Prepared By:

Region of Peel

Stormwater Servicing Plan for Regional Road Infrastructure

GMBP File: 719020

November 17, 2022

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Executive Summary

Background

The Region of Peel (the Region) is made up of three local municipalities: the City of Mississauga, the City of Brampton, and the Town of Caledon. Each of the local municipalities is responsible for the conveyance and control of stormwater within the local road network, associated private/public connections, and drainage to their respective stormwater management and conveyance systems. The Region is responsible for the installation, maintenance and operation of all public stormwater infrastructure located within Peel Regional Roads.

The Region's stormwater system is made up of the minor and major systems. The minor system consists of ditches, the underground storm sewer system, and Low Impact Development (LID) Best Management Practices, which provide the first response level of protection by conveying flows from the more frequent, lower intensity storm events. Flow to the minor system is restricted to the capacity of the pipes, LIDs, and associated appurtenances. The major system consists of specially engineered overland flow routes along the road network, ditches, swales, and high-capacity water courses. It is designed to convey runoff from the less frequent, higher intensity storm events that are in excess of the minor system design capacity.

Objectives

The key objectives of the Stormwater Servicing Plan for Regional Road Infrastructure (herein referred to as the "Stormwater Master Plan") are as follows:

- Confirm the overall Regional stormwater servicing objectives and perform first principal engineering analysis of the servicing alternatives
- Satisfy the Municipal Class EA requirements for the servicing strategy
- Consider unique opportunities and challenges associated with utility and infrastructure services, environment and natural features, and socio-economic impacts
- Provide effective communication and consultation with partners, agencies, Indigenous communities, and the public throughout the entire Class EA study process
- Analyze, develop, and select the preferred solution to ensure successful implementation of the infrastructure components
- Identify any issues and consider potential remediation
- Provide sufficient level of conceptual design to demonstrate the extents of the infrastructure, improve project cost estimating, provide detailed implementation requirements, and identify overall operational concepts
- Deliver comprehensive documentation of the strategy, evaluation, and recommendations

Problem Opportunity Statement

The Problem/Opportunity Statement provides a clear identification of opportunities and challenges that are being addressed through the study. The Problem/Opportunity Statement for the Stormwater Master Plan is summarized as follows:

Provide efficient stormwater servicing to existing and future Regional Road infrastructure by taking into account existing aging infrastructure, growth, natural environment, climate change, and compliance within regulatory framework.

Figure 1A provides an overview of the study area, consisting of Peel's Regional Road network.

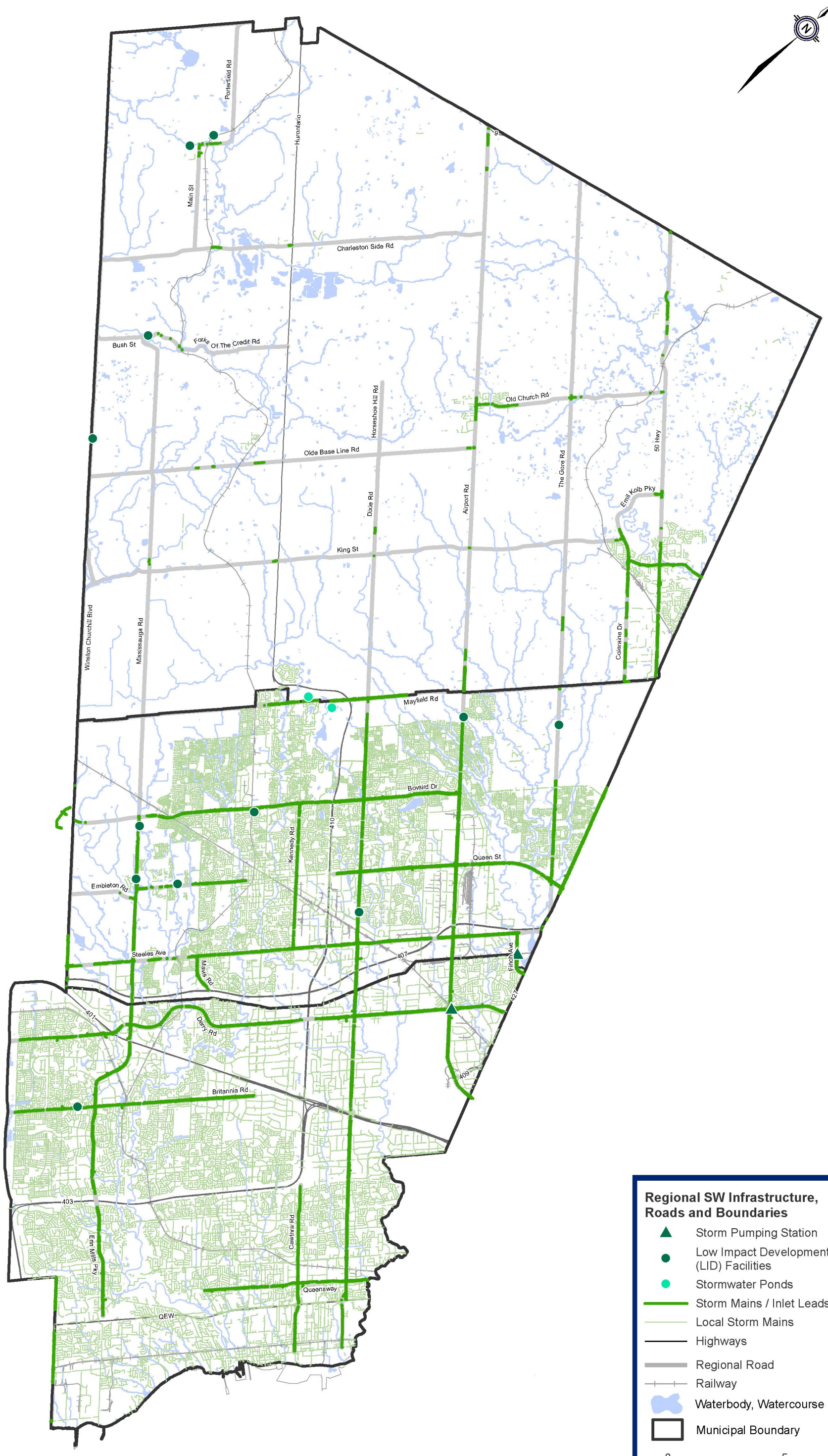
A Unique Master Plan

The Region's Stormwater Master Plan is not a traditional Master Plan due to scope and make-up of the assets and subcatchments involved in the study. The Region is responsible for only the stormwater assets within the Regional right of way while lower-tier municipalities are responsible for the stormwater assets within the lower-tier rights of way. This leads to unique situations within the Regional stormwater management system where Regional stormwater assets may have upstream or downstream connectivity with lower-tier stormwater assets. In addition to the lower-tier connectivity, the Regional stormwater network is made-up of over 400 sub-networks with associated outfalls into urbanized and naturalized watercourses. As such, each of the sub-networks is reviewed and analyzed independently of each other. The Region also does not permit private connections to Regional stormwater infrastructure unless there is no alternative outlet available to either lower-tier stormwater infrastructure or an alternative outlet such as a Conservation Authority controlled/managed watercourse. As such, the Region and this Stormwater Master Plan do not account for growth or population in a traditional Master Plan sense.

Policy and Planning Context

Growth

The Region of Peel's population projections are driven by "A Place to Grow: Growth Plan for the Greater Golden Horseshoe" which was amended in 2020 to include growth projections to 2051. The Region are currently in the process of updating the Region of Peel Official Plan, which will include adaptions to bring the Official plan in line with "A Place to Grow". However, growth as it relates to Region managed stormwater is driven by increases in impervious surface, such as new roads and lane widening. As such, the Region of Peel Long Range Transportation Plan, prepared in 2019, is a critical document in determining growth-related projects within the Region's stormwater management systems.



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Stormwater Servicing Plan for Regional Road Infrastructure

Existing Stormwater Infrastructure (Regional)

Baseline Understanding

BluePlan Engineering

Figure 1A
November 2022
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Level of Service

Per the Region of Peel's Stormwater Design Criteria and Procedural Manual, 2019 (Version 2.1), the Region's level of service for the minor system is conveyance of the 1-in-10 year storm event. The 4-hour Chicago design storm was utilized for modelling urban runoff within the Region. It is important to note that the Region updated their design storm within the 2019 (Version 2.1) iteration of their design guidelines. Based on the analysis conducted within the Master Plan document, it was determined that the updated design storm adequately accounts for climate change for the 10-year modeled storm event.

Level of Service Framework

As a component of the Stormwater Master Plan, a Level of Service Framework was developed with the aim of creating a risk-based framework for stormwater infrastructure that will assist with asset management approaches and contribute to compliance with the Ontario Regulation 588/17 for Asset Management. The framework provides a long list of performance indicators that the Region is recommended to track over time and report on progress as part of future Stormwater Asset Management Plans (AMP). At the time of writing, the Region is using this new framework as they develop their first Stormwater specific Asset Management Plan (AMP).

Strategy Development

Assessment of Existing Stormwater Infrastructure

A critical step in the Master Planning process is the assessment of the existing infrastructure to establish the stormwater system baseline conditions. These baseline conditions will become the basis of the future recommendations of the Master Plan; therefore, it was important to ensure that they were determined through a comprehensive detailed analysis of the system. Once the existing system conditions were established, the following factors were considered to ensure a comprehensive review of the system needs:

- Infrastructure condition (State of Good Repair Program)
- Existing capacity deficiencies
- Growth and non-growth related transportation projects, and impacts
- Locations for LID projects

Hydraulic Stormwater Model

The stormwater model for Regional Road infrastructure has been developed using the Region of Peel's approved modelling software, InfoWorks ICM (Integrated Catchment Modelling). The model was developed from scratch, as the Region did not have an existing minor storm system conveyance model. The Region's existing municipal GIS infrastructure data was imported into InfoWorks ICM to develop the minor system conveyance network. This was further supported through the use of available CCTV/inspection records to fill in gaps from the municipal GIS information. The stormwater model was used to understand where existing and future capacity constraints may be present within the Region's minor system conveyance infrastructure.

Evaluation Process

The Stormwater Master Servicing Plan evaluates current servicing gaps/needs and future servicing needs based on growth within the Region, aligned with the Region's Long-Range Transportation Plan. Two independent evaluations/project classes were conducted, one with the intent of identifying the locations of "capacity-based" projects and one with the intent of identifying the most (and least) applicable locations for the implementation of Low Impact Development (LID) Best Management Practices. The process included developing a long-list of servicing locations and strategies for each group of projects and screening the lists into short-lists based on feasibility and needs of the individual project locations. The short-lists were then evaluated based on of five major areas of impact: technical, environmental, financial, legal/jurisdictional, and socio/cultural.

Capacity-Based Projects

The results of the modelling analysis provided a "long-list" of potential locations with capacity concerns. These results were then further screened to determine a "short-list" of true capacity concerns using the following screening process:

1. **Model Build Constraints:** All surcharging locations were manually reviewed to determine if there are potential model build errors which would cause false surcharging
2. **Drainage Area Definition Constraints:** All surcharging locations were manually reviewed to determine if there are potential assumptions in the manual subcatchments delineation which may lead to over-contribution of stormwater
3. **Review of "Real" Capacity Issues:** As the model is conservative in its assumptions, the 1-in-5 year event results were used to filter projects for highest priority and "real" issues based on existing system flows/design size

The results of the short list of capacity-based project locations are as follows:

1. Emil Kolb Parkway & De Rose Ave
2. Bovaird Drive & Conestoga Drive
3. Steeles Avenue West and Rivermont Road
4. Steeles Avenue West and Lancashire Lane
5. Derry Road and Dishley Court
6. Erin Mills Parkway and QEW Ramp West

Based on the evaluation methodology outlined in the Stormwater Master Plan report, the preferred alternative is "minor system upsizing" for each of the six capacity-based project locations.

LID-Based Projects

Per discussions with the Region at the onset of the Stormwater Master Plan, the Region of Peel strives to increase the use of Low Impact Development Best Management Practices where possible, in order to holistically manage stormwater in a way that mimics the pre-development Through this project, a screening tool has been developed that can be used by the Region for all future transportation projects to help identify where LIDs will be most feasible based on a variety of factors that impact their effectiveness. natural environment. This screening process established a “short-list” of LID project locations which are recommended for implementation of an LID BMP. **Figure 2A** provides a visual interpretation of the basic methodology of the decision-making model.

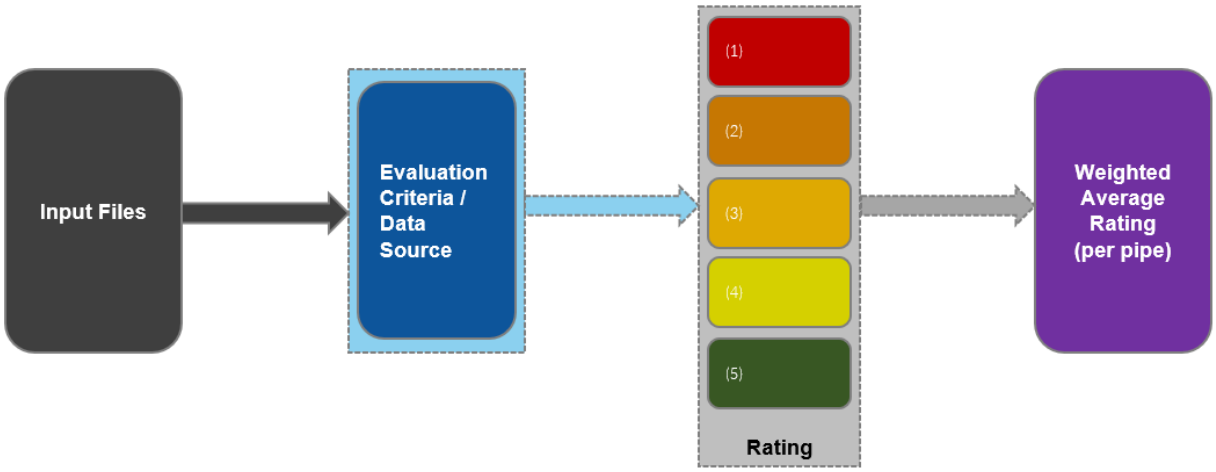


Figure 2A: Decision making methodology.

The results of the short-list of LID-based project locations are as follows:

1. Erin Mills south of Highway 401
2. Derry Road and McLaughlin Road
3. Derry Road east of Highway 410
4. Derry Road west of Highway 410
5. Mayfield Road east of Dixie Road
6. Erin Mills north of Highway 403
7. Dixie Road south of Highway 401
8. Erin Mills south of Highway 403
9. Kennedy Road south of Bovaird Drive

Capital Program

A capital cost is provided for all projects proposed as part of the Stormwater Master Plan. For capacity-based projects, a high-level implementation cost was obtained using a unit rate cost based on upsized pipe diameter. The unit costs were estimated based on an average pipe diameter and historical construction costing information. Design, administration, contingency, and non-recoverable HST costs were added to arrive at a final preliminary project cost, for budget planning purposes. High-level costing sheets were developed to support the financial evaluation for each capital project.

For LID project costing, a high-level estimate has been provided based on peer reviewed results of LID implementation costs carried out by Credit Valley Conservation (Grey to Green Road Retrofit, 2014). As LID projects vary significantly based on the type of LID to be implemented, a conservative capital cost of $1,000,000 has been carried forward for each LID project location.

Table 1A provides a summary of the capital program for both the capacity-based projects and the LID-based projects. **Figure 3A** provides an overview of the associated capital program project locations **Appendix J** includes the detailed costing methodology utilized for minor system upsizing.

Implementation Plan

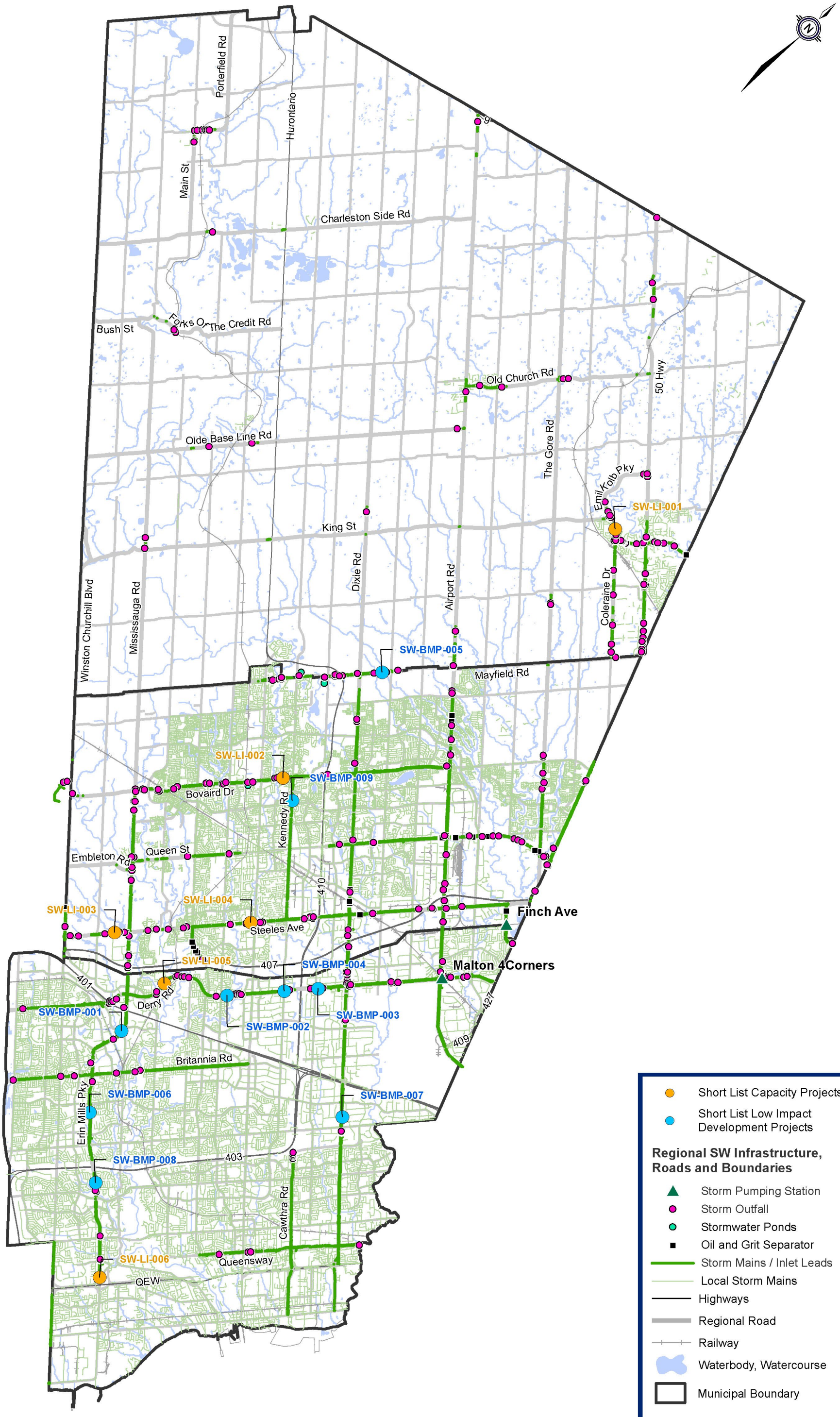
In order to successfully plan for future Stormwater Master Plan updates, an implementation plan has been developed to guide next steps that will provide the Region with a clearer picture in the future. The implementation plan includes the investigations and data collection scope items required to better understand the stormwater system, the tools and framework items required to utilize the data collected, and the studies and consultation required to develop a detailed/comprehensive understanding of the stormwater system. The following is a summarized list of the recommended implementation plan items:

- Rural Ditch Survey
- Flow Monitoring Program
- LID Maintenance Program
- Stormwater Model Update and Calibration
- Stormwater Funding Study/Policy
- Stormwater Management Policy Updates
- Long Range Transportation Plan and Sustainable Transportation Strategy EAs/Studies
- Stormwater Master Plan Update
- Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA

Table 1A. Capital program summary.

Capital Program ID	Name	Class EA Schedule	Project Type	Size (mm)	Length (m)	Class Estimate Type	Project Complexity	Accuracy Range	Area Condition	Total Estimated Cost (2022$)	Timeline
SW-LI-001a	Emil Kolb Parkway and De Rose Avenue	A+	Linear Infrastructure	375 mm	70 m	Class 4	Low	30%	Suburban	$112,000	2038
SW-LI-001b	Emil Kolb Parkway and De Rose Avenue	A+	Linear Infrastructure	450 mm	115 m	Class 4	Low	30%	Suburban	$201,000	2038
SW-LI-001c	Emil Kolb Parkway and De Rose Avenue	A+	Linear Infrastructure	525 mm	120 m	Class 4	Low	30%	Suburban	$226,000	2038
SW-LI-001d	Emil Kolb Parkway and De Rose Avenue	A+	Linear Infrastructure	600 mm	130 m	Class 4	Low	30%	Suburban	$315,000	2038
SW-LI-002a	Bovaird Drive and Consetoga Drive	A+	Linear Infrastructure	450 mm	289 m	Class 4	Low	30%	Suburban	$506,000	Opportunistic
SW-LI-002b	Bovaird Drive and Consetoga Drive	A+	Linear Infrastructure	525 mm	144 m	Class 4	Low	30%	Suburban	$1,183,000	Opportunistic
SW-LI-002c	Bovaird Drive and Consetoga Drive	A+	Linear Infrastructure	600 mm	97 m	Class 4	Low	30%	Suburban	$234,000	Opportunistic
SW-LI-003a	Steeles Avenue West and Rivermont Road	A+	Linear Infrastructure	375 mm	101 m	Class 4	Low	30%	Suburban	$161,000	2024
SW-LI-003b	Steeles Avenue West and Rivermont Road	A+	Linear Infrastructure	450 mm	309 m	Class 4	Low	30%	Suburban	$1,453,000	2024
SW-LI-004	Steeles Avenue West and Lancastershire Lane	A+	Linear Infrastructure	375 mm	196 m	Class 4	Low	30%	Suburban	$315,000	Opportunistic
SW-LI-005a	Derry Road and Dishley Court	A+	Linear Infrastructure	375 mm	100 m	Class 4	Low	30%	Suburban	$160,000	2030
SW-LI-005b	Derry Road and Dishley Court	A+	Linear Infrastructure	450 mm	77 m	Class 4	Low	30%	Suburban	$135,000	2030
SW-LI-005c	Derry Road and Dishley Court	A+	Linear Infrastructure	525 mm	13 m	Class 4	Low	30%	Suburban	$25,000	2030
SW-LI-006	Erin Mills Parkway and QEW Ramp West	A+	Linear Infrastructure	375 mm	170 m	Class 4	Low	30%	Suburban	$272,000	2030
SW-BMP-001	Erin Mills north of Mississauga Road	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2024
SW-BMP-002	Derry Road near McLaughlin	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2028
SW-BMP-003	Derry Road east of Highway 410	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2028
SW-BMP-004	Derry Road west of Highway 410	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2028
SW-BMP-005	Mayfield Road east of Dixie Road	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2024 or 2039
SW-BMP-006	Erin Mills south of Mississauga Road	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2028

Capital Program ID	Name	Class EA Schedule	Project Type	Size (mm)	Length (m)	Class Estimate Type	Project Complexity	Accuracy Range	Area Condition	Total Estimated Cost (2022$)	Timeline
SW-BMP-007	Dixie Road south of Highway 401	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2038
SW-BMP-008	Erin Mills south of Highway 403	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2028
SW-BMP-009	Kennedy Road south of Queen Street	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2022
									Total	**$14,298,000**	



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Stormwater Servicing Plan for Regional Road Infrastructure

Capital Program

BluePlan Engineering

Figure 3A
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Appendices

List of Abbreviations

Terms of Acronym	Definition
ALOS	Asset Level of Service
AMP	Asset Management Plan
ANSI	Area of Natural and Scientific Interest
CA	Conservation Authority
CCDP	Climate Change Data Portal
CCTV	Closed Circuit Television
CHER	Cultural Heritage Evaluation Report
CLI ECA	Consolidated Linear Infrastructure Environmental Compliance Approval
CTC	Credit Valley, Toronto and Region and Central Lake Ontario
CVC	Credit Valley Conservation Authority
d/D	Depth / Diameter
EA	Environmental Assessment
EAA	Environmental Assessment Act
EBA	Event Based Area
EGRA	Ecologically Significant Volume Groundwater Recharge Areas
EIS	Environmental Impact Study
EPR	External Point Repair
ESA	Environmentally Sensitive Area
ESR	Environmental Study Report
GhG	Greenhouse Gas
GIS	Geographic Information System
HC	Halton Conservation Authority
HGL	High Grade Line
HGRA	High Volume Groundwater Recharge Areas
HIA	Heritage Impact Assessment
HVA	Highly Vulnerable Aquifer
ICA	Issue Contributing Area
ICM	Integrated Catchment Modelling
IDF	Intensity Duration Frequency
IPZ	Intake Protection Zone
km	Kilometers
LGRA	Low Volume Groundwater Recharge Areas
LID	Low Impact Development
LID TTT	Low Impact Development Treatment Train Tool
LOS	Levels of Service
LRTP	Long Range Transportation Plan
LSRCA	Lake Simcoe Region Conservation Authority
m	Meters
MACP	Manhole Assessment Certification Program
MCEA	Municipal Class Environmental Assessment
MECP	Ministry of Environment, Conservation & Parks
MGRA	Medium Volume Groundwater Recharge Areas

Terms of Acronym	Definition
mm	Milimeters
MNRF	Ministry of Natural Resources & Forestry
MOP	Mississauga Official Plan
MTD	Manufactured Treatment Device
NEP	Niagara Escarpment Plan
NVCA	Nottawasaga Valley Conservation Authority
OGS	Oil/Grit Separator
OMB	Ontario Municipal Board
ORMCP	Oak Ridges Moraine Conservation Plan
PACP	Pipeline Assessment Certification Program
PCCP	Peel Community Climate change Partnership
RFP	Request for Propopsal
ROP	Regional Official Plan
ROW	Right of Way
SABE	Settlement Area Boundary Expansion
SGBLS SPP	South Georgian Bay Lake Simcoe Source Protection Region
SGRA	Signficant Volume Groundwater Recharge Areas
SoGR	State of Good Repair
SOP	Standard Operating Procedure
SPA	Source Protection Area
SPR	Source Protection Region
SPS	Sewage Pumping Station
STS	Sustainable Transportation Strategy
SWS	Subwatershed Study
TRCA	Toronto and Regional Conservation Authority
TSS	Total Suspended Solids
VSA	Vulnerable Scoring Areas for Groundwater and Surface Water
WHPA	Wellhead Protection Area
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

1.0 Introduction and Background

GM BluePlan was retained by the Region of Peel (the Region) to complete a Stormwater Servicing Plan for Regional Road Infrastructure (herein referred to as the "Stormwater Master Plan") in July 2019 (RFP# 2019-309P). The intent of the Stormwater Master Plan is to create the first long-term servicing strategy for the stormwater system owned and maintained by the Region.

The primary aim of the project is to guide the management of stormwater infrastructure and provide a strategic, economical, and optimized vision that will govern the Region into the 2041 horizon year considering the 2021 Official Plan Consolidation[1]. The Stormwater Master Plan creates a long-term vision for servicing of the Regional Road infrastructure with an emphasis on cost-effective and technically viable solutions, protecting and enhancing the natural and cultural environment, achieving participation from a broad range of partners, and minimizing social impacts. This process will provide the Region with a basis to make sound decisions to service current and future growth in a manner that addresses the expected impacts of climate change and complies with all provincial and federal regulatory frameworks. The following objectives represent the key project tasks:

- Undertake a comprehensive Class Environmental Assessment (EA) process to create a holistic and optimized stormwater management strategy to efficiently service existing and future Regional Road stormwater drainage needs of the Region, evaluate alternatives, and recommend solutions with proposed projects
- Establish a risk-based framework for stormwater 'Levels of Service (LOS)' (technical, operational, and performance based) as it relates to stormwater infrastructure in a manner that will ensure the Region's compliance with Ontario's 2018 Asset Management regulation (O. Reg. 588/17)
- Develop a hydraulic model that will provide a tool to assess capacity and performance of the minor (piped) system, support the evaluation of alternative stormwater strategies, and confirm the effectiveness of the proposed servicing strategies
- Identify and confirm drainage areas of the piped stormwater, including external drainage
- Explore and validate the application of different stormwater management options including Low Impact Development (LID), considering the best solutions from technical, environmental, social, and economic perspective
- Establish the ability of the strategies to achieve the stormwater level of service goals and their impact on the lifecycle funding needs of the stormwater infrastructure system
- Review the recently completed condition-based asset management recommendations and propose optimized solutions for retrofit projects by considering options

[1] Note: The Region of Peel is currently in the process of finalizing and implementing a new 2022 Official Plan which was not available during through the analysis stages of the study and is anticipated for adoption in July 2022. As such, the study has been completed under the 2021 Official Plan context with added reference to the 2022 Official Plan.

- Prepare a Municipal Class EA Report that satisfies the requirements for all Schedule A/A+ projects that are in the implementation plan (including Phase 1 {Problem / Opportunity} and Phase 2 {Alternative Solutions})
- Complete a cost estimate, phasing, and implementation plan for the preferred alternative solutions and recommended LID and/or other projects
- Consider the future resourcing needs, software, and hardware requirements to implement the proposed stormwater management program to service Regional road infrastructure

Through the course of the project, additional objectives were agreed upon with the Region for the benefit of the overall project. These additional objectives include:

- Piloting the use of the stormwater model to provide input to the Region's Development Engineering review team with regard to theoretical capacity within the stormwater system for active development projects
- The development of a tool which rates the feasibility of Low Impact Development implementation across the Region's urban road network
- Hydraulic analysis of the Regional stormwater network associated with the Finch Stormwater Pumping Station to determine the feasibility of a pumping station decommissioning
- Review of Policy options regarding right to connect to Regional stormwater infrastructure

1.1 Background

Stormwater management, in the province of Ontario, operates in a multi-stage, multi-agency environment. Multiple provincial and federal legislations and accompanying administrative structures and agencies govern and manage Ontario waters. For any given project, there can be over a dozen different federal, provincial, and/or municipal legislation, policies, and/or bylaws that need to be considered. Further, site specific restrictions and considerations may further influence stormwater management requirements. As such, there is no set comprehensive framework from which all municipalities can follow.

Municipalities need to review and weigh the different considerations and establish their own policies in order to best manage their unique systems. Although there is no set framework, stormwater management in Ontario follows these general principles:

- Maintain the natural hydrologic cycle
- Prevent an increase in risk of flooding
- Prevent undesirable stream erosion
- Protect water quality

The specifics of these management principals are set through the development of an integrated planning process of both Environmental and Municipal Land Use Planning documents that utilize a multi-layered approach, starting with a broad area level study with subsequent detailed studies reviewing a more discretized area and establishing more refined objectives.

This study is being planned in accordance with the Master Planning process (Approach #1) as set out in Section A.2.7 of the Municipal Engineer Association (MEA) Class Environmental Assessment (Class EA) (October 2000, as amended in 2007, 2011 & 2015). This approach involves the preparation of a Master Plan document at the conclusion of Phase 1 and 2 of the Class EA process where the level of investigation, consultation and documentation are sufficient to fulfil the requirements for Schedule A/A+ projects, if required.

1.2 Study Area

The Region of Peel is located in southern Ontario and borders the Regional Municipality of Halton and the County of Wellington to the west, the City of Toronto and Regional Municipality of York to the east, the County of Dufferin and County of Simcoe to the north, and Lake Ontario to the south. Peel Region includes three lower tiers municipalities, the City of Mississauga, the City of Brampton, and the Town of Caledon. The Region is responsible for the installation, maintenance and operation of all public stormwater infrastructure located within Peel Regional Roads, whereas the lower tier municipalities are responsible for the installation, maintenance, and operation of all public stormwater infrastructure located within their local roads.

The study area is located within the Region of Peel, specifically within the Regional Road right of ways (ROW). **Figure 1** provides a map of the study area that will be the focus of the Stormwater Master Plan.

