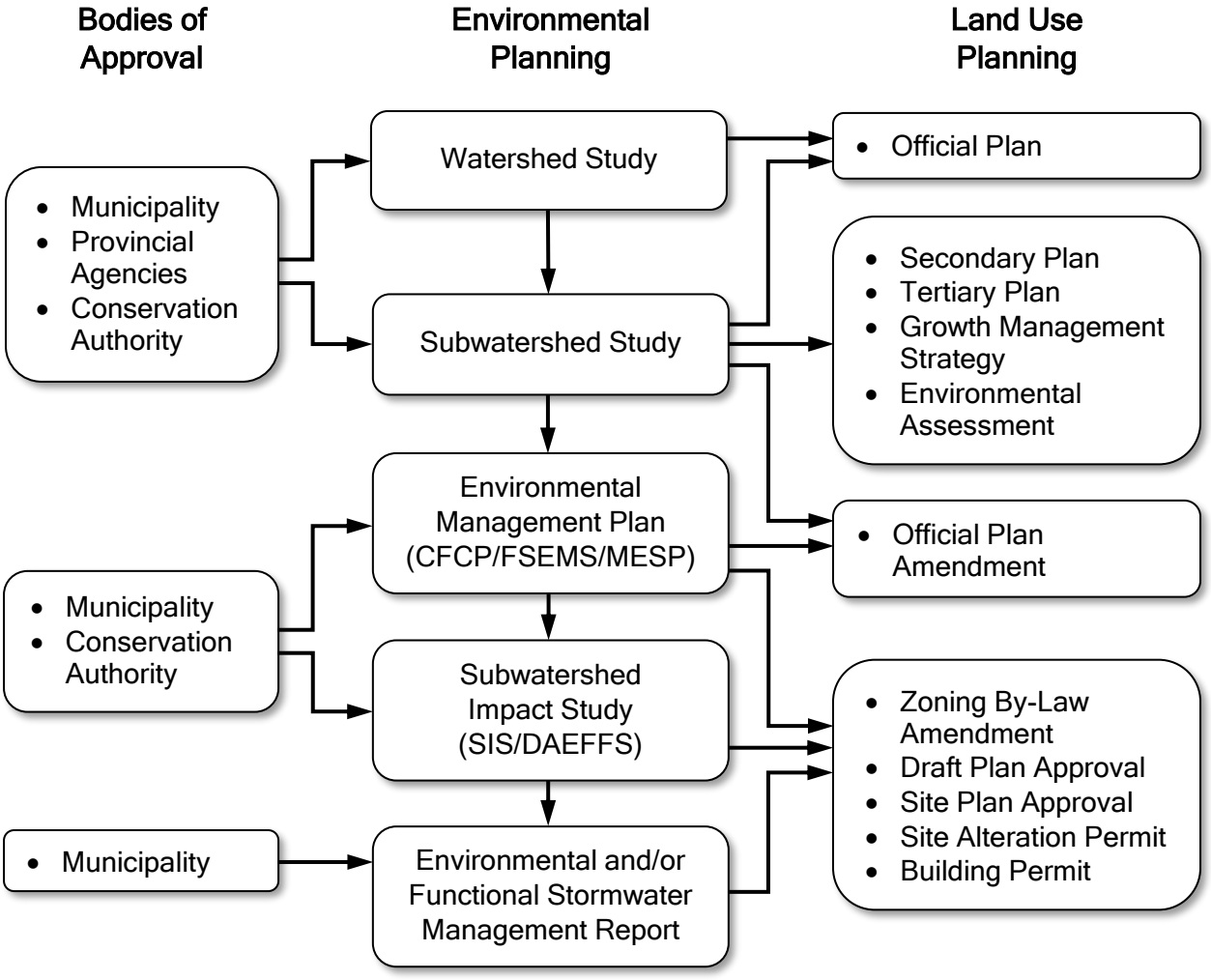
- Fisheries Act (1985 and as amended)
- Species at Risk Act (2002 and as amended)
- Canadian Environmental Protection Act (1999 and as amended)

4.3 Stormwater and Environmental Management Studies

Any change in land use will affect the hydrologic cycle. Regardless of the status of land use planning, any proposed change in land use will need to be accompanied by stormwater and environmental management studies.

Typically, SWM planning and design occurs through a multi-phase process which is completed concurrently with the land use planning process. Figure 4.2 outlines the Integrated Watershed Management and Land Use Planning process.

Figure 4.2 Integrated Watershed Management and Land Use Planning Process



Note: Figure 4.2 has been adapted from the SWM Planning and Design Manual (MOE, 2003).

In some instances, where there are a limited number of landowners and drainage areas are discrete, there may be an opportunity to combine the Subwatershed Impact Study (SIS) with the Functional Stormwater Management Plan. Prior to initiating such a process, the proponent is required to review site specific details with the Town and Conservation Authorities as required.

4.3.1 Guidance Documentation

4.3.1.1 Watershed and Subwatershed Plans

The Town supports the implementation of Watershed and Subwatershed Planning Studies in concert with the land use planning process. Watershed and Subwatershed planning plays an important role in the development of Official Plan Land Use Designations and Secondary Planning.

The determination as to whether a Watershed or Subwatershed Planning Study is necessary for Official Plan Amendments, Secondary Plans or individual developments will be determined in consultation between the Town, the Owner(s), Conservation Authorities and other Ministries or public agencies having jurisdiction.

Rationale and justification to undertake Watershed or Subwatershed Planning Studies must include consideration of:

- Type and extent of the proposed land use changes
- Area of land use change with respect to the total watershed/subwatershed area
- Physical sensitivity/significance of the receiving watercourse
- Existing downstream conditions and land use (e.g., flood and erosion hazards, water usage, etc.)
- Location and characteristics of the development area with respect to the potential to provide integrated servicing and SWM which would minimize long term maintenance and operation cost incurred to the Town

It is important to recognize that each Watershed or Subwatershed Plan will have widely varying goals and objectives specific to the issues within each area. For these reasons, the study objectives, organization, and funding arrangements will differ for each study.

The Town of Milton has had Watershed and Subwatershed plans developed for both the Sixteen Mile Creek Watershed and Indian Creek Subwatershed. The Town's Watershed Plans prescribe general policies related to watershed functions, as well as specific goals and targets for its various subwatersheds.

The Town's Subwatershed Plans provide specific recommendations on topics related to stormwater and environmental management including flooding, erosion, water quality, terrestrial features, aquatic habitat, groundwater, and valley slopes. The following list provides the Watershed and Subwatershed Studies that have been completed by the

Town:

- Sixteen Mile Creek Watershed Plan (Gore and Storrie, 1996)
- Sixteen Mile Creek Subwatershed Planning Study – Areas 2&7 (Phillips Engineering, 2000)
- Indian Creek/Sixteen Mile Creek, Sherwood Survey, Subwatershed Management Study (Phillips Engineering, 2004)
- Sixteen Mile Creek, Area 2&7 Subwatershed Update Study (AMEC, 2015)
- South Milton Subwatershed Study (AMEC, August 31, 2021, revised February 28, 2023)

4.3.1.2 Environmental Management Plans

- Conceptual Fisheries Compensation Plan (CFCP)
- Functional Stormwater and Environmental Management Strategy (FSEMS)
- Master Environmental Servicing Plan (MESP)

4.3.1.3 Subwatershed Impact Studies (SIS)/Development Area Environmental and Functional Servicing Study (DAEFSS)

This intermediate level of study is required in areas where multiple land ownership within the subwatershed occurs. This level of study focuses on integrating servicing and SWM of adjacent development to a greater level of detail than is normally achieved through the Subwatershed Plan.

The objectives of this level of study include, but are not limited to, the following:

- Preferred servicing plan
- Road layout
- Preliminary grading information
- Integration of SWM facilities
- Opportunities to integrate passive recreation opportunities with SWM (e.g., trails)
- Natural Environment Impact Analysis
- Local Monitoring Plans and Management Recommendations
- Phasing and cost sharing in areas of multiple ownership

As outlined in Figure 4.2, Subwatershed Impact Studies inform Zoning By-Law Amendments and Draft Plan of Subdivision applications. Detailed Terms of Reference can be provided to applicants upon request. Areas of single land ownership may be required to complete a scoped SIS through consultation with the Town.

4.3.1.4 Stormwater Management Plans

Stormwater Management Plans are prepared in support of individual development applications. The Stormwater Management Plans complement the land use planning

process associated with Official Plan Amendment, Draft Plans of Subdivision, Site Plans, Zoning By-Law Amendments, Consents, and associated permits such as Site Alteration permits, Building permits, and Environmental Compliance Approvals. SWM reports associated with the planning stage would be the 'Functional Design.' Subsequently, in support of final/construction a 'Detailed Design' is required.

a. Functional Design:

   This level of design typically involves demonstrating the feasibility of providing SWM for a particular development. In areas where no Subwatershed Plan has been completed, the Stormwater Management Plan will be required to address additional issues such as environmental baseline conditions and screening of various SWM strategies and techniques. Functional stormwater designs are typically required for the applications noted below;

   - Official Plan Amendment
   - Draft Plan of Subdivision
   - Zoning By-Law Amendment
   - Consent to Sever

b. Detailed Design:

   The detailed design submission shall demonstrate how the required information, outlined in Functional Design Report (if applicable), has been integrated as well as addressing details related to minor/major system design, landscaping, safety and maintenance aspects of facility design, and monitoring requirements. Detailed stormwater designs are required prior to construction associated with the following;

   - Subdivision Registration
   - Site Plan Approval
   - Building Permit
   - Site Alteration Permit
   - MECP Environmental Compliance Approval & Stormwater Permit (Stormwater Management (SWM) By-Law 095-2022)

Refer to Part 5 (Parks and Open Space) for further information related to landscape requirements including planting, trails, and signage.