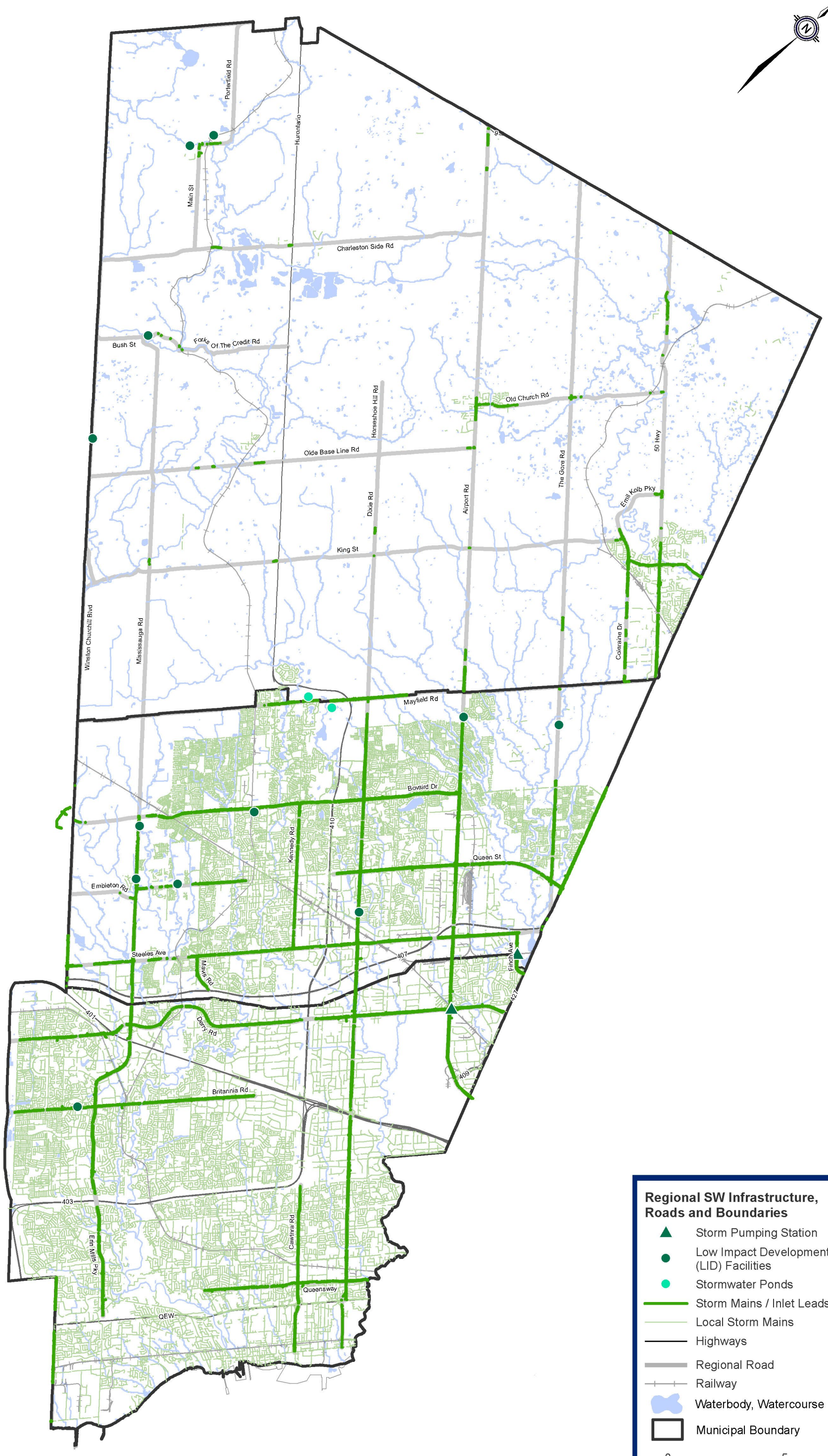
The stormwater system is made up of the minor and major systems. The minor system consists of ditches, the underground storm sewer system, and Low Impact Development (LID) Best Management Practices, which provide the first response level of protection by conveying flows from the more frequent, lower intensity storm events. Flow to the minor system is restricted to the capacity of the pipes, LIDs, and associated appurtenances.

The major system consists of specially engineered overland flow routes along the road network, ditches, swales, and high-capacity water courses. It is designed to convey runoff from the less frequent, higher intensity storm events that are in excess of the minor system design capacity. The major system conveys the stormwater to an engineered receiving point. Right of way grading must be designed such that an overland flow route is maintained. This route must be clearly identified including the ultimate outlet of the overland flow route (i.e. watercourse or roadway).

The existing Region of Peel stormwater consists of the asset classes and quantities outlined in **Table 1**.

Table 1. Existing stormwater infrastructure.

Infrastructure Type	System Type	Quantity
Storm Sewers	Minor System	331 km
Ditches / Swales	Minor System	417 km
LID Facilities	Minor System	46 facilities
Stormwater Pump Stations	Minor System	2 facilities
Stormwater Management Facilities	Major System	2 facilities
Manufactured Treatment Devices	Major System	140 facilities



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Stormwater Servicing Plan for Regional Road Infrastructure

Existing Stormwater Infrastructure (Regional)

Baseline Understanding

BluePlan Engineering

Figure 1
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1.3 Stormwater Master Plan Objectives

The goal of the Stormwater Master Plan is to address a system-wide Problem/Opportunity Statement. Through the EA process, a preferred servicing strategy will be developed including project locations, type of project, and high-level construction timing. The objectives of the study are to:

- Confirm the overall Regional stormwater servicing objectives and perform first principal engineering analysis of the servicing alternatives
- Satisfy the Municipal Class EA requirements for the servicing strategy
- Consider unique opportunities and challenges associated with utility and infrastructure services, environment and natural features, and socio-economic impacts
- Provide effective communication and consultation with partners, agencies, Indigenous communities, and the public throughout the entire Class EA study process
- Analyze, develop, and select the preferred solution to ensure successful implementation of the infrastructure components
- Identify any issues and consider potential remediation
- Provide sufficient level of conceptual design to demonstrate the extents of the infrastructure, improve project cost estimating, provide detailed implementation requirements, and identify overall operational concepts
- Deliver comprehensive documentation of the strategy, evaluation, and recommendations

1.4 Problem and Opportunity Statement

As part of Phase 1 of the Municipal Class EA process, a Problem/Opportunity Statement provides a clear identification of opportunities and challenges that are being addressed through the study. The Problem/Opportunity Statement for this Master Plan is summarized as follows:

Provide efficient stormwater servicing to existing and future Regional Road infrastructure by taking into account existing ageing infrastructure, growth, natural environment, climate change, and compliance within regulatory framework

The Problem/Opportunity Statement for the Stormwater Master Plan aims to achieve the following strategy goals:

- Identify key candidate locations within Regional roads to incorporate LID infrastructure
- Provide an appropriate level of servicing security (resilience and/or redundancy) while considering growth within the Region
- Provide infrastructure capacity and flexibility to adapt to increasingly extreme wet weather events
- Minimize total capital, operation and maintenance, and lifecycle costs
- Minimize environmental impacts including natural and socio-economic

1.5 A Unique Master Plan

The Region's Stormwater Master Plan is not a traditional Master Plan due to scope and make-up of the assets and subcatchments involved in the study. The Region is responsible for only the stormwater assets within the Regional right of way while lower-tier municipalities are responsible for the stormwater assets within the lower-tier rights of way. This leads to unique situations within the Regional stormwater management system where Regional stormwater assets may have upstream or downstream connectivity with lower-tier stormwater assets. In addition to the lower-tier connectivity, the Regional stormwater network is made-up of over 400 sub-networks with associated outfalls into urbanized and naturalized watercourses. The fragmentation of the overall Regional stormwater management infrastructure, particularly the minor system, leads to unique opportunities and constraints which are outlined in **Section 9.1.1** and **Section 10.1.1**. In order to promote understanding of the Region's responsibility and role in stormwater management the project team created an information animation, which can found on the Region's website and YouTube (https://www.youtube.com/watch?v=VclEa5VcS1U).

Figure 2. Screenshot of the Region's Stormwater Information Animation.

The Region also does not permit private connections to Regional stormwater infrastructure unless there is no alternative outlet available to either lower-tier stormwater infrastructure or an alternative outlet such as a Conservation Authority controlled/managed watercourse. As such, the Region and this Stormwater Master Plan do not account for growth or population in a traditional Master Plan sense. With few private connections to Regional stormwater infrastructure, there are no traditional population projections or growth associated with the storm sewer network outside of road widenings or new Regional Roads as outlined in the Region's Long Range Transportation Plan (LRTP), which was published in 2019. The LRTP is a five-year plan based on the 2041 planning horizon which guides transportation needs in the Region of Peel. The LRTP outlines Regional Road projects which support growth in the Regional Road network. These projects are in various stages of permitting, and the supporting studies account for stormwater management needs due to any increased imperviousness related to road widenings or new roads. Further context on the LRTP is provided in **Section 3.2** Further context on the ways in which the Stormwater Master Plan accounts for growth are summarized in **Section 11.2.1**

2.0 Master Planning Process

The Stormwater Master Plan comprehensively documents the development of the preferred stormwater servicing strategy for the Region of Peel to meet servicing needs of existing users and future development to 2041.

The Municipal Class EA process clearly defines approaches for completion of Master Plans within the EA context. **Figure 3** provides a summary of the phases within the Municipal Class Assessment process.

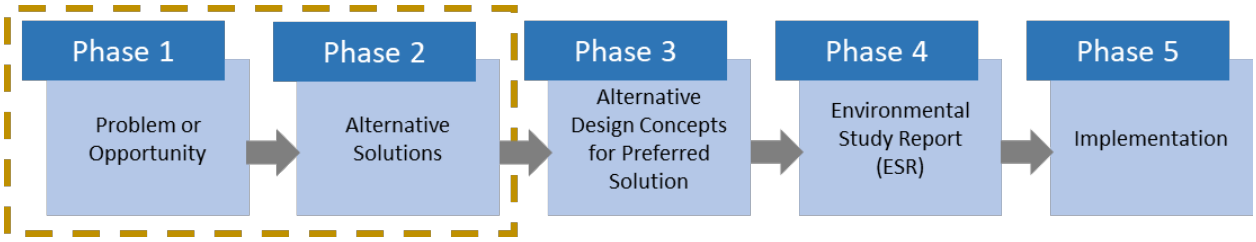


Figure 3. Municipal Class Assessment Process.

The following section provides a description of the Class EA and Master Planning process.

2.1 Class Environmental Assessment Process

2.1.1 Class Environmental Assessment Act

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

The EAA's comprehensive definition of the environment is:

- Air, land or water
- Plant and animal life, including human life

- The social, economic, and cultural conditions that influence the life of humans or a community
- Any building, structure, machine, or other device or thing made by humans
- Any solid, liquid, gas, odour, heat, sound, vibration, or radiation resulting directly or indirectly from human activities
- Any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario

The purpose of the EAA is the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation, and wise management of the environment in Ontario (RSO1990, c.18, s.2). An EAA must also ensure that decisions result from a rational, objective, transparent, replicable, and impartial planning process.

As set out in Section 5(3) of the EAA, an EA document must include the following:

- A description of the purpose of the undertaking
- The undertaking
- The alternative methods of carrying out the undertaking
- Alternatives to the undertaking

The EA document must also include a description of:

- The environment that will be affected or that might reasonably be expected to be affected, directly or indirectly, by the undertaking or alternatives to the undertaking
- The effects that will be caused or that might reasonably be expected to be caused to the environment by the undertaking or alternatives to the undertaking
- The actions necessary or that may reasonable be expected to be necessary to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment by the undertaking or alternatives to the undertaking
- An evaluation of the advantages and disadvantages to the environment of the undertaking, the alternative methods of carrying out the undertaking and the alternatives to the undertaking (RSO1990, c.18, s.2)

2.1.2 Principals of Environmental Planning

The EAA sets a framework for a rational, objective, transparent, replicable, and impartial planning process based on the following five key principles:

1. **Consultation with affected parties.** Consultation with the public and government review agencies is an integral part of the planning process. Consultation allows the proponent to identify and address any concerns cooperatively before final decisions are made. Consultation should begin as early as possible in the planning process.

2. **Consideration of a reasonable range of alternatives**. Alternatives include functionally different solutions, “alternatives to” the proposed undertaking and “alternative methods” of implementing the preferred solution. The “do nothing” alternative must also be considered.

3. **Identification and consideration of the effects of each alternative on all aspects of the environment.** These aspects include the natural, social, cultural, technical, and economic environments.

4. **Systematic evaluation of alternatives in terms of their advantages and disadvantages to determine their net environmental effects.** The evaluation shall increase in the level of detail as the study moves from the evaluation of “alternatives to” to the evaluation of “alternative methods”.

5. **Provision of clean and complete documentation of the planning process followed to allow “traceability” of decision-making with respect to the project.** The planning process must be documented in such a way that it may be repeated with similar results.

2.1.3 Class Environmental Assessment Approach

“Class” Environmental Assessments (Class EAs) were approved by the Minister of the Environment in 1987 for municipal projects having predictable and mitigable impacts. The Municipal Class EA process was revised and updated in 1993, 2000, 2007, 2011 and 2015. The Class EA approach streamlines the planning and approvals process for municipal projects that are:

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

The Municipal Class Environmental Assessment, prepared by the Municipal Engineers Association (October 2000, as amended in 2007, 2011 and 2015) outlines the procedures to be followed to satisfy Class EA requirements for water, wastewater, stormwater management, and road projects. The process includes five phases:

- **Phase 1:** Problem or Opportunity Definition
- **Phase 2:** Identification and Evaluation of Alternative Solutions to Determine a Preferred Solution while taking input from the public and other stakeholders into consideration
- **Phase 3:** Examination of Alternative Methods of Implementation of the Preferred Solution while taking input from the public and other stakeholders into consideration
- **Phase 4:** Documentation of the Class EA process in the form of an Environmental Study Report (ESR) for public review

- **Phase 5:** Implementation and Monitoring.

2.1.4 Project Schedules

Projects subject to the Class EA process are classified into the following four “schedules” depending on the extent of the expected impacts. **Figure 4** illustrates the Municipal Class EA planning and design process with the phases required for each schedule.

Schedule A projects are minor or emergency operational and maintenance activities and are approved without the need for further assessment. These projects are typically smaller in scale and do not have a significant environmental effect.

Schedule A+ projects are also pre-approved; however, the public is to be advised prior to the project implementation. Although projects of this class do not usually have the potential for adverse environmental impacts, they tend to be broader in scale in comparison to Schedule A projects.

Schedule B projects require a screening of alternatives for their environmental impacts and Phases 1 and 2 of the planning process must be completed (refer to **Figure 4**). The proponent is required to consult with the affected public and relevant review agencies. If there are still outstanding issues after the public review period, requests may be made to the Minister of the Environment to provide additional detail and information on projects and to confirm that the correct approach to project evaluation has been applied. Provided that no significant impacts are identified, or issues reported, once a Schedule B project is approved, work may proceed directly to implementation.

Schedule C projects must satisfy all five phases of the Class EA process. These projects have the potential for greater environmental impacts. Phase 3 involves the assessment of alternative methods of carrying out the project, as well as public consultation on the preferred conceptual design. Phase 4 normally includes the preparation of an Environmental Study Report (ESR) that is filed for public review. Provided no significant impacts are identified, once a Schedule C project is approved, work can proceed directly to implementation.

2.1.5 Master Planning Process

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

The Stormwater Master Plan is based on Approach 1 of the Master Planning process, which involved the preparation of a master plan document at the conclusion of Phases 1 and 2 of the Class EA Process where the level of investigation, consultation and documentation satisfy the requirements for Schedule A/A+ projects.

2.2 Public and Stakeholder Consultation

Public consultation is an important component of the Class EA process and includes informing members of the community and stakeholders to provide balanced and objective information as well as to obtain valuable feedback on the study process, alternatives, and preliminary preferred solution. The Region of Peel continues to coordinate with the City of Mississauga, City of Brampton, Town of Caledon, Toronto and Region Conservation Authority (TRCA), and Credit Valley Conservation (CVC) regarding coordination of various EA and infrastructure projects within the study area.

The primary goals and objectives of the public consultation process are to:

- Present clear and concise information at key stages of the study process
- Solicit community, regulatory, Regional, and Local staff input
- Identify concerns that might arise from the undertaking
- Undertake a comprehensive Indigenous communities' consultation to fulfill the Region's Duty to Consult with Indigenous communities
- Consider stakeholder comments when developing the preferred solution
- Meet Municipal Class EA Consultation requirements

To fulfill the consultation requirements of the MEA Municipal Class EA and enhance the overall Class EA process, the Master Plan was designed to:

- Build on past communication protocols and consultation plans from previous Class EA and municipal planning initiatives, to ensure consistency and continuity
- Meet public and agency notification and consultation requirements for Phases 1 and 2 of the MEA Municipal Class EA
- Ensure the general public, Regional, and municipal councillors, partners, external agencies (including federal and provincial), and special interest groups have an opportunity to participate in the study process
- Ensure that information is provided to interested and affected stakeholders early and often throughout the study process
- Contact external agencies to obtain legislative or regulatory approvals, or to collect pertinent technical information

An important component at the outset of the public consultation process was to develop a Communication and Consultation Plan. The primary objective of the Plan was to strategize two-way communication with the community, regulatory agencies, Regional, and Local staff. The Communication and Consultation Plan is provided in **Appendix A.**

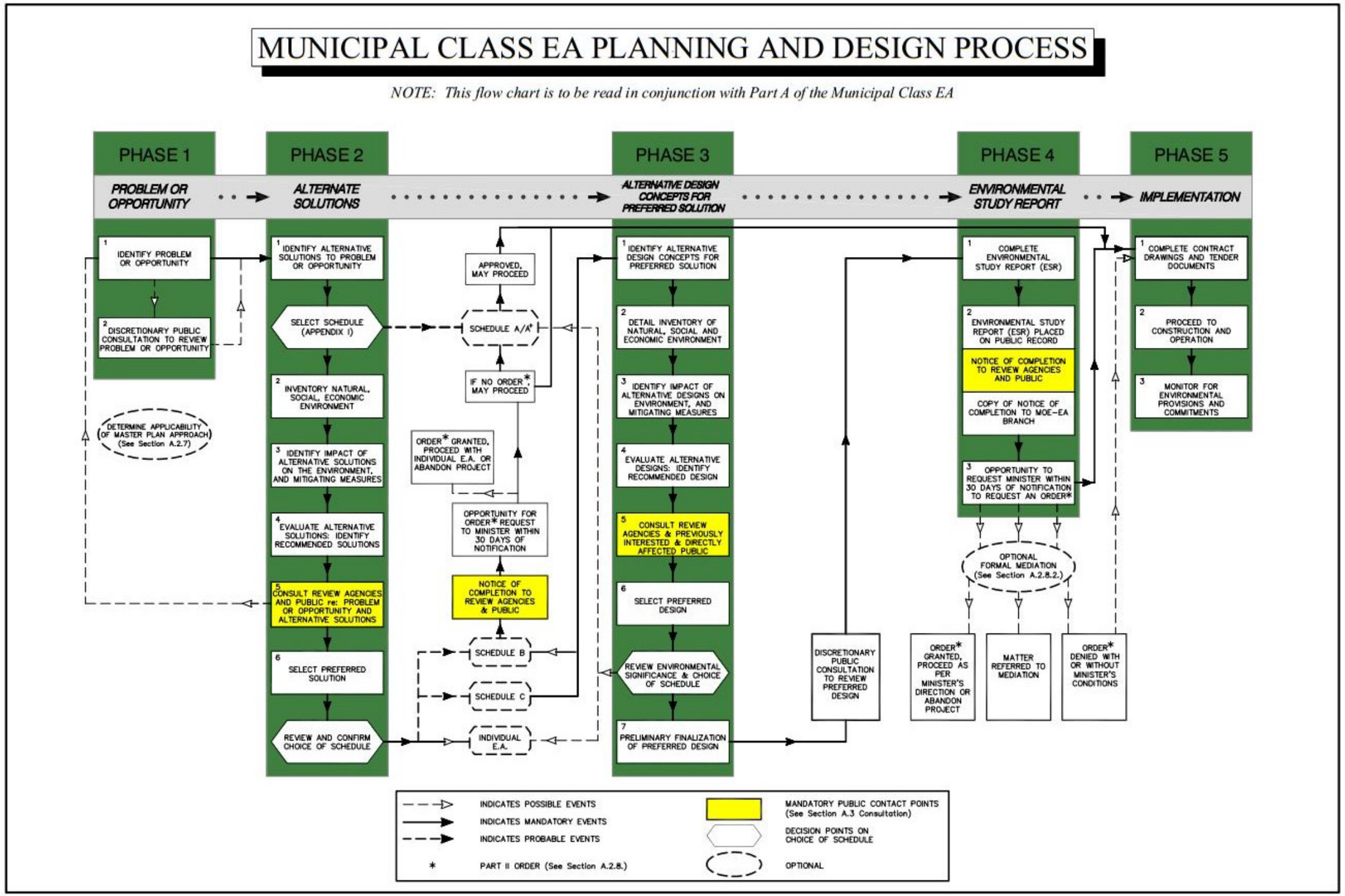


Figure 4. Municipal Class EA Planning and Design Process.

3.0 Related Studies and Background Information

The Region of Peel has developed various stormwater related guidelines and strategies that will be used to support and guide the Stormwater Master Plan. The intent of this review is to identify key considerations and previous works that will inform the Stormwater Master Plan. The following section summarizes these key documents, culminating with a summary table that identifies the primary considerations that will be taken forward as part of this Master Plan.

3.1 Stormwater Management Framework

As noted in **Section 1.1**, there is no set framework for municipalities to follow requiring each to establish approaches and polices to manage their own systems.

Execution of reasonable policies and LOS objectives are essential in ensuring that the proper planning and design principles are followed in the development of detailed servicing strategies, implementation of system capital program, and operations and maintenance practices.

In the context of the Stormwater Master Plan, these Policies and LOS objectives provide guidelines and direction to the master planning process, in addition to ensuring that stormwater flows are adequately representative to support the decision making for sizing and timing of future infrastructure.

Through the master planning process, draft policies and LOS objectives were established and used to guide decision making for the stormwater systems. This section summarizes the key policy and LOS objectives as it relates to stormwater system while a more detailed description of master planning policies and the LOS Framework created through this project are included in **Section 4.**

3.2 Long Range Transportation Plan, 2019

The Long Range Transportation Plan (LRTP) is a five-year plan that guides transportation planning within the Region of Peel to 2041 and beyond. The LRTP addresses the growth and foreseeable increase in travel demand by identifying and evaluating transportation servicing strategies alternatives such as road improvements (e.g. new roads, widening existing roads) and sustainable modes (e.g. walking and cycling infrastructure). The Plan serves as the basis for infrastructure programming and capital budgeting needs and is an input into the Development Charges Bylaw Update. Existing and LRTP planned infrastructure along Regional Roads will be considered in the Stormwater Master Plan strategy identification and evaluation.

The Region have initiated the process of updating the LRTP in the foreseeable future. It is recommended that the Stormwater Master Plan be updated following completion of the LRTP update to ensure that stormwater systems are managed to account for growth in the Region of Peel's transportation network.

3.3 Stormwater Design Criteria and Procedural Manual, 2019 (Version 2.1)

The Stormwater Design Criteria and Procedural Manual provides minimum design standards for various stormwater-related infrastructure. The document also provides guidelines on stormwater management requirements including quality, quantity and erosion and sediment control.

The Stormwater Master Plan will consider the design requirements when developing the hydraulic model, in addition to identifying stormwater servicing strategy alternatives. Further details on the hydraulic model development are provided in **Section 6.**

Note that the most recent iteration of the Region's Stormwater Design Criteria and Procedure Manual supersedes any of the summarized information in the following subsections. The Region anticipates updates to the Stormwater Design Criteria and Procedure Manual to include requirements of the CLI ECA.

3.3.1 Stormwater Servicing Principles and Policies

Servicing principles have been previously established to guide the development of stormwater servicing policies and strategies within the Region. In general, the Region of Peel is looking to build and maintain efficient, reliable, sustainable, and well-managed stormwater systems that provide high level of service to the public.

The principals and policies summarized in the following subsections support sustainable growth within the Region. Additionally, a draft policy framework has been developed as part of the Stormwater Master Plan to assist in funding growth and maintenance-related stormwater practices within the Region. The suggested policy, which is for discussion only, outlines the general approach to the use of the Region's stormwater infrastructure, as it relates to its drainage purpose and for other parties wishing to connect and use the system. The policy also outlines an approach to cost sharing. This conceptual policy statement, included in **Appendix B,** is provided as a draft for discussion only. This should be considered as a reference framework with further refinement recommended based on consultation with partners and stakeholders before such a policy would become effective.

3.3.1.1 Hydraulic Performance Criteria Summary

The 4-hour Chicago design storm event was utilized for modelling the urban runoff following the Region's design criteria to determine rainfall intensity (mm/hr). Rainfall intensity is calculated using the following equation:

$$I = \frac{A}{(TC + C)^B}$$

Where A, B, and C are the IDF values provided in **Table 2,** and TC is the storm duration in minutes.

Table 2. Region of Peel IDF values per Storm Sewers Linear Municipal Infrastructure Standards (2019).

Parameter	A	B	C
2-year	1070	0.8759	7.85
5-year	1593	0.8789	11.00
10-year	2221	0.9080	12.00
25-year	3158	0.9335	15.00
50-year	3886	0.9495	16.00
100-year	4688	0.9624	17.00

The 4-hour Chicago storm distribution was used in the hydraulic model for peak runoff prediction in an urban watershed, per the recommendations of the Public Works Stormwater Design Criteria and Procedure Manual (Region of Peel, 2019). The 10-year return period was used to assess the minor system conveyance capacity per the Region's minor system level of service target.

3.3.1.2 Water Quantity and Flood Controls

Per the Public Works Stormwater Design Criteria and Procedure Manual (Region of Peel, 2019), the following policies and design considerations are applicable to development within the Region of Peel as it relates to stormwater management:

- Post to Pre-control of peak flows of 2 to 100-year design storms to the appropriate Watershed Flood Control Criteria and/or local requirement. Where Watershed Flood Control Criteria does not exist, at a minimum, post-development flows must be equal to pre-development.
- Post development flows shall not:
  - a) Adversely affect the performance of downstream Region of Peel infrastructure
  - b) Negatively impact adjacent properties
  - c) Exacerbate or increase the downstream flood or erosion risk.
- Flood Control is per the applicable Conservation Authority's jurisdiction. Consultation with the agency's stormwater management criteria document or applicable reference documents as required. The following are the Conservation Authorities which have jurisdiction within the Region of Peel:
  - Credit Valley Conservation (CVC)
  - Toronto and Regional Conservation Authority (TRCA)
  - Lake Simcoe Region Conservation Authority (LSRCA)
  - Nottawasaga Valley Conservation Authority (NVCA)
  - Halton Conservation Authority (HC)

3.3.1.3 Water Quality

The Region of Peel outlines the following water quality control requirements for use in stormwater management planning and designing for works related to Regional Roads:

- Ensure stormwater management practices minimize stormwater contaminant loads and increase the extent of vegetative and pervious surfaces
- Where possible, retain rural cross-section using Low Impact Development
- Level 1 enhanced treatment through the long-term removal of 80% total suspended solids (TSS), per the Ministry of Environment, Conservation, and Parks (MECP) criteria

Additionally, due to the presence of Redside Dace and Jefferson Salamander, the Region outlines additional water quality control requirements within the endangered species habitat, which include:

- Limit the Total Suspended Solids (TSS) within discharge to 25mg/L above background stream level
- Thermal mitigation: to minimize thermal impacts, preventative measures (e.g. LID practices) and mitigation measures should be applied to limit discharges to 24 °C maximum

3.3.1.4 Volume Control

At the time of development of the Region's Stormwater Design Criteria and Procedure Manual (Region of Peel, 2019), the Ministry of Environment, Conservation, and Parks Low Impact Development Stormwater Management Guidance Manual is in draft format (not formally released). As such, the Region's volume control criteria are only recommendations at this time, and not requirements.

The Region's recommendations for volume control are summarized as follows:

- Control of runoff from the Regional specific 90th percentile rainfall volume (27-28 mm) using the control hierarchy outlined in the Stormwater Design Criteria and Procedure Manual (Region of Peel, 2019)
    - Priority 1 – Volume retention (infiltration, re-use, and/or evapotranspiration) using LIDs to satisfy pre-development water balance requirements
        - Minimum post-development recharge of the first 5 mm for any precipitation event
    - Priority 2 – LID volume capture and release using LID filtration techniques
        - Treat remainder of 90th percentile rainfall volume (27-28 mm) not retained using Priority 1 measures to enhance water quality and reduce runoff volumes
    - Priority 3 – Volume capture and release using oil/grit separators (OGS), dry ponds, wet ponds, and/or wetlands
        - Treat remainder of 90th percentile rainfall volume (27-28 mm) not retained using Priority 1 or Priority 2 measures respectively to enhance water quality and reduce runoff volumes

3.3.1.5 Stormwater Erosion Control

The Region requires the avoidance of increases in the amount of surface runoff during rainfall events causing streams to become wider and more unstable as erosion of the banks occurs and increased sediment enters the streams as a result of erosion of the banks. As such, the following requirements are to be followed:

- At a minimum, retain 5 mm on site where conditions do not warrant the detailed analyses
- If the site drains to a sensitive creek, or if a subwatershed study, Master Environmental Servicing Plan, or Environmental Impact Report is required, then the proponent must complete a geomorphic assessment study to determine the erosion threshold. The proponent may need to consult the appropriate Conservation Authority for direction on how to identify whether the creek is sensitive
- For sites with stormwater management ponds and sites which directly discharge to a watercourse, 25 mm (48 hour) detention may also be required, depending on the results of the erosion assessment

3.3.1.6 Water Balance

Per the Stormwater Design Criteria and Procedure Manual (Region of Peel, 2019), water balance is defined as the mass balance accounting for water entering, accumulating, and exiting a system. It can include rainwater, potable drinking water, evapotranspiration and infiltration, wastewater and stormwater.

The following requirements are intended to offset the impacts of any increase in impervious surfaces which may impact groundwater recharge, infiltration volumes and patterns, flows to wetlands and streams, and local water supply aquifers:

- Stormwater management should mimic pre-development hydrologic regimes by incorporating a ‘treatment-train’ approach and low-impact development (LID) source and conveyance controls
- Mandatory requirement to meet the pre-development water balance using LID Retention (Priority 1) for Significant, Ecologically Significant, High and Medium Volume Groundwater Recharge Areas (SGRA, EGRA, HGRA, and MGRA) as well as endangered species habitat. Site specific water balance analyses is required
- For Low Volume Groundwater Recharge Areas (LGRA), provided the site does not impact a sensitive ecological feature, or require a subwatershed study, or EIS, the proponent has the option to:
    - Provide a minimum post development recharge of the first 5 mm for any precipitation event, or
    - Complete a site-specific water balance to identify pre-development groundwater recharge rates to be maintained post-development
- For natural features (woodlands, wetlands, watercourses) maintain hydrologic regimes and hydroperiods. The proponent should determine with the appropriate conservation authority whether a feature-based water balance is required

Additionally, due to the presence of Redside Dace and Jefferson Salamander, the Region outline additional water quality control requirements within the endangered species habitat, which include:

- Post development water balance to match predevelopment water balance in order to protect the natural hydrological functions of streams
- Retention (no storm run-off from rainfall events in the range of 5-15 mm (depend on the recommendations set forth in the subwatershed plan and on the in-situ soil permeability)

3.3.1.7 Gravity Sewer System Capacity

Sewer surcharging conditions will be defined and assessed when peak system hydraulic grade line (HGL) within a pipe satisfies the following conditions under the 10-year design storm:

- Existing Infrastructure
  - The Hydraulic Grade Line (HGL) in the pipe reaches surface elevation, or
  - The depth of flow in pipe is equal to the obvert elevation (d/D <= 1)
- New/Upgraded Infrastructure
  - Gravity sewers will achieve a d/D target of 0.7

3.4 Climate Trends and Future Projections in the Region of Peel, 2016

This technical report provides metrics on the on the expected changes in climate including temperature and precipitation into the 2080s for the Region of Peel. The report characterizes the trends and provides predictions to be used within the Region of Peel. The risks and vulnerabilities within the Region with respect to infrastructure are reviewed in this report.

3.5 Peel Climate Change Partnership Action Plan, 2017

In 2009, the City of Brampton, City of Mississauga, Town of Caledon, Credit Valley Conservation, Toronto and Region Conservation Authority, and the Region of Peel formed the Peel Community Climate Change Partnership (PCCP) to develop an intergovernmental climate change strategy. The action plan includes an assessment of the collective impact over the next five years. Several sub-strategies were developed to reduce community greenhouse gas (GhG) emissions and address vulnerability to extreme heat and flooding.

3.6 Watershed Health Indicator – Level of Service Document (CVC, In Progress)

The 2019 Growth Plan for the Greater Golden Horseshoe and the 2020 Provincial Policy Statement support locally-derived, site-specific stormwater performance criteria (or levels of service) based on (sub)watershed studies, providing a strong connection between the master planning and asset management processes and the protection of watershed health. In the absence of provincial-wide standards or guidance on how to set watershed and stormwater levels of service and assess associated risk in light of climate change, the Peel Climate Change Partnership is developing the following tools and guidance to be released in early 2023:

1. A technical guidance document providing direction for (sub)watershed studies to better support infrastructure planners and asset managers set watershed levels of service and assess climate-related risk with consideration for both environmental and public safety (flood and natural hazards).

2. A discussion paper providing guidance on how watershed-based levels of service may be tracked and monitored as part of community levels of service and/or technical levels of service, as per O. Reg. 588/17.

3. The Risk and Return on Investment Tool can be run at various scales across Peel Region to prioritize risks and provide cost benefit analyses of management scenarios for mitigating multi-flood, erosion and water quality hazards to critical infrastructure under existing and future climate scenarios.