When a Draft Plan of Subdivision is being prepared for a portion of a community, the Licensed Professional Engineer will be required to prepare the Functional Stormwater Management Report. Based on the proposed street and lot layouts, the Engineer will be able to define the extent and directions of the major and minor system flows and how the facilities will meet the constraints and requirements of the Subwatershed Plan and Subwatershed Impact Study (SIS). Additionally, the requirements for erosion and sediment control should be conceptually investigated.

Detailed Design SWM Reports are more detailed documents that are submitted to the

Town and Conservation Authority before construction of stormwater works. They contain detailed design for flow conveyance and stormwater facilities, drainage systems, sediment controls, and re-vegetation.

Only when detailed design drawings (with lot grades, street grades, and preliminary storm sewer and catchbasin designs) become available, is it possible to prepare the Detailed Design SWM Report. The details from this report are then incorporated into the detailed design drawings. The Functional SWM Report should document how the works will meet or exceed the applicable requirements of the Watershed, Subwatershed and Environmental Management Studies and should detail the erosion and sediment control measures.

The information for both the Functional Design and Detailed Design should be organized as a report including text, plans, tables, figures and appendices. Minimum requirements associated with the reports include the following:

a. Text:

i. Introduction

- Description of site location and plan purpose

ii. Criteria, Policy, and Guidelines

- Outlines of specific and applicable criteria, policy and guidelines for the management of flooding, erosion, base flow, watercourses, stormwater quality, terrestrial and aquatic features related to Subwatershed and Watershed Plan.
- Any other unique requirements resulting from Town and/or Agency consultation.

iii. Hydrology

- Details on the methodology adopted to generate design flows for the estimation of post-development impacts associated with site development, including flooding, erosion, and where appropriate, base flow.

iv. Hydraulics

- Depending on the proposed means of flow conveyance within the site development, the methodology of calculating both minor (5-year) and major (100-year or regional) flows through the site to a safe and satisfactory outlet should be detailed.

v. Stormwater Management

- This section is to outline various alternatives for the management of both the quality and quantity of runoff.

- An evaluation of alternatives including impacts on Municipal operations and maintenance should be included.
- The performance of the recommended or preferred SWM practices is to be summarized.

vi. Erosion and Sediment Control

- Details on the principles and general practices proposed for managing erosion and sediment during construction should be presented.

vii. Conclusions/Recommendations

- Clear and concise summary of study findings and recommendations.

b. Drawings:

- Excerpts from applicable sections of the Official/Secondary Plans
- Proposed development layout
- Minor drainage system (sewers, swales, and appurtenances)
- Major drainage system including overland flow routes for the 100-year design storm (or regulatory flood if greater)
- Regulatory floodlines on-site (as applicable)
- Hydraulic grade line (HGL) illustrated on Plan and Profile drawings
- Details of SWM practices, including landscaping where appropriate
- Erosion and Sediment Control Plan

c. Tables:

- Catchment parameterization
- Pre-development and post-development flows at critical locations
- Hydraulic grade line (HGL) calculations for the 100-year design event
- Inflow/outflow from SWM facilities for range of storms, related to pre-development flows for the same storm frequencies
- Overland flow calculations including flows, depths, and velocities at key points on roads and at outfalls to major system for the 100-year design storm
- Hydraulic information and flood levels for regulated on-site watercourses (as applicable)
- Water budget calculation (as applicable)

d. Figures:

- Schematics of computer models
- Pre-development and post-development drainage areas and hydrographs at outfalls and at outlets from SWM facilities
- Details of erosion and sediment control measures
- Details of control structures and facilities

e. Appendices:

- Hydrologic Modelling Input/Output (also electronically provided)
- Hydraulic Modelling Input/Output (also electronically provided)
- Records of Agency and Town Consultation
- Geotechnical records (where applicable)

4.3.2 Existing Studies

Various documents have been prepared by the Town, Region, and Conservation Authorities in support of the planning, design, and construction of SWM practices within the Town. It is recommended that these documents and their recommendations be reviewed prior to design.

New studies may be prepared following the development of this manual, and it is the responsibility of the designer to verify with the Town and agencies that the most up-to-date documentation is reviewed. Studies listed with an asterisk are not finalized.

4.3.2.1 Bristol

- Southwest Bristol Survey Neighbourhood Impact Study (Marshall Macklin Monaghan Limited, May 2001)

4.3.2.2 Sherwood

- Milton Heights Neighbourhood Sherwood Survey Secondary Plan Area Subwatershed Impact Study Areas 1, 2 & 4 (Rand Engineering et al., October 2013, Addendum February 2014)

- Sherwood Survey Lands, Town of Milton, Subwatershed Impact Study SIS Area 5B (The Municipal Infrastructure Group Limited, et al., July 2006, 1st Addendum May 2007, 2nd Addendum August 2007, 3rd Addendum January 2014)

- Sherwood Survey Lands, Town of Milton, Subwatershed Impact Study SIS Area 6 (The Municipal Infrastructure Group, et al., July 2006, 1st Addendum May 2007, 2nd Addendum August 2007)

- Sherwood Survey Lands Town of Milton Subwatershed Impact Study SIS Area 10 (The Municipal Infrastructure Group, et al., July 2006, 1st Addendum May 2007, 2nd Addendum September 2007)

- Subwatershed Impact Study SIS Area 9 (The Municipal Infrastructure Group, et al., June 2008, Addendum April 2009)

- Subwatershed Impact Study for Indian Creek – Area 7 in the Town of Milton Phase Two (David Schaeffer Engineering Ltd., et al., December 2004, 1st Addendum November 2005, 2nd Addendum February 2006, 3rd Addendum December 2006, 4th Addendum August 2007)

- Sherwood Survey Lands, Town of Milton, Subwatershed Impact Study SIS Area 6 (The Municipal Infrastructure Group, et al., July 2006, 1st Addendum May 2007, 2nd Addendum August 2007)

- Milton Heights Neighbourhood Sherwood Survey Secondary Plan Area Subwatershed Impact Study Areas 1, 2 & 4 Addendum (Andrin) (Rand Engineering et al., June 2024)

4.3.2.3 Boyne

- Boyne Survey Block 1 Subwatershed Impact Study (The Municipal Infrastructure Group, et al., June 2019)

- Boyne Survey Block 2 Final Subwatershed Impact Study (MTE Consultants Inc., August 2016)

- Subwatershed Impact Study for Area 5A, 5B and 6 Boyne Survey Lands, Phase 3 in the Town of Milton, Region of Halton (David Schaeffer Engineering Ltd., et al., September 2018)

- Area 5B (Centre Trubutary) Addendum – Subwatershed Impact Study for Areas 5A, 5B, and 6 Boyne Survey Lands, Phase 3 Centre Tributary Addendum in the Town of Milton (David Schaeffer Engineering Limited, June 2022)

- Area 5B (Omagh) Addendum – Subwatershed Impact Study for Areas 5A, 5B, and 6 Boyne Survey Lands, Phase 3 Omagh Tributary Addendum in the Town of Milton (David Schaeffer Engineering Limited, February 2023)

- Area 6 Addendum – Subwatershed Impact Study for 5A, 5B, and 6 Boyne Survey Lands, Phase 3 Area 6 Addendum (David Schaeffer Engineering Limited, March 2020)

- Technical Appendix: Functional Stormwater and Environmental Management Strategy, Boyne Secondary Plan Area, Final Report Town of Milton (AMEC Environment & Infrastructure, et al., March 2013, 1st Addendum May 2015, 2nd Addendum November 2015)

- Milton Urban Expansion Conceptual Fisheries Compensation Plan, Boyne Survey Area, Milton Phase 3 (AMEC Environment & Infrastructure, et al., March 2013, 1st Addendum May 2015, 2nd Addendum November 2015)

4.3.2.4 Derry Green

- Derry Green Corporate Business Park Subwatershed Impact Study (SIS) Areas 1&2 Derry Green Corporate Business Park (C.F. Crozier & Associates Inc., et al., May 2022)

- Derry Green Corporate Business Park Subwatershed Impact Study (SIS) Area 3A (Broccolini) (Jennifer Lawrence and Associates Inc., et al., November 2021)

- Derry Green Corporate Business Park Subwatershed Impact Study (SIS) Area 3A (Addendum), 3B & 4 (Remington/Anatolia) (Stantec Consulting., October 2023)

- Derry Green Corporate Business Park Subwatershed Impact Study (SIS) – Study Area 5A (Menkes and Orlando) (The Municipal Infrastructure Group Ltd., et al., October 2017)

- Derry Green Corporate Business Park Subwatershed Impact Study (SIS) Area 5A Addendum (Broccolini) (Jennifer Lawrence and Associates Inc., et al., May 2021)

- Derry Green Corporate Business Park Subwatershed Impact Study Area 5A Addendum (Remington/Anatolia, Stantec Consulting., October 2023)

- Derry Green Corporate Business Park Subwatershed Impact Study Area 5A Addendum (Takol), (Jennifer Lawrence and Associates Inc., et al., July 2024)

- DRAFT Derry Green Corporate Business Park Subwatershed Impact Study (SIS) Areas 5B and 6 (Highberm Holdings) (Paul Brown and Associates., September 2021)

- Sixteen Mile Creek Area 2 & 7 Subwatershed Update Study Technical Appendix: Functional Stormwater and Environmental Management Strategy, Derry Green Corporate Business Park Secondary Plan Area, Town of Milton, Final Report (AMEC Environment & Infrastructure, et al., April 2013, Addendum November 2015)

- Milton Urban Expansion Conceptual Fisheries Compensation Plan, Derry Green Corporate Business Park, Town of Milton (Amec Environment & Infrastructure, et al., April 2013, Addendum November 2015)

4.3.2.5 North Porta Lands

- DRAFT Milton North Porta Comprehensive Environmental and Servicing Study (CESS) (Orlando) (TyLin, et al., March 2023)

4.3.2.6 Highway 401 Industrial

- Functional Stormwater and Environmental Management Strategy, Highway 401 Industrial/ Business Park, Secondary Plan Area, Town of Milton (Philips Engineering Ltd., March 2000, Addendum July 2000)

4.3.2.7 Milton Education Village (MEV)

- Functional Stormwater and Environmental Management Strategy (Final Report), Milton Education Village, Milton, ON (Wood Environment & Infrastructure Solutions, February 2023)

- Scoped Characterization and Baseline Inventory (Final Report), Milton Education Village Lands, Town of Milton (AMEC Foster Wheeler Environment & Infrastructure, February 2023)

- DRAFT Subwatershed Impact Study for the Milton Education Village (DSEL, et al., April 2023) or as subsequently completed and approved.

4.4 Stormwater Drainage Policy

4.4.1 Quantity Control (Flood Management)

The Town and Conservation Halton do not support the use of LIDs or rooftop storage to reduce flows within regulatory storm analysis or flood hazard mapping.

4.4.1.1 Criteria

All newly developing or redeveloping areas must assess their potential impacts on local and regional flooding, and mitigate accordingly. The Town encourages early consultation with Conservation Authorities to determine flood hazard limits and any potential permitting that may be required.

4.4.1.2 Design

In areas where no higher level study has been completed, it is the general policy of the Town to require that peak runoff flows are controlled onsite to pre-development runoff flows. The proponent must demonstrate through appropriate modelling and analysis that post-development runoff flow will not cause detrimental impacts to downstream properties or watercourse systems and will not cause increased flood conditions or increase areas of known surcharging.

Where higher levels of study have been completed, the Owner will be required to comply with the recommendations of the study. Any proposed deviations from a higher level of study will be required to be vetted through the Town, be appropriately supported by detailed analysis, and must also be approved by any agencies having jurisdiction including but not limited to the Region and the Conservation Authority.

4.4.2 Erosion Control

4.4.2.1 Criteria

Depending on the downstream water level and the nature of the soil strata affected, stream banks can be subject to increased erosion potential. In these cases, the Owner will be required to provide appropriate protection in accordance with the applicable higher level study, as well as policies of the Conservation Authorities.

In areas where no Subwatershed Plan exists, it shall be the responsibility of the Owner to provide adequate erosion protection in accordance with Provincial Guidelines, unless it can be demonstrated through appropriate modelling and/or analysis that erosion processes will not be adversely affected by the proposed development.

4.4.2.2 Design

Erosion Control and management involves:

- Extended Detention storage for the 25 mm rainfall event as outlined in the Provincial Guidelines (ref. SWMP Planning & Design Manual, MOEE, 2003), in the absence of specific direction from a higher level of study.

- Assessment of downstream erosion susceptibility and critical flow values in conjunction with event modelling.

- Assessment of downstream erosion critical velocity or shear forces in conjunction with continuous simulation techniques (duration analysis).

In areas where the downstream receiving watercourse is determined to be unstable, or where control/over control of flow rates is ineffective or not feasible, design of channel alterations may be considered, subject to design in accordance with natural channel design best practice including but not limited to CVC/TRCA Guidance, Highway Drainage Design Standards (MTO, 2008), and CVC Geomorphological Considerations with regards to Natural Channel Design (June, 2010).

Storm sewer outfalls in natural channels should be provided with proper protection against erosion which includes appropriate bank scouring protection on either side of the outfall and creek. When storm sewer outfalls outlet to steep and/or deep valleys, drop structures should be designed in such a manner as to provide integral bank stability. Such local erosion protection measures should be designed so as not to interfere with the natural channel forming processes of the receiving watercourse system. Permitting of natural channels may be required through the Conservation Authority.

4.4.3 Major Conveyance System

4.4.3.1 Criteria

Flows in excess of the minor system capacity (periods of surcharging), are referred to as major system flow. The major system comprises the minor system, as well as the overland route followed by runoff not captured by the minor system (either due to excessive flow or operational failures). Common elements of the major system include natural streams, valleys, swales, ponds, roadways, dedicated blocks, and drainage channels.

The level of protection should be established based upon sound economic analysis and the nature of the area drained (i.e., risk of loss of life and property damage).

4.4.3.2 Design

The Town supports the policies of the Conservation Authorities, which generally require that no new building be subject to flood damages from the Regulatory flood as per the Technical Guide - River and Stream Systems: Flooding Hazard Limit, (Ontario Ministry of Natural Resources (MNRF), 2002), Federal Geomatics Guidelines for Flood Mapping (Natural Resources Canada, 2019), and the Federal Hydrologic and Hydraulic Procedures for Flood Hazard Delineation (Natural Resources Canada, 2019).

The MNRF has defined Regulatory Flood Hazard as the greater of the areas inundated by water from a rainfall experienced event or by the 100-year (1% annual probability of occurrence) flow event. In Ontario, Hurricane Hazel is a regionally experienced storm event which generally produces flows in excess of the 100-year flood.

No development, should intrude upon Hazard Lands without consultation and ultimate approval by Conservation Authorities and the Town. In conjunction with this objective, the Town shall require the Owner to delineate floodplains in a proposed development resulting from the 100-year and Regional Storm for both the pre-development and post-development conditions.

Major overland flooding cannot exceed 150 mm depth over the crown during a 100-year event for any roadway. It is preferred that flooding remain within the designated right-of--way and not over-top the curb, but in no instance shall the water depth extend onto private property. Blocks dedicated through easement or ownership to the Town will be required to convey overland flow from roadways to open watercourse systems. These blocks must be designed for stability and safety to the Town's satisfaction.

In the event that the 100-year flows are piped, the requirements for overland flow route remain. Refer to Section 4.5.3 (Overland Flow Routes).

Where the Major System is being conveyed underground, stormwater design sheets shall be provided for the Town's review and approval. The design flow in any pipe section shall not exceed 85% of the full flow capacity of the pipe section.

The Town requires that flood-free access and egress to buildings be provided as per MNRF and CH guidance and to the Town's satisfaction. It is the Town's requirement that all emergency vehicles be provided with safe access and egress during all storm events.

4.4.4 Minor Conveyance System

4.4.4.1 Criteria

The minor system (commonly referred to as the conveyance system), handles urban drainage from relatively 'minor' storms having a frequency (return period) of 5 years. This system typically consists of drainage pipes, roadway gutters and swales, enclosed

conduits, and roof leaders. Its purpose is to prevent frequent flooding which may 'inconvenience' motorists, home and business owners, and pedestrians.

The Town will not allow residential development to proceed until adequate provisions, in the form of storm sewers, has been made available.

4.4.4.2 Design

The minor or conveyance system, comprising of street gutters, catch basins, and storm sewers, shall be designed to a 1 in 5-year un-surcharged standard.

In some higher value commercial areas, the criteria may be increased to 1 in 10-year floods at the discretion of the Town.

Stormwater design sheets shall be provided for the Town's review and approval. The design flow in any pipe section shall not exceed 85% of the full flow capacity of the pipe section.

Stormwater design sheets shall be sealed, signed, and dated by P.Eng.

4.4.5 Quality Management

4.4.5.1 Criteria

Water quality treatment will be required for all new development within the Town. Water quality treatment performance shall conform to provincial requirements, including but not limited to, Provincial Water Quality Objectives (MOE, 1994), Stormwater Management Planning and Design Manual (MOE, 2003), and Draft Low Impact Development Stormwater Management Guidance Manual (MECP, 2022).

In areas of existing development where re-development is proposed, provisions for water quality measures will be evaluated on a site-specific basis, based on the feasibility of implementation. Where on-site measures are considered infeasible, the Town may consider the potential for contributions to off-site improvements (i.e., cash-in-lieu), at the discretion of the Town, subject to agency consultation. A Master Plan approach to compensation for off-site works is advocated by the Town.

In areas where a Subwatershed Study has been prepared and approved, the guidelines and criteria cited within the plan shall be adopted by the Owner.

4.4.5.2 Design

Specific guidelines for SWM have been developed by the province, based on the type of fisheries habitat downstream of the proposed development and as described in the Stormwater Management Planning and Design Manual (MOE, 2003) and, once approved, the Draft Low Impact Development Stormwater Management Guidance

Manual, (MECP, 2022).

Additional SWM guidance for each specific Secondary Plan has been established through the Town's Subwatershed and Environmental Planning Documents.

Three levels of protection are given, with the goal to maintain or enhance existing aquatic habitat, based on the suspended solids removal performance for the different end-of-pipe SWM facilities developed in the continuous simulation modelling. These levels of protection are based on a general relationship between the end-of-pipe SWMFs long-term suspended solids removal and the lethal and chronic effects of suspended solids on aquatic life. The levels of protection correspond to the following long-term suspended solids removal:

- Enhanced protection (Level 1 Quality) corresponds to the end-of-pipe storage volumes required for the long-term removal of 80% of suspended solids.

- Normal protection (Level 2 Quality) corresponds to the end-of-pipe storage volumes required for the long-term removal of 70% of suspended solids.

- Basic protection (Level 3 Quality) corresponds to the end-of-pipe storage volumes required for long-term removal of 60% of suspended solids.

Note: Although there are 3 levels of protection listed, it is the Town's standard to design SWM infrastructure to the 'enhanced' level of protection.

4.4.6 Groundwater

4.4.6.1 Criteria

A thorough understanding of site-specific groundwater conditions is critical to ensure design feasibility. The feasibility of specific stormwater infrastructure, such as LID infiltration facilities, may not be applicable in areas of a high groundwater table.

4.4.6.2 Design

Designs are to review local groundwater conditions relative to the development through completing site-specific geotechnical and hydrogeological investigations. Through these investigations, seasonally high groundwater elevations need to be evaluated. In addition, proximity to groundwater users through private wells needs to be considered to ensure feasibility of the SWM design.