3.7 Region of Peel Corporate Green Infrastructure Opportunity Assessment, 2018

The Region of Peel Corporate Green Infrastructure Opportunity Assessment provides a high-level analysis of how green infrastructure practices could be implemented on Region of Peel owned lands to achieve stormwater management benefits. The assessment evaluates cost, feasibility, and effectiveness of implementing green infrastructure within Region-owned lands for stormwater management benefit.

3.8 Climate Change Master Plan, 2019

The Climate Change Master Plan provides details for decision makers on solutions to achieving the Region's climate change outcomes. Outcomes include emission reduction, preparedness, capacity building, investment, and monitoring/reporting, all to mitigate and adapt to climate change effects. The Climate Change Master Plan provided 20 actions and 66 activities which will guide the way the Region manages Regional assets, infrastructure, and services. The following activities have been extracted to demonstrate the importance of the activities outlined within the Climate Change Master Plan as they relate to the Stormwater Master Plan:

- Activity 13.3 - Develop a Climate Change Adaptation Management Tool for Transportation and Infrastructure Planning
- Activity 14.4 - Implement green infrastructure elements of future Storm Servicing Master Plan for Regional Road Infrastructure.

Climate change is an important factor to consider in stormwater servicing as it effects the frequency, intensity, and duration of rain events and as such will be incorporated into the Stormwater Master Plan.

3.9 Region of Peel Draft System-Wide Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA), 2022

The Region of Peel are currently in the process of acquiring a full, system-wide Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA 009-S701) for their Regional Road stormwater management system in 2022. This includes collection and conveyance (sewers, ditches), stormwater management facilities, manufactured treatment devices (such as oil/grit separators), low impact development facilities, and stormwater management pumping stations. Once complete and approved, the CLI ECA will cover all Regional stormwater assets and allow for the addition of new stormwater assets following the Ministry of Environment, Conservation, and Parks' new municipal process for approvals. The ECA sets forth conditions for alterations to the system as well ongoing operation of the system and comes with mandatory stormwater management criteria for design of pre-approved alterations. The MECP is the regulating body that the Region reports to on ECA compliance.

Based on the output of the CLI ECA, the Region are in the process of developing an Asset Management Plan (AMP) for stormwater infrastructure. The AMP will utilize the Level of Service Framework as discussed in **Section 4**. Its expected completion date is Fall 2022.

3.10 Peel Synthesis Report: Compilation of Conservation Authority Existing Watershed Plans and Related Studies, 2019

As the Region of Peel updates their Regional Official Plan, the five (5) local conservation authorities (CAs) have identified and summarized available watershed planning information in and associated studies such that the Region can make informed decisions throughout the Region's Official Plan process. This report summarizes the available information related to watershed planning for the Region to help demonstrate Growth Plan policy conformity.

3.11 2021 Enterprise Asset Management Plan, 2021

Per the 2021 Enterprise Asset Management Plan, "The Enterprise Asset Management Plan outlines the Region's corporate strategy and plan to achieve the Region's long-term infrastructure risk management goal of finding the balance between providing reliable, efficient services, and doing it at the lowest reasonable cost. The asset management plan uses a risk-based approach to maintaining the Region's assets to meet the council-approved Asset Level of Service (ALOS) targets.

3.12 Existing Planning Policy, Guidelines, and Criteria

The following subsections provide a brief outline and introduction to Regional and Municipal Official Plan documentation as well as provincial regulatory and conservation authority information.

These documents provide high-level guidance that the Master Plan will consider.

3.12.1 Region of Peel Official Plan (September 2021 Consolidation)

The Planning Act requires municipalities to update their official plans every 5 years. This requirement ensures that a municipality's official plan:

- Corresponds with provincial plans
- Reflects what's also important to the Province
- Is consistent with policy statements issued under the Act

Peel Regional Council approved the Regional Official Plan (ROP) on October 22, 1996. The ROP is the Regional Council's long-term policy framework to assist the Region in decision making. It sets the Regional context for detailed planning by protecting the environment, managing resources, directing growth, and setting the basis for providing Regional services in an efficient and effective manner. The ROP provides direction for future planning activities and for public and private initiatives aimed at improving the existing physical environment. The current Regional Official Plan establishes the requirements for growth using a 2031 planning horizon; however, Regional Council have passed a by-law to adopt a new Region of Peel Official Plan which adds policies on growth management including changing the planning horizon to 20512.

The purpose of the ROP is to:

- Provide Regional Council with the long-term Regional strategic policy framework for guiding growth and development in Peel while having regard to protecting the environment, managing the renewable and non-renewable resources, and outlining a regional structure that manages this growth within Peel in the most effective and efficient manner
- Interpret and apply the intent of Provincial legislation and policies within a Regional context using the authority delegated or assigned to the Region by the Province
- Provide a long-term Regional strategic policy framework for the more specific objectives and land use policies contained in the area municipality official plans which must conform to this Plan
- Recognize the duality in the Region of Peel between the urban nature of the Cities of Brampton and Mississauga and the primarily rural nature of the Town of Caledon
- Recognize the need for effective environmental protection and management measures to ensure environmental sustainability
- Recognize the importance of protecting and enriching the natural and cultural heritage of the Region of Peel
- Provide for the health and safety of those living and working in Peel
- Maintain and enhance the fiscal sustainability of the Region of Peel

The ROP includes objectives and policies around the natural environment, water resources, and cultural heritage. These will be considered when assessing servicing alternatives.

[2] Note: The Region of Peel is currently in the process of finalizing and implementing a new Official Plan which was not available during through the analysis stages of the study and was anticipated for adoption in July 2022. As such, the study has been completed under the 2021 Official Plan context with added reference to the 2022 Official Plan.

3.12.1.1 2051 Draft Official Plan Update

The Region of Peel has developed a brand-new Official Plan which reflects the updated 2051 planning horizon per Amendment 1 to "A Place to Grow: Growth Plan for the Greater Golden Horseshoe" (herein referred to as A Place to Grow). This includes modifications to the previous Official Plan document, including the following focus areas:

- Age-friendly planning
- Aggregates resources and excess soil
- Agricultural and rural systems
- Climate Change
- Greenland system
- Growth management
- Health and the built environment
- Housing
- Major transit station areas
- Other focus areas (including cultural heritage, Indigenous engagement, waste management, and rural settlement boundary refinement)
- Provincial Greenbelt plans (including Oak Ridges Moraine Conservation Plan and Niagara Escarpment Plan)
- Settlement area boundary expansion
- Transportation
- Wildland fires
- Water resources

Of significant importance to the Stormwater Master Plan are climate change, growth management, and water resources. The Draft Official Plan establishes the needs for both road improvements and new roads to service Regional growth, as well as the needs of growth through a sustainable transportation network through the Sustainable Transportation Strategy. These are important factors which will drive the growth-related recommendations presented in **Section 11.2.1**. The following are new additions to the purpose of the ROP, in addition to the "purpose" components presented as part of the 2021 Official Plan Consolidation:

- Recognize the duality in the Region between the urban nature of the Cities of Brampton and Mississauga and southern Caledon, and the primarily rural nature of northern Caledon

- Integrate climate change considerations in planning and managing growth to reduce greenhouse gas emissions and improve the resilience of the Region to respond and adapt to a changing climate
- Recognize the importance of planning for equity and inclusion in consideration of the population diversity in the Region

Although not yet Provincially approved, the following policies within the Region of Peel 2051 Official Plan outline general requirements for the development of Stormwater Master Plans:

- 2.6.20.7 Work jointly with the local municipalities and the conservation authorities to develop stormwater master plans for serviced settlement areas that:
    a) are informed by watershed planning;
    b) protect the quality and quantity of water by assessing existing stormwater systems and facilities;
    c) characterize existing environmental conditions;
    d) examine the cumulative environmental impacts of stormwater from existing and planned development, including an assessment of how climate change and extreme weather events will exacerbate these impacts and the identification of appropriate mitigation and adaptation strategies;
    e) incorporate appropriate low impact development and green infrastructure approaches;
    f) identify the need for stormwater management retrofit opportunities that could improve the level of stormwater management for areas where stormwater is uncontrolled or inadequately controlled;
    g) identify the full life cycle costs of the stormwater infrastructure, including maintenance costs, and options to finance costs over the long term; and
    h) include an implementation and maintenance plan.
- 2.6.20.9 Promote and implement stormwater management practices to maintain the natural hydrologic cycle, reduce risks associated with flooding and stream erosion, replenish ground water resources and protect, improve or restore water quality and natural heritage system functions.
- 2.6.20.10 Promote and implement a treatment train approach to manage stormwater incorporating a hierarchy of stormwater management practices including at source, conveyance and end of pipe solutions.
- 2.6.20.11 Direct the local municipalities to develop and implement stormwater management programs which address policy, planning, design, operations, and maintenance requirements for the provision of stormwater services to local communities.

- 2.6.20.12 Direct the local municipalities to integrate stormwater management planning requirements throughout the planning approvals process in accordance with provincial requirements and to implement the guidance and recommendations of watershed and subwatershed plans, master environmental servicing plans, environmental impact studies and stormwater master plans, as appropriate.

- 2.6.20.13 Direct the local municipalities to require proposals for large-scale development to be supported by a stormwater management plan that:

    a) is informed by a subwatershed plan or equivalent

    b) incorporates an integrated treatment train approach which meets stormwater management requirements including for water balance, water quantity, water quality and erosion control;

    c) incorporates low impact development and green infrastructure approaches;

    d) minimizes vegetation removal, grading and soil compaction, sediment erosion and impervious surfaces; and

    e) aligns with the stormwater master plan for the settlement area, where applicable.

- 2.6.20.14 Encourage the local municipalities to prepare comprehensive flood and stormwater management plans for areas undergoing intensification and redevelopment in advance of or concurrent with development approvals.

- 2.6.20.15 Manage stormwater quality and quantity by undertaking environmentally sustainable site design and building practices that avoid, minimize or mitigate stormwater runoff volume, contaminant loads and impacts to receiving watercourses and ground water.

- 2.6.20.16 Implement low impact development and green infrastructure practices which recognize that stormwater is most effectively managed on-site where it falls to mimic natural hydrology to the greatest extent possible through infiltration, evapotranspiration, harvesting, filtration, and detention of stormwater supplemented by conveyance, then end-of-pipe solutions.

- 2.6.20.17 Discourage the use of Regional road rights-of-way to accommodate drainage from development or site alteration on adjacent lands.

- 2.6.20.18 Only allow the use of Regional road rights-of-way to convey stormwater when it is demonstrated by the proponent that directing the flow of drainage into the local municipal storm sewer system is not feasible and the stormwater run-off from a proposed development or site alteration will not negatively impact the performance of the Regional road drainage system to the satisfaction of the Region and relevant approval agencies.

- 2.6.20.19 Require that all drainage from development or site alteration on adjacent lands that drain into a Regional storm sewer meet criteria identified in assessment studies such as watershed or subwatershed plans and demonstrate the following:

    a) Post-development flow should be equal to or less than the pre-development levels in order to not exacerbate or increase the downstream flood risk;

b) Drainage does not adversely affect the capacity and performance of Regional infrastructure;

c) Drainage does not adversely impact water balance, or exacerbate or increase the downstream erosion risk; and

d) Drainage does not adversely impact water quality to the Regional road drainage system or receiving waterways.

- 2.6.20.20 Direct the local municipalities and conservation authorities to ensure that stormwater drainage from Regional roads is considered and comprehensively managed during the development of stormwater management plans for new development or redevelopment.

In the context of the Stormwater Master Plan, growth projections from the 2020 Official Plan consolidation will be used. Per **Section 1.5**, the Region of Peel is responsible for managing stormwater within the Regional right of way. Growth does not impact the Region's Stormwater Master Plan in the sense of a traditional master plan as private stormwater will be conveyed to lower-tier infrastructure. Additionally, the Region's requirement for any existing stormwater connections states that post-development conditions must not exceed pre-development conditions. As such, growth within the Region does not negatively impact stormwater management within the Regional infrastructure network.

3.12.1.2 Scoped Subwatershed Study for the Peel 2051 Official Plan Review

The Peel 2051 process identified locations for settlement area boundary expansions to accommodate employment and community (residential) growth. A Settlement Area Boundary Expansion Study (SABE) is one of the studies that must be conducted as part of the Region's Municipal Comprehensive Review. The Scoped Subwatershed Study (Scoped SWS) was completed in support of the SABE and was split into the following three (3) parts:

- Part A – Characterization
- Part B – Impact Assessment
- Part C – Implementation Plan

These documents provide broad guidance and context for stormwater management within the SABE. This study should be reviewed and referenced for any recommended stormwater improvements that are planned to service Regional roads located within the 2051 New Urban Area. The Scoped SWS includes recommendations, criteria and guidance for water management and stormwater quantity and quality control.

3.12.2 Region of Peel Strategic Plan

The Region is currently working on its first Strategic Plan that will cover 2015-2035. The Strategic Plan's vision will take on more complex challenges and bring bigger ideas to life than is possible over a single term of Council. The 20-year vision for Peel is "Community for Life" which was developed from citizens' feedback to reflect their priorities and hopes for life in the Region of Peel. The Strategic Plan has a 20-year outlook and will be fulfilled in stages. This allows the Region to plan across multiple terms of Council and undertake larger scope plans and challenges. The 2018-2022 Term of Council is focused on seven priorities including four living priorities, two thriving priorities and one leading priority. The strategic plan was utilized to ensure that the Stormwater Master Plan is in line with the Region's strategic initiatives.

3.12.3 City of Mississauga Official Plan

The official consolidation of the Mississauga Official Plan (MOP) has been updated to include the Ontario Land Tribunal, formerly known as the Land Planning Appeal Tribunal, formerly known as the Ontario Municipal Board, decisions and City Council approved Official Plan Amendments as of October 21, 2021. Appeals to the Plan have been identified and until all original appeals are resolved, both Mississauga Plan (2003) and Mississauga Official Plan will need to be referred to since they are both partially in effect. The current City Official plan is under review to ensure it reflects the changing needs, opportunities, and aspirations of the City.

The City's Official Plan includes general land use designations, intensification areas and environmental features. It provides direction for the next stage of the city's growth and planning policies to guide the city's development to year 2031, as required by provincial legislation. The MOP key policies relevant to stormwater networks were considered in the development of the Stormwater Master Plan, as there is cross-connection between the City and Regional storm sewer networks.

3.12.4 City of Brampton Official Plan

The City of Brampton Official Plan was adopted by City Council in October 2006 and approved by the Ontario Municipal Board (OMB) in October 2008. The September 2020 Office Consolidation includes the OMB decisions and LPAT decisions that have resolved several of the appeals to the 2006 Official Plan as well as amendments made to reflect Council decisions. It also includes City Council approved official plan amendments along with updates to conform with the provincial Growth Plan. Starting in late 2019, the City of Brampton began development of a new Official Plan. The Draft Official Plan has not yet been adopted by Council.

The current City of Brampton Official Plan provides direction for decision-making on issues related to land use, built form, transportation and the environment within the City to 2031. The purpose of the Official Plan is to give clear direction as to how development and land-use decisions should take place in Brampton to meet the current and future needs of its residents. It is also intended to reflect their collective aims and aspirations, as to the character of the landscape and the quality of life to be preserved and fostered within Brampton. The Plan also provides guidance and assists in the delivery of municipal services and responsibilities. The City of Brampton Official Plan key policies relevant to stormwater networks were considered in the development of the Stormwater Master Plan, as there is cross-connection between the City and Regional storm sewer networks.

3.12.5 Town of Caledon Official Plan

The Town of Caledon Official Plan (April 2018 Office Consolidation) aims to guide future land use, physical development and change, and the effects on the social, economic, and natural environment within the Town of Caledon to 2031. The Rural Service Centres are designated as the primary growth areas for the planning period and will be the focus of most new residential and employment growth. The Town of Caledon is creating a new Official Plan – a road map for the next 20+ years. It will guide development, housing, transportation, employment, facilities and more.

Key policies relevant to the stormwater networks were considered in the development of the Stormwater Master Plan, as there is cross-connection between the Town and Regional storm sewer networks.

3.12.6 Provincial Policy Statement

The Provincial Policy Statement sets the policy foundation for land use planning and development in Ontario. The Provincial Policy Statement provides guidance and support for appropriate land use planning and development while protecting resources of provincial interest, public health and safety, and the quality of the natural and built environment.

The Provincial Policy Statement applies to land use planning decisions made under the Planning Act by provincial ministers, municipal councils, local boards, and planning boards, among other approval authorities. All municipal decisions affecting planning matters shall be consistent with the policies outlined in the Provincial Policy Statement.

Section 1.6.6 of the Provincial Policy Statement provides key policies relevant to planning for stormwater management including, but not limited to the following:

- Be integrated with planning for sewage and water services and ensure that systems are optimized, feasible and financially viable over the long term
- Minimize, or, where possible, prevent increases in contaminant loads
- Minimize erosion and changes in water balance, and prepare for the impacts of a changing climate through the effective management of stormwater, including the use of green infrastructure;
- Mitigate risks to human health, safety, property and the environment;
- Maximize the extent and function of vegetative and pervious surfaces; and
- Promote stormwater management best practices, including stormwater attenuation and re-use, water conservation and efficiency, and low impact development.

The Greenbelt Plan, the Niagara Escarpment Plan, and the Oak Ridges Moraine Conservation Plan work within the framework set out by the Growth Plan for the Greater Golden Horseshoe for where and how future population and employment growth should be accommodated.

Together, all four provincial plans build on the Provincial Policy Statement to establish a land use planning framework for the Greater Golden Horseshoe and the Greenbelt Plan Area that supports a thriving economy, a clean and healthy environment and social equity.

3.12.7 A Place to Grow: Growth Plan for the Greater Golden Horseshoe

A Place to Grow is the provincial initiative to plan for growth in Ontario. The most recent growth plan, A Place to Grow - The Growth Plan for the Greater Golder Horseshoe (the Growth Plan), was first introduced in July 2017 replacing the 2006 Growth Plan, and later amended in May 2019 and August 2020.

The Growth Plan is a long-term plan that works together with the Greenbelt Plan, the Oak Ridges Moraine Conservation Plan, and the Niagara Escarpment Plan to manage growth and development in a way that supports economic prosperity, protects the natural environment, and helps build complete communities that achieve a high quality of life.

To support these goals, the Growth Plan for the Greater Golden Horseshoe works to:

- Support the achievement of complete communities that offer more options for living, working, learning, shopping and playing.
- Reduce traffic gridlock by improving access to a greater range of transportation options.
- Provide housing options to meet the needs of people at any age.
- Revitalize downtowns to become more vibrant and to provide convenient access to an appropriate mix of jobs, local services, public service facilities and a full range of housing.
- Curb sprawl and protect farmland and green spaces.
- Promote long-term economic growth.

Like other provincial plans, the Growth Plan builds upon the policy foundation provided by the Provincial Policy Statement and provides additional and more specific land use planning policies to address issues facing specific geographic areas in Ontario. While the Provincial Policy Statement provides for a time horizon of up to 25 years to make enough land available to meet projected needs, the Provincial Policy also suggests that a provincial plan may provide an alternate time horizon for specific areas of the province. The 2020 Growth Plan provides that the applicable time horizon for land use planning is 2051.

The 2020 Growth Plan includes revised population and employment forecasts for the Region of Peel are provided in **Table 3** below.

Table 3. Peel Region Population and Employment Forecasts.

Peel Region	2031	2036	2041	2051
Population	1,770,000	1,870,000	1,970,000	2,280,000
Employment	880,000	920,000	970,000	1,070,000

Source: 2020 Growth Plan for the Greater Golden Horseshoe
Note: Numbers rounded to the nearest 10,000

The 2020 Growth Plan includes the following specific density targets:

- A minimum of 50 percent of all residential development occurring annually within the Region of Peel will be within the delineated built-up area.
- 200 residents and jobs combined per hectare for each of the Downtown Brampton and Downtown Mississauga urban growth centres.
- A minimum density target that is not less than 50 residents and jobs combined per hectare for designated greenfield areas within the Region of Peel.

The Growth Plan also provides for minimum density targets for Major Transit Station Areas and Priority Transit Corridors, as follows:

- 160 residents and jobs combined per hectare for those that are served by light rail transit or bus rapid transit.
- 150 residents and jobs combined per hectare for those that are served by the GO Transit rail network.

It is important to note that at the initiation of the Stormwater Master Plan, the Growth Plan had not yet been updated to include both 2041 and 2051 population and employment projections. The updated growth metrics from the 2020 Growth Plan impact the Region of Peel Official Plan population projections. The Region of Peel was in the process of updating the Official Plan to meet the 2019 Growth Plan projections; however, the 2020 update to the Growth Plan initiated a full Region of Peel Official Plan update which is anticipated for implementation in July 2022. Due to the timelines for completion of the Stormwater Master Plan, the updated projections have not been utilized.

The Growth Plan guides the density targets set within the Region of Peel Official Plan and as such, affects stormwater decision making and considerations.

3.12.8 Greenbelt Plan

The Greenbelt Plan (2017) builds upon the existing policy framework established in the Provincial Policy Statement. The purpose of the plan is to inform the decision-making process to protect agricultural lands, natural heritage, and water resource systems, and to provide for a diverse range of economic and social activities related to rural communities, agriculture, tourism, recreation, and resource uses.

The Greenbelt Plan includes lands within the Niagara Escarpment and the Oak Ridges Moraine and builds upon the ecological protections provided by the Niagara Escarpment Plan (NEP) and the Oak Ridges Moraine Conservation Plan (ORMCP). The Protected Countryside lands identified in the Greenbelt Plan are intended to enhance the spatial extent of agriculturally and environmentally protected lands covered by the NEP and the ORMCP while improving linkages between these areas and the surrounding major lake systems and watersheds. A portion of the Greenbelt lands extend into the Town of Caledon boundaries, restricting the type of development that occurs in those areas. These provincial plans also provide guidance when undertaking stormwater management planning in order to protect natural heritage and water resources.

3.12.9 Niagara Escarpment Plan

The Niagara Escarpment Plan (2017) builds on the 2011 Plan and has been updated to reflect new legislations and to coordinate with the Greenbelt Plan and other provincial land use planning policy documents. The plan serves as a framework of objectives and policies aimed to balance between development, protection and the enjoyment of the Niagara Escarpment and the resources it supports.

Some of the objectives of the Niagara Escarpment Plan include:

- To protect unique ecologic and historic areas
- To maintain and enhance the quality and character of natural streams and water supplies
- To ensure that all new development is compatible with the purpose of the Plan
- To support municipalities within the Niagara Escarpment Planning Area in their exercise of the planning functions conferred upon them by the Planning Act

These objectives were considered while developing the Stormwater Master Plan objectives.

3.12.10 Oak Ridge Moraine Conservation Plan

The Oak Ridges Moraine Conservation Plan (ORMCP) (2017) is a regulation to the Oak Ridges Moraine Conservation Plan Area. The plan provides land use and resource management direction to provincial ministers, ministries, agencies, municipalities, landowners, and other stakeholders on how to protect the ecological and hydrological features and functions of the land and water resources within the Moraine.

Some of the objectives of the ORMCP include:

- Protect the ecological and hydrological integrity of the ORM Area
- Ensure that only land and resource uses that maintain, improve, or restore the ecological and hydrological functions of the ORM Area are permitted
- Maintain, improve, or restore all the elements that contribute to the ecological and hydrological functions of the ORM Area, including the quality and quantity of its water and its other resources
- Provide for land and resource uses and development that are compatible with the other objectives of the Plan

These objectives were considered while developing the Stormwater Master Plan objectives.

3.12.11 Water Opportunities and Conservation Act

The Ontario Government passed the Water Opportunities and Conservation Act in 2010. The purposes of the Act are as follows:

- To foster innovative water, wastewater and stormwater technologies, services, and practices
- To create opportunities for economic development and clean-technology jobs in Ontario

- To conserve and sustain water resources for present and future generations.

To further the purposes of the Act, the MECP may establish aspirational targets in respect of the conservation of water and other matters.

The Act requires certain municipalities, persons, and entities to prepare, approve, and submit to the MECP municipal water sustainability plans for municipal water services, municipal wastewater services, and municipal stormwater services under their jurisdiction. The Minister may establish performance indicators and targets for these services. The Act also authorizes the making of regulations requiring public agencies to prepare water conservation plans, achieve water conservation targets, and consider technologies, services, and practices that promote the efficient use of water and reduce negative impacts on Ontario's water resources. The Act is an overarching policy document that must be considered while developing Stormwater Master Plan objectives.

3.12.12 Safe Drinking Water Act

The Safe Drinking Water Act was adopted in 2002. The Act provides for the protection of human health and the prevention of drinking water hazards through the control and regulation of drinking water systems and drinking water testing. Key features of the Act include the following:

- Legally binding standards for contaminants in drinking water
- Requirement to use licensed laboratories for drinking water testing
- Requirement to report any results that do not meet the standards to the Ministry of the Environment and the local Medical Officer of Health and to undertake corrective action
- All operators of municipal drinking water systems must be trained and certified
- Establishment of a licensing regime for drinking water systems
- Inspections and enforcement to determine compliance with the Act

3.12.13 Clean Water Act

The Clean Water Act was adopted in 2006 with the objective to protect existing and future sources of drinking water including rivers, lakes, and underground aquifers. The Act requires the following:

- That local communities assess existing and potential threats to their water, and that they set out and implement the actions needed to reduce or eliminate these threats
- Empowers communities to take action to prevent threats from becoming significant
- Public participation on every local source protection plan – the planning process for source protection is open to anyone in the community
- That all plans and actions be based on sound science

3.12.13.1 Drinking Water Source Water Protection Policies

Under the Clean Water Act, 2006, 19 watershed-based Source Protection Regions (SPR) and 38 conservation authority based standalone Source Protection Areas (SPA) were established across Ontario SPRs are groups of local SPAs. The majority of the Region falls within two source protection areas:

1. Toronto Source Protection Area
2. Credit Valley Source Protection Area

A portion of the Region also falls within the following source protection areas:

- Halton Region Source Protection Area (western portion of City of Mississauga)
- Nottawasaga Valley Source Protection Area (northeast portion of Town of Caledon)
- Lakes Simcoe and Couchiching/Black River Source Water Protection Area (northeast portion of Town of Caledon

SPRs were established to protect existing and future sources and to identify areas of significant drinking water threats. The Region of Peel falls within three Source Water Protection Regions:

- Credit Valley, Toronto and Region and Central Lake Ontario (CTC)
- South Georgian Bay Lake Simcoe Source Protection Region (SGBLS SPP)
- Hamilton Halton Source Protection Region

The majority of the Region falls withing the CTC, including the Regional Road infrastructure focus of the Stormwater Master Plan. Applicable policies from the SGBLS SPP and Hamilton Halton Source Protection Region will apply to any projects within their boundaries. **Figure 5** provides a map showing the conservation areas and boundaries within the Region of Peel. CTC includes Credit Valley Conservation and Toronto and Region Conservation Authority. SGBLS includes Lake Simcoe Region Conservation Authority and Nottawasaga Valley Conservation Authority. Hamilton Halton Source Protection Region includes Conservation Halton.

Under the CTC, sewage includes drainage and stormwater, while sewage systems include stormwater retention pond discharges. Therefore, the applicable source protection plan policies (SWG-11, SWG-12, SWG-15, SWG-16, SWG-17, SWG-18, SWG-19) have been considered throughout this Class EA study. Additionally, the applicable SGBLS SPP policies per the 2015 Approved Source Protection Plan have been considered throughout this Class EA study.

The Source Water Protection Plans identify vulnerable areas that have been delineated under the Clean Water Act including Wellhead Protection Areas (WHPA), Issues Contributing Areas (ICA), Intake Protection Zones (IPZ), Highly Vulnerable Aquifers (HVA), Significant Groundwater Recharge Areas (SGRA), Event Based Areas (EBA), and Vulnerable Scoring Areas for Groundwater and Surface Water (VSA) as well as water quantity vulnerable areas. According to the Source Protection Plan:

- WHPAs are areas on the land around a municipal well, the size of which is determined by how quickly water travels underground to the well, measured in years

- IPZs are the areas on the water and land surrounding a municipal surface water intake
- SGRAs are areas characterized by porous soils that allow the water to seep easily into the ground and flow to an aquifer
- HVAs are aquifers that can be easily changed or affected by contamination from both human activities and natural processes as a result of (a) its intrinsic susceptibility, as a function of the thickness and permeability of overlaying layers, or (b) by preferential pathways to the aquifer
- EBAs are areas where spills from a specific activity within an EBA would cause a significant risk to the drinking water source and hence the activity would be identified as a significant threat
- ICAs are areas where activities and conditions as a result of past activities have or are likely to contribute to the elevated concentration of the substance in a well

3.12.14 Conservation Authorities

The legislative mandate of the Conservation Authority, as set out in Section 20 of the Conservation Authorities Act, is to establish and undertake programs designed to further the conservation, restoration, development, and management of natural resources.

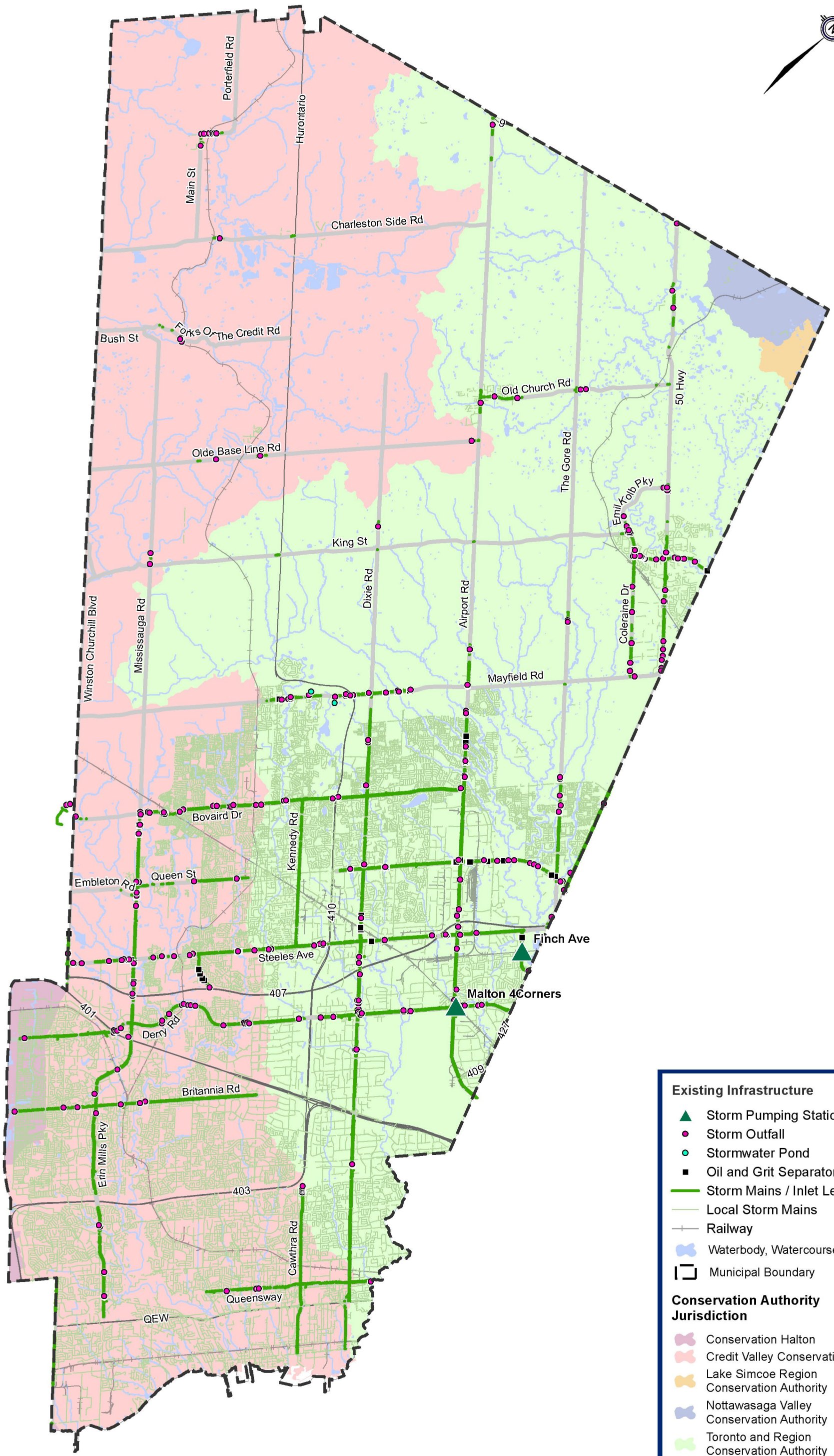
Conservation Authorities are local agencies that protect and manage water and other natural resources at the watershed level. These agencies have a number of responsibilities and functions in the land use planning and development process.

The study area falls within the Credit Valley Conservation Authority (CVC) for the majority of Caledon, Brampton, and Mississauga and Toronto and Region Conservation Authority (TRCA) for the eastern portion. In addition, a small portion of the Region falls within Conservation Halton (CH), Lake Simcoe Region Conservation Authority (LSRCA), and Nottawasaga Valley Conservation Authority (NVCA). **Figure 5** provides a map indicating the conservation areas and boundaries within the Region.

Conservation Authorities are commenting agencies on the development applications under the Planning Act based on regulations approved by their Board of Directors and the province. These Conservation Authorities have agreements with partnering municipalities to provide technical services regarding matters associated with natural heritage protection, hazardous land management, and water resources (e.g., stormwater management).

In addition, Conservation Authorities have the delegated responsibility from the Ministries of Natural Resources and Municipal Affairs and Housing to implement Section 3.1 (Natural Hazards) of the Provincial Policy Statement (2020), consistent with the Provincial one-window planning initiative.

TRCA, CVC, CH, LSRCA and NVCA also administer Ontario Regulation (O. Reg) 166/06, 160/06, 162/06, 179/06, and 172/06, respectively, under Section 28 of the Conservation Authorities Act. In general, these regulations prohibit altering a watercourse, wetland, or shoreline and prohibit development in areas adjacent to river and stream valleys, hazardous lands, and wetlands without the prior written approval from the Conservation Authority (i.e., issuance of a permit).



Region of Peel
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Stormwater Servicing Plan for Regional Road Infrastructure

Limits of Conservation Authority

Baseline Understanding

BluePlan ENGINEERING

Figure 5
November 2022
719020-SW-011
NAD 1983 UTM Zone 17N

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4.0 Level of Service Framework

A component of the scope of the Servicing Master Plan was to develop a Level of Service Framework for the Region's stormwater infrastructure. The aims and objectives of the task were as follows:

Aim:

- To create a risk-based framework for stormwater infrastructure that will assist with asset management approaches and contribute to compliance with the Ontario Regulation 588/17 for Asset Management.

This aim was achieved through completion of the following objectives:

- Complete a background review of the Region's existing relevant reports
- Complete a best practice review for establishing LOS frameworks
- Facilitate workshops with stakeholders to identify customer and technical performance indicators and ensure alignment with lower tier municipalities and conservation authorities
- Document final framework

The framework provides a long list of performance indicators that the Region is recommended to track over time and report on progress as part of future Stormwater Asset Management Plans (AMP). The next steps for the Region will be to consolidate the performance indicators and select the most applicable prior to moving forward with the future AMP.

The final technical memorandum on the development of the framework is included in **Appendix C**.

At the time of writing, the Region is using this new framework as they develop their first Stormwater specific Asset Management Plan (AMP). The AMP will collate existing information on state of infrastructure, use the LOS Framework to populate measures, and use them to identify strategies and financing needs to ensure the continued, sustainable operation of stormwater assets. The expected completion date of the AMP is Fall 2022.

5.0 Existing Stormwater System Features & Characteristics

The Region of Peel's understanding of the existing conditions and performance of the stormwater system is continuing to evolve. The Region has made significant recent advances including completing a full inventory and CCTV survey of its system. This information forms the foundation for a state of good repair program that the Region is advancing to ensure assets are repaired and replaced in a timely, proactive manner

Throughout the development of the Stormwater Master Plan, it was determined that the best plan of action, as it related to the stormwater infrastructure, was to undertake a high-level assessment and evaluation of the stormwater system with the goal of establishing the overall vision and strategy for the management of the stormwater system, which will then be utilized to establish a preliminary stormwater capital program. The resulting preliminary stormwater capital program will be used as a guide while the Region undertakes subsequent investigations and studies to strengthen the Region's understanding of the condition and performance of the stormwater systems, develop and confirm the desired servicing objectives, refine local stormwater servicing strategies, and confirm upgrade needs.

5.1 Existing Stormwater Infrastructure

The Region of Peel's stormwater collection and conveyance system consists of a gravity system following local topography. The system has over 400 distinct separate subsystems with over 400 contributing subcatchments which are delineated based on ultimate outlet locations and receiving watercourses. As discussed within **Section 3.3.1**, the minor system sewers are required to meet the 10-year storm event level of service.

An overview of the existing stormwater system is provided in **Figure 6.**

5.1.1 Manufactured Treatment Devices

The Region of Peel currently has 142 Manufactured Treatment Devices (MTD) within the Regional Road network which provide stormwater quality treatment. The asset breakdown is as follows:

- 128 Oil/Grit Separators (OGS)
- 12 Filtration Units
- 2 Stormwater Treatment Boxes

Figure 6 presents the locations of MTDs within the Regional right of way.

5.1.2 Low Impact Development Best Management Practices (LIDs)

The Region of Peel owns, operates, and maintains multiple Low Impact Development (LID) Best Management Practices within the regional right of way. These LIDs manage stormwater through the use of decentralized practices which help maintain and restore the natural water balance within the stormwater management system. The Region's LIDs benefit the stormwater system through the following factors:

- Water quality treatment
  - Total suspended solids (TSS) removal
  - Stormwater runoff temperature
- Peak flow attenuation
- Increased infiltration and evapotranspiration
- System storage

Table 4 presents the Region's existing LIDs at the time of completion of this report, while **Figure 6** depicts these assets graphically.

Table 4. Summary of Regional LID assets.

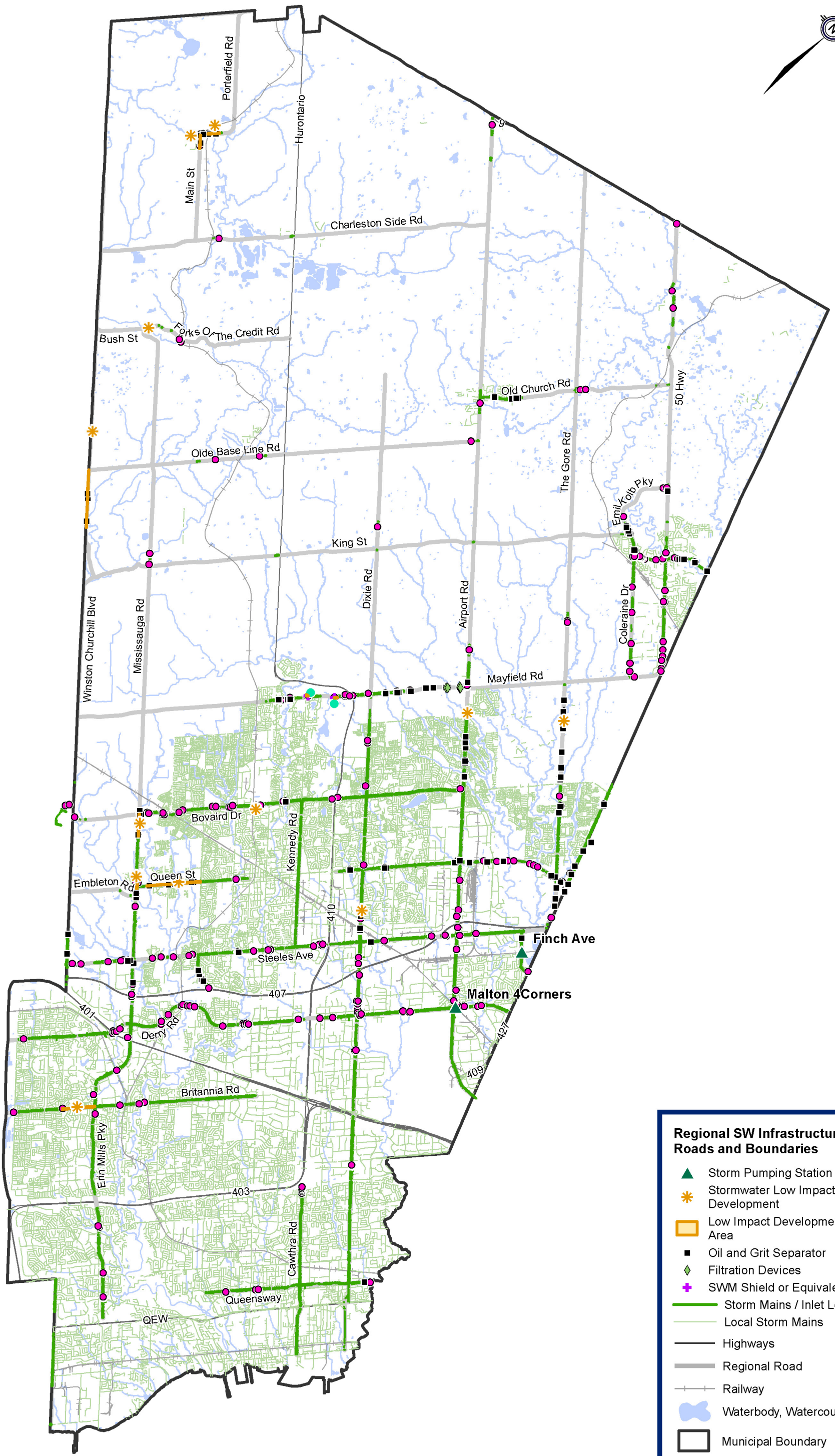
LID BMP	Area/Length of LID BMP
Bioretention	1,924 m^2
Bioswales	10,588 m^2
Infiltration Features with Chambers	1,024 m^2
Infiltration Features without Chambers	2.95 km
Permeable Pavement Systems (includes Pavers and EcoRaster)	1,604 m^2

5.1.3 Pumping Stations

There are two (2) Region owned stormwater pumping stations which lift stormwater runoff from low points in the regional right of way to the gravity storm sewer system. These Region's pumping stations are as follows:

- Malton Four Corners Stormwater Pumping Station
- Finch Avenue Stormwater Pumping Station

These pumping stations are presented in **Figure 6**.



Region of Peel
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Stormwater Servicing Plan for Regional Road Infrastructure

Treatment Devices and Existing Low Impact Development Projects

Baseline Understanding

BluePlan Engineering

Figure 6
November 2022
719020-SW-017
NAD 1983 UTM Zone 17N

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5.2 Drainage

The majority of the Region of Peel is tributary to both Credit Valley Conservation (CVC) and Toronto and Region Conservation Authority (TRCA) regulated watercourses. As such, an understanding of the drainage characteristics within the Region of Peel, with focus on CVC and TRCA interactions, is critical in the successful planning for existing and future stormwater infrastructure.

CVC and TRCA stormwater management guidelines note that engineered infiltration features are generally not considered suitable in areas that have/are:

- High slopes
- The water table within 1 m of the bottom of the infiltration feature
- Bedrock within 1 m of the bottom of the infiltration feature
- Soils with an infiltration rate of less than 15 mm/hr
- Within floodplains
- Close to points of concern such as landfills or water supply wells
- In HVA if the infiltrated water is potentially contaminated
- In the higher risk WHPA unless additional controls are in place

The technical memorandum provided in **Appendix D** provides context on infiltration potential within the Region of Peel right of way in locations with urban underground minor system conveyance (stormwater conveyance pipes). This will later be used as input into the evaluation methodology as outlined in **Section 7.**

The following subsections provide additional details on the existing drainage conditions within the study area.

5.2.1 ributary Areas, Outlets, and Drainage Pattern

The Region's stormwater management system is segmented into over 400 sub-networks, each with a unique outlet across the Regional Roads within Brampton, Caledon, and Mississauga. The outlets consist of a combination of Regional infrastructure discharging into:

- Lower-tier municipal infrastructure
- Region ditches, open channels, and stormwater management facilities
- Conservation Authority controlled watercourses

The Region is responsible for managing stormwater within the Regional right-of-way, with lower-tier municipalities managing stormwater within the right-of-way of lower-tier roads.

Stormwater within the Region of Peel follows the natural north to south drainage pattern, ultimately discharging into Lake Ontario through various watercourses. The predominant watercourses within the Region of Peel which collect Regional stormwater through the minor system are as follows:

- Applewood Creek watershed
- Clearview Creek watershed
- Cooksville Creek watershed
- Credit River watershed
- Etobicoke Creek watershed
- Humber River watershed
- Mimico Creek watershed
- Sheridan Creek watershed
- Sixteen Mile Creek watershed

5.2.2 Condition of Receiving Watercourses

The following reports by provide in-depth information on the condition of the receiving watercourses within the Region of Peel:

Credit Valley Conservation:

- Credit River Water Management Strategy Update (2006) including the following studies related to specific subwatersheds:

Table 5. CVC Subwatersheds.

Subwatershed #	Location
1	Loyalist Creek
2	Carolyn Creek
3	Sawmill Creek
4	Mullet Creek
5	Fletcher's Creek
6	Levi Creek
7	Huttonville Creek
8a	Springbrook Tributary
8b	Churchville Tributary
9	Norval to Port Credit
12	Cheltenham to Glen Williams
13	East Credit River
14	Glen Williams to Norval
15	West Credit River
16	Caledon Creek
17	Shaw's Creek
18	Melville to Forks of the Credit
20	Forks of the Credit to Cheltenham
21	Lake Ontario Shoreline West Tributaries
22	Lake Ontario Shoreline East Tributaries

- Sawmill Creek Subwatershed Study (1993)
- West Credit Subwatershed Study Characterization Report (1998)
- Fletchers Creek Subwatershed Plan (1996)
- Fletchers Creek Restoration Study (2012)
- Caledon Creek and Credit River Subwatershed Study (2001)
- Glen Williams Integrated Planning Project – Scoped Subwatershed Plan (2003)
- Credit Valley Subwatershed Study [Huttonville Creek (7), Springbrook Creek (8a), Churchville Tributary (8b)] (2004)
- East Credit Subwatershed Study - Subwatershed 13 (2007)
- Mount Pleasant Subwatershed Study (2011)
- Draft Shaws Creek Subwatershed Study
    - Background Report (2006)
    - Subwatershed 17 Phase I Characterization Report (2012)
    - Subwatershed 17 Phase II/III Impact, Management, and Implementation (2017)
    - Implementation Plan for Protecting Shaws Creek Subwatershed (2017)

- Headwaters Subwatershed Study
    - Phase 3: Management, Implementation, and Monitoring Plan (2021)

Toronto and Region Conservation Authority:

- Etobicoke Creek Watershed Characterization Report (Toronto and Region Conservation Authority, 2021)
- Etobicoke-Mimico Creeks Watersheds Technical Update Report (Toronto and Region Conservation Authority, 2011)
- Humber River Watershed Plan (Toronto and Region Conservation Authority, 2008)
- Humber River Hydrology Study (2015)

Conservation Halton:

- Sixteen Mile Creek Watershed Plan (1996)
- Ninth Line Lands Scoped Subwatershed Study (Amec 2015 & 2017)

5.2.3 Soil and Groundwater Condition

The Region of Peel has a diverse surficial geology. The study area is made up of areas with:

- **Coarse-grained deposits like sands and gravels:** expected to have relatively higher hydraulic conductivity values and to be more conducive to infiltration
- **Fine-grained deposits like silts and clays:** expected to have relatively lower hydraulic conductivity values and to be more restrictive to infiltration
- **Medium-grained deposits like silts and sands:** expected to have moderate hydraulic conductivity values and to be potentially conducive to infiltration

The depth to water table and bedrock is also an important consideration when determining the locations of stormwater drainage.

- Areas where the estimated depth to the water table is less than 1 m and/or less than 5 m below ground surface may have less capacity for infiltration due to the shallow water table depths, which leave limited thicknesses of unsaturated soils to accept infiltrated water
- Areas where the estimated depth to bedrock is less than 5 m below ground surface may be restricted by the shallow bedrock, which typically has less water storage capacity than soils and across most of the Region (aside from the northwest corner, above the Niagara Escarpment) is comprised of low hydraulic conductivity shale

Appendix F contains the Hydrogeological and Geotechnical Desktop Study, which provides further details and mapping on the surficial geology.

5.2.4 Source Water Protection Areas

The conservation areas provide details on drinking water source protection areas within the Region. Stormwater drainage should be avoided in these areas to avoid drinking water contamination:

- **Wellhead Protection Areas (WHPA):** areas represent the horizontal extents of municipal water well groundwater capture areas based on risk ratings and modelled time of travel for groundwater supplying each well. To protect the groundwater supplies of these wells, certain activities may be restricted or prohibited in the WHPA, including discharge or infiltration of stormwater.

- **Issue Contributing Areas (ICAs):** areas that the Source Protection Plans have identified as vulnerable to certain drinking water threats due to existing issues water quality occurring in the area. In the Region, the ICAs have identified threats due to nutrients, pathogens, and chloride, which are all potentially present in stormwater.

- **Highly Vulnerable Aquafers (HVAs):** areas with aquifers that the Source Protection Plans have identified as vulnerable to groundwater contamination due to their close connection to surface water and infiltration. The vulnerable aquifers are considered closely connected to surface due to either shallow depth and/or highly conductive subsurface materials between the surface and the aquifer.

- **Floodplain areas:** areas not considered suitable for infiltration due to their limited infiltration capacity, which becomes even more limited during highwater periods when infiltration capacity is most needed.

Appendix D provides further details and mapping on the source water protection areas across the Region.

5.3 Hydraulic and Fluvial Geomorphic Hazard Assessment.

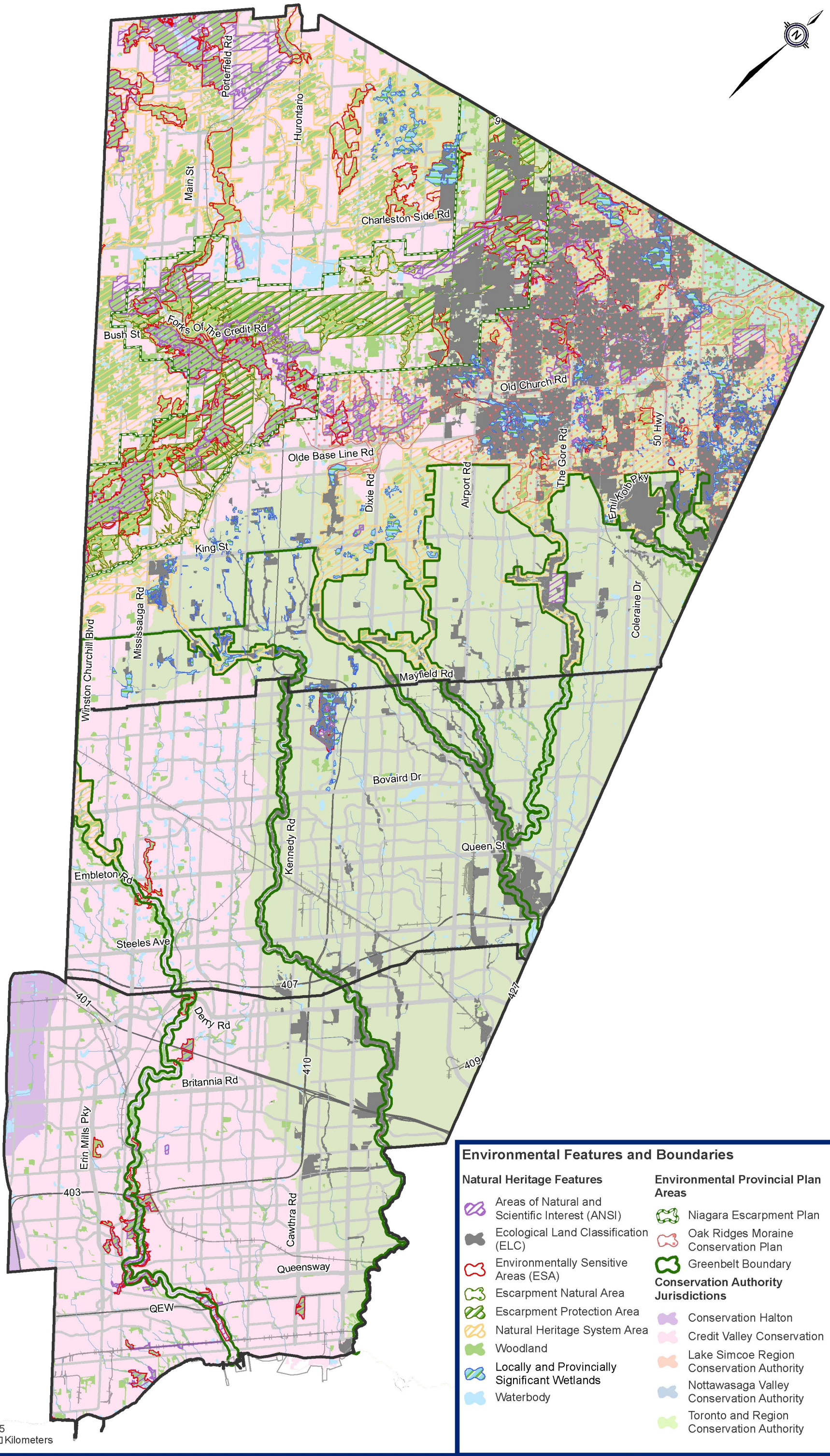
It is necessary to consider the impacts of proposed stormwater management solutions on the receiving waterbodies. A Hydraulic and Fluvial Geomorphic Hazard Assessment was carried out at all water crossings for proposed Low Impact Development projects as part of the Stormwater Master Plan preferred solutions. The results of the assessment were used to determine if the planned stormwater works in the vicinity of each watercourse crossing could be at risk of channel encroachment or migration and, in turn, merit mitigation measures to minimize potential impacts. The preliminary geomorphic and hazard limit was derived in the vicinity of the crossing locations. The anticipated locations of the proposed Low Impact Development practices were compared against the preliminary hydraulic and geomorphic hazard limit to determine the relative likelihood that installations could be potentially impacted by channel encroachment or migration. This ranking was used to inform possible mitigation measures.

The Hydraulic and Fluvial Geomorphic Hazard Assessment is contained in **Appendix E**.

5.4 Natural Features

The following subsections provide details on the different natural features within the study area. A desktop Natural Environmental Report was prepared to identify potential natural environmental constraints within the proposed locations for implementation of Low Impact Development practices. The assessment can be used to present development constraints or areas of increased sensitivity to stormwater runoff and inform the selection of preferred locations for stormwater improvements and Low Impact Development implementation. The evaluation of existing conditions in the study area for each site included a background information search and literature review to gather data about the local areas and provide context for the evaluation of natural features.

Further details are provided in the Natural Environment Report, contained in **Appendix G. Figure 7** show the mapped natural features within the Region.



Environmental Features and Boundaries

Natural Heritage Features

- Areas of Natural and Scientific Interest (ANSI)
- Ecological Land Classification (ELC)
- Environmentally Sensitive Areas (ESA)
- Escarpment Natural Area
- Escarpment Protection Area
- Natural Heritage System Area
- Woodland
- Locally and Provincially Significant Wetlands
- Waterbody

Environmental Provincial Plan Areas

- Niagara Escarpment Plan
- Oak Ridges Moraine Conservation Plan
- Greenbelt Boundary

Conservation Authority Jurisdictions

- Conservation Halton
- Credit Valley Conservation
- Lake Simcoe Region Conservation Authority
- Nottawasaga Valley Conservation Authority
- Toronto and Region Conservation Authority

Region of Peel working with you

Stormwater Servicing Plan for Regional Road Infrastructure

Significant Environmental Areas

Baseline Understanding

BluePlan Engineering

Figure 7
November 2022
719020-SW-005
NAD 1983 UTM Zone 17N

Document Path: \\garnsby.local\gmprojects\GTA\719000\719020 SW Servicing Plan for Regional Road Infrastructure\5 Work in Progress\GIS and Data\719020-SW-005-Environmental Features.mxd

5.4.1 Environmentally Sensitive Area

Environmentally Sensitive Areas (ESA) typically have special ecosystem functions or characteristics that warrant protection. In many cases ESAs contain features which are considered significant under other categories such as Woodlands, Wetlands, or Valley and Stream Corridors.

There are multiple ESAs located within City of Mississauga, City of Brampton, and Town of Caledon.

5.4.2 Areas of Natural and Scientific Interest

Area of Natural and Scientific Interest (ANSI) are designated by the province according to standardized evaluation procedures. ANSIs are ranked by the Ministry of Natural Resources and Forestry (MNRF) as being either provincially or regionally significant.

There are multiple ANSIs located within City of Mississauga, City of Brampton, and Town of Caledon.

5.5 Socio-economic and Cultural Environment

The Region of Peel has diverse land uses including urban, suburban, rural, agricultural, and natural landscapes. The Region has outlined a Regional Urban Boundary to distinguish between lands meant for urban purposes and lands meant for agricultural or rural purposes. The following subsections describe the socio-economic and cultural environmental factors which were considered at a high-level during the evaluation of preferred alternative solutions.

5.5.1 Urban System

The Urban System contain lands within the Regional Urban Boundary including lands for urban development, urban growth centres, intensification corridors, and the Toronto Pearson International Airport, as well as lands protected as part of the natural environment.

Urban growth centres and the Regional intensification corridor are major locations of intensification that include compact forms of urban development and redevelopment providing a range and mix of housing, employment, recreation, entertainment, civic, cultural, and other activities for Peel residents and workers and other residents of adjacent areas. Significant residential land uses have developed over the years in proximity to major arterial roads and highways with expected higher intensification concentrated in urban growth centres and intensification corridors.

5.5.2 Employment Areas

Employment areas are key centres of economic activity designated in area municipal official plans. These lands will remain important for the Region to maintain a healthy economy and will accommodate uses such as manufacturing, warehousing, offices, and associated retail and ancillary facilities.

5.5.3 Toronto – Lester B. Pearson International

Toronto Pearson International Airport, located in the City of Mississauga, is one of Canada's busiest airport and an important element in the GTHA's transportation and economic systems. Because of its significance, it is a priority for the Region to ensure that new development is compatible with Airport operations and allows the Airport to function efficiently while recognizing existing and approved land uses and other considerations.

5.5.4 Rural System

The Rural System has diverse natural and rural landscapes that are outside of the Regional Urban Boundary. This system includes the Protected Countryside as identified in the Greenbelt Plan and lands identified and protected as part of the natural environment and resources in the Regional Official Plan. Other components of Peel's Rural System include the Brampton Flying Club, three Rural Service Centres, an Estate Residential Community, and other rural settlements and rural area.

5.5.5 Prime Agricultural Area

The Prime Agricultural Area is part of the Region's rural system consisting of protected lands for long term use for agriculture. These lands represent natural resources of major importance for the economic sustainability of the Region that should be preserved and protected. The Region of Peel supports the continuation of a thriving, healthy and viable agricultural industry in the Region including diversification, agricultural innovation, and new practices in all aspects of the industry.

5.5.6 Mineral Aggregates Resources Areas

Planning responsibility for mineral aggregate resources is shared among the Province, the Region, and the local municipalities. The Region of Peel Official Plan identifies areas designated as having high potential mineral aggregate resources which have economic benefits such as reducing the transportation costs of supplying materials for urban development in the Region and attracting value-adding processing facilities that use aggregates and shale as raw materials. Mineral aggregate resources are an important component of the economic development and employment opportunities in the Region and therefore appropriate resource areas should be protected for possible use.

5.5.7 Road Network

The Stormwater Master Plan focuses on stormwater servicing strategies along Regional Roads. **Table 6** provides the 26 Regional Roads located within the Region of Peel.

Table 6. Regional roads in Peel Region.

Regional Road No.	Regional Road Name	Regional Road No.	Regional Road Name
1	Erin Mills Parkway/Mississauga Rd	**15**	Steeles Avenue
2	Finch Avenue	**16**	Kennedy Road
3	Britannia Road	**17**	Cawthra Road
4	Dixie Road	**18**	Mavis Road
5	Derry Road	**19**	Winston Churchill Boulevard
6	Queen Street	**20**	Queensway
7	Airport Road	**22**	Old Church Road
8	The Gore Road	**23**	Garafraxa Townline
9	King Street	**24**	Charleston Sideroad / Highway 24
10	Bovaird Drive	**50**	Highway 50
11	Forks of the Credit Rd / Bush St	**107**	Queen Street East / Bovaird Drive
12	Olde Base Line Road	**136**	Main Street / Queen Street East – Porterfield Road
14	Mayfield Road	**150**	Coleraine Drive

5.5.8 Cultural Heritage and Archeological Resources

The Region of Peel and the local municipalities encourage and support heritage preservation and recognizes the significant role of heritage in developing the overall quality of life for residents and visitors. The Region is committed to identify, preserve, and promote cultural heritage resources for present and future generations.

The Region of Peel follows established provincial guidelines to identify, preserve, and interpret the cultural heritage features, structures, archaeological resources, and cultural heritage landscapes. Cultural heritage policies established by the Region include the need for appropriate assessment, preservation, interpretation and/or rescue excavation of cultural heritage and archaeological resources including mitigation measures as prescribed by the Province.

A Stage 1 Archeological Assessment was conducted for the proposed Low Impact Development locations. The objective of the Stage 1 Archeological Assessment was to compile available information about the known and potential cultural heritage resources within the study areas and provide specific direction for the protection, management, and recovery of these resources.

A Cultural Heritage Screening Report was also conducted for the proposed Low Impact Development locations. The objectives of the Cultural Heritage Screening Report are to inform project planning by identifying all known and potential built heritage resources and cultural heritage landscapes within the study areas, and determine if the project will require subsequent cultural heritage studies such as a Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment or property specific Cultural Heritage Evaluation Reports (CHERs) and Heritage Impact Assessments (HIAs).

Appendix H contains the Stage 1 Archeological Assessment while **Appendix I** contains the Cultural Heritage Screening Report.

5.6 Additional Existing Infrastructure

The Region owns and operates other above and below ground infrastructure including the water and wastewater systems. Utilities also feature in many Regional Road ROWs. This infrastructure can impact decision making on the stormwater network through spacing and distance requirements and requires consideration for project planning. The following sections provide a brief overview of these systems and utilities within the study area.

5.6.1 Existing Wastewater System

The Region of Peel operates and maintains a lake-based wastewater system comprising of approximately 3,510 km of sanitary sewers which service the City of Mississauga, much of the City of Brampton, and parts of the Town of Caledon. The system consists of two separate gravity trunk sewer systems, the east trunk and west trunk, that end near Lake Ontario at the G.E. Booth (Lakeview) Wastewater Treatment Plant (WWTP) and the Clarkson WWTP. The Region also has 36 Sewage Pumping Stations (SPS) throughout the Region's serviced areas. Key wastewater infrastructure of the Region of Peel can be seen in **Figure 8.**

5.6.2 Existing Water System

The Region of Peel's lake-based water system services the City of Mississauga, the City of Brampton, and parts of the Town of Caledon. Water is supplied from Lake Ontario by two water treatment plants (WTP) and conveyed by the transmission and distribution systems. The two water treatments plants, the A.P. Kennedy WTP and the Lorne Park WTP, are located at the shoreline of Lake Ontario in the City of Mississauga.

The transmission system consists of the two treatment facilities, transmission mains, pumping stations, reservoirs, and elevated tanks. Due to the width of the Region's lake-based service area, the transmission system has been divided into three main trunk systems: West, Central, and East. The transmission system provides direct supply to the local water distribution system which consists of the water mains extending down to the water service level for each customer. Combined, all the components of the transmission and distribution systems deliver water to users through seven pressure zones separated by approximately 30 m intervals of elevation. The Region of Peel also maintains four municipal groundwater systems servicing rural communities in the Town of Caledon.

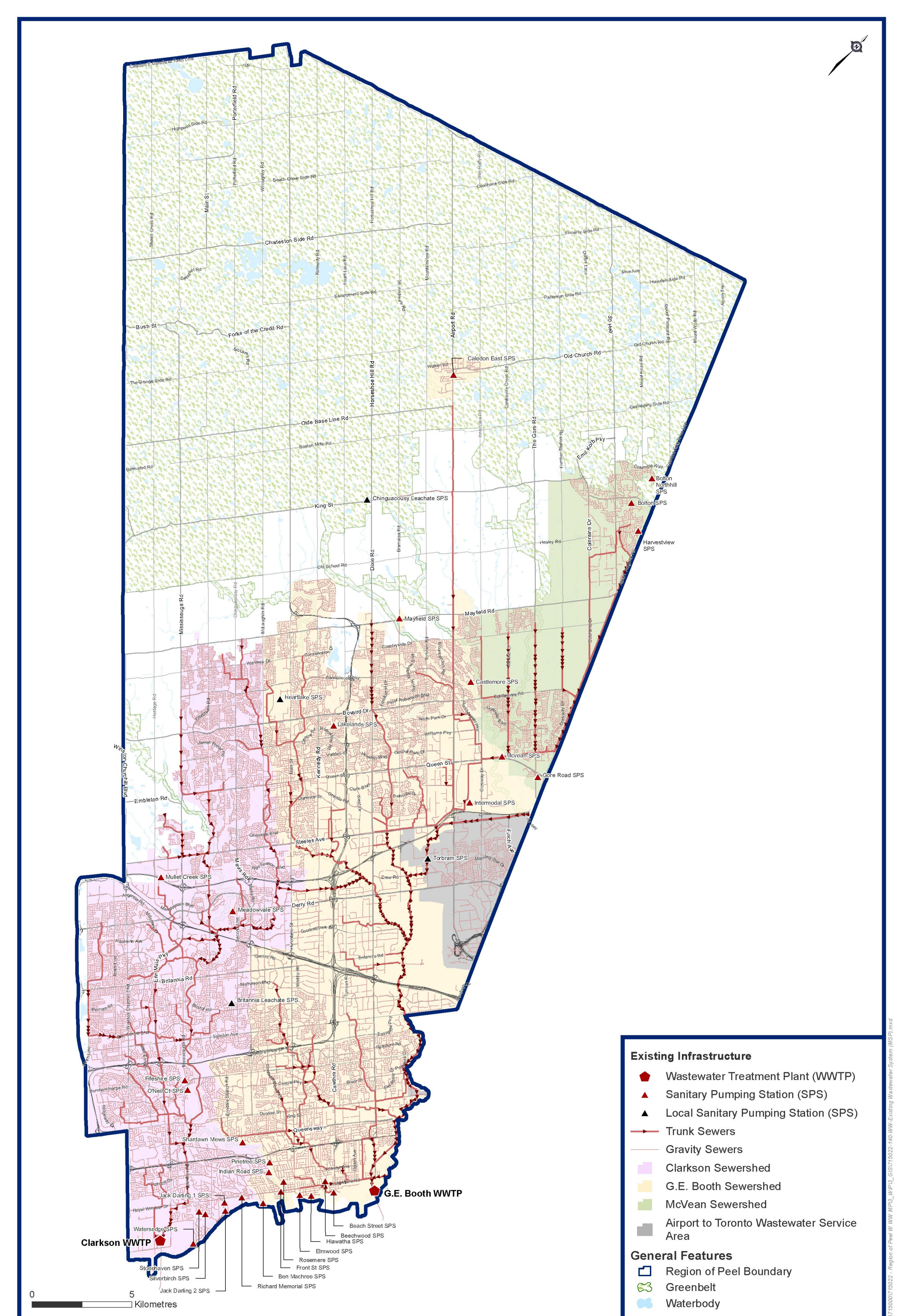
Figure 9 provides a map of the Regional water infrastructure located within the study area.