During water taking activities, for both construction, and long-term water takings, the designer is to consult with the Town, the Region, the Conservation Authority, and the MECP on water taking activities. Permitting for water takings is regulated by the MECP, and the proponent is responsible for obtaining a Permit to Take Water (PTTW) or Environmental Activity and Sector Registry (EASR) as needed.

Permitting may also be required by the Town for any temporary and permanent groundwater discharge to existing Town SWM infrastructure or collection system.

4.4.7 Infiltration and Water Balance

4.4.7.1 Criteria

As a general consideration, maintenance of the natural hydrologic cycle including infiltration is encouraged, and therefore the use of SWM practices, which enhance or maintain infiltration, should be considered for each development. The Town understands that the implementation of infiltration measures is typically favorable in areas of high permeability, and that the soils throughout Milton are of low permeability. Regardless of soil permeability rates, the Town encourages the use of infiltration practices, where practical, sized accordingly to accommodate higher volumes where there is low underlying soil permeability.

Passive measures such as disconnection of roof leaders have been historically utilized in many areas and should be implemented as a matter of course in all areas unless specific constraints preclude these measures.

In all cases, the potential for groundwater contamination shall be considered, particularly where infiltration of road runoff is contemplated.

In areas where hydrogeological concerns are identified and/or critical linkages to fisheries habitat are present, additional study and analysis may be required to determine the appropriate level of mitigation.

Water balance analysis shall be undertaken by a qualified professional taking into consideration any prior analysis completed as part of a Subwatershed Study.

4.4.7.2 Design

Through the design process, proponents are to maintain the water balance requirements outlined through higher-level studies. In the circumstance that higher-level studies applicable to the site do not exist, proponents are to ensure that the pre-development to post-development water balance is maintained. The water balance analysis should be undertaken by a qualified hydrogeologist taking into consideration any prior analysis completed as part of a Subwatershed Study.

4.5 Stormwater Design Standards

4.5.1 Lot/Surface Grading

4.5.1.1 Criteria

All lot areas are to be graded to provide positive surface drainage, directed away from houses to side yard or rear yard swales. Lots within a plan of subdivision are to be completely top soiled and sodded. Minimum depth of topsoil is 150 mm, or as specified in the reports listed in Section 2.3.3 (First Submission of Engineering and Landscape Design) to the satisfaction of the Town.

Prior to final grading certification, the Consultant and the Town must walk the site to visually inspect lot grading. Any deficiencies noted must be rectified. Refer to Section 2.9.2 (Requirements for Commencement of Maintenance Period).

Grading works not associated with a planning application may require a Site Alteration Permit. Refer to the Site Alteration By-Law 094-2022 (as amended).

4.5.1.2 Design

Grading design shall be in accordance with Section 2.4 (Lot Siting Plans for Building Permits), Lot Grading TMSDs (06-03.01 through 06-03.03), and the following:

a. The minimum slope of sodded areas is 2.0%.

b. The maximum slope of sodded areas is 3:1.

c. Rear yards shall have a minimum of 75% of the yard area graded at 2.0% to 5.0%.

d. Side yards shall be a minimum of 600 mm wide, graded at 2.0% to 5.0% away from the house.

e. Clear stone shall be used when building separation on side yards is 2.2 m or less and must be inspected by the Town prior to the placement of stone.

f. Grading to be back-to-front wherever possible. Back-to-front drainage must be directed to a combined side yard property line swale which is directed to the front of the property.

g. Split-lot and front-to-back grading designs, utilizing adjacent lots with back-to-front grading, for drainage conveyance are accepted subject to following criteria:

    - Drainage from the upstream lot is to be collected by a rear yard property line interceptor swale and directed to the side yard swale of the downstream lot.

- Side yard property line swales on the downstream lot are to accept drainage from one upstream lot (or equivalent) only.
- The minimum grade of the side yard swale of a receiving lot shall be 3.0%.

h. Lot Grading Sitings will be reviewed manually by the Town. Sitings shall be to scale to ensure that minimum requirements are met.

i. If these criteria cannot be met, rear lot catch basins must be utilized on the split drainage lot. Refer to Section 4.5.5 (Catchbasins and Ditch Inlets).

j. Swales shall be designed to the following:

- Longitudinal slope between 2.0% and 7.0%
- Maximum side slopes of 3:1
- Typical swale depth of 150 mm to 300 mm
- A recommended swale depth of 600 mm (where feasible, in accordance with CSA W204:19)
- Maximum length of rear yard swales of 50 m where directed to a RYCB
- Swales to be located on the common lot line
- Phasing of developments must account for future lot grading patterns

4.5.1.3 Future Building Lots/Blocks

Any lots or blocks with no immediate intent for development must be graded to provide positive drainage, top soiled, and seeded to the Town's satisfaction. Fencing, signage, and maintenance work may be required at the Town's discretion. Timing of the above requirements shall also be at the discretion of the Town.

4.5.1.4 Retaining Walls

As a minimum, all retaining walls are to be constructed of cast-in-place concrete, pre-cast concrete block, or armour stone. Gabion style retaining walls will not be accepted on public lands.

Retaining walls that exceed 600 mm of exposed height and which are located on public property, or private property to which the public is admit require guards having a minimum height of 1.07 m.

Retaining walls exceeding 1.0 m of exposed height shall be designed by a structural P.Eng., registered in the Province of Ontario and will require a building permit.

Retaining walls having the face of the wall placed on the property line shall have any tie backs, footings, etc., located entirely within the upper lot, or entirely within private property. Subject to the Town's discretion, and reviewed on a case-by-case basis.

Retaining walls which are located on private property, must be fully contained within

private property. The Town does not encourage the use of retaining walls on public property.

4.5.2 Roof Leader Criteria

For all residential buildings, the stormwater roof leaders must discharge to a sodded area with the use of a concrete splash pad or raingarden. Discharge should be directed away from hard surfaces such as driveways and sidewalks as they can become a hazard under freezing conditions.

4.5.3 Overland Flow Routes

Major flows in excess of the minor system capacity shall be safely routed to the receiving watercourse to prevent water from accumulating at or near buildings and to prevent damage to structures. An overland flow route must be established through all areas (including all sags) and shall be contained within either the road right-of-way or by other lands in the Town's ownership or control (e.g., within the public boulevard or through blocks or easements).

Overland flow routes must be appropriately stabilized to resist erosion during a design event, to the satisfaction of the Town. Overland flow routes should control the maximum water elevation during the major storm design event within the road right of way, however, if that is not possible, a minimum vertical separation of 0.3 m freeboard below building openings must be provided as per Clause 6.7.2 g) of the 'Flood Resilient Design of New Residential Communities' (Canadian Standards Association (CSA W204:19), 2019).

Servicing blocks are required to allow drainage of public lands, while easements are required to allow drainage of private lands.

The requirements for flooding permitted on streets and at intersections during the 100-year storm, as per 'Flood Resilient Deign of New Residential Communities' (Canadian Standards Association (CSA W204:19), 2019 and 'Guideline on Basement Flood Protection and Risk Reduction' Canadian Standards Association (CSA Z800-18), revised 2019), are as follows:

- The product of the water velocity (m/s) and depth (m) during the major storm event should not exceed the following:
    - 0.60 m^2/s for longitudinal flow for overland flow paths such as along all classes of roads and local swales
    - 0.40 m^2/s for longitudinal flow where there is an obvious risk of serious injury or loss of life
    - 0.45 m^2/s at transverse flow locations such as road intersections
    - 0.30 m^2/s for transverse flow where there is obvious risk to life, such as road surface flows at major culvert crossings or causeways

- The velocity of street and overland flows should not exceed 3.0 m/s.

- For all roads, the depth of water at the crown shall not exceed 0.15 m, shall be contained within the right-of-way or block and is preferred to have no curb overtopping. In no instance shall flooding extend onto private property.

- For local roads, the depth of flow should be less than 0.15 m at the crown. The maximum depth of flow should be less than or equal to 0.30 m.

- For collector/urban arterial roads, designs shall ensure that the flow spread will leave at least one lane free of water, or the width of one lane over the centreline of the road.

- Where possible, overland discharge routes within residential areas shall also provide public access to parks and open space. Servicing Blocks, which also act as public access routes, are subject to the criteria of Section 5.2 (Open Space Linkages/Pathway Blocks).

- The depth of flooding (during the 100-year storm event) on a residential property with a RYCB, in a public open space, and in parking areas should ideally be no deeper than 0.15 m, but shall not exceed 0.30 m. Adequate freeboard shall be provided to building openings to provide climate change resiliency.

4.5.4 Storm Sewers

4.5.4.1 Criteria

The Town requires that a storm sewer system be used to collect runoff from lots and within the right-of-way and that the storm sewer system be constructed on every street within all plans of residential subdivision.

For additional information related to drainage within parks and open space, refer to Section 5.4.3 (Base Condition - Drainage).

4.5.4.2 Design

The methodology for calculation of flows for the storm sewer system is the Rational Method. (Refer to Tables 4.2 and 4.3 for IDF equations). The storm sewer should be designed to accommodate the 5-year rainfall event unless otherwise approved by the Town.

Average Rainfall Intensity for Set Duration Formula:

$i = \frac{A}{(t_d + b)^2}$ where: A, b, and c are constants
t_d = Duration

Rational Method Formula:

$Q = 2.78\ CiA$ where: C = Runoff Coefficient
i = Rainfall Intensity (mm/hr)
A = Drainage Area (ha)

Note: Inlet Time of Concentration (Tc) = 10 minutes. The Airport Formula may be used subject to the Towns approval.

Airport Formula:

$Tc = \frac{3.26\ (1.1-C)\ L^{0.5}}{S^{0.33}}$ where: Tc = Time of Concentration (min)
C = Runoff Coefficient
L = Flow length (m)
S = Slope (%)

Table 4.2 Intensity, Duration, and Frequency Values[(i)]

Duration (minutes)	2-Year (mm/hr)	5-Year (mm/hr)	10-Year (mm/hr)	25-Year (mm/hr	50-Year (mm/hr)	100-Year (mm/hr)
5	107.4	141.5	164.2	192.7	213.9	235.0
10	79.0	103.5	119.8	140.3	155.5	170.6
15	65.3	86.5	100.7	118.5	131.7	144.8
30	43.0	57.0	66.3	78.0	86.7	95.4
60	24.3	32.2	37.5	44.1	49.0	53.9
120	14.2	19.2	22.5	26.7	29.8	32.8
360	6.2	8.5	10.1	12.1	13.5	15.0
720	3.5	4.9	5.9	7.1	7.9	8.8
1440	2.0	2.8	3.3	4.0	4.6	5.1

Notes for Table 4.2:

i. The information in this table was taken from AES Toronto Pearson International Airport – 39 Years of Record, 1950 - 1990.

ii. This table may be updated from time to time. Contact Development Engineering to

confirm current values.

Table 4.3 Rainfall Intensity Equation Coefficients

Return Event	A	b	c	Correlation Coefficient
2-year	779	6.0	0.8206	0.99985036
5-year	959	5.7	0.8024	0.99982256
10-year	1089	5.7	0.7955	0.99978510
25-year	1234	5.5	0.7863	0.99976364
50-year	1323	5.3	0.7786	0.99976825
100-year	1435	5.2	0.7751	0.99974784

Runoff coefficients to be used are shown in Table 4.4 below. When a development is mixed-use, a weighted runoff coefficient is to be used. When site plans are available, the runoff coefficient is to be a weighted average based on land use. The calculation of a weighted runoff coefficient is to be reviewed and approved by the Town. For higher level SWM studies, a more conservative approach should be applied.

Table 4.4 Runoff Coefficients for Subdivision Design

Land Use	Runoff Coefficient (C)
Parks[(i)]	0.25 - 0.60
Open Space	0.25
Detached Residential	0.65
Semi-Detached Residential	0.70
Townhouses, Apartments, Schools, and Churches	0.75
SWM Facility Block	0.50
Right-of-Way	0.95
Back-to-Back Townhouses	0.90
Industrial, Commercial, Institutional, High Density Residential and Mixed Use Blocks	0.90

Notes for Table 4.4:

i. Parks runoff coefficients are subject to review, based on the intended park programming.

Table 4.5 Runoff Coefficients for Site Plan Design

Land Use	Runoff Coefficient (C)
Impervious Areas (e.g., Asphalt, Concrete, Rooftop, and Water Surface)	0.90
Gravel	0.60
Pervious Areas (e.g., Grass, Garden, and Forest)[(i)]	0.25
Low Impact Development	Refer to Manufacturer's Specifications and consult with Town and Agency staff.

Notes for Table 4.5:

i. Runoff coefficients for green roofs and landscaped areas above underground parking structures shall be determined through design review on a case-by-case basis, to the satisfaction of the Town.

4.5.4.3 Sewer Location

Generally, the obvert of storm sewers are to be placed 1.5 m below the finished centerline grade of a road. Where foundation drainage is provided by sump pumps, the minimum cover will be no less than 1.2 m. Refer to Section 4.5.4.9 (Service Laterals).

Foundation and weeping tile drains are to drain by gravity to the storm sewer wherever possible. Surcharging of foundation drains is not allowed during the 100-year storm.

Joint burial/common trenching with wastewater sewers will only be considered when supported by the recommendation of a soils report prepared by a qualified Geotechnical Consultant.

In special circumstances (including Site Plan development) storm sewers with cover of 1.5 m or less will be permitted under approval of the Town. Storm sewers with cover of 1.2 m or less must be insulated and have calculations provided in accordance with OPSD 1109.030.

Sewers shall be terminated with a manhole at the subdivision limits when external drainage areas are being considered in the design. The design of terminal manholes must allow for the future extension of the sewer.

4.5.4.4 Easements and Block Requirements

Table 4.6 below provides the Town's guidelines for the minimum widths of easements

and blocks. However, regardless of Table 4.6, all situations will be reviewed on an individual basis at the Town's discretion.

Table 4.6 Easement and Block Width Requirements

Width of Pipe	Depth to Invert	Minimum Width
250 mm RYCB lead	-	1.8 m
250 mm to 375 mm	3.0 m maximum	3.0 m
450 mm to 675 mm	3.0 m maximum	4.5 m
750 mm to 1500 mm	3.0 m maximum	6.0 m
1650 mm and up	4.0 m maximum	4.0 m + (3 x OD of Pipe)

Notes for Table 4.6:

i. Depth to inverts exceeding those in the table will be reviewed by the Town and a block width will be recommended.

4.5.4.5 Radius Pipes

Radius pipe will be allowed for 1050 mm Ø storm sewers and larger. Manholes are to be placed in accordance with the Town's spacing requirement and/or as required by the pipe manufacturer. Refer to Section 4.5.6.2 (Manhole Spacing). The Town will allow the use of prefabricated manhole tees. The minimum centreline radius allowable shall be in accordance with the minimum radii table as provided by the pipe manufacturer.

4.5.4.6 Pipe Size and Type

The Town of Milton will allow the use of concrete pipe with no size limit or plastic pipe (at a minimum, SDR-35) to a maximum of 450 mm Ø. The minimum size for main line storm sewers shall be 300 mm. Foundation drain collectors shall be a minimum of 150 mm.

Single catchbasin leads shall be 250 mm Ø and double catchbasin leads shall be 300 mm Ø.

Concrete pipe which is to be used within the public right-of-way to be reinforced concrete.

Table 4.7 Roughness Coefficients

Pipe Material	n Value
Plastic	0.013
Concrete	0.013
Corrugated Metal	0.024 (for plain pipe) 0.020 (for paved invert)

4.5.4.7 Standards and Specifications

a. OPSS 410 is modified as follows:

- Asbestos cement pipe is not allowed.
- Ribbed PVC pipe is not allowed.
- HDPE pipe is allowed to a maximum size of 450 mm Ø.
- A native trench backfill material to be compacted to 95% SPDD. The upper 600 mm of the trench on the travelled portion of the road must to be compacted to 98% SPDD and untraveled portions to 95% SPDD.
- Granular backfill to be compacted to 98% SPDD.
- Prior to the issuance of building permits, the contractor, consultant and Town staff must visually inspect the storm system.
- The Owner is responsible for providing two video inspections of all storm sewer pipes including manholes, catch basin leads and rear lot catch basins. The first video inspection shall be completed prior to Building Permit issuance and the second prior to top asphalt.
- A third video is required prior to Assumption if more than 5 years have passed since the time of last video.
- Storm sewer video inspections shall include a written report by the Consultant, which will include their recommendations, based on their review and assessment of the storm sewer video and contractor's report. Any required repairs shall be completed and re-videoed to the Town's satisfaction. Videos to be performed no more than 90 days prior to submission.

b. OPSD 802.010, 802.030, 802.031, and 802.032 are modified as follows:

- Bedding material shall be 19 mm crusher run limestone, compacted to 98% SPDD or HL6 clear stone.

- Covering material shall be sand.

4.5.4.8 Minimum and Maximum Velocity (Grade)

Under full flow conditions, the allowable velocity is to be no lower than 0.75 m/s and no greater than 6.00 m/s, unless otherwise approved by the Town. The gradient range will be governed by the velocity criteria. Additional protection against erosion, souring, and pipe displacement must be provided by a Licensed Engineering Practitioner where flow velocities exceed 4.5 m/s.

In no case shall the gradient be less than 0.5% for pipes that are 525 mm Ø or smaller, and 0.25% for pipes that are 600 mm Ø or larger.

4.5.4.9 Service Laterals

Foundation drains should be connected to the storm sewer via gravity connection, with the building's underside of footing elevation being a minimum of 0.3 m above the 100-year hydraulic grade line (HGL) of the storm sewer. Where this cannot be achieved, a foundation drain drawn to a sump pump must be used.

Sump pumps may discharge to grade or to the storm sewer with a service lateral, as determined by a SWM Report. Refer to TMSD 05-03.01 for sump discharge details.

Where a sump pump discharges to grade, the following criteria must be met:

- No more than one sump pump may discharge to any side yard swale.
- Sump pumps may not discharge to a location that is graded to drain over a sidewalk.

Where any of the above conditions cannot be met, a sump pump connection to the storm sewer is required.

In all cases, any dwelling with an underside of footing elevation that is lower than its surrounding dwellings must be supplied with a storm sewer service connection, as it is likely to have a more active sump pump.

Where provisions for a gravity or sump pump system cannot be made, a foundation drain collector (FDC) system with a minimum slope of 0.5% will be considered, subject to the proponent providing a detailed technical justification.

Refer to TMSD 05-01.01 for the location of service laterals at lot frontages.

Design requirements for service laterals are as follows:

a. For detached, semi-detached, and townhouse (foundation drain only), minimum size is 150 mm Ø, material is a minimum PVC SDR 28, and minimum slope is 2.0%. With a service connection (or sump discharge) being provided for each unit.

b. For commercial, institutional, and industrial areas (sized for surface drainage), minimum size is 300 mm Ø, material is a minimum PVC SDR 28, and minimum slope is 0.5%.

c. Service lateral cover at street line shall be a minimum of 1.2 m.

d. Double connections are acceptable in residential areas where all other utilities can be accommodated and where the difference in the two connecting basement elevations does not exceed 500 mm.

e. Halton Region's standards for wastewater service connections can be found online at: https://www.halton.ca/The-Region/Regional-Planning/Planning-Applications/Download-Engineering-Design-Guides-Manuals

f. Service laterals connecting to a storm sewer from foundation drains (where no sump pump is being utilized) must be equipped with backwater valves or backflow prevention devices inside the dwelling at an accessible location.