5.6.3 Existing Utilities

There are several utility companies with assets located within the Peel Region including:

- **Electricity:** Alectra Utilities, Hydro One Networks
- **Gas:** Enbridge Gas Distribution, Enbridge Pipelines, Union Gas
- **Cable:** Rogers Cable, Bell Canada, GT Fiber 360 Networks
- **Other Pipelines:** Trans-Northern Pipelines Inc., TransCanada Pipeline
- **Railway:** Canadian Pacific Railway

These utility companies have been consulted throughout the study.



Existing Infrastructure

- Wastewater Treatment Plant (WWTP)
- Sanitary Pumping Station (SPS)
- Local Sanitary Pumping Station (SPS)
- Trunk Sewers
- Gravity Sewers
- Clarkson Sewershed
- G.E. Booth Sewershed
- McVean Sewershed
- Airport to Toronto Wastewater Service Area

General Features

- Region of Peel Boundary
- Greenbelt
- Waterbody

Region of Peel
working with you

Existing Lake-Based Wastewater System

Baseline Understanding

BluePlan Engineering

Figure 8
June 2020
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Existing Water System

Baseline Understanding

Bolton North Hill PS
Bolton ET
West Bolton ET
Bolton Standpipes ET
Victoria RES
Mayfield West ET
Tullamore RES PS
North Brampton RES PS
Snelgrove ET
Alloa RES PS
Airport RES PS
East Brampton RES PS
West Brampton RES PS
Beckett Sproule RES PS
Meadowvale North RES PS
Hanlan RES PS
Battleford Booster PS
Streetsville RES PS
Silverthron RES PS
Herridge RES PS
Lorne Park WTP
Arthur P. Kennedy WTP

Existing Infrastructure

- Water Treatment Plant (WTP)
- Pumping Station (PS)
- Reservoir (RES)
- Elevated Tank (ET)
- Sub- Transmission Main
- Transmission Main

Existing Pressure Zones

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- Zone 6
- Zone 7

General Features

- Provincial Freeways
- Regional Roads
- Region of Peel Boundary
- Greenbelt

0 5 Kilometres

Region of Peel
working with you

BluePlan ENGINEERING

Figure 9
June 2020
715022-139-W-PIC 2
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6.0 Hydraulic Stormwater Model

The stormwater model for Regional Road infrastructure has been developed using the Region of Peel's approved modelling software, InfoWorks ICM (Integrated Catchment Modelling). The model was developed from scratch, as the Region did not have an existing minor storm system conveyance model. One of the primary objectives for the model build was to review all sources of data and to utilize the latest and most accurate date to build the sewer network model, as this will become the starting point for future model updates and decision making to build on. The sources of data used to build the model are as follows:

- Region of Peel GIS data
- CCTV survey data
- As-constructed drawings and condition reports for pumping stations
- Lower-tier municipal GIS data (Brampton, Caledon, Mississauga)
- Existing hydraulic and hydrologic models

Once the model network was created the following processes were completed:

- Resolve sewer network connectivity issues within model
- Delineation of contributing subcatchments to all 400 subnetworks
- Initial assignment of flow generation and runoff parameters
- Use of localized flow monitoring results used compare observed data against model results
- Review of historic flooding and reported incidents to validate initial model results
- Establish model scenarios (2, 5, 10, 25, 50, and 100-year Chicago storm events), including climate change considerations

6.1 Network Development

The Region's existing municipal GIS infrastructure data was imported into InfoWorks ICM to develop the minor system conveyance network. This was further supported through the use of available CCTV/inspection records to fill in gaps from the municipal GIS information. Data flags in the InfoWorks ICM model were used to indicate whether infrastructure information was determined through the municipal GIS data or CCTV data/inspection.

Once the Region's GIS datasets were in the model, errors, inconsistencies, and connectivity issues were identified and addressed. The lower-tier municipal stormwater infrastructure datasets (City of Brampton, Town of Caledon, and City of Mississauga) were underlaid in the modelling software for schematic reference; however, the model development does not include the detailed lower-tier networks; only relevant pipes from the lower-tier municipalities were included for connectivity purposes. As such, any interaction between the Regional system and the local/lower-tier municipal sewer networks that may affect capacity were not taken into account in the model results. At the time of model development, Region owned ditch infrastructure was not available as a spatial dataset; however, critical ditches were manually input while analyzing data gaps to ensure connectivity in the model from minor system pipe assets to Region outfalls. As such, the model is developed predominantly for the urban minor system and not the rural minor system. Additionally, boundary conditions at the outfall as well as watercourse conveyance have not been included in the scope of model development.

6.2 Facility Development

Each system facility (stormwater pond, pumping station, low impact development) was manually reviewed and input into the model based on available facility information. The scope of the facility development included:

- Reviewing and updating the network configuration around each facility
- Outlet/orifice/weir object characteristics were assigned (e.g. orifice diameter)

Regional facility assets that do not impact conveyance characteristics of the system were not modelled. This includes LIDs such as permeable pavers that discharge directly to a watercourse.

While the volume and outlet details of stormwater management ponds within the Regional road stormwater network are not represented in the model, any hydraulic controls at the pond's inlet are modelled to account for the hydraulic impacts on the upstream stormwater network.

6.3 Subcatchment Delineation

As part of the model development, subcatchments were created based on the up-to-date GIS data. Within the Regional right of way, the following process was followed for the delineation of subcatchments:

- DEM surface was created from contour information
- Subcatchments were manually delineated within the Regional right-of-way based on DEM surface to align catchment areas with catchbasins and nodes within the model

Lower-tier municipal systems which interact with the Regional stormwater network were also accounted for as follows:

- Lower-tier GIS information was used (schematically) in conjunction with DEM surface to delineate the extent of the contributing area
- Contributing areas were loaded to the inlet node within the Regional stormwater network
- Model parameters for the contributing lower-tier municipal subcatchments were modified to estimate attenuation in the local system

- Lower-tier minor system hydraulics were not used directly in the development of the InfoWorks ICM model
- Detailed modelling and validation of the lower-tier system was not possible based on available background information

Contributing private property subcatchments adjacent to Regional Roads were accounted for as follows:

- Private property adjacent to Regional Roads in which a potential external outlet (to lower-tier municipal systems or watercourses) was available were excluded from the model under the understanding that these connections to Regional systems were not permitted based on Region preference
- Private property in which there was no apparent available external outlet (to lower-tier municipal systems or watercourses) were loaded to the nearest Regional node, with contributing area delineated based on the DEM surface and parcel fabric
    - External information for any on-site storage or controls was no available. As such, the private property catchments were loaded directly based on the land type and hydrology.

6.4 Runoff Generation

A near-infrared spatial analysis was completed using high-resolution LiDAR data to approximate the proportion of pervious and impervious surface area within each model subcatchment. As the available LiDAR data was from 2015 and there has been significant development in the Region over the last 5 years, an additional spatial analysis was completed using the Region of Peel building footprint polygon layer to calculate the amount of current roof area within each model subcatchment. These pervious and impervious areas were then overlaid with the subcatchment layers to determine runoff characteristics to be loaded into the model. Soil types and land use were further used to refine and define the pervious area infiltration characteristics impacting runoff generation.

6.5 Model Validation

The Region of Peel had flow monitoring data available for two subnetworks within the greater system of subnetworks. The results of available flow monitoring data were compared against the theoretical model results to confirm alignment between real-world and model results. Due to the unique nature of the Region's network with over 400 subnetworks, the available flow monitoring data was not sufficient to validate the model build.

7.0 Evaluation Methodology

The identification and evaluation of servicing concepts is a critical stage in the master planning process. Various servicing strategies are reviewed in a transparent process in order to demonstrate clear decision making and provide defensible recommendations through the presentation of a clear evaluation methodology. The Stormwater Master Servicing Plan will evaluate current servicing gaps/needs and future servicing needs based on growth within the Region, aligned with the Region's Long-Range Transportation Plan.

The Region intends for the Stormwater Master Servicing Plan to meet the Approach 1 requirements under the Municipal Engineers Association (MEA) Class EA process. Under Approach 1, a master plan report is prepared at the conclusion of Phases 1 and 2 of the Class EA process. This approach allows for all Schedule A and A+ projects identified in the master plan to move forward to implementation. Any Schedule B and C projects identified will require supporting information and decision-making to proceed onto separate studies and continue through Phases 3 and 4 of the Class EA process. The Regions stormwater assets service the Regional road network, so typically, Regional stormwater infrastructure projects are associated as part of a larger transportation/road project which are completed as schedule B or C projects.

7.1 Evaluation Process

Opportunities and constraints for the stormwater system were identified at the outset of the study and were used as an initial point for determination of servicing concepts (see **Section 9.1.1** and **10.1.1**). The evaluation process begins with both a high-level, long-list of servicing locations and servicing strategies based on decision making tools such as the modelling data outlined in **Section 6.** This long-list of servicing strategies and servicing locations was then further evaluated to determine a short-list of servicing strategies and locations based on feasibility and needs of the individual project locations. The progression from long-list to short-list allows for an efficient decision-making process as it screens out non-feasible and unfavourable servicing locations and concepts prior to carrying forward a detailed evaluation.

The next step in determining the preferred servicing solution is to evaluate the detailed servicing alternatives. This process uses the reasoned argument approach to provide a clear and thorough rationale of trade-offs among each alternative based on the anticipated project impacts, in relation to the evaluation criteria. The basis of this approach is to qualitatively evaluate the relative advantages, disadvantages, and impacts of each alternative against the established criteria.

Servicing concepts are then subject to evaluation of five major areas of impact: technical, environmental, financial, legal/jurisdictional, and socio/cultural.

7.2 Evaluation Criteria

The servicing alternatives are evaluated against five factors, described as follows:

- **Technical:** Addresses practical aspects of constructability and system benefits.
- **Financial:** Addresses the lifecycles costs including capital and O&M
- **Legal/Jurisdictional:** Addresses property needs and permitting and approvals
- **Environmental:** Addresses environmental impacts and benefit opportunities
- **Social/Cultural:** Addresses disruption and heritage aspects

The evaluation criteria aligned with each are factor are listed in **Table 7**.

Table 7. Multiple-bottom-line evaluation factors and associated evaluation criteria.

Factor	Evaluation Criteria
Technical	Meets existing and future servicing needs
	System security/reliability
	Minimizes and manages construction risk
	Technical viability
	Traffic management/traffic impacts
	Resilience to climate change
Financial	Capital cost & life cycle cost (overall servicing strategy)
	Operations & maintenance cost
	Alignment with approval and permitting process
Legal/Jurisdictional	Property acquisition
	Permitting requirements
Environmental	Protects environmental features
	Geology/hydrogeology considerations
	Protects wildlife & species at risk
	Minimizes impacts of climate change
Socio/Cultural	Community impact (residents and local business)
	Manages and minimizes construction impacts
	Protects cultural heritage and archeological features

Each of the evaluation criteria categories for the five (5) major factors will be assessed using a ranked approach as outlined in **Table 8**.

Table 8. Ranking system for evaluation criteria.

Symbol	Ranking	Description
	High	Solution generates beneficial impacts and/or has no substantial challenges
	Medium	Solution contains a mix of positive and negative elements
	Low	Solution presents negative impacts and/or has substantial challenges

7.3 Stormwater Servicing Concepts

As noted in **Section 1.5** the Stormwater Master Plan is unique when compared to a traditional master plan due to the segmentation of the Regional network into over 400 independent subnetworks as well as the need to manage only the stormwater assets within the Regional Road rights of way. Additionally, population growth does not directly impact stormwater in the traditional sense as any intensification is required to manage stormwater to pre-development conditions or better. This provides a unique methodology in determining and evaluating stormwater concepts. However, indirectly, a result of population growth is the potential need to expanded road transportation networks, which in turn requires upsized or enhanced stormwater drainage. As such any growth-related road needs should translate to the stormwater needs in these instances.

Within the decision-making process for the Stormwater Master Plan, there are two major project classes which will be evaluated, which are:

1. Capacity based projects
2. Low Impact Development based projects

Each of the project classes will use supporting background information to determine a “short-list” of project locations from an initial “long-list” of locations. The “short-list” will be evaluated for alternatives as a group, with independent projects coming from each group recommendation.

Additionally, the Region had previously undertaken a State of Good Repair (SoGR) program which summarized the condition (via CCTV surveys) of existing stormwater linear assets. A summary of this program is provided in **Section 8.**

8.0 Assessment of Existing Stormwater Infrastructure

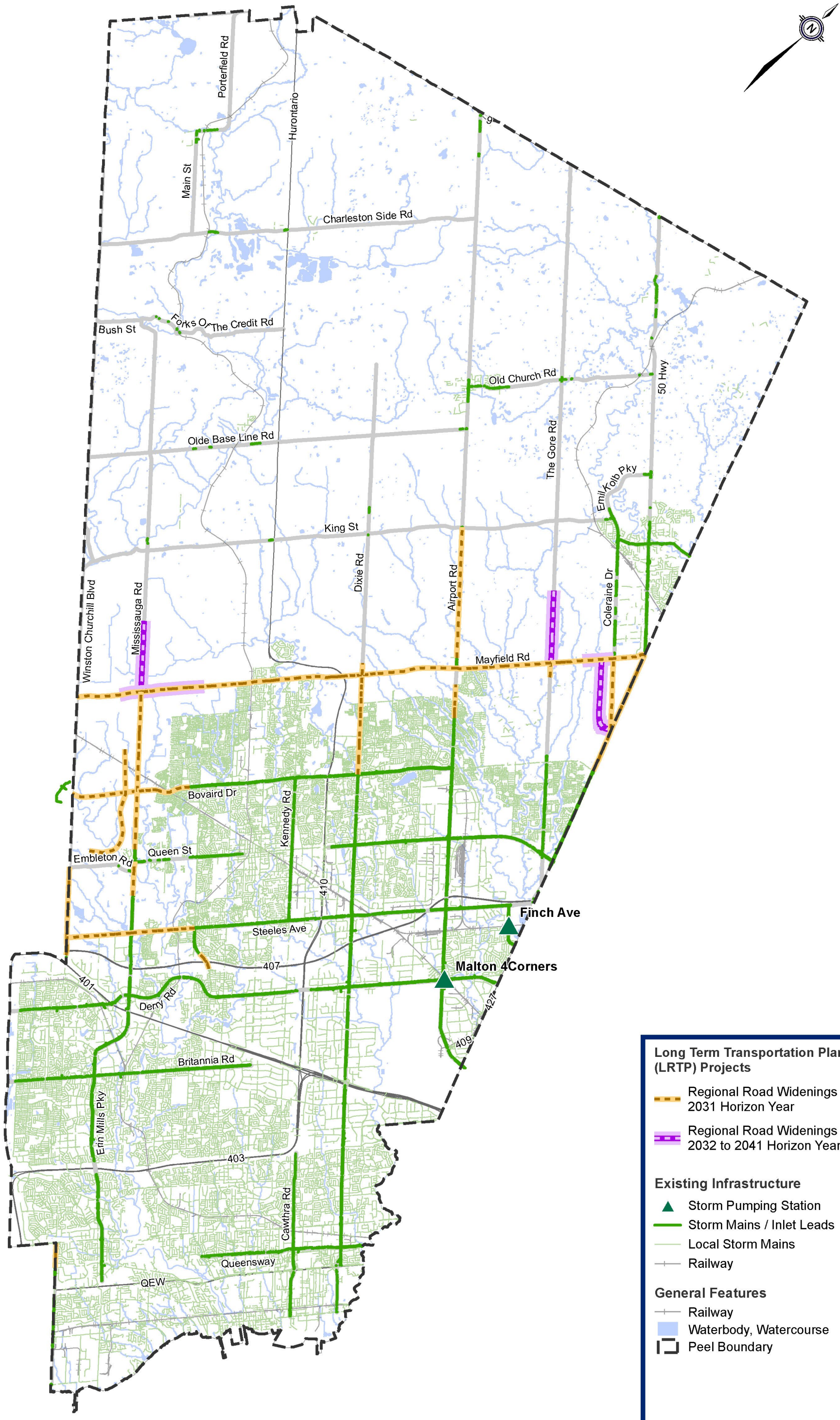
A critical step in the Master Planning process is the assessment of the existing infrastructure to establish the stormwater system baseline conditions. These baseline conditions will become the basis of the future recommendations of the Master Plan; therefore, it was important to ensure that they were determined through a comprehensive detailed analysis of the system. Once the existing system conditions were established, the following factors were considered to ensure a comprehensive review of the system needs:

- Infrastructure condition (State of Good Repair Program)
- Existing capacity deficiencies
- Growth and non-growth related transportation projects, and impacts
- Locations for LID projects

Per the Region's stormwater management policy and design criteria, all future development, intensification, and expansion areas are required to control post-development stormwater peak flowrates to the pre-development stormwater peak flowrates. As such, the existing system model was assumed to adequately represents the future conditions for all locations with existing stormwater collection and conveyance. Future planned road widenings, that would increase storm runoff, are subject to their own specific study and drainage needs are duly considered. All development and future growth will be required to maintain or improve upon existing conditions, with any required controls being managed on-site. Under this requirement, there is no anticipated net (negative) change in stormwater quantity, quality, or peak runoff for exiting stormwater subsystems. Modified (road widening) or new Regional Road systems as proposed in the Long Range Transportation Plan (LRTP) will require new or updated stormwater management controls; however, these systems are evaluated as part of project specific EAs per the LRTP. **Figure 10** presents an overview of the proposed Regional projects per the LRTP.

As such, the stormwater servicing concepts presented in **Section 10.2** will be evaluated to address existing deficiencies.

The following subsections describe the components evaluated as part of the Stormwater Master Plan including the problem and opportunities associated with developing and expanding the stormwater system to meet growing demands to the 2041 planning horizon and beyond, in line with the Regional of Peel LRTP.



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Stormwater Servicing Plan for Regional Road Infrastructure

Regional Growth - Road Widening and New Roads

Long Term Transportation Plan

BluePlan Engineering

Figure 10
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719020-SW-016b
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8.1 Climate Change

The scientific community expects that the increase in temperature and severe weather events due to climate change will lead to increased intensity and frequency of future storm events. In 2019, the Region of Peel released an update to their Public Works Stormwater Design Criteria and Procedure Manual. This update included modifications to their IDF curves. **Table 9** presents a comparison of the former IDF curves and the 2019 IDF curves.

Table 9. Comparison of the REgion of Peel's pre- and post-climate change adjusted IDF Curves.

Parameter	A		B		C	
	Pre-2019	2019	Pre-2019	2019	Pre-2019	2019
2-year	610	1070	0.78	0.8759	4.6	7.85
5-year	820	1593	0.78	0.8789	4.6	11
10-year	1010	2221	0.78	0.9080	4.6	12
25-year	1160	3158	0.78	0.9335	4.6	15
50-year	1300	3886	0.78	0.9495	4.7	16
100-year	1450	4688	0.78	0.9624	4.9	17

Figure 11 provides a graphical representation comparing the pre-2019 and 2019 IDF curves for the 10-year storm event on a logarithmic scale. The 10-year return period was utilized for the comparison as this is the Region of Peel's level of service for minor system conveyance.

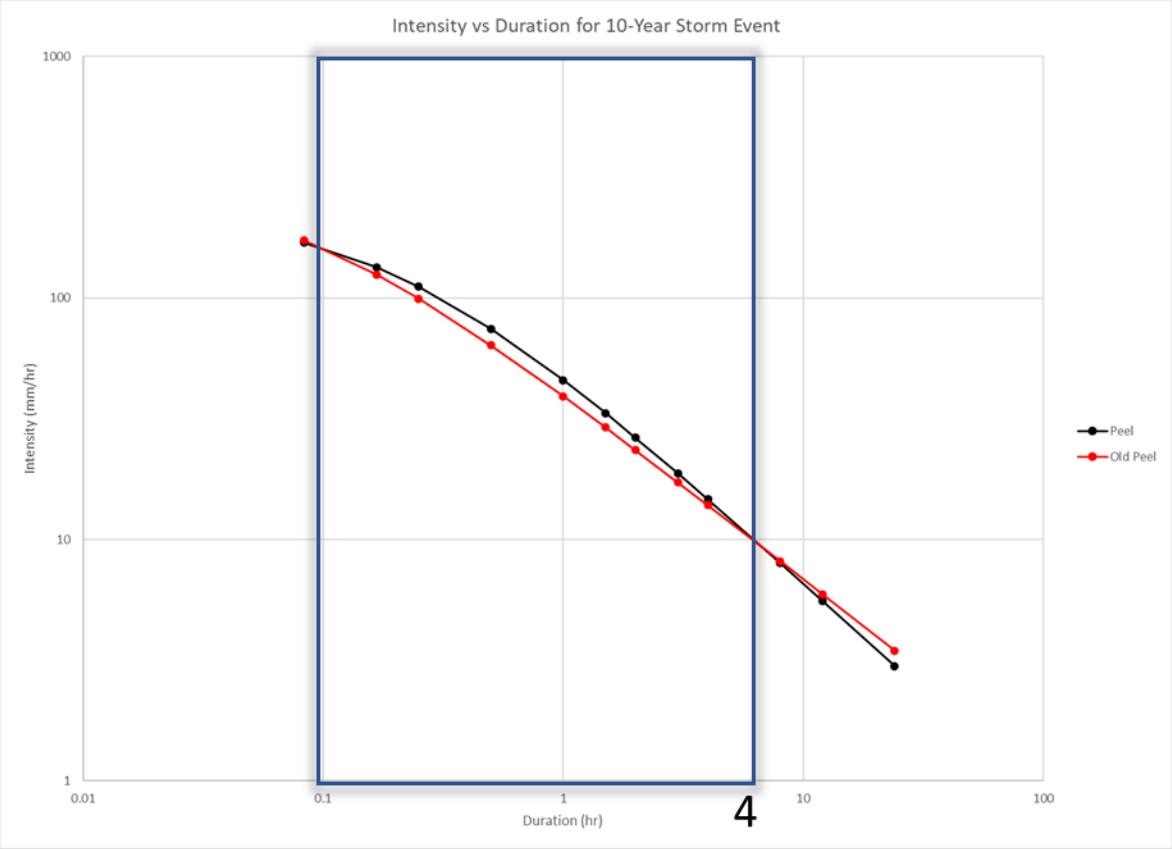


Figure 11. Graphical representation depicting the Region of Peel's pre- and post- adjusted IDF curves.

The Public Works Stormwater Design Criteria and Procedure Manual (Region of Peel, 2019) indicates that climate change should be accounted for in one of three ways:

- Apply the results of Localized Climate Projections for the Region of Peel developed from statistical downscaling of global model from a full ensemble of the latest generation of climate models (Coupled Model Intercomparison Project version 5 - CMIP5) or most recent (if available)
- Apply Predicted IDF Curves under Climate Change using the IDF_CC tool or Climate Change Data Portal (CCDP)
- An adjustment to the design flows (i.e. % adjustment for IDF curves) - not a preferred approach by the Region of Peel

To validate that the 2019 IDF curves are representative of projected climate change conditions for the 10-year return period event, the IDF_CC tool (https://www.idf-cc-uwo.ca/) was used to compare the Region's 2019 IDF curve against the projected climate change scenario. **Figure 12** provides a graphical representation comparing the 2019 Peel IDF curve against the IDF_CC tool climate change adjusted event for the 10-year storm event on a logarithmic scale.

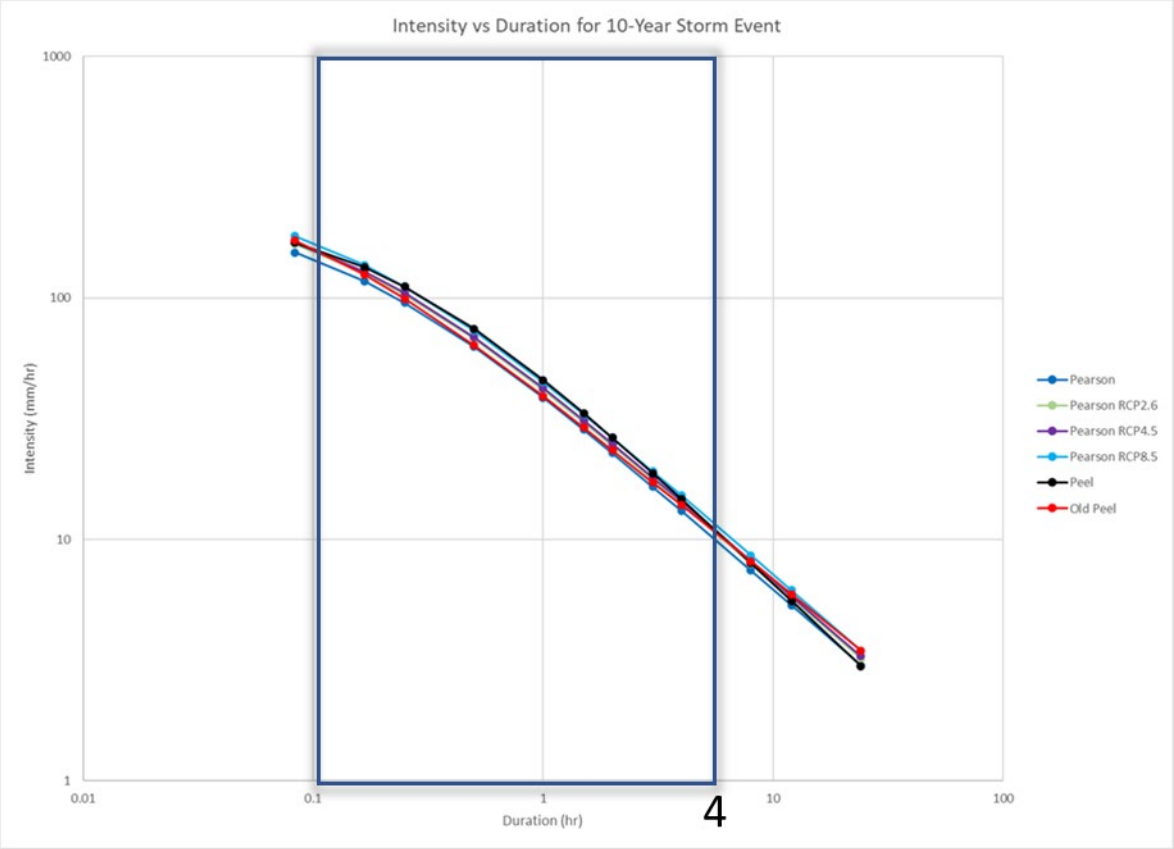


Figure 12. Graphical representation comparing the 2019 Peel IDF curve against the IDF_CC tool climate change adjusted event for the 10-year storm event.

When using the IDF_CC tool for comparison's sake, the Pearson Airport rain gauge/weather station data was used in the analysis. This data was then adjusted for climate change within the tool using RCP2.6, RCP4.5, and RCP8.5 climate change scenarios. As it is difficult to observe the differences between intensity and duration when comparing these events, the depth vs duration was also plotted in **Figure 13** to provide a better visual aid.

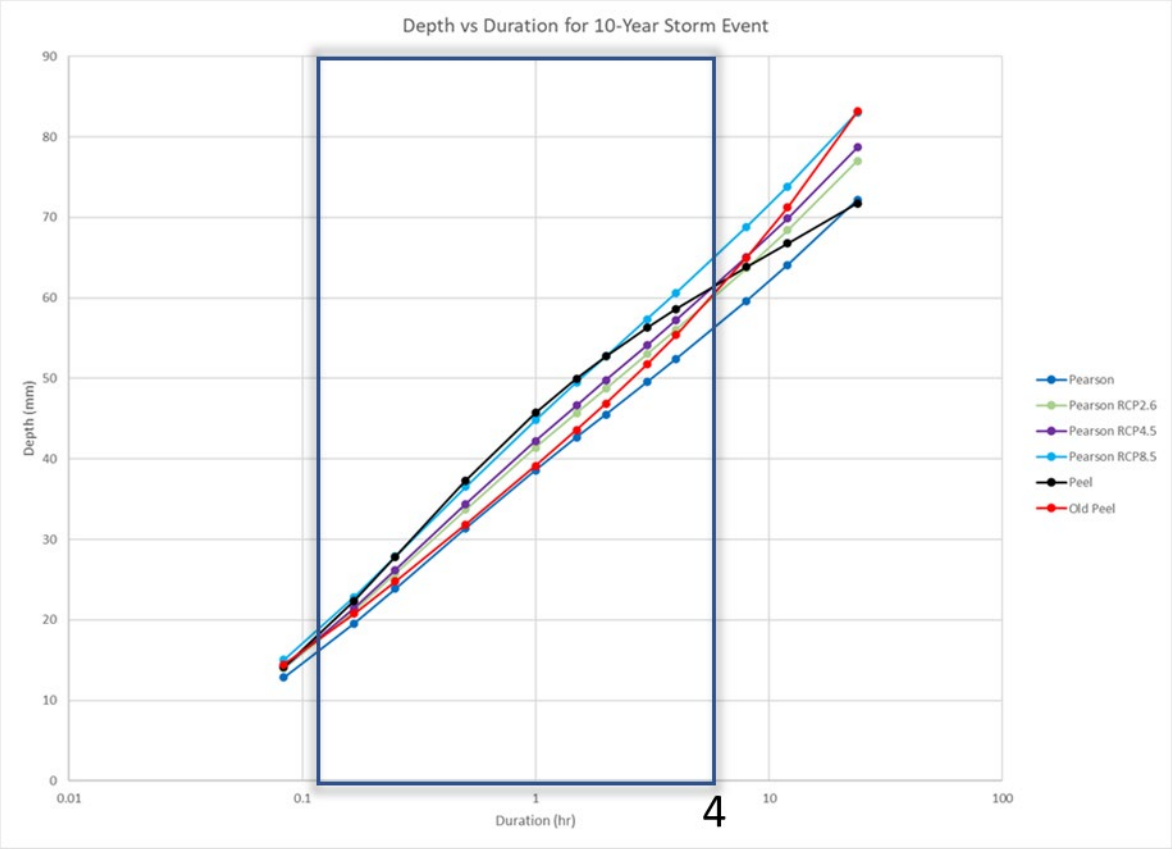


Figure 13. Depth vs. duration of various storm events.

As seen in **Figure 13**, the 2019 Peel storm event curve presents a higher rainfall depth within the 4-hour event time than both the RCP2.6 and RCP4.5 scenarios. The Peel storm event curve has a marginally lower depth than the RCP8.5 scenario at the 4-hour duration; however, the RCP8.5 scenario is the worst-case scenario available in the IDF_CC tool. This indicates that the 2019 IDF curve appears to be representative of a Climate Change adjusted storm event. Future analysis surrounding the development of Climate Change IDF curves is recommended to confirm that the Region is adequately accounting for Climate Change in their storm events.

In addition to the review of potential changes to rainfall intensity covered above, the Region is currently in the process of completing or have completed the following Climate Change Related studies and tools:

- Climate Change Master Plan
- Goods Movement Strategic Plan
- Enterprise Climate Change Risk, Financial Planning and Adaptation Assessment

This master plan will follow the Municipal Class Environmental Assessment (MCEA) process which requires evaluation of alternative solutions to determine a preferred solution to ensure the best solution possible is selected. For all determined system deficiencies, LID BMPs will be evaluated as one of the alternative solutions following the MCEA process, where possible. Through the process of determining existing storm system deficiencies, the master plan will cross reference existing public works and roads/transportation projects and timelines to determine implementation timelines which align with existing planned water/wastewater/roads system upgrades, ultimately ensuring that system upgrade and proposed LID costs and timelines are aligned and bundled with existing proposed projects. Accounting for increases in intensity, duration, and frequency of storm events within the stormwater system model will ensure the Region can plan and adapt to future climate scenarios, while proposing LID projects will help build resiliency to the potential effects of climate change on the stormwater system.