4.5.4.10 Main Line Connections

Installation of service tees at the sewer main shall be as follows:

a. For storm main sewer pipe of all sizes, prefabricated tees from the plant shall be utilized unless otherwise approved by the Town.

b. Storm sewer shall be drilled or scribed at the plant during manufacturing, as opposed to breaking through the pipe wall on site.

c. Service lateral locations are to be identified by installing a 40 mm x 90 mm (2" x 4") wooden stake at the end of each residential connection (street line). Stakes are to extend from the invert of the pipe to 1.0 m above ground level with the top 0.5 m painted white.

4.5.5 Catchbasins and Ditch Inlets

4.5.5.1 Criteria

Catchbasins (CB) or ditch inlets are used to collect surface water from gutters, swales or ditches. The maximum areas collected by any CB shall be 2 000 m^2 of pavement or 5 000 m^2 of grass. Catchbasins are to be constructed flush to base course asphalt and raised only prior to top asphalt.

Maximum road CB spacing: 90 m where the road gradient is < 3.0%
60 m where the road gradient is ≥ 3.0%

4.5.5.2 Design

a. Road CBs shall be located upstream of pedestrian crossings, intersections, and shall not be located within driveway curb depressions.

b. Double catchbasins (DCB) are required at road low points.

c. Curb face inlet (CFI) catchbasins will be allowed on arterial and major collector roads at the Town's discretion.

d. The use of high-performance bedding (HPB) will not be permitted.

e. The first joint out of a road CB to be concrete encased, if concrete pipe is used, or have a flexible joint, if PVC pipe is used. (Refer to OPSD 708.020.)

f. The first joint out of a rear lot CB to be concrete encased, if concrete pipe is used, or fully concrete encased from CB to private property line, if PVC pipe is used.

g. CB leads within the road allowance to be a maximum of 25 m in length.

h. Road CB leads to have a minimum slope of 2.0%.

i. RYCB leads to have a minimum slope of 0.5% and are subject to the velocity requirements in Section 4.5.4.8.

j. RYCBs are to be sumpless, with any sump filled with mass concrete and tooled to a smooth finish at invert of CB lead.

k. DICBs are required where the grade differential exceeds 2:1 or as determined by the Town.

l. Where a development property abuts a park or open space block, drainage from the development property shall not drain into the park or open space block unless approved by the Town. Refer to Section 5.4.3 (Base Condition - Drainage).

m. An effort must be made to minimize the blind connections of all catch basins.

n. Blind connections from RYCBs to the storm sewer main are **not** permitted. Manholes are to be constructed for all RYCB connections for maintenance access to the RYCB lead. Every reasonable effort shall be made to avoid the use of RYCBs.

Table 4.8 OPSDs for CB Structures, Grates, and Adjustment Rings

	Road CB	RYCB	DICB
Structure	705.010 (single) 705.020 (double)	705.010	705.030
Grate	400.010	400.020	403.010
Adjustment Rings	704.010	704.010	704.010

Notes for Table 4.8:

i. The maximum total height of adjustment rings shall be 300 mm, utilizing a minimum of 1 ring and a maximum of 3 rings.

4.5.6 Manholes

4.5.6.1 Criteria

Manholes are to be provided at pipe junctions, change in pipe alignment (vertical and horizontal), change in pipe size or material, and where the maximum pipe run is attained. Manhole structures are to be per OPSDs with lids/grates constructed flush to base course asphalt and raised only prior to top asphalt.

a. Granular backfill around manhole and catchbasin manholes shall be placed a minimum of 600 mm around the manhole up to the subgrade elevation.

b. The first pipe joint out of a manhole shall be concrete encased, where concrete pipe is used, or utilize a flexible joint, where PVC pipe is used.

c. A property line/sampling manhole is to be installed at street line for all commercial and industrial connections at the Town's discretion. (Refer to TMSD 05-04.01.)

d. The connection from a site to receiving storm sewer shall be through an orifice tube. Orifice plates are not acceptable within private development.

e. Manhole frames and covers shall be per OPSD 401.010 (Type 'A'), with raised 'STORM' lettering.

4.5.6.2 Manhole Spacing

Maximum MH spacing: 100 m for pipes ≤ 450 mm Ø
130 m for pipes ≥ 525 mm Ø

4.5.6.3 Pipe Angle at Manhole

Maximum change in direction: 90° for pipes that are ≤ 975 mm Ø
45° for pipes that are ≥ 1050 mm Ø

4.5.6.4 Head Losses and Drops

Suitable drops shall be provided across manholes to compensate for the loss in energy due to the change in flow velocity and for the difference in the depth of flow in the sewers. The minimum drops across a manhole are provided in Table 4.9.

In order to reduce the amount of drop required, the design will restrict the change in velocity between the inlet and outlet pipes to 0.6 m/s.

The obvert of a MH inlet pipe shall not be lower than the obvert of the outlet pipe. Where the difference in elevation between the invert of the inlet and outlet pipes exceed 1.2 m, an external drop pipe shall be installed on the inlet pipe.

Safety platforms are not permitted.

Table 4.9 Minimum Drop Across a Manhole

Change in Direction	Minimum Drop
0°	20 mm
1° to 45°	50 mm
46° to 90°	80 mm

Where the difference in pipe size is greater than minimum required drop, the difference in pipe size shall be used as the required drop (i.e., match obverts).

4.5.7 Watercourses

4.5.7.1 Inlet and Outlet Structures

Inlet and outlet structures shall be fully detailed on the engineering drawings. The details provided shall include the existing topography, proposed grading and the works necessary to protect against erosion of the channel and undermining of the structure.

Appropriate protection shall be provided at all inlets/outlets to prevent erosion of the watercourse and of the area adjacent to the headwall. The extent of the erosion protection shall be indicated on the engineering drawings and shall be dependent upon the velocity of the flow at the storm outlet/inlet, the soil conditions, the flow in the

existing watercourse and slope conditions.

The openings to inlets and outlets must be protected to prevent unauthorized access and blockage of the system. Safety grates are required where pipes exceed 300 mm Ø.

The invert elevation of inlet pipes in SWM ponds is to be set at or above the permanent pool elevation and the extended detention elevation, unless otherwise justified to the satisfaction of the Town that there is no backwater effect on the upstream stormwater conveyance system.

Where a SWM pond's outlet storm sewer pipe directly drains into a watercourse, it shall be designed such that the invert of the pipe is above the 2-year event water level as a minimum, but preferably the 5-year level of the watercourse, to ensure no backwater effect of the SWM pond and its associated minor system. Additionally, the alignment of the outlet pipe shall be placed to direct flow in generally with the flow of the watercourse, unless otherwise justified to the satisfaction of the Town. (i.e., Outlets at 90° to the watercourse flow will not be accepted.)

Complete slope restoration shall be provided where slope stability is an issue. Natural stabilization methods are encouraged, including plant replacement/enhancement and bio-engineering techniques. All outlets to a regulated watercourse require a permit from the Conservation Authority.

4.5.7.2 Watercourse Crossings

Culverts larger than 1800 mm may not require grates where the system is open at both ends and the length is determined to be acceptable. Where grates are not utilized, warning signs will be required. Wording on signs is to be to the Town's satisfaction. Safety guards are required on structures where a vertical face exists greater than 1.0 m in height. Safety grates shall utilize horizontal bars. Vertical bars will not be allowed.

Road crossings of watercourses shall be designed to the listed flood frequencies. For major events (100-year and regional) transverse water crossings shall have a maximum depth at the crown of the road of 0.15 m and a maximum velocity of 0.4 m/s.

Table 4.10 Watercourse Crossing Design Frequency

Road Classification	Design Flood Frequency
Temporary Detour	1:10 Year
Urban Local	1:25 Year
Collector	1:50 Year
Arterial	1:100 Year to Regional

Notes for Table 4.10:

i. Driveway culvert minimum size is 375 mm Ø with 3:1 side slopes, sodded or as otherwise approved by the Town.

ii. Proposed culvert lengths must be approved by the Town.

iii. Culverts are to be corrugated metal of size and specification to accommodate the drainage flow.

iv. Headwalls are subject to approval by the Town.

v. Bridges and other major structures require special design as determined by the Town. Hydraulic calculations will be required.

vi. Permitting from the Conservation Authority for the above noted works may be required.

vii. Freeboard and clearance criteria shall be in accordance with Highway Drainage Design Standards (Ministry of Transportation, 2008 or as amended).

For additional information related to culverts and bridges within parks and open spaces, refer to Sections 5.14.7 (Culverts) and 5.14.8 (Bridges).

4.5.8 Stormwater Management Facilities

4.5.8.1 Criteria

A stormwater management facility (SWMF) is a facility designed for the treatment, retention, infiltration, or control of stormwater. This is inclusive of wet ponds, dry ponds, wetlands, and hybrid facilities.

4.5.8.2 Design

SWMFs shall be designed to the Town's Engineering Standards, as well as to the Stormwater Management Planning and Design Manual (MOE, 2003), or any future

revisions. Additionally, SWMF designs should take into account the stormwater management guidelines set out by CH, GRCA, and other agencies, as applicable.

The location of SWMFs shall be determined by higher level studies and through consultation with the Town and other applicable agencies.

The Town requires that the design of SWMFs include the following components:

a. Designed to an Enhanced level of protection as per the Stormwater Planning and Design Manual (MOE, 2003).

b. The Town supports the preferred pond depths outlined in the Stormwater Management Planning and Design Manual (MOE, 2003).

c. Staff gauges shall be installed at all SWMF outlet structures per TMSD 08-01.01.

d. Stormwater Management Pond Safety Signs (TMSD 16-07.01) are to be installed at all public access points to the pond.

e. Stormwater Management Pond Information Signs (TMSD 16-07.02) are to be installed one per subdivision, in a suitable location determined through consultation with the Town.