8.2 State of Good Repair (SoGR)

The Region of Peel completed a full Inspection and CCTV sewer Condition Assessment program between 2016 and 2020. The program consisted of two distinct phases which were later used to develop a State of Good Repair (SoGR) prioritization program. The SoGR program allows the Region to prioritize stormwater infrastructure repair, rehabilitation, and replacement requirements based on the existing condition of the infrastructure.

Although the SoGR program is a separate study from the Stormwater Master Plan, the results of the SoGR program impact the timelines for planned capacity-based projects. The following subsections will provide a high-level overview of the SoGR program in relation to the impacts on the Stormwater Master Plan a

8.2.1 Phase 1 – Inventory Collection and GIS Geodatabase Collection

Between April 2016 and March 2017, the Region hired a consultant (andrews.engineer) who conducted a field inventory of existing Region of Peel stormwater assets. This inventory was created using existing available Region of Peel GIS database data and was field verified where required.

8.2.2 Phase 2 – CCTV and Panoramic Inspections, Condition Assessment, and Rehabilitation Planning

Between September 2017 and March 2020, the Region's consultant conducted the field inspections required and recorded condition data to populate the relevant information into the inventory created in Phase 1. This included:

- CCTV inspection of storm sewers and catchbasin leads
- Panoramic inspection of manholes, catchbasins, and ditch inlets
- Condition grading information provided for all assets inspected

Condition grades followed NASSCO Pipeline Assessment Certification Program (PACP) and Manhole Assessment Certification Program (MACP), with the inclusion of additional grades provided for assets in which inspection/surveys were abandoned, indicating additional works required in order to provide a condition grade. **Table 10** presents the full list of condition grades for pipe assets.

Table 10. Existing condition grading for piped stormwater assets.

Condition Grade	Description
CG1	Good (Acceptable structural condition)
CG2	Fair (Minimal structural or service failure risk with potential for further deterioration)
CG3	Poor (Structural or service failure unlikely in the near future but further deterioration likely)
CG4	Bad (Structural or service failure likely in the foreseeable future)
CG5	Failed (Structural or service failure imminent or failed)
CG7	Abandoned due to heavy debris
CG8	Abandoned due to obstructions
CG9	Access issue. Survey abandoned due to no access.
CG10	GIS issue. (Ex. Recent construction has made changes to previously established network.)
CG11	Outfall channel issues.

8.2.3 State of Good Repair Prioritization Program

Utilizing the inventory created in Phase 1 and condition assessment grades assigned in Phase 2, the Region of Peel analyzed the data to create a prioritized program for asset rehabilitation and replacement. The prioritization program includes the planning for cleanout and reinspection of all assets falling under CG6-CG11, which indicate obstructions during the inspection process leading to a “Survey Abandonment”. Assets assigned a rating of CG3, CG4, and CG5 were further prioritized based on grade, location, and upcoming capital works project synergies. **Table 11**, **Table 12**, and **Table 13** provide summarized results of the CG3, CG4, and CG5 piped linear assets, respectively. This includes the proposed treatment of either “Replacement” or “External Point Repair” (EPR).

Table 11. CG3 SOGR results.

Asset ID	Location	Size (mm)	Length (m)	Treatment
STMHRR001-0310-STMHRR001-0306	Erin Mills Pkwy	375	23.62	Replace
STNDRR050-0588-STINRR050-0160	Highway 50	525	28.92	Replace
STMHRR020-0132-STMHRR020-0131	Queensway	300	12.96	Replace
STMHRR009-0075-STMHRR009-0017	King St	375	104.15	Replace
STMHRR007-0432-STNDRR007-0865	Airport Rd	300	14.67	Replace
STMHRR007-0576-STMHRR007-0548	Airport Rd	600	69.03	Replace
STMHRR004-0113-STMHRR004-0112	Dixie Rd	375	31.39	EPR
STMHRR005-0465-STMHRR005-0466	Derry Rd	300	33.49	EPR
STMHRR107-0378-STMHRR107-0366	Queen Street East	450	45.4	EPR
STMHRR007-0532-STMHRR007-0533	Airport Rd	300	50.58	EPR
STINRR007-0332-STMHRR007-0353	Airport Rd	300	40.02	EPR

Table 12. CG4 SOGR results.

Asset ID	Location	Size (mm)	Length (m)	Treatment
STMHRR050-0328-STMHRR050-0327	Highway 50	300	45.86	Replace
STMHRR107-0486-STNDRR107-0239	Bovaird Dr	450	13.57	Replace
STMHRR107-0577-STNDRR107-0255	Bovaird Dr	450	14.64	Replace
STMHRR050-0402-STMHRR050-0381	Highway 50	300	0	Replace
STMHRR007-0453-STNDRR007-0866	Airport Rd	375	49.27	EPR
STINRR010-0042-STMHRR010-0062	Bovaird Dr	250	10.45	EPR
STMHRR014-0060-STNDRR014-0647	Mayfield Rd	300	8.11	EPR
STMHRR050-0328-STMHRR050-0327	Highway 50	300	45.86	Replace

Table 13. CG5 SOGR results.

Asset ID	Location	Size (mm)	Length (m)	Treatment
STMHRR004-0067-STMHRR004-0069	Dixie Rd	375	22.53	Replace
STMHRR007-0144-STMHRR007-0143	Airport Rd	375	30.63	Replace
STMHRR003-0130-STMHRR003-0129	Britannia Rd	300	52.06	Replace
STMHRR001-0057-STNDRR001-0720	Erin Mills Pkwy	250	80.14	Replace
STMHRR007-0245-STMHRR007-0243	Airport Rd	375	80.5	Replace
STMHRR005-0240-STMHRR005-0241	Derry Rd	450	44.07	Replace
STMHRR005-0271-STMHRR005-0268	Derry Rd	300	45.51	Replace
STINRR005-0372-STMHRR005-0195	Derry Rd	375	18.76	Replace
STMHRR010-0138-STNDRR010-0008	Bovaird Dr	300	13.13	Replace
STINRR009-0073-STMHRR009-0020	King St	450	39.9	Replace
STMHRR008-0122-STMHRR008-0121	The Gore Rd	300	8.11	Replace
STINRR050-0195-STNDRR050-0228	Highway 50	600	111.88	Replace
STMHRR020-0094-STMHRR020-0095	Queensway	600	36.64	EPR
STMHRR005-0433-STMHRR005-0430	Derry Rd	250	72.29	EPR
STINRR005-0465-STMHRR005-0278	Derry Rd	250	27.73	EPR
STMHRR005-0270-STMHRR005-0269	Derry Rd	250	26.86	EPR
STMHRR107-0509-STMHRR107-0507	Bovaird Dr	375	31.97	EPR
STMHRR007-0151-STMHRR007-0147	Airport Rd	300	45.28	EPR
STINRR107-0166-STMHRR107-0498	Bovaird Dr	300	49.40	EPR
STMHRR107-0490-STMHRR107-0486	Bovaird Dr	300	94.24	EPR
STMHRR015-0042-STMHRR015-0045	Steeles Ave	300	57.96	EPR
STMHRR015-0039-STMHRR015-0037	Steeles Ave	300	56.39	EPR
STMHRR010-0092-STMHRR010-0094	Bovaird Dr	300	46.50	EPR

8.3 Pumping Stations

8.3.1 Finch Pumping Station

The Finch Pumping Station has been subject for planned maintenance/upgrades, and the following studies have evaluated the condition, pre-design, and potential alternative solutions to the existing station:

- Condition Assessment Report (GM BluePlan, 2015)
- Pre-Design Report (Associated Engineering, 2020)
- Stormwater Servicing Plan for Regional Road Infrastructure (GM BluePlan, Ongoing)

The pumping station is required for a section of Finch Avenue West, which is an isolated low point in the storm sewer network due to the CN Rail overpass which Finch Avenue West passes beneath. The pumping station conveys rainwater for an approximate 0.5km (1.7ha) stretch of the Regional Road Right-of-Way, lifting stormwater from a low point within the minor and major stormwater systems. Without it, the right-of-way would experience frequent flooding with no available outlet.

The Condition Assessment Report reviewed the field condition of the pumping station and outlined recommendations for maintenance and operational upgrades which would improve efficiency of the system and ensure that it is operating safely. This included proposed upgrades to the safety measures such as access & egress improvements and power supply upgrades, bringing the existing pumping station up to modern design standards. This also includes operational and monitoring upgrades such as flow monitors, float switches, and upgrades to automated monitoring systems and warning alarms.

Within the Stormwater Servicing Plan for Regional Road Infrastructure, an assessment was performed following the Municipal Class Environmental Assessment (MCEA) process to determine if any practical or achievable alternatives were available outside of the pumping station upgrades. Alternative discharge locations and conveyance alignments were explored as methods to decommission the pumping station. This analysis determined that there are no apparent practical alternatives to a pumping station in this location due to the elevation of the contributing drainage area and the elevation of nearby potential outfall locations. As such, the pumping station is a crucial component of the stormwater system which can not be replaced by gravity sewers. The analysis included modelled results utilizing future climate change storm event scenarios to ensure that the proposed pump upgrades account for increased rainfall intensity due to climate change. Under existing conditions, the pumping station does not meet the modelled capacity for the 10-year level of service, which poses a risk of flooding. Upgrades to the pumping station would ultimately make the system and section of Regional Road more resilient to climate change.

8.3.2 Malton Four Corners Pumping Station

The Malton Four Corners Pumping Station is located at the intersection of Derry Road and Airport Road in the City of Mississauga. Due to the presence of the Malton GO Station and associated railway line, there is a localized low spot in the road system which does not have an adequate gravity major or minor system outlet. The pumping station is in place to lift the stormwater from this localized low spot at the intersection of Derry Road and Airport Road, and discharge the stormwater into the nearby watercourse, approximately 250 m north of the intersection.

The Malton Four Corners Pumping Station was recently rehabilitated following the results of a Condition Assessment Report completed in 2015. An in-depth review of the possibility for decommissioning was not conducted due to the recently completed rehabilitation works.

9.0 Capacity Based Projects

9.1 Assessment of Existing and Growth-Related Conditions / Infrastructure

Per **Section 3.3**, the Region of Peel's minor system level of service requires conveyance of the 10-year return period storm event. Model results from the InfoWorks ICM hydraulic model were used to analyze the system performance, including outlining which pipes were predicted to surcharge and which nodes were flooding to surface under the modeled event scenario. As with any modelling tool, the results of the model were scrutinized against the assumptions and level of confidence building the model, per **Section 6.**. The process followed to distill and validate the results is outlined in **Section 9.1.2.**

9.1.1 Opportunities & Constraints

Existing and future stormwater opportunities and constraints were identified through discussions with Region staff, as well as through hydraulic analyses and review of infrastructure data (e.g. GIS, design reports, as-built information, etc.). In general, the minor conveyance system has various sewer deficiencies for the applicable level-of-service (10-year) storm event.

The following opportunities and constraints have been identified:

- Conveyance
  - Determine bottlenecks and beneficial infrastructure upgrades
  - Short-term and long-term strategies to manage conveyance capacity
- Water Quality
  - Temperature control for stormwater runoff and sensitive species
  - Implement Low Impact Development (LID) technologies
- Future Infrastructure
  - Road widening and capital projects synergies
  - Planning for newly constructed Regional Road right-of-way

9.1.2 Capacity Project Location Methodology

The results of the modelling analysis provided a "long-list" of potential locations with capacity concerns. These results were then further screened to determine a "short-list" of true capacity concerns using the following process:

1. Model Build Constraints

First, all surcharged locations and flagged pipes which may have surcharging triggered due to the model build were reviewed. The model was prepared based on the Region's infrastructure shapefiles in combination with the shapefiles available as part of the Inspection and Condition Assessment project. There were some locations which had assumed inverts due to missing information or flat pipes based on the information contained in the shapefiles. These were filtered out of the potential project locations as "potential issues with model network build". These locations have been identified and documented to enable the Region to plan future data collection efforts to fill gaps.

2. Drainage Area Definition Constraints

Next, as all subcatchments were manually delineated, delineation assumptions were required for areas outside of the Regional Right of Way. This included assumptions around private properties which appeared to have no lower-tier municipal outlet or direct outlet to watercourses. These were manually delineated based on DEM information and parcel mapping. There was no information surrounding potential on site controls for these lots and as such, some of these lots may be over-contributing in the model when compared to real-world conditions. Additionally, the lower-tier network was not modeled and was only used to estimate the contributing lower-tier area conveyed to the Regional network. There are significant model assumptions associated with these external contributing area scenarios and as such, these were filtered out as "potential issue with drainage area definition".

3. Selection of "worst" areas with probable "real" capacity issues

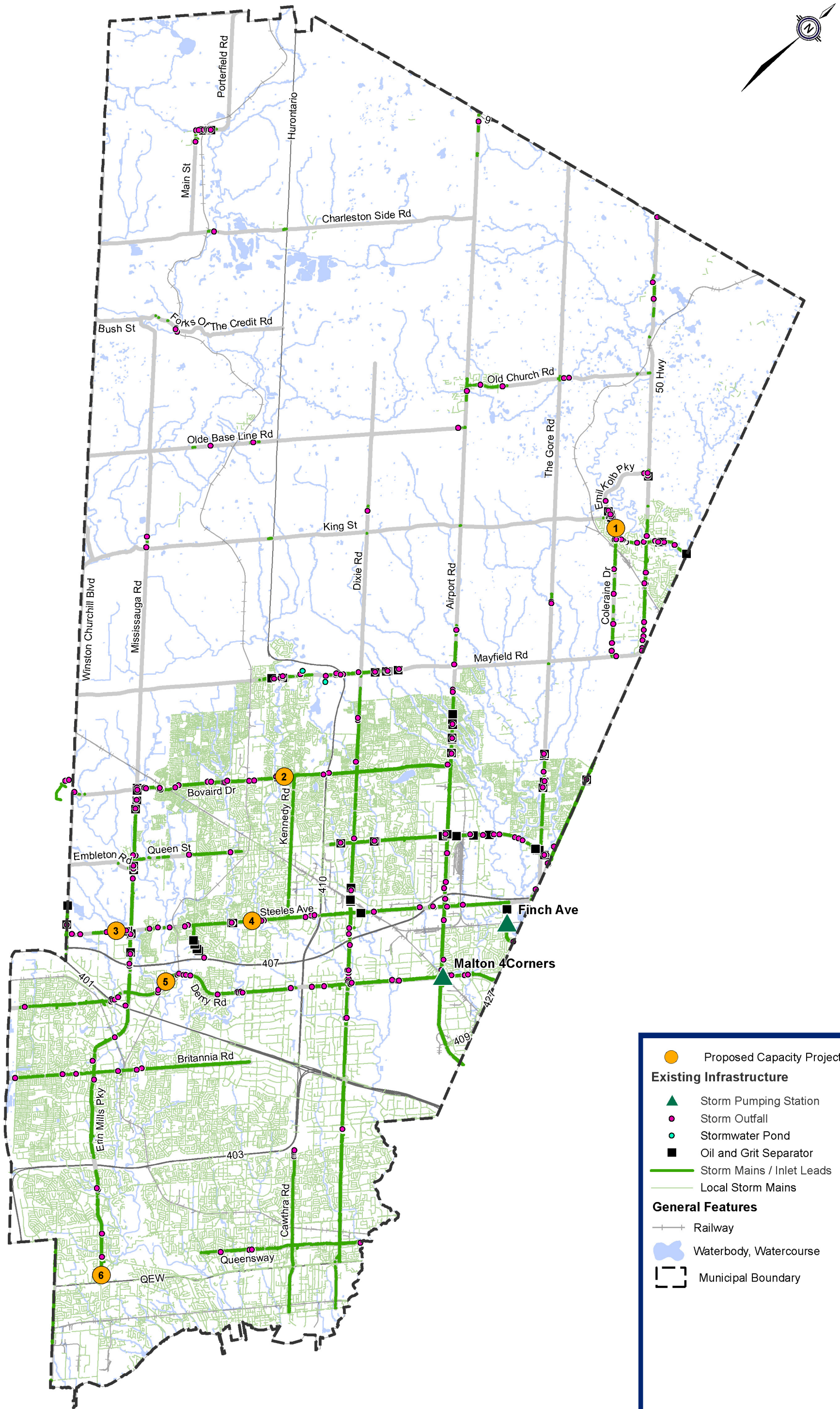
Lastly, the model was quite conservative in its assumptions (conservative flows/worst case scenario as a system). Combined with the Region's recent (2019) update to their IDF curves to account for climate change, there are a significant number of surcharging pipes under the 10-year event even though there is no history of flooding or customer complaints in these locations. Simply put, the general system was designed to accommodate a lower intensity 10-year storm (pre-2019 IDF) compared to that which we used for analysis, which is representative of climate change. As such, the results were further filtered to determine the theoretical highest priority areas, which were identified as the ones which do not meet a 5-year storm event level of service and are flooding under the 5-year event. These are the projects which are highest priority and point towards being "real" issues in the system based on existing flows/design size.

9.1.3 Short-List of Capacity Project Locations

Following the screening process outlined in **Section 9.1.2** the “long-list” of capacity concerns following the results of the stormwater model were distilled into a “short-list” of minor system capacity concerns. The “short-list” contains the capacity projects which have a higher probability and level of certainty in requiring upsizing to meet the Region of Peel’s level of service per the 10-year return period storm event from the 2019 IDF curves. The results of the short list of locations are as follows:

1. Emil Kolb Parkway & De Rose Ave
2. Bovaird Drive & Conestoga Drive
3. Steeles Avenue West and Rivermont Road
4. Steeles Avenue West and Lancashire Lane
5. Derry Road and Dishley Court
6. Erin Mills Parkway and QEW Ramp West

Figure 14 provides a map of the proposed “short-list” of capacity project locations.



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Stormwater Servicing Plan for Regional Road Infrastructure

Proposed Capacity Projects

BluePlan ENGINEERING

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9.1.3.1 Emil Kolb Parkway & De Rose Avenue

There is an approximate 435-meter network of existing storm sewers within Emil Kolb Parkway from Chickadee Lane south to the watercourse just south of De Rose Avenue. This storm sewer network contains pipes varying between 300 mm in diameter and 525 mm in diameter. This section of Regional storm sewer network discharges into a 750 mm diameter sewer or culvert which then further discharges east, to a ditch/watercourse just south of De Rose Avenue. **Figure 15** provides a visual indication of the network of interest.

Figure 15. Emil-Kolb Parkway and De Rose Avenue capacity project location.

Under existing conditions, a portion of this network is undersized and surcharging under the climate change adjusted 10-year storm event scenario per the InfoWorks ICM model described in **Section 6.** Per the Sustainable Transportation Strategy, there are construction works proposed to take place in 2038.

9.1.3.2 Bovaird Drive & Conestoga Drive

There is an approximate 530-meter network of existing storm sewers within Bovaird Drive from just west of Kennedy Road conveying west towards Etobicoke Creek. This storm sewer network contains pipes varying between 375 mm in diameter and 525 mm in diameter. This section of Regional storm sewer network discharges into Etobicoke Creek which is a TRCA regulated watercourse. **Figure 16** provides a visual indication of the network of interest.

Figure 16. Bovaird Drive and Conestoga Drive capacity project location.

Under existing conditions, a portion of this network is undersized and surcharging under the climate change adjusted 10-year storm event scenario per the InfoWorks ICM model described in **Section 6**. The network currently contains quality treatment through the use of a Manufactured Treatment Device prior to the Etobicoke Creek outfall. There are no upcoming proposed capital works projects within the project location.

9.1.3.3 Steeles Avenue West and Rivermont Road

There is an approximate 410-meter network of existing storm sewers within Steeles Avenue West at Rivermont Road / Hereford Street conveying stormwater from west to east towards Levi Creek. This storm sewer network contains pipes varying between 300 mm in diameter and 375 mm in diameter. This section of Regional storm sewer network discharges into Levi Creek which is tributary to the Credit River watershed and is a CVC regulated watercourse. **Figure 17** provides a visual indication of the network of interest.

Figure 17. Steeles Avenue West and Rivermont Road capacity project location.

Under existing conditions, a portion of this network is undersized and surcharging under the climate change adjusted 10-year storm event scenario per the InfoWorks ICM model described in **Section 6**. Per the Region's roadworks capital program, there are road construction works proposed to take place in 2024.

9.1.3.4 Steeles Avenue West and Lancashire Lane

There is an approximate 195-meter subnetwork of existing storm sewers within Steeles Avenue West just east of Lancashire Lane which convey stormwater from east to west into a larger stormwater conveyance system just west of Lancashire Lane. The stormwater network eventually discharges into Fletchers Creek. This section of the storm sewer network contains pipes that are 300 mm in diameter. This greater storm sewer network within Steeles Avenue West ultimately discharges into Fletchers Creek which is tributary to the Credit River watershed and is a CVC regulated watercourse. **Figure 18** provides a visual indication of the network of interest.

Figure 18. Steeles Avenue West and Lancashire Lane capacity project locations.

Under existing conditions, the subsection of the greater network is undersized and surcharging under the climate change adjusted 10-year storm event scenario per the InfoWorks ICM model described in **Section 6**. The network currently contains quality treatment through the use of a Manufactured Treatment Device prior to the Fletchers Creek outfall. There are no upcoming proposed capital works projects within the project location.

9.1.3.5 Derry Road West and Dishley Court

There is an approximate 190-meter network of existing storm sewers within Derry Road West from Godwick Drive to the baseball diamond just southwest of Dishley Court. This storm sewer network contains pipes varying between 300 mm in diameter and 450 mm in diameter. This section of Regional storm sewer network discharges into a 450 mm diameter sewer beneath the baseball diamond southwest of Dishley Court which then enters the lower-tier stormwater system within Godwick Drive. Boundary conditions within the lower tier minor system have not been modeled. As such, potential lower tier downstream restrictions will need to be evaluated in any future upsizing project at this location. **Figure 19** provides a visual indication of the network of interest.

Figure 19. Derry Road West and Dishley Court capacity project location.

Under existing conditions, this portion of network is undersized and surcharging under the climate change adjusted 10-year storm event scenario per the InfoWorks ICM model described in **Section 6**. Per the Sustainable Transportation Strategy, there are construction works proposed to take place in 2030.

9.1.3.6 Erin Mills Parkway and QEW Ramp West

There is an approximate 170-meter network of existing storm sewers within Erin Mills Parkway just north of the QEW Ramp West. This section of the storm sewer network contains pipes that are 300 mm in diameter. **Figure 20** provides a visual indication of the network of interest.

Figure 20. Erin Mills Parkway and QEW Ramp West capacity project location.

Under existing conditions, this portion of network is undersized and surcharging under the climate change adjusted 10-year storm event scenario per the InfoWorks ICM model described in **Section 6**. Per the Sustainable Transportation Strategy, there are road character improvements proposed to take place in 2030.

9.1.4 Capacity Project Servicing Concepts

For each location outlined in the "short-list" of capacity projects, an evaluation of servicing concepts was conducted to propose an adequate solution to the existing capacity concerns/constraints. **Table 14** provides an overview of the proposed servicing concepts.

Table 14. Proposed servicing concepts.

Servicing Concept	Description	Peak Flow Control	Volume Control	Quality Control
Status Quo	• As-is system (do nothing)	✘	✘	✘
Minor System Upsizing	• Sewer upsizing	✓	✘	✘
Storage Solution	• Pond • Underground storage	✓	(✓)	✓
Low Impact Development (LID)	• Infiltration LID • Water quality LID • Flow attenuation LID	(✓)	(✓)	(✓)
Major System Upgrades	• Roadway ditching • Roadway curbing • Open channel • New Sewers • Inlet controls/MTDs	✓	✓	(✓)

Legend:

✘ – The item addresses the control criteria

✓ – The item does not address the control criteria

(✓) – The item may address the control criteria depending on implementation

9.2 Servicing Concepts Evaluation

The following section relates to the short-list of "capacity-based" project locations. These project locations were identified through assessment of the results of the InfoWorks ICM model, which was used as a tool to help identify the locations within the regional storm sewer network that do not adequately convey the 10-year storm event (minor storm event) per the Region's level of service objectives. These locations were screened from a long-list of locations based on the surcharging state of the pipes in the model to a short-list based on the methodology outlined in **Section 9.1.2**.

Based on the results of the analysis and the similarity of the constraints identified it is appropriate to evaluate alternatives on a system-wide basis. **Table 15** below details the evaluation of alternatives to address the minor system capacity issues identified.

Table 15. Capacity based alternative evaluation.

Factor	Evaluation Criteria	Status Quo	Minor System Upsizing	Storage Solution	Low Impact Development (LID)	Major System Upgrade
Technical	Meets existing and future servicing needs	○	●	◑	◑	○
	System security/reliability	○	●	●	◑	●
	Minimizes and manages construction risk	●	◑	○	○	○
	Technical viability	●	●	●	○	○
	Traffic management/traffic impacts	●	◑	◑	◑	○
	Resiliance to climate change	○	◑	◑	●	●
Financial	Capital cost & life cycle cost (overall servicing strategy)	◑	●	◑	○	●
	Operations & maintenance cost	◑	●	◑	○	◑
	Alignment with approval and permitting process	●	●	●	●	●
Legal/Jurisdictional	Property acquisition	●	●	●	●	●
	Permitting requirements	●	◑	○	○	○
Environment	Protects environmental features	◑	◑	◑	●	◑
	Geology/hydrogeology considerations	◑	◑	◑	○	◑
	Protects wildlife & species at risk	◑	◑	◑	●	◑
	Minimizes impacts of climate change	○	◑	◑	●	◑
Socio/Cultural	Community impact (residents and local business)	●	◑	◑	◑	○
	Manages and minimizes construction impacts	●	●	●	●	●
	Protects cultural heritage and archeological features	●	●	●	●	●

Based on the results of the **Table 15** the preferred alternative is “minor system upsizing”. Minor system upsizing is recommended for each of the capacity project locations based on the technical, financial, legal/jurisdictional, environmental, and social/cultural evaluation factors. Both “status quo” and “major system upgrades” do not adequately meet the technical requirements in relation to deficiencies in the minor system. Storage solutions are technically feasible; however, they are generally not financially beneficial, and they can attract higher life cycle costs through increased O&M requirements. LID BMPs operate well in mitigating the impacts of climate change and providing water quality enhancements; however, they provide low benefit in relation to capacity deficiencies. Following this reasoning and the supporting evaluation results, minor system upgrades are the preferred alternative for each of the capacity project locations.

10.0 LID Based Projects

10.1 Assessment of Existing Conditions / Infrastructure

Per discussions with the Region at the onset of the Stormwater Master Servicing Plan, the Region of Peel strives to increase the use of Low Impact Development Best Management Practices where possible, in order to holistically manage stormwater in a way that mimics the pre-development natural environment. This initiative is aligned with the Region of Peel's 2021 Enterprise Asset Management Plan and the Draft 2022 Official Plan to increase resilience to climate change and plan for more sustainable stormwater management best management practices.

Through this project, a screening tool has been developed that can be used by the Region for all future transportation projects to help identify where LIDs will be most feasible based on a variety of factors that impact their effectiveness. As described in the latter subsections, this tool has been used to highlight the locations where the implementation of an LID BMP would provide the greatest system benefit. This screening process established a "short-list" of LID project locations which are recommended for implementation of an LID BMP. Although the "short-list" provides the current recommendations for implementation, the screening process and tool can be utilized in future road right-of-way projects to confirm the applicability of LID implementation.

10.1.1 Opportunities and Constraints

Opportunities and constraints were identified through workshops with Region staff, hydraulic analysis, a review of infrastructure data (e.g. GIS, design reports, as-built information, etc.), and background supporting reports (environmental factors such as depth to water table). LID projects are planned to support growth within the Region of Peel through synergies with proposed upcoming capital projects per the Region's internal water, wastewater, and transportation planning which includes both roads and sustainable transportation methods (trails, bike lanes etc).

The following opportunities have been identified:

- Project Synergies
  - Reduced program costing due to "piggybacking" on upcoming planned capital projects
  - Short-term and long-term projects allow holistic implementation over the range of the Official Plan planning horizon
- Water Balance
  - Reduction in "hardscaped" space allows better integration with natural water cycle including infiltration and evapotranspiration
- Water Quality
  - Temperature control for stormwater runoff and sensitive species
  - Total Suspended Solids removal
  - Potential for phosphorus removal
- Future Infrastructure

- Road widening and capital projects synergies
- Planning for newly constructed Regional Road right-of-way

- Conveyance
  - Benefit of minor peak flow attenuation through implementation of LID technologies
  - LID technologies can act as stormwater storage systems

10.1.2 Low Impact Development Project Location Methodology

The ability to determine the most applicable locations for implementation of an LID BMP required the development of a defensible and robust decision-making tool. A decision-making model was developed which utilized available Region of Peel asset register data and spatial relationships to establish a scoring/ranking system. The LID BMP rating system is associated with the piped assets, as these assets have a unique identifier and provide a fair spatial representation of the urban water system within the Region of Peel.

The methodology for creation of the decision-making model is as follows:

1. Relevant input factors are established which would impact the decision making for implementation of an LID BMP
2. These input files are ‘cleaned-up’ and spatially processed
3. Each input file/factor is then assigned a scoring/rating system based on the beneficial impact implementation of an LID would have on the specific evaluation factor
4. These scores are then spatially joined to each individual pipe asset within the Region’s asset register to establish a matrix of all Regional linear piped assets against evaluation factors
5. These evaluation factors are then weighted based on impact/value of the evaluation factor against the benefit to implementation of an LID

Figure 21 provides a visual interpretation of the basic methodology of the decision-making model.

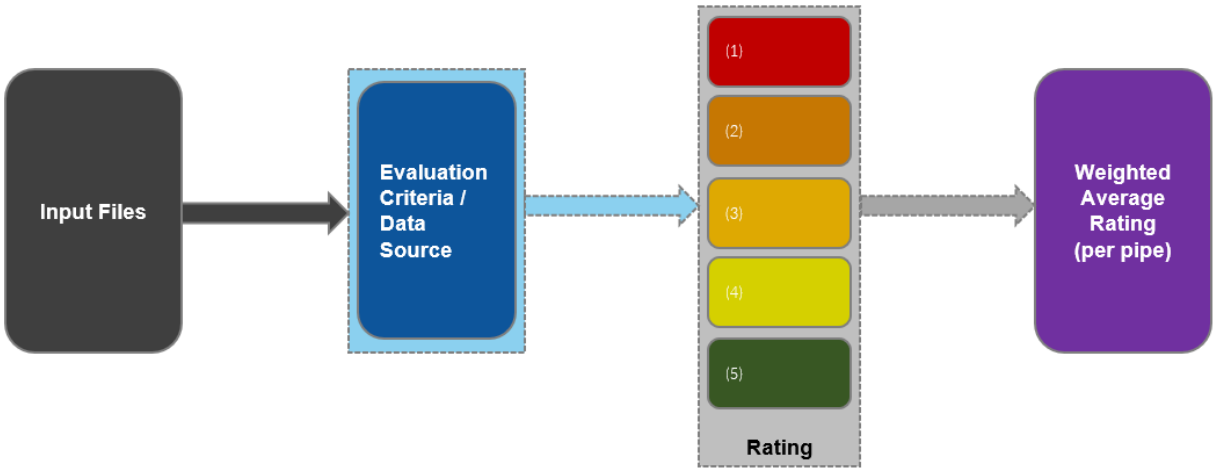


Figure 21. Decision-making methodology.

Table 16 summarizes the input factors used in the decision-making model as well as the weighting for each factor, which was established through discussions with the Region of Peel. These weightings are impacted by technical relevance to LID implementation, redundancy against similar factors, and the impact of synergies across existing Region of Peel planned capital projects.

Table 16. Decision-making methodololgy input factors and weightings.

Factor	Weighting	Justification
LID Infiltration Potential	1	Many LIDs are infiltration based and require specific subsurface conditions to perform as designed
Pipe Condition (SOGR)	1	Alignment with pipe condition provides opportunities for synergies through LID implementation during SOGR works
Sustainable Transportation	1	Alignment with the Sustainable Transportation Strategy (STS) provides opportunities for synergies through LID implementation during planned STS works
Roads Capital Program	1	Alignment with the roads capital program provides opportunities for synergies through LID implementation during planned capital program works
Roads Condition (SOGR)	1	Alignment with road condition provides opportunities for synergies through LID implementation during repaving
Sewer Capacity	1	There is a higher benefit from the implementation of LIDs in locations which require a reduction or attenuation of stormwater due to capacity constraints
Existing Quality Treatment	1	LIDs can provide water quality benefits and the absence of existing quality treatment indicates a higher need for an LID
Existing W/WW Project	0.5	Alignment with W/WW capital projects provides opportunities for synergies through LID implementation during planned capital works
Road Studies	0.2	There may be minor benefit to consider the implementation of LIDs as

		an additional component in locations with existing studies underway
Intersection Improvements	0.2	There may be minor benefit to consider the implementation of LIDs in locations with planned intersection improvements, although the planned construction area is minor
Environmental Sensitivity	0.2	As existing water quality treatment is already a full consideration in the weighted average, the inclusion of environmental sensitivities at the outfall provides additional benefit for implementation of LIDs

The detailed process flow for the model, including the evaluation scoring system for individual factors, is presented in **Figure 22.**

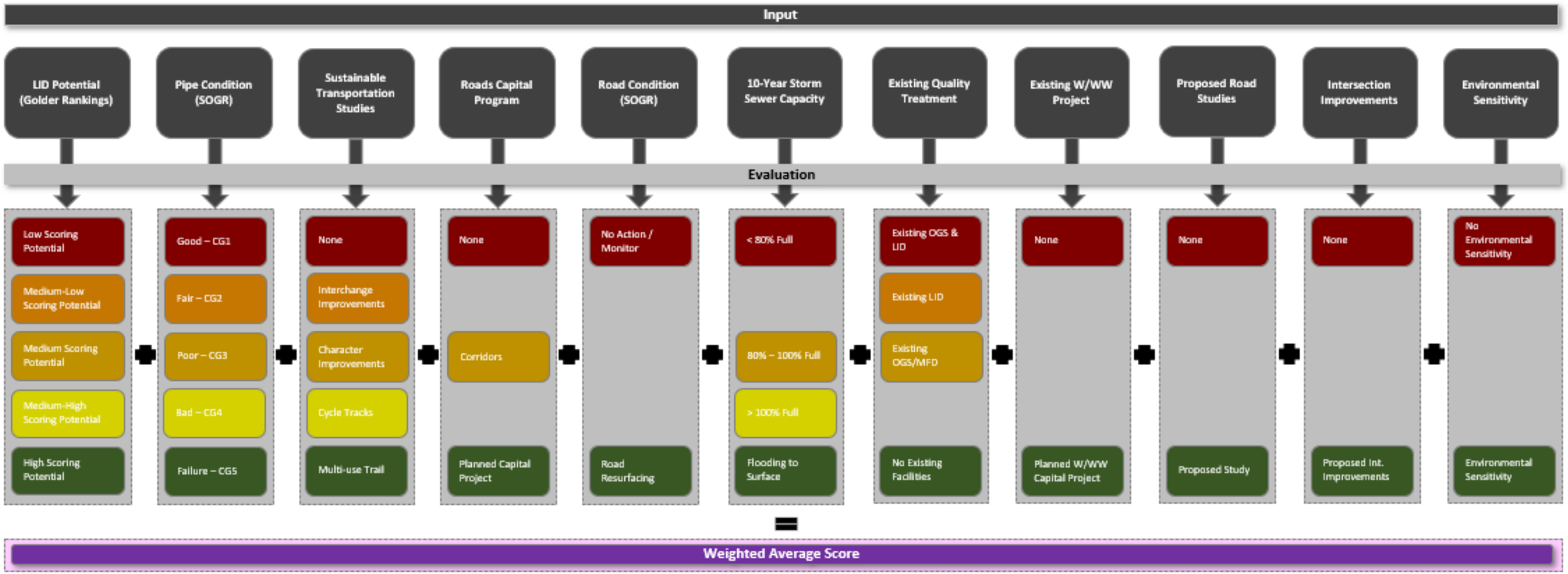


Figure 22. Detailed LID area selection methodology-decision flow.

10.1.3 Short-List of LID Project Locations

Following the project location screening methodology outlined in **Section 10.1.2**, a "short-list" of LID project locations was established. The "short-list" contains the locations within the Regional right-of-way which have the highest potential benefit for implementation of an LID BMP when evaluated against future proposed capital project synergies. These were the locations which had clusters of "high-scoring" pipes based on the screening methodology. It is important to highlight that the proposed locations are not the only locations where the implementation of an LID BMP is feasible or beneficial. The decision-support tool will be used internally by the Region of Peel when evaluating future water, wastewater, and transportation capital program projects to highlight whether an LID BMP would be beneficial for inclusion in future stormwater project scopes. Proposed LID sites may be updated in the future by ongoing or future studies/projects completed by the Region, CVC or others to identify priority LID sites within the Region.

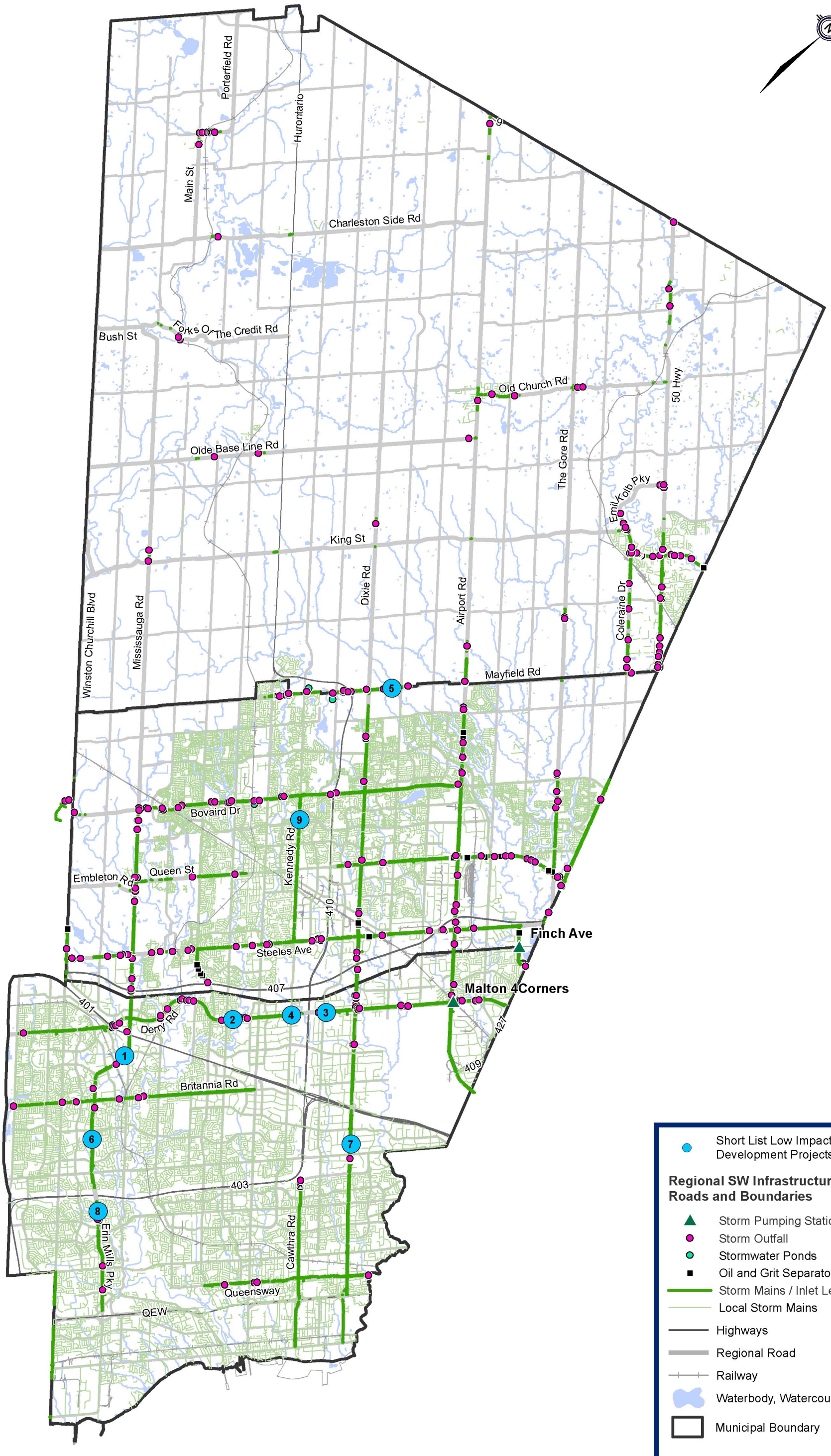
The following are the proposed LID project locations based on the analysis:

1. Erin Mills south of Highway 401
2. Derry Road and McLaughlin Road
3. Derry Road east of Highway 410
4. Derry Road west of Highway 410
5. Mayfield Road east of Dixie Road
6. Erin Mills north of Highway 403
7. Dixie Road south of Highway 401
8. Erin Mills south of Highway 403
9. Kennedy Road south of Bovaird Drive

For each of the short-listed LID project locations, additional information will be included such as:

- Total contributing area (ha)
- Total length of potentially affected underground infrastructure (km)
- Existing outfall watercourse
- Approximate right-of-way length for study area (km)
- Number of subnetworks within the study area limits
- Breakdown of the results of the area selection analysis per Section 10.1.2 methodology
- Details surrounding potential project synergies with planned future Region projects including but not limited to sustainable transportation, roads capital works, water projects, and wastewater projects

Figure 23 provides a map of the proposed "short-list" of LID project locations.



Region of Peel working with you

Stormwater Servicing Plan for Regional Road Infrastructure

Short List of Low Impact Development Projects

BluePlan Engineering

Figure 23
November 2022
719020-SW-014
NAD 1983 UTM Zone 17N

Document Path: W:\GTA\719000\719020 SW Servicing Plan for Regional Road Infrastructure\5 Work in Progress\GIS and Data\719020-SW-013-Short List LID.mxd

10.1.3.1 Erin Mills south of Highway 401

Figure 24 presents the proposed spatial extents of the short-listed LID project area. It is important to note that the location selection methodology was conducted at a high-level and the project extents are approximate/subject to change based on future permitting/approvals and project alignment with proposed future Region of peel external roads or sustainable transportation projects. Further, the project sheet following **Figure 24** provide additional details surrounding the LID project location.

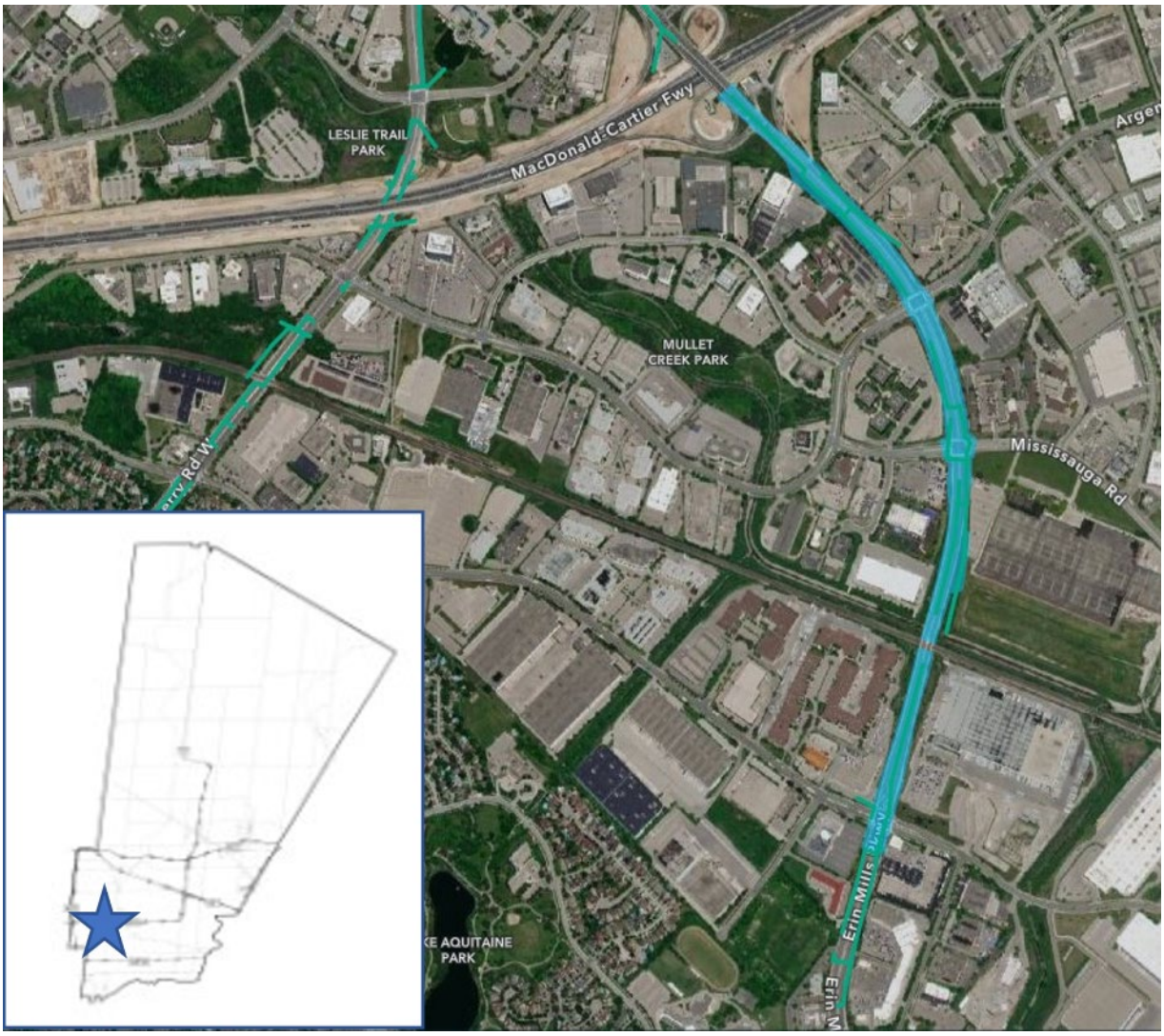
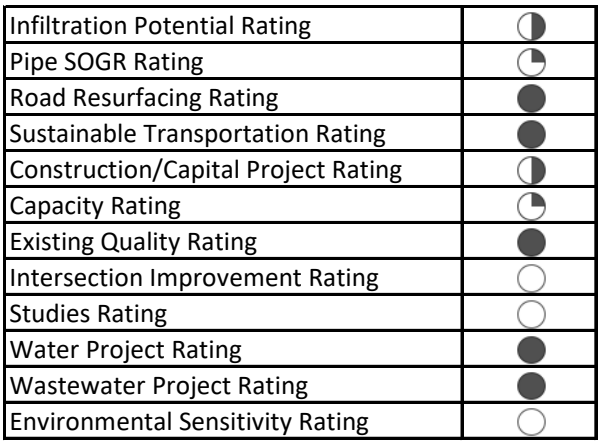


Figure 24. Project location - Erin Mills south of Highway 401.

<table>
<tr><th colspan="4">ID#1 Erin Mills south of Highway 401</th></tr>
<tr><td>Total contributing area (ha)</td><td>Approx. 33 ha</td><td>Linear Underground Infrastructure Length (km)</td><td>3.6 km</td></tr>
<tr><td>Historical Level of Service</td><td>10-year storm event</td><td>Outlets</td><td>Mullet Creek (Credit River Watershed)</td></tr>
<tr><td>Approximate Length of Right-of-Way (km)</td><td>2 km</td><td>Subnetworks</td><td>3</td></tr>
<tr><td>Location</td><td>Erin Mills Parkway</td><td>Limits</td><td>• Highway 403
• Battleford Road</td></tr>
<tr><td>Area Selection Analysis Results</td><td colspan="3"> 
</td></tr>
<tr><td>Project Details</td><td colspan="3">The proposed LID project location consists of 3 separate subnetworks which discharge to separate outfalls, all within the Credit River watershed.
• None of the subnetworks have quality controls under existing conditions
• Road resurfacing is proposed for completion in 2024/2025
• Corridor projects are proposed in 2024
• A multiuse trail is proposed in 2024
• The stormwater model indicates that parts of the subnetwork are surcharging and parts of the subnetwork are flooding under the 1-in-10 year storm event
• Per the Water & Wastewater Master Servicing Plan, the following projects are proposed:
○ Water Project T-135 – Meadowvale North Transmission Main (2031)
○ Wastewater Project T-248 – West Sanitary Trunk Sewer Twinning (2022)</td></tr>
</table>

10.1.3.2 Derry Road and McLaughlin Road

Figure 25 presents the proposed spatial extents of the short-listed LID project area. It is important to note that the location selection methodology was conducted at a high-level and the project extents are approximate/subject to change based on future permitting/approvals and project alignment with proposed future Region of peel external roads or sustainable transportation projects. Further, the project sheet following **Figure 25** provide additional details surrounding the LID project location. Per the results of the Hydraulic and Geomorphic Analysis, implementation of erosion protection is recommended along the conveyance path between the proposed outlet and receiving channel as well as the bank of the channel. Additionally, installation of a headwall at the proposed outlet is recommended.

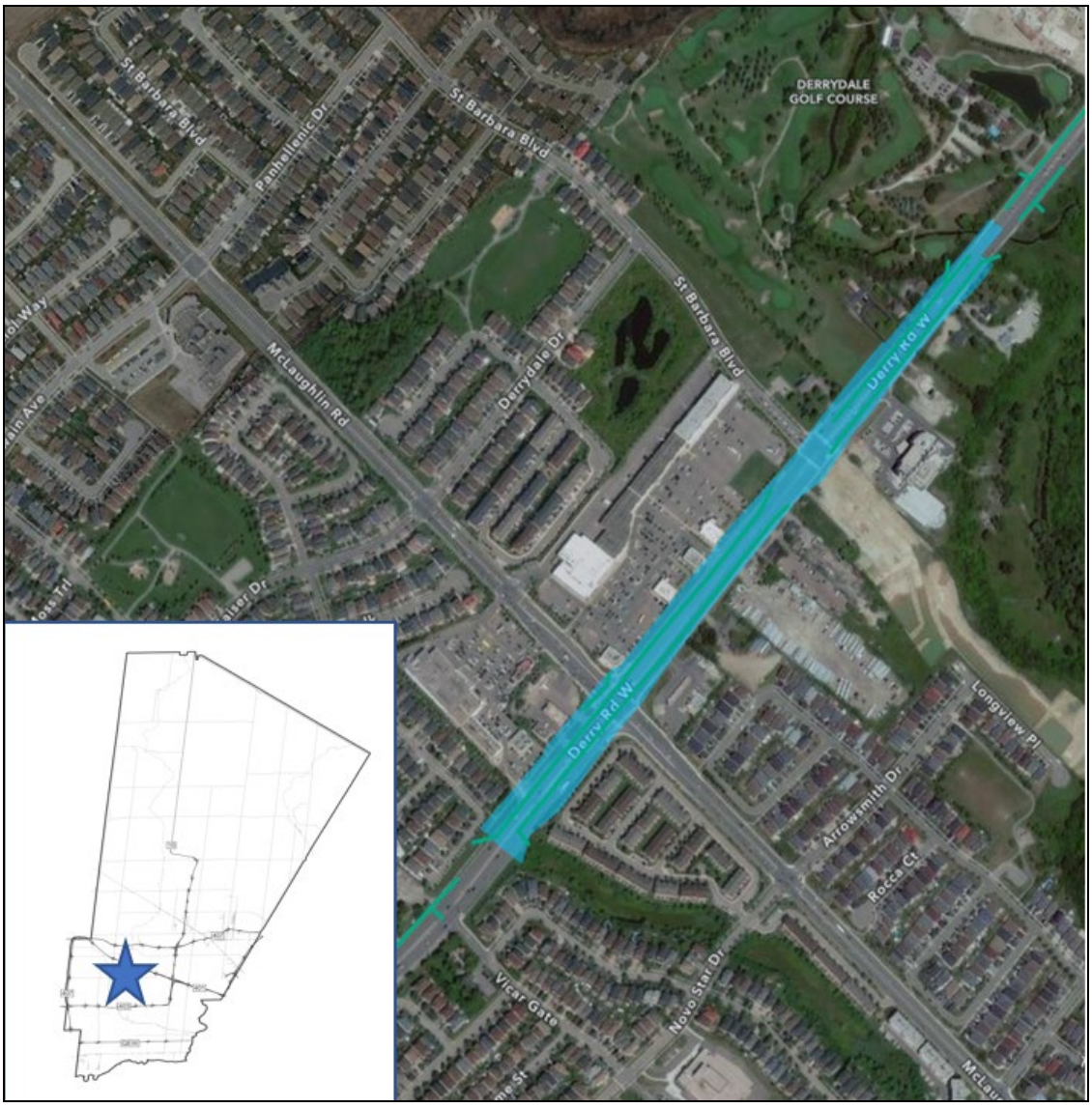


Figure 25. LID project location - Derry Road and McLaughlin Road.

<table>
<tr><th colspan="4">ID #2 Derry Road and McLaughlin Road</th></tr>
<tr><td>Total Contributing Area (ha)</td><td>Approx. 4 ha</td><td>Linear Underground Infrastructure Length (km)</td><td>1.7 km</td></tr>
<tr><td>Historical Level of Service</td><td>10-year storm event</td><td>Outlets</td><td>Fletcher’s Creek (Credit River Watershed)</td></tr>
<tr><td>Approximate Length of Right-of-Way (km)</td><td>1 km</td><td>Subnetworks</td><td>4</td></tr>
<tr><td>Location</td><td>Derry Road</td><td>Limits</td><td>• West of McLaughlin
• Fletchers Creek</td></tr>
<tr><td>Area Selection Analysis Results</td><td colspan="3">
<table>
<tr><td>Infiltration Potential Rating</td><td>◕</td></tr>
<tr><td>Pipe SOGR Rating</td><td>◔</td></tr>
<tr><td>Road Resurfacing Rating</td><td>○</td></tr>
<tr><td>Sustainable Transportation Rating</td><td>◑</td></tr>
<tr><td>Construction/Capital Project Rating</td><td>◑</td></tr>
<tr><td>Capacity Rating</td><td>◑</td></tr>
<tr><td>Existing Quality Rating</td><td>●</td></tr>
<tr><td>Intersection Improvement Rating</td><td>○</td></tr>
<tr><td>Studies Rating</td><td>●</td></tr>
<tr><td>Water Project Rating</td><td>○</td></tr>
<tr><td>Wastewater Project Rating</td><td>●</td></tr>
<tr><td>Environmental Sensitivity Rating</td><td>◔</td></tr>
</table>
</td></tr>
<tr><td>Project Details</td><td colspan="3">The proposed LID project location consists of 4 separate subnetworks which discharge to separate outfalls, all within the Credit River watershed.
• None of the subnetworks have quality controls under existing conditions
• Some subnetworks discharge directly to core greenland areas
• Right-of-way corridor projects are proposed in 2028
• Right-of-way character projects are proposed in 2028
• Sections of the network have a higher than average infiltration potential for the Region of Peel
• The stormwater model indicates that parts of the subnetwork are surcharging and parts of the subnetwork are flooding under the 1-in-10 year storm event
• Per the Water & Wastewater Master Servicing Plan, the following projects are proposed:
○ Wastewater Project T-130 – East-to-West Diversion Sanitary Trunk Sewer (2025)</td></tr>
</table>

10.1.3.3 Derry Road east of Highway 410

Figure 26 presents the proposed spatial extents of the short-listed LID project area. It is important to note that the location selection methodology was conducted at a high-level and the project extents are approximate/subject to change based on future permitting/approvals and project alignment with proposed future Region of peel external roads or sustainable transportation projects. Further, the project sheet following **Figure 26** provide additional details surrounding the LID project location.

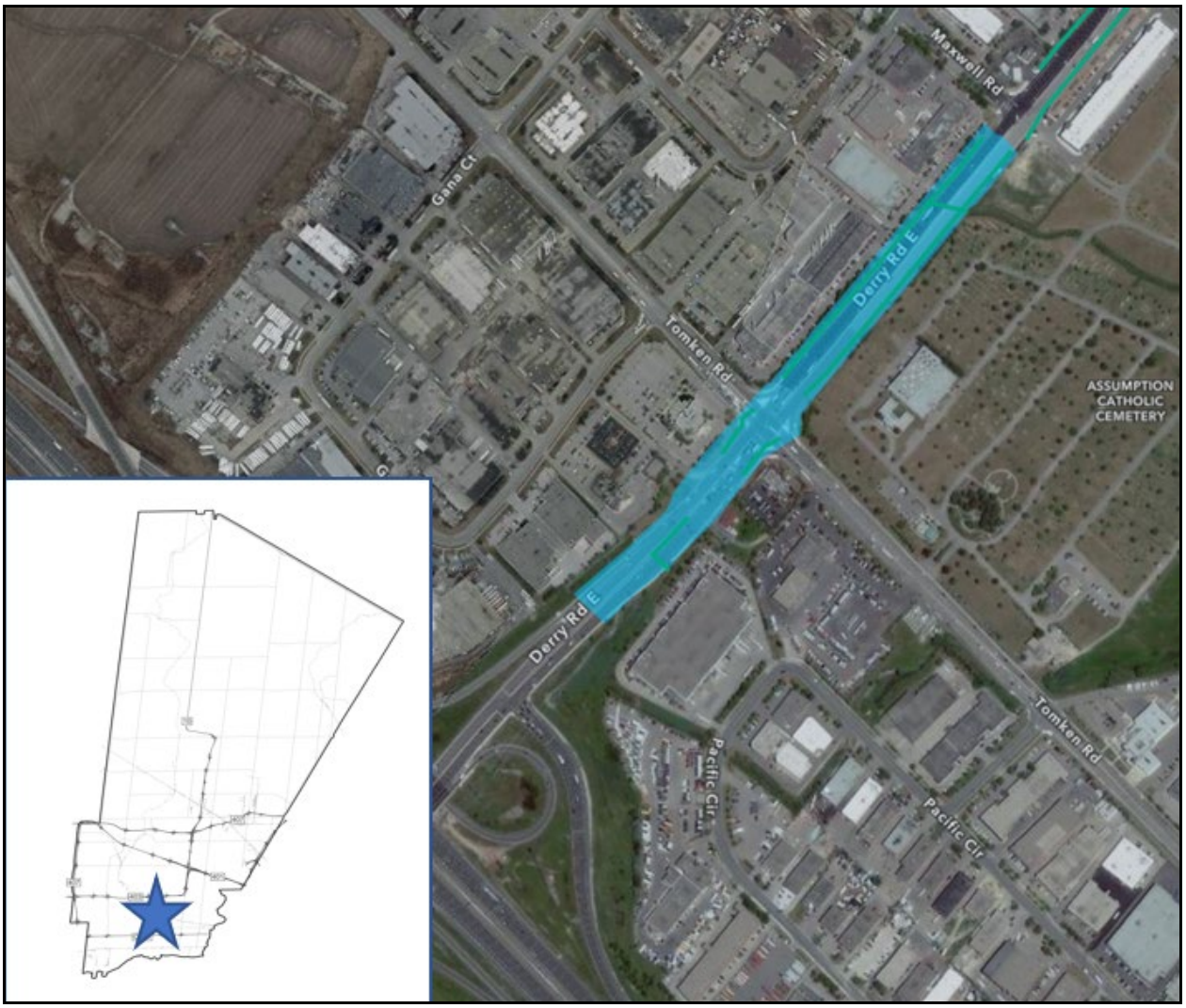


Figure 26. LID Project location - Derry Road east of Highway 410.

<table>
<tr><th colspan="4">ID #3 Derry Road east of Highway 410</th></tr>
<tr><td>Total Contributing Area (ha)</td><td>Approx. 3 ha</td><td>Linear Underground Infrastructure Length (km)</td><td>1.0 km</td></tr>
<tr><td>Historical Level of Service</td><td>10-year storm event</td><td>Outlets</td><td>Upper Etobicoke Creek (Etobicoke Creek Watershed)</td></tr>
<tr><td>Approximate Length of Right-of-Way (km)</td><td>0.75 km</td><td>Subnetworks</td><td>4</td></tr>
<tr><td>Location</td><td>Derry Road</td><td>Limits</td><td>• Highway 410
• Maxwell Road</td></tr>
<tr><td>Area Selection Analysis Results</td><td colspan="3"><table>
<tr><td>Infiltration Potential Rating</td><td>◑</td></tr>
<tr><td>Pipe SOGR Rating</td><td>◔</td></tr>
<tr><td>Road Resurfacing Rating</td><td>○</td></tr>
<tr><td>Sustainable Transportation Rating</td><td>●</td></tr>
<tr><td>Construction/Capital Project Rating</td><td>◑</td></tr>
<tr><td>Capacity Rating</td><td>◔</td></tr>
<tr><td>Existing Quality Rating</td><td>●</td></tr>
<tr><td>Intersection Improvement Rating</td><td>○</td></tr>
<tr><td>Studies Rating</td><td>●</td></tr>
<tr><td>Water Project Rating</td><td>○</td></tr>
<tr><td>Wastewater Project Rating</td><td>●</td></tr>
<tr><td>Environmental Sensitivity Rating</td><td>○</td></tr>
</table></td></tr>
<tr><td>Project Details</td><td colspan="3">The proposed LID project location consists of 4 separate subnetworks which discharge to separate outfalls, all within the Etobicoke Creek watershed.
• None of the subnetworks have quality controls under existing conditions
• Corridor projects are proposed in 2028
• A multiuse trail is proposed in 2028
• The stormwater model indicates that parts of the subnetwork are surcharging under the 1-in-10 year storm event
• Per the Water & Wastewater Master Servicing Plan, the following projects are proposed:
  ○ Wastewater Project T-130 – East-to-West Diversion Sanitary Trunk Sewer (2025)</td></tr>
</table>

10.1.3.4 Derry Road west of Highway 410

Figure 27 presents the proposed spatial extents of the short-listed LID project area. It is important to note that the location selection methodology was conducted at a high-level and the project extents are approximate/subject to change based on future permitting/approvals and project alignment with proposed future Region of peel external roads or sustainable transportation projects. Further, the project sheet following **Figure 27** provide additional details surrounding the LID project location.

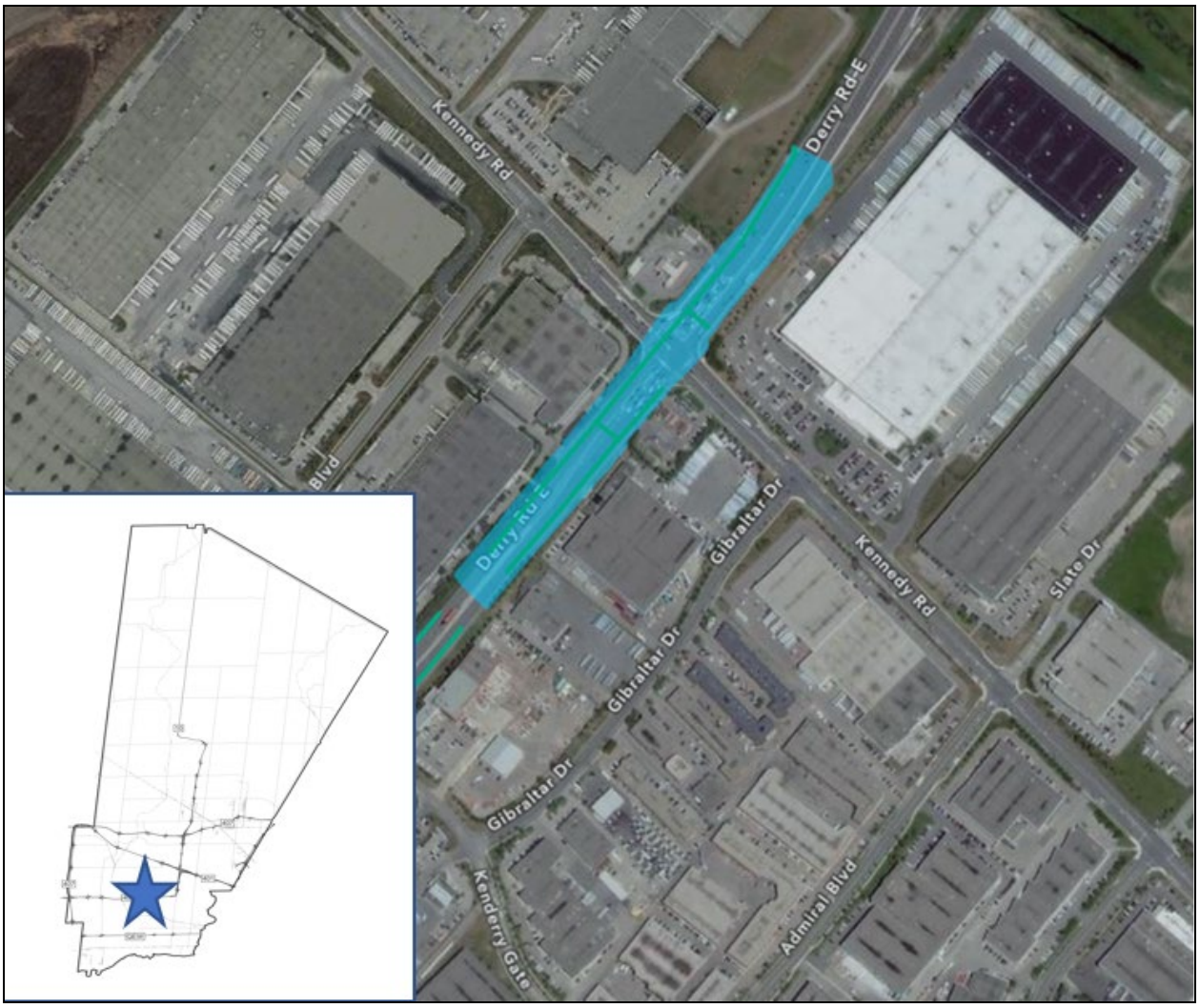


Figure 27. LID Project Location - Derry Road west of Highway 410.