4.5.8.3 Modelling Requirements

Contact Development Engineering for modelling requirements for the design of SWMFs.

The Town, at its sole discretion, may require final SWMF designs to undergo hydrologic modelling verification at the cost of the Developer.

4.5.8.4 Sediment Removal

The Developer shall notify the Town prior to the removal of sediment from a SWMF for assumption. The Town shall be provided the following documentation for review, and approval, prior to the commencement of sediment removal work:

a. A drawing showing the residential units to be notified of the works. At a minimum, the Developer is to notify all residents located adjacent to the SWMF and any associated walking trails, as well as residents located along the sediment hauling route.

b. A copy of the residential notification as per the Town's Template. Refer to Section 4.5.8.6 (SWM Pond Sediment Removal Notification Template).

c. A drawing showing the location(s) which sign(s) will be installed to deter pedestrians during the works.

d. A copy of the chemical analysis of pond sediment.

e. Details of the final sediment disposal Site, including address and phone number.

f. A drawing showing the proposed sediment hauling route.

g. Confirmation that the sediment sampling and disposal plan meet the requirements of the Ontario On-Site and Excess Soil Management Regulation (O.Reg. 406/19) and the Ontario Rules for Soil Management and Excess Soil Quality Standards.

h. A Sediment Dewatering Plan, with Material Safety Data Sheet (MSDS) if polymer use is proposed.

i. A Certification Letter from the Qualified Person that the cleanout has been conducted as per the Ontario On-Site and Excess Soil Management Regulation (O.Reg. 406/19) and the Ontario Rules for Soil Management and Excess Soil Quality Standards.

j. A copy of the Ministry of Northern Development, Mines, and Natural Resources and Forestry (NDMNRF) Fish and Wildlife Collection Permits.

k. A copy of the Wildlife Salvage and Relocation plan as per NDMNRF guidelines.

l. A permit from the Conservation Authority (as required).

m. A permit to dewater from the MECP (as required).

n. A drawing showing the Erosion and Sediment Control Plan, including outlet discharge point with sediment capture identified (e.g., the use of filter bags).

Following the Developer providing the Town with the above noted information for review and approval, and prior to the sediment removal commencing, the Developer is to schedule an on-site preconstruction meeting with the Town, Consultant, and Contractor to discuss at a minimum, the sediment removal schedule, the equipment, the access and haul route, cleaning of the structures, pumping/bypass pumping, and the procedure for emergency spills.

4.5.8.5 Assumption

SWMFs which are to be assumed by the Town must be constructed to the satisfaction of the Town prior to transfer of ownership. The Developer shall notify the Town when they plan to initiate the pond assumption process.

The following are the requirements prior to assumption:

a. Final water chemistry sample and analysis to confirm Total Suspended Solids removal rate.

b. Pond sediment characterization testing report and confirmation of disposal location as per the MECP Soil Management and Excess Soil Standards (O.Reg. 406/19).

c. SWMF clean-out to design elevations and grades. A bathymetric survey registered to an approved benchmark shall be provided to confirm that the facility has been cleaned and graded as per the design. SWMF Sediment Removal requirements are provided in Section 4.5.8.3 (Sediment Removal). The Town approves the use of the disk and rod bathymetric survey method, as well as the use of dual-frequency depth sounding equipment (i.e., SONAR). Where dual-frequency depth sounding equipment is used, the Town requires rod and disk measurements to verify readings. Plan and profile bathymetric survey drawings, as well as an isopach figure showing sediment depths, are to be provided to the Town.

d. P.Eng. Certification that the SWMF has had accumulated sediment removed and confirmation of design depth, volume and performance.

e. P.Eng. Certification that the SWMF has been constructed according to the approved plans and specifications.

f. SWM Pond Operations and Maintenance Manual, sealed, signed, and dated by a P.Eng. provided to the Town's satisfaction. SWM Pond Operations and Maintenance Manual requirements are provided in Section 4.5.8.5 (Operation and Maintenance Manual).

g. Written notification to the Town of the upcoming assumption and that the status of the ownership of the SWMF has been changed from 'Operating Authority' to 'Town of Milton' (Owner) on the CLI-ECA, as applicable.

h. Completion of any Subwatershed Impact Study (or equivalent) monitoring requirements.

i. Conservation Authority clearance letter.

j. Development Engineering Inspector sign-off.

k. Forestry and Horticultural Manager sign-off.

l. Statutory Declaration.

4.5.8.6 Operation and Maintenance Manual

The final Operation and Maintenance Manual (O&M Manual) shall be received and accepted by the Town prior to assumption of the SWMF. This manual will serve as an instruction manual to the Town's operation/maintenance crews and should include, but not be limited to, the following information:

a. Introduction:

- Overview with respect to the purpose of the manual.
- Description of the location of the SWMF, with a key map illustrating the location of the subject development.
- Description of the drainage area including a key map illustrating the drainage area, downstream receiver and arrows showing the direction of flow.

b. Stormwater Management Plan:

- Brief summary of the storm water management system including subwatershed and/or MECP targets, design objectives (e.g., water quality/quantity, erosion and flood control) and the expected facility performance (i.e., level of protection)
- Description of the SWMF features (e.g., sediment forebay, permanent pool, extended detention storage, outlet/inlet structures); draw-down time and how the pond operates under various storm events. Provide As-Constructed Drawings and details.

c. Inspections:

- Inspection checklist, procedures and frequency of inspections for regular points of inspection and embankment inspection.

d. Maintenance Activities:

- Description of maintenance activities (e.g., access route repairs, grass cutting, weed control, planting, trash removal, side slope stabilization, unclogging, pipe repairs, etc.)
- Spills response plan in accordance with Town of Milton Bylaw #095-2022.

e. Sediment Removal:

- Sediment accumulation estimation.
- Forebay sediment removal frequency.
- Complete SWMF sediment removal frequency.
- Methods of removal including drying locations.
- Sediment sampling procedures and disposal location suggestions.

f. Monitoring:

- Performance highlights of the SWMF based on historical data after the full build-out condition.
- Monitoring plan required as per Town of Milton CLI-ECA #333-S701.

g. Maintenance Costs:

- Estimated costs for monitoring, inspection, maintenance, and sediment removal in tabular form, based on historical information.

h. Appendices:

- Location Key Map
- Storm Drainage Area Plan
- 279 mm x 432 mm (11” x 17”) tabloid size As-Constructed Drawings
- Example of inspection forms
- Copy of MECP ECA or Town of Milton CLI-ECA Permit
- Bathymetric survey following clean-out

4.5.8.7 SWM Pond Sediment Removal Notification Template

[Company Letterhead]

[Date]

Subject: **Stormwater Management (SWM) Pond Sediment Removal**
[Subdivision Name]

Dear Resident of the [Development Name] community,

We would like to advise you that [Contractor Name] on behalf of [Developer Name] will be removing the accumulated sediment at the SWM Pond located at [location description]. This is part of the regular maintenance required to ensure that the SWM Pond functions as designed, reducing flooding and protecting local waterways.

Work will include, but is not limited to, the operation of pumps, generators and heavy equipment such as excavators, dump trucks and dozers. Before draining the SWM Pond, wildlife in and around the Pond will be safely relocated as directed by the Ministry of Northern Development, Mines, Natural Resources and Forestry (NDMNRF).

All areas impacted by this work will be clearly marked and all traffic control measures, including flag personnel, as required, will be in place during the duration of the work for public safety. All impacted areas will be cleaned and secured at the end of each day.

Access to the Pond and trail area will be closed to the public during the duration of the work.

It is the expectation that roads will be clean and free of dirt and mud, but we ask that all residents exercise caution while works are undertaken.

Work will be completed between 7:00 am and 7:00 pm, Monday to Friday and possibly Saturday from 9:00 am to 7:00 pm as required. Work is anticipated to begin on [date], and take approximately [time period] to complete. These dates are tentative and weather-permitting.

Thank you in advance for your cooperation and should you have any questions or concerns, please contact our office.

[Contact Name]
[Engineering Consulting Firm]
[Phone Number]

To learn more about SWM in Milton please visit: Milton.ca/stormwater

4.5.9 Low Impact Development

4.5.9.1 Criteria

The Town encourages the use of LID facilities wherever possible as part of a treatment train approach, to achieve water quality and water balance objectives. Table 4.11 outlines the LID practices that the Town currently endorses and Table 4.12 summarizes the function of the LID practices.

Table 4.11 Preferred Stormwater LID Practices

Type of Practice	ROW	Buffer or Setback	Park	Res. Lot	Comm. Indust. & Institu. Sites	Res. Condo
Green Roofs	-	-	-	Yes	Yes	Yes
Rainwater Harvesting	-	-	-	Yes	Yes	Yes
Permeable Pavement	-	-	Yes	Yes	Yes	Yes
Soakaway Pits	-	-	Yes	Yes	Yes	Yes
Infiltration Trenches	Yes	Yes	Yes	Yes	Yes	Yes
Bumpouts	Yes	-	-	-	-	-
Bioretention	Yes	Yes	Yes	Yes	Yes	Yes
Perforated Pipe Systems	Yes	-	Yes	-	-	-
Bioretention Planters	Yes	-	Yes	Yes	Yes	Yes
Tree Cells	Yes	-	-	-	Yes	Yes
Rain Gardens	-	-	Yes	Yes	Yes	Yes
Filter Strips	-	Yes	Yes	Yes	Yes	Yes
Enhanced Grassed Swales	Yes	Yes	Yes	Yes	Yes	Yes
Rooftop Storage	-	-	-	-	Yes	Yes
Parking Lot Storage	-	-	-	-	Yes	Yes
Underground Storage	-	-	-	-	Yes	Yes
Third Pipe Systems	-	-	Yes	-	Yes	Yes

Notes for Table 4.11:

i. For standard drawings and/or details pertaining to LID practices, refer to STEP's Low Impact Development Stormwater Management Planning and Design Guidance Wiki, as well as current LID Guidance published from the MECP.

Table 4.12 SWM Function Provided by Preferred LID Source Control Practice

Type of Practice	Flood Control	Erosion Control	Quality Control	Runoff Volume Reduction	Groundwater Recharge
Green Roofs	-	Yes	Yes	Yes	-
Rainwater Harvesting	-	Yes	-	Yes	-
Permeable Pavement	-	Yes	Yes	Yes	Yes[(i)]
Soakaway Pits	-	Yes	Yes	Yes	Yes
Infiltration Trenches	-	Yes	Yes	Yes	Yes
Bumpouts	-	Yes	Yes	Yes[(ii)]	Yes[(ii)]
Bioretention	-	Yes	Yes	Yes[(ii)]	Yes[(ii)]
Perforated Pipe Systems	-	Yes	Yes	Yes[(ii)]	Yes[(ii)]
Bioretention Planters	-	Yes	Yes	Yes[(ii)]	Yes[(ii)]
Tree Cells	-	Yes	Yes	Yes	Yes
Rain Gardens	-	Yes	Yes	Yes	Yes
Filter Strips	-	Yes	Yes	Yes	-
Enhanced Grassed Swales	-	-	Yes	Yes	-
Rooftop Storage	-	Yes	-	Yes	-
Parking Lot Storage	-	Yes	-	Yes	-
Underground Storage	-	Yes	-	Yes	Yes[(iii)]
Third Pipe Systems	-	Yes	-	Yes	-

Notes for Table 4.12:

i. Acceptance of permeable pavement for groundwater recharge is contingent upon approval of the anticipated quality of surface runoff.

ii. Runoff volume reduction/groundwater recharge function requires design of infiltration medium below subdrain.

iii. Provided that storage tank is open bottom design with infiltration medium below.

4.5.9.2 Design

The Town understands that stormwater design practices are continuously evolving, thus practitioners should note that potential LIDs are not limited to those listed above. The final acceptable location of LID practices is to be determined through consultation with Town staff.

Designers must reference higher level watershed studies specific to the Secondary Plan Area (where available) and meet design criteria established within, including but not limited to, infiltration targets. Designers must also utilize current LID design resources available through the Sustainable Technology Evaluation Program (STEP) partnership including the Low Impact Development Stormwater Management Planning and Design Guidance Wiki, as well as current LID Guidance published from the MECP. The most current LID Guidance published by the MECP at the time of developing this Manual is the Draft Low Impact Development Stormwater Management Guidance Manual (MECP, 2022-January).

At a minimum, the designer is to evaluate the following site-specific information in order to determine the feasibility of LID implementation:

- Seasonal maximum groundwater elevation on the site
- Site soil type(s) and infiltration capacity
- Depth to bedrock
- Downstream groundwater use (e.g., private wells, source water protection areas, etc.)
- Utility conflicts
- O&M requirements

The Town requires that the following design details be incorporated into LID designs:

- Inspection, monitoring, and maintenance ports
- Overflow wells
- LID signs (TMSD 16-08.01) are to be installed at LID facilities within subdivisions. (One sign per facility, with location determined via consultation with the Town.)

4.5.9.3 Assumption

LIDs which are to be assumed by the Town are to be constructed to the satisfaction of the Town prior to transfer of ownership. At the time of assumption by the Town, the LID(s) are to be in the condition which they were designed. The Developer is to notify the Town of plans to initiate the LID assumption process.

The following is required prior to assumption:

a. Inspection of the LID is performed by a qualified person at the cost of the Developer, and as approved by the Town as per the TRCA's Matrix of Inspection and Testing Indicators by BMP Type (Low Impact Development Stormwater Management Practice Inspection and Maintenance Guide, 2016) to confirm at a minimum, the following:

   - Visual Inspection of performance indicators
   - Soil characterization testing - texture and particle size distribution, organic matter content, pH, available Phosphorus, cation exchange capacity (CEC), soluble salts, saturated hydraulic conductivity at 75% to 85% maximum dry density, depth (within 10% of design), compaction, surface/sub-surface resistance (for bioretention media)
   - Sediment accumulation testing – pre-treatment device, catchbasin sumps, and LID surface
   - Surface infiltration rate testing (as applicable)
   - Continuous monitoring (as determined to be necessary via consultation with the Town)

b. P.Eng. certification that the LID Inspection results confirm that the LID is functioning as designed. Should the inspection result in the identification of deficiencies, the LID is to be restored to design conditions at the cost of the Developer.

c. LID is cleaned out to design conditions, and any sediment, trash or debris accumulated is removed.

d. P.Eng. certification that the LID has been constructed according to the approved plans and specifications.

e. LID Operations and Maintenance manual, signed and stamped by a P.Eng. and provided to the Town's satisfaction.

f. Assumption request letter to the Town's Clerk

g. Conservation Authority clearance letter

h. Development Engineering Inspector sign-off

i. Forestry and Horticulture Manager sign-off

j. Statutory Declaration

4.5.9.4 Operation and Maintenance Manual

The final O&M Manual shall be received and accepted by the Town before assumption of the SWMF. This manual will serve as an instruction manual to the Town's operation/maintenance crews and should include, but not be limited to, the following information:

a. Introduction:

- Overview with respect to the purpose of the manual.
- Description of the location of the LID facility(ies), with a key map illustrating the location of the subject development.
- Description of the drainage area including a key map illustrating the drainage area, overflow area, and arrow(s) showing the general direction of flow.

b. Stormwater Management Plan:

- Brief summary of the SWM system including subwatershed and/or MECP targets, design objectives (e.g., water quality/quantity, erosion, and flood control) and the expected facility performance
- Description of the LID facility features (e.g., inlet, overflow, monitoring well, filter bed, inspection and maintenance port, etc.)
- Design details
- As-Constructed drawings and details

c. Inspections:

- Inspection checklist, procedures, and frequency of inspections for regular points of inspection.

d. Maintenance Activities:

- Description of maintenance activities (e.g., adding mulch, clean/flush underdrain pipe, prune, core aeration for lawns, restoring vegetation, litter removal, weeding, vacuum cleaning, sediment removal, lawn mowing, sediment removal, etc.)
- Spills response plan in accordance with Town of Milton Bylaw #095-2022.

e. Sediment Removal:

- Sediment accumulation monitoring method and frequency of monitoring.
- Sediment removal frequency and method.
- Sediment characterization sampling and disposal.

f. Monitoring:

- Performance highlights of LID facility based on historical data after full build-out condition.
- Monitoring plan.

g. Maintenance Costs:

- Estimated costs for monitoring, inspecting, maintaining, removal of sediment, and rehabilitation in a tabular form, based on historical information.

h. Appendices:

- Location Key Map
- Storm Drainage Area Plan
- 279 mm x 432 mm (11" x 17") tabloid size As-Constructed Drawings
- Example of inspection forms
- Copy of MECP ECA or Town of Milton CLI-ECA Permit

4.5.10 Water Quality Treatment Devices

Proponents are required to provide water quality control in accordance with the specified level of control outlined within the higher-level study (where available). Where a higher level study does not exist, the Town requires Level 1 Protection (Enhanced – 80% Average Annual Removal of Total Suspended Solids) for all developments.

This requirement shall apply for the total impervious coverage of the development site, regardless of the existing impervious coverage. Specifically for re-development applications, the Town requires that proponents provide treatment for the whole of the redevelopment site, regardless of its current use. Rooftop areas may be considered as 'clean' impervious area for the purposes of calculating water quality treatment requirements, provided that these flows are separated from runoff from other areas. The Town requires that stormwater runoff not cause any adverse effects in downstream surface water receivers.

4.5.10.1 Sedimentation Manufactured Treatment Devices

In accordance with Stormwater Management BMPs and in consultation with Conservation Halton's Guidelines for Stormwater Management Engineering Submissions (November, 2021), as amended, sedimentation manufactured treatment devices must meet ETV Canada testing protocols. For non-accredited units, the Town only accepts a credit of 50% TSS removal efficiency for units sized to provide 80% TSS removal. It is the preference of the Town that proposed unaccredited units be paired with an LID practice to create a treatment train approach to water quality control. The

Town also notes the following requirements:

a. When two or more manufactured treatment devices are installed in series, no additional sediment removal credit shall be applied beyond the sediment removal credit of the largest device in the series.

b. The sedimentation manufactured treatment device should be sized for the highest suspended solids percent removal physically and economically practicable, and used as a pre-treatment device in a treatment train designed to achieve water quality criteria.

4.5.10.2 Filtration Manufactured Treatment Devices

All filtration manufactured treatment devices shall meet ETV Canada testing protocols for 80% TSS removal.

4.5.10.3 Emerging Technology

The Town will consider the use of innovative technology under the circumstance that the following information is provided to the Town for review and approval:

a. A Department of Environmental Protection (NJDEP) and/or Canadian Environmental Technology Verification (CA-ETV) or;

b. A formal assessment of the technology provided by the proponent including:

- A thorough review of existing background information by a third-party reviewer, as selected by the Town and paid for by the Developer or Technology Manufacturer.

- A pilot study performed by or at a minimum verified by a third-party reviewer, as selected by the Town and paid for by the Developer or Technology Manufacturer.

- A field demonstration to obtain performance data. The demonstration is to be performed by or at a minimum verified by a third-party reviewer, as selected by the Town and paid for by the Developer or Technology Manufacturer. The Town will review the field demonstration performance data, and should the data not show successful performance of the technology, the Developer is responsible for all fees associated with replacing the technology with equipment that ensures the designed water quality objectives are met.