<table>
<tr><th colspan="4">ID #4 Derry Road west of Highway 410</th></tr>
<tr><td>Total Contributing Area (ha)</td><td>Approx. 3 ha</td><td>Linear Underground Infrastructure Length (km)</td><td>0.8 km</td></tr>
<tr><td>Historical Level of Service</td><td>10-year storm event</td><td>Outlets</td><td>Pond – Upper Etobicoke Creek (Etobicoke Creek Watershed)</td></tr>
<tr><td>Approximate Length of Right-of-Way (km)</td><td>0.55 km</td><td>Subnetworks</td><td>1</td></tr>
<tr><td>Location</td><td>Derry Road</td><td>Limits</td><td>• Kenderry Gate
• Highway 410</td></tr>
<tr><td>Area Selection Analysis Results</td><td colspan="3">
<table>
<tr><td>Infiltration Potential Rating</td><td>◑</td></tr>
<tr><td>Pipe SOGR Rating</td><td>◑</td></tr>
<tr><td>Road Resurfacing Rating</td><td>○</td></tr>
<tr><td>Sustainable Transportation Rating</td><td>◕</td></tr>
<tr><td>Construction/Capital Project Rating</td><td>◑</td></tr>
<tr><td>Capacity Rating</td><td>◑</td></tr>
<tr><td>Existing Quality Rating</td><td>●</td></tr>
<tr><td>Intersection Improvement Rating</td><td>○</td></tr>
<tr><td>Studies Rating</td><td>●</td></tr>
<tr><td>Water Project Rating</td><td>○</td></tr>
<tr><td>Wastewater Project Rating</td><td>●</td></tr>
<tr><td>Environmental Sensitivity Rating</td><td>○</td></tr>
</table>
</td></tr>
<tr><td>Project Details</td><td colspan="3">The proposed LID project location consists of 1 subnetwork which discharges to an outfall within the Etobicoke Creek watershed.
• The subnetwork does not have quality controls under existing conditions
• Corridor projects are proposed in 2028
• A multiuse trail and road character projects are proposed in 2028
• The stormwater model indicates that parts of the subnetwork are surcharging under the 1-in-10 year storm event
• Per the Water & Wastewater Master Servicing Plan, the following projects are proposed:
○ Wastewater Project T-130 – East-to-West Diversion Sanitary Trunk Sewer (2025)</td></tr>
</table>

10.1.3.5 **Mayfield Road East of Dixie Road**

Figure 28 presents the proposed spatial extents of the short-listed LID project area. It is important to note that the location selection methodology was conducted at a high-level and the project extents are approximate/subject to change based on future permitting/approvals and project alignment with proposed future Region of peel external roads or sustainable transportation projects. Further, the project sheet following **Figure 28** provide additional details surrounding the LID project location. Per the results of the Hydraulic and Geomorphic Analysis, implementation of erosion protection is recommended along the conveyance path between the proposed outlet and receiving channel as well as the bank of the channel.

Figure 28. LID Project Location - Mayfield Road East of Dixie Road.

<table>
<tr><th colspan="4">ID #5 Mayfield Road east of Dixie Road</th></tr>
<tr><td>Total Contributing Area (ha)</td><td>Approx. 6 ha</td><td>Linear Underground Infrastructure Length (km)</td><td>2.7 km</td></tr>
<tr><td>Historical Level of Service</td><td>10-year storm event</td><td>Outlets</td><td>West Humber River (Humber River Watershed)</td></tr>
<tr><td>Approximate Length of Right-of-Way (km)</td><td>1.5 km</td><td>Subnetworks</td><td>6</td></tr>
<tr><td>Location</td><td>Mayfield Road</td><td>Limits</td><td>• Dixie Road
• East of Bramalea Rd</td></tr>
<tr><td>Area Selection Analysis Results</td><td colspan="3">
<table>
<tr><td>Infiltration Potential Rating</td><td>◑</td></tr>
<tr><td>Pipe SOGR Rating</td><td>○</td></tr>
<tr><td>Road Resurfacing Rating</td><td>●</td></tr>
<tr><td>Sustainable Transportation Rating</td><td>●</td></tr>
<tr><td>Construction/Capital Project Rating</td><td>●</td></tr>
<tr><td>Capacity Rating</td><td>◔</td></tr>
<tr><td>Existing Quality Rating</td><td>◕</td></tr>
<tr><td>Intersection Improvement Rating</td><td>○</td></tr>
<tr><td>Studies Rating</td><td>○</td></tr>
<tr><td>Water Project Rating</td><td>●</td></tr>
<tr><td>Wastewater Project Rating</td><td>●</td></tr>
<tr><td>Environmental Sensitivity Rating</td><td>◑</td></tr>
</table>
</td></tr>
<tr><td>Project Details</td><td colspan="3">The proposed LID project location consists of 6 separate subnetworks which discharge to separate outfalls, all within the Humber River watershed.
• Four (4) of the subnetworks have manufactured treatment devices at the outfall to control runoff quality
• Road resurfacing is proposed for completion in 2024
• Road capital projects are proposed in 2023/2024
• A multiuse trail is proposed in 2039
• Sections of the network have a higher than average infiltration potential for the Region of Peel
• The stormwater model indicates that parts of the subnetwork are surcharging and parts of the subnetwork are flooding under the 1-in-10 year storm event
• Per the Water & Wastewater Master Servicing Plan, the following projects are proposed:
o Water Project ST-113 – Mayfield Road Sub-Transmission Main (2037)</td></tr>
</table>

10.1.3.6 Erin Mills north of Highway 403

Figure 29 presents the proposed spatial extents of the short-listed LID project area. It is important to note that the location selection methodology was conducted at a high-level and the project extents are approximate/subject to change based on future permitting/approvals and project alignment with proposed future Region of peel external roads or sustainable transportation projects. Further, the project sheet following **Figure 29** provide additional details surrounding the LID project location. Per the results of the Hydraulic and Geomorphic Analysis, implementation of erosion protection is recommended along the conveyance path between the proposed outlet and receiving channel as well as the bank of the channel.

Figure 29. LID Project location - Erin Mills north of Highway 403.

<table>
<tr><th colspan="4">ID #6 Erin Mills north of Highway 403</th></tr>
<tr><td>Total Contributing Area (ha)</td><td>Approx. 14.5 ha</td><td>Linear Underground Infrastructure Length (km)</td><td>3.8 km</td></tr>
<tr><td>Historical Level of Service</td><td>10-year storm event</td><td>Outlets</td><td>Mullet Creek (Credit River Watershed)</td></tr>
<tr><td>Approximate Length of Right-of-Way (km)</td><td>2 km</td><td>Subnetworks</td><td>1</td></tr>
<tr><td>Location</td><td>Erin Mills Parkway</td><td>Limits</td><td>• Vista Boulevard
• Erin Centre Boulevard</td></tr>
<tr><td>Area Selection Analysis Results</td><td colspan="3">
<table>
<tr><td>Infiltration Potential Rating</td><td>◕</td></tr>
<tr><td>Pipe SOGR Rating</td><td>○</td></tr>
<tr><td>Road Resurfacing Rating</td><td>○</td></tr>
<tr><td>Sustainable Transportation Rating</td><td>●</td></tr>
<tr><td>Construction/Capital Project Rating</td><td>○</td></tr>
<tr><td>Capacity Rating</td><td>◔</td></tr>
<tr><td>Existing Quality Rating</td><td>●</td></tr>
<tr><td>Intersection Improvement Rating</td><td>○</td></tr>
<tr><td>Studies Rating</td><td>○</td></tr>
<tr><td>Water Project Rating</td><td>●</td></tr>
<tr><td>Wastewater Project Rating</td><td>●</td></tr>
<tr><td>Environmental Sensitivity Rating</td><td>○</td></tr>
</table>
</td></tr>
<tr><td>Project Details</td><td colspan="3">The proposed LID project location consists of 1 subnetwork which discharges to the Credit River watershed.
• None of the subnetworks have quality controls under existing conditions
• A multiuse trail is proposed in 2028
• Sections of the network have a higher than average infiltration potential for the Region of Peel
• The stormwater model indicates that parts of the subnetwork are surcharging under the 1-in-10 year storm event
• Per the Water & Wastewater Master Servicing Plan, the following projects are proposed:
  ○ Water Project T-131 – Streetsville Transmission Main (2028)
  ○ Wastewater Project T-248 – West Sanitary Trunk Sewer Twinning (2022)</td></tr>
</table>

10.1.3.7 **Dixie Road south of Highway 401**

Figure 30 presents the proposed spatial extents of the short-listed LID project area. It is important to note that the location selection methodology was conducted at a high-level and the project extents are approximate/subject to change based on future permitting/approvals and project alignment with proposed future Region of peel external roads or sustainable transportation projects. Further, the project sheet following **Figure 30** provide additional details surrounding the LID project location.

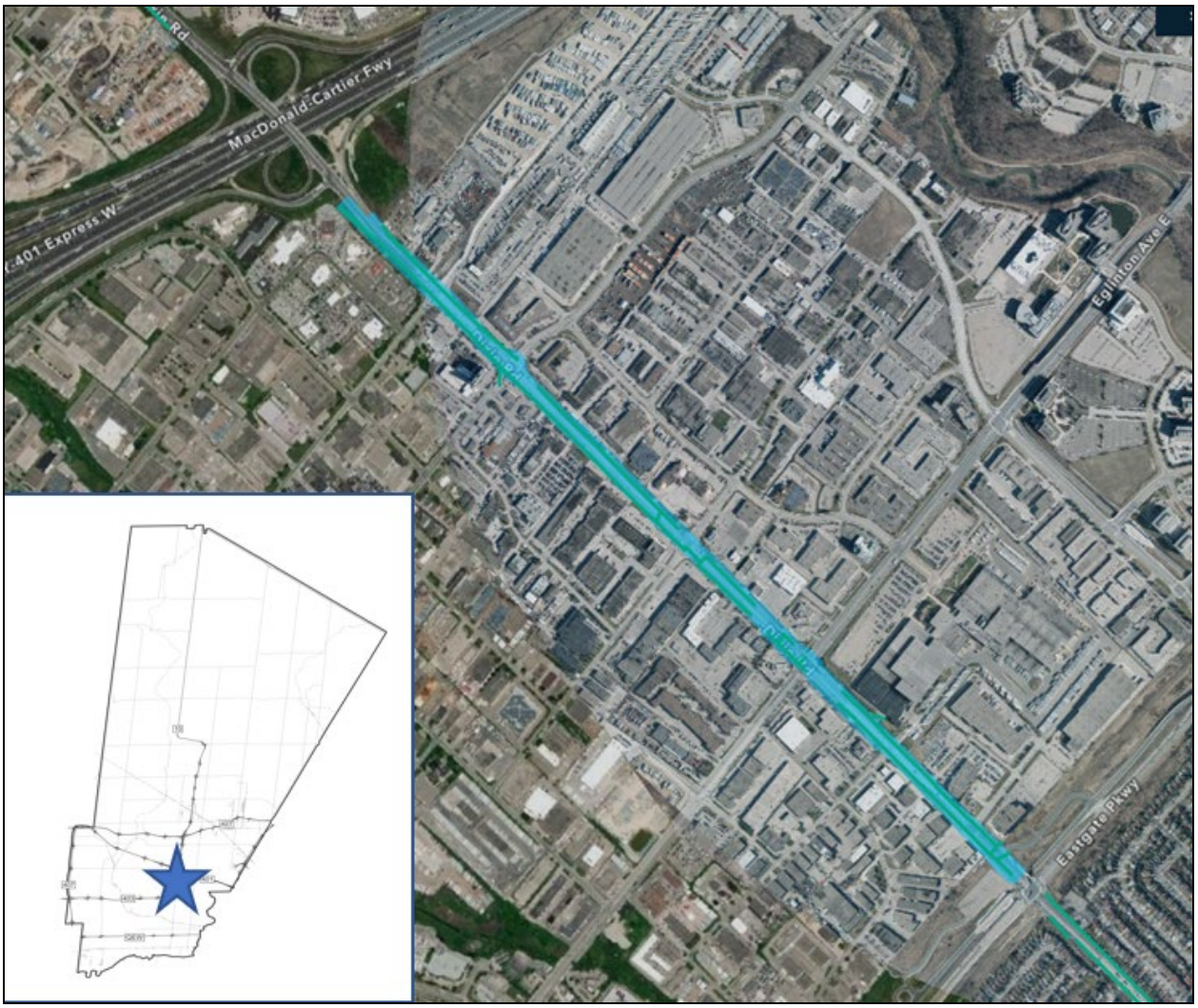


Figure 30. LID project location - Dixie Road south of HIghway 401.

<table>
<tr><th colspan="4">ID #7 Dixie Road south of Highway 401</th></tr>
<tr><td>Total Contributing Area (ha)</td><td>Approx. 15.5 ha</td><td>Linear Underground Infrastructure Length (km)</td><td>4.2 km</td></tr>
<tr><td>Historical Level of Service</td><td>10-year storm event</td><td>Outlets</td><td>Little Etobicoke Creek and Lower Etobicoke Creek (Etobicoke Creek Watershed)</td></tr>
<tr><td>Approximate Length of Right-of-Way (km)</td><td>2.5 km</td><td>Subnetworks</td><td>5</td></tr>
<tr><td>Location</td><td>Dixie Road</td><td>Limits</td><td>• Highway 401
• Eastgate Parkway</td></tr>
<tr><td>Area Selection Analysis Results</td><td colspan="3">
<table>
<tr><td>Infiltration Potential Rating</td><td>◕</td></tr>
<tr><td>Pipe SOGR Rating</td><td>◔</td></tr>
<tr><td>Road Resurfacing Rating</td><td>●</td></tr>
<tr><td>Sustainable Transportation Rating</td><td>●</td></tr>
<tr><td>Construction/Capital Project Rating</td><td>○</td></tr>
<tr><td>Capacity Rating</td><td>○</td></tr>
<tr><td>Existing Quality Rating</td><td>●</td></tr>
<tr><td>Intersection Improvement Rating</td><td>◑</td></tr>
<tr><td>Studies Rating</td><td>○</td></tr>
<tr><td>Water Project Rating</td><td>○</td></tr>
<tr><td>Wastewater Project Rating</td><td>○</td></tr>
<tr><td>Environmental Sensitivity Rating</td><td>◕</td></tr>
</table>
</td></tr>
<tr><td>Project Details</td><td colspan="3">The proposed LID project location consists of 5 separate subnetworks which discharge to separate outfalls, all within the Etobicoke Creek watershed.
• None of the subnetworks have quality controls under existing conditions
• Some subnetworks discharge directly to core greenland areas
• Road resurfacing is proposed for completion in 2024
• A multiuse trail is proposed in 2038
• Intersection improvements are proposed in 2023 & 2027
• Sections of the network have a higher than average infiltration potential for the Region of Peel</td></tr>
</table>

10.1.3.8 Erin Mills south of Highway 403

Figure 31 presents the proposed spatial extents of the short-listed LID project area. It is important to note that the location selection methodology was conducted at a high-level and the project extents are approximate/subject to change based on future permitting/approvals and project alignment with proposed future Region of peel external roads or sustainable transportation projects. Further, the project sheet following **Figure 31**provide additional details surrounding the LID project location. Per the results of the Hydraulic and Geomorphic Analysis, implementation of erosion protection is recommended along the conveyance path between the proposed outlet and receiving channel as well as the bank of the channel.

Figure 31. LID project location - Erin Mills south of Highway 403.

<table>
<tr><th colspan="4">ID #8 Erin Mills south of Highway 403</th></tr>
<tr><td>Total Contributing Area (ha)</td><td>Approx. 6 ha</td><td>Linear Underground Infrastructure Length (km)</td><td>1.5 km</td></tr>
<tr><td>Historical Level of Service</td><td>10-year storm event</td><td>Outlets</td><td>Sawmill Creek (Credit River Watershed)</td></tr>
<tr><td>Approximate Length of Right-of-Way (km)</td><td>1 km</td><td>Subnetworks</td><td>4</td></tr>
<tr><td>Location</td><td>Erin Mills Parkway</td><td>Limits</td><td>• Highway 403
• Burnhamthorpe Road West</td></tr>
<tr><td>Area Selection Analysis Results</td><td colspan="3">
<table>
<tr><td>Infiltration Potential Rating</td><td>◑</td></tr>
<tr><td>Pipe SOGR Rating</td><td>◔</td></tr>
<tr><td>Road Resurfacing Rating</td><td>○</td></tr>
<tr><td>Sustainable Transportation Rating</td><td>●</td></tr>
<tr><td>Construction/Capital Project Rating</td><td>○</td></tr>
<tr><td>Capacity Rating</td><td>◔</td></tr>
<tr><td>Existing Quality Rating</td><td>●</td></tr>
<tr><td>Intersection Improvement Rating</td><td>○</td></tr>
<tr><td>Studies Rating</td><td>○</td></tr>
<tr><td>Water Project Rating</td><td>●</td></tr>
<tr><td>Wastewater Project Rating</td><td>●</td></tr>
<tr><td>Environmental Sensitivity Rating</td><td>●</td></tr>
</table>
</td></tr>
<tr><td>Project Details</td><td colspan="3">The proposed LID project location consists of 5 separate subnetworks which discharge to separate outfalls, all within the Etobicoke Creek watershed.
• None of the subnetworks have quality controls under existing conditions
• Some subnetworks discharge directly to core greenland areas
• Road resurfacing is proposed for completion in 2024
• A multiuse trail is proposed in 2038
• Intersection improvements are proposed in 2023 & 2027
• Sections of the network have a higher than average infiltration potential for the Region of Peel</td></tr>
</table>

10.1.3.9 Kennedy Road south of Bovaird Drive

Figure 32 presents the proposed spatial extents of the short-listed LID project area. It is important to note that the location selection methodology was conducted at a high-level and the project extents are approximate/subject to change based on future permitting/approvals and project alignment with proposed future Region of peel external roads or sustainable transportation projects. Further, the project sheet following **Figure 32** provide additional details surrounding the LID project location.

Figure 32: LID project location – Kennedy Road south of Bovaird Drive.

<table>
<tr><th colspan="4">ID #9 Kennedy Road south of Bovaird Drive</th></tr>
<tr><td>Total Contributing Area (ha)</td><td>Approx. 47 ha</td><td>Linear Underground Infrastructure Length (km)</td><td>1.8 km</td></tr>
<tr><td>Historical Level of Service</td><td>10-year storm event</td><td>Outlets</td><td>Upper Etobicoke Creek (Etobicoke Creek Watershed)</td></tr>
<tr><td>Approximate Length of Right-of-Way (km)</td><td>1.5 km</td><td>Subnetworks</td><td>3</td></tr>
<tr><td>Location</td><td>Kennedy Road</td><td>Limits</td><td>• Queen Street
• North of Vodden Street East</td></tr>
<tr><td>Area Selection Analysis Results</td><td colspan="3">
<table>
<tr><td>Infiltration Potential Rating</td><td>◑</td></tr>
<tr><td>Pipe SOGR Rating</td><td>○</td></tr>
<tr><td>Road Resurfacing Rating</td><td>●</td></tr>
<tr><td>Sustainable Transportation Rating</td><td>●</td></tr>
<tr><td>Construction/Capital Project Rating</td><td>○</td></tr>
<tr><td>Capacity Rating</td><td>○</td></tr>
<tr><td>Existing Quality Rating</td><td>●</td></tr>
<tr><td>Intersection Improvement Rating</td><td>◔</td></tr>
<tr><td>Studies Rating</td><td>○</td></tr>
<tr><td>Water Project Rating</td><td>◕</td></tr>
<tr><td>Wastewater Project Rating</td><td>○</td></tr>
<tr><td>Environmental Sensitivity Rating</td><td>●</td></tr>
</table>
</td></tr>
<tr><td>Project Details</td><td colspan="3">The proposed LID project location consists of 3 separate subnetworks which discharge to separate outfalls, all within the Etobicoke Creek watershed.
• None of the subnetworks have quality controls under existing conditions
• The subnetworks discharge directly to core greenland areas
• Road resurfacing is proposed for completion in 2022
• A multiuse trail is proposed in 2022
• Sections of the network have a higher than average infiltration potential for the Region of Peel
• The stormwater model indicates that parts of the subnetwork are surcharging under the 1-in-10 year storm event
• Per the Water & Wastewater Master Servicing Plan, the following projects are proposed:
○ Water Project ST-118 – Williams Parkway Sub-Transmission Main (Phase 1 & Phase 2) (2022)
○ Water Project D-246 – 600mm Watermain - Kennedy Road North (2021)</td></tr>
</table>

10.1.4 LID Project Servicing Concepts

For the LID project locations outlined in **Section 10.1.3** an evaluation of servicing concepts was conducted to highlight the preferred solution for the existing concerns/constraints. **Table 17** provides the results of an analysis conducted by Hatch (2014) which outlines the applicability of certain LID BMPs depending on the type of project and associated considerations and benefits for each LID BMP.

Table 17: Hatch (2014) SWM and LID practice selection and evaluation

Legend: High ● Moderate ◑ Low ○		SWM Ponds	Bio-Retention Facilities	Enhanced Grass Swales	Bioswales	Perforated Pipe	Permeable Pavement	Proprietary SWM Devices	Superpipe Storage	Infiltration Trenches
Type of Project	Facility Site Development	●	●	●	●	●	●	●	●	●
	Road Works (Urban)	○	●	●	●	◑	◑	●	●	●
	Road Works (Rural	◑	●	●	●	○	◑	◑	○	◑
Municipal Staff and Financial Considerations	Community Engagement	●	●	○	●	○	◑	○	◑	◑
	Inter-department Coordination	●	●	○	●	○	○	○	◑	◑
	Design Team	●	●	○	●	○	◑	◑	◑	◑
	Capital Cost	●	●	○	◑	○	●	●	◑	◑
	Operation & Maintenance Cost	●	●	○	◑	○	◑	●	◑	◑
Design Considerations	Geotechnical Testing Complexity	◑	◑	◑	●	◑	●	○	◑	◑
	Infiltration Testing Complexity	◑	◑	◑	●	◑	●	○	◑	◑
	Planning Complexity	●	●	○	◑	◑	◑	◑	◑	◑
	Design Complexity	◑	◑	○	◑	◑	●	◑	◑	◑
Benefits	Flood Risk Reduction	●	◑	○	◑	◑	◑	○	●	○
	Pollutant Removal	●	●	◑	●	◑	◑	●	○	●
	Groundwater Recharge	○	◑	◑	◑	◑	●	○	○	●
	Stream Channel Erosion Control	●	●	◑	◑	●	●	○	○	◑
	Amenity and Aesthetic Value	●	●	◑	◑	○	○	○	◑	◑
	Traffic Calming	○	○	○	○	○	○	○	◑	◑
	Urban Tree Canopy	●	●	○	○	○	○	○	◑	◑
	High Profile with Community and Media	●	●	○	●	○	○	◑	◑	◑

Table 17 was then used in conjunction with discussions with Region of Peel staff based on current Operations and Maintenance experience with past implemented Regional LID BMPs to conduct a screening of the LID BMPs and determine a "short-list" of LID BMP alternatives. The results of the screening process are provided in **Table 18**

Table 18. Screening for SWM/LID Selection.

Servicing Concept	Screening Status	Justification
SWM Ponds	Eliminated	• Segmentation of Regional stormwater system (over 400 subnetworks) • Land acquisition requirements
Bio-Retention Facilities	Carried Forward	• Ranks highly for Regional right-of-way per **Table 17**
Enhanced Grass Swales	Carried Forward	• Ranks highly for Regional right-of-way per **Table 17**
Bioswales	Carried Forward	• Ranks highly for Regional right-of-way per **Table 17**
Perforated Pipe	Carried Forward	• Implementation through existing infrastructure locations (exfiltration)
Permeable Pavement	Eliminated	• Difficult to maintain and conflicts with road salting in winter
Proprietary SWM Devices	Eliminated	• Not considered an "LID" but can act as pre-treatment
Superpipe Storage	Eliminated	• Not considered an "LID"
Infiltration Trenches	Carried Forward	• Ranks highly for Regional right-of-way per **Table 17**

10.2 Servicing Concepts Evaluation

Following the completion of the LID screening outlined in **Section 10.1.4**, the short-list of LID BMPs will be evaluated to determine the preferred alternative. Due to the high-level nature of the Stormwater Master Plan, the evaluation will be applied on a system-wide basis. Due to the screening process/methodology utilized in **Section 10.1.2** to select the proposed LID project locations, there is no significant variance in results of the evaluation from location to location with the current available information and high-level analysis performed. As such, the completion of one system-wide evaluation is appropriate in the context of the Stormwater Master Plan. It is important to note that at the future time of implementation, the preferred alternative may change based on local site conditions and cohesion with concurrent capital projects such as underground water/wastewater capital works or sustainable transportation/boulevard capital works.

Table 19: LID BMP evaluation table

Factor	Evaluation Criteria	Bioretention	Enhanced Grass Swales	Bioswales	Perforated Pipe	Infiltration Trench
Technical	Meets existing and future servicing needs	●	◑	●	●	●
	System security/reliability	●	●	●	●	●
	Minimizes and manages construction risk	●	●	●	●	●
	Technical viability	●	○	◑	●	●
	Traffic management/traffic impacts	◑	◑	◑	◑	◑
	Resiliance to climate change	◑	○	◑	●	●
Financial	Capital cost & life cycle cost (overall servicing strategy)	◑	●	◑	◑	◑
	Operations & maintenance cost	◑	●	◑	◑	◑
	Alignment with approval and permitting process	●	●	●	●	●
Legal/Jurisdictional	Property acquisition	●	●	●	●	●
	Permitting requirements	●	●	●	●	●
Environment	Protects environmental features	●	◑	●	◑	◑
	Geology/hydrogeology considerations	◑	●	●	◑	◑
	Protects wildlife & species at risk	●	◑	●	●	●
	Minimizes impacts of climate change	●	●	●	●	●
Socio/Cultural	Community impact (residents and local business)	●	●	●	●	●
	Manages and minimizes construction impacts	●	●	●	●	●
	Protects cultural heritage and archeological features	●	●	●	●	●

Based on the results of **Table 19**, the following LID BMPs are preferred solutions.

- Bioretention
- Bioswales
- Perforated pipe
- Infiltration trench

Each LID BMP is diverse and can be designed around the site conditions. **Table 20** provides an overview of the proposed servicing concepts and the potential benefit to the system.

Table 20. Proposed servicing concepts and benefit to system.

Servicing Concept	Peak Flow Attenuation	Infiltration / Water Balance	Water Quality (TSS Loading)	Water Quality (Temperature)
Bio-Retention Facilities	(✓)	(✓)	(✓)	(✓)
Enhanced Grass Swales	✘	(✓)	✓	✘
Bioswales	✘	(✓)	✓	✘
Perforated Pipe	(✓)	✓	(✓)	✘
Infiltration Trenches	(✓)	✓	(✓)	(✓)

Legend:

✘ – The item addresses the control criteria

✓ – The item does not address the control criteria

(✓) – The item may address the control criteria depending on implementation

In general, grassed swales are more relevant in the context of rural stormwater management or private site design. As such, the lack of technical feasibility for grassed swales in an urban stormwater system reduced the scoring below the other alternatives. For the remaining four alternatives, it is not possible to determine one preferred LID BMP for the Regional stormwater management system, as there will be minor site nuances that can not be determined through a high-level analysis. Ultimately, each of the LID BMPs will be possible at each of the sites and flexibility in the Stormwater Master Plan process should be observed, with detailed design driving the ultimate LID BMP selection.

11.0 Capital Program and Implementation Plan

The Master Plan sets out to satisfy the Environmental Assessment (EA) Approach 1 requirements according to the Municipal Engineers Association (MEA) Class EA guidelines. A capital cost is provided for all projects proposed as part of the Stormwater Master Plan. For capacity-based projects, a high-level implementation cost was obtained using a unit rate cost based on upsized pipe diameter. The unit costs were estimated based on an average pipe diameter and historical construction costing information. Design, administration, contingency, and non-recoverable HST costs were added to arrive at a final preliminary project cost, for budget planning purposes. High-level costing sheets were developed to support the financial evaluation for each capital project.

For LID project costing, a high-level estimate has been provided based on peer reviewed results of LID implementation costs carried out by Credit Valley Conservation.

The Class EA requirements for each project have been identified in the capital program. Schedule A and A+ projects may move forward to design and construction, with A+ projects requiring public notification prior to implementation. The design and construction of the future proposed projects within TRCA jurisdiction are to meet the Living City Policies (2014) and fulfill Ontario Regulation 166/06.

The costing sheets are supported by an implementation plan outlined in **Section 11.5**.

11.1 Project Costing Methodology

11.1.1 Minor System Upsizing

For capacity-based project locations where minor system upsizing is the preferred alternative, the Region of Peel 2020 Water & Wastewater Master Plan cost estimate was utilized. Specifically, the methodology for wastewater infrastructure, including wastewater unit rates, was implemented to estimate a high-level cost for linear stormwater projects. In summary, the total length or capacity needs of the required infrastructure is multiplied by a unit rate, applicable to the size or capacity and particular construction type (e.g., 5-metre depth sewer, 10-metre depth sewer, tunnelling). Additional costs are added to account for creek, road, railway or utility crossings, valves, tunneling requirements, etc., where applicable.

In cases where construction will occur in built up areas, such as intensification areas, a cost escalation factor is applied to the installation cost. This factor provides additional project costs to account for utility coordination/relocation, urban reinstatement, and urban construction impacts.

The sum of the base cost, plus additional costs results in the Base Construction Cost.

Soft costs such as geotechnical/hydrogeological, property/easements, engineering and design, contract administration and contingency allowances, are added to the Base Construction Cost to arrive at the Total Project Cost.
Appendix J includes the detailed costing methodology utilized for minor system upsizing.

11.1.2 LID Project Implementation

It is not possible or practical to calculate project-specific estimates for LID BMP implementation as the specific site conditions, LID BMP selected, size of the LID, and synergies with other capital projects creating costing efficiencies will all greatly vary the cost to implement an LID BMP. As such, for budgeting purposes, LID costs were estimated through the peer review study conducted in Grey to Green Road Retrofit (Credit Valley Conservation, 2014).

Table 1.2.1 in Grey to Green Road Retrofit provides a summary of the construction cost comparison for specific LID case studies. Road lengths for LID implementation vary between 200 m and 335 m across various LID BMPs including bioretention, permeable pavers, perforated pipe, vegetative landscaping, and swales. Costs were adjusted for inflation by 20% to account for the eight (8) year gap between Grey to Green Road Retrofit and the Stormwater Master Plan. Excluding one outlier for permeable asphalt, the upper cost for implementation of an LID was approximately $1,000,000 once adjusted for inflation. As such, a conservative capital cost of $1,000,000 has been carried forward for each LID project location. As details on sizing and specific LID BMPs become available in the future planning and design process, it is recommended that the Low Impact Development Treatment Train Tool (LID TTT) be considered to assist in estimating and refining both the capital cost for site-specific LIDs and the operations and maintenance/lifecycle costs.

11.2 Development Charge Contributions

The Region of Peel does not currently collect development charges or system connection charges specifically in relation to stormwater management practices. Additionally, the Region does not have stormwater user/customer fees as there are minimal stormwater service connections (customers) to the Regional storm sewer network. In general, private developments discharge stormwater to the lower-tier system and any stormwater user charges, depending on lower-tier municipal policies, are collected and utilized to support the lower-tier stormwater systems. However, there are occasions when the region is requested to allow site drainage to connect to the regional stormwater system. In these cases, it may be appropriate to apply a charge to account for the use of the Region's Infrastructure. **Appendix B** includes a draft policy document which outlines a potential cost sharing/development charge framework for the Region of Peel to support funding stormwater management practices. This draft document has been prepared to initiate discussion within the Region and its partners and stakeholders. It should not, at this stage, be considered a firm recommendation for adoption.

11.2.1 Growth Related Projects

For the proposed projects in this master plan that are recommended in conjunction with other transportation projects it is suggested that any growth-related contribution percentages applied to the transportation project be equally applied to the stormwater drainage project that is an inherent aspect of the overall transportation project.

Per the Draft 2051 Official Plan (5.10.34 Sustainable Transportation):

> *"As outlined through the policy directions of the Provincial Policy Statement and the Growth Plan, the Region of Peel will need to provide transportation choices that expand transit, active transportation, and transportation demand management strategies to ensure the needs of all road users are appropriately accommodated. The forecasted growth in population and employment in Peel Region has led, and will continue to lead, to increased travel demand. A sustainable transportation system is an important component of the range of solutions that will be needed to accommodate this future growth and travel demand.*
>
> *As part of this sustainable transportation system, through the Long Range Transportation Plan (LRTP) and the Sustainable Transportation Strategy (STS), the Region of Peel is implementing the 50 per cent sustainable transportation model share…"*

As such, projects which are aligned with either future LRTP or STS (including multi-use trails) projects will provide opportunities for implementation alignment with growth, to support growth-related modifications to the Region of Peel's transportation network. **Table 21** provides a summary of the proposed capacity-based projects and their alignment with either the Long Range Transportation Plan or Sustainable Transportation Strategy.

Table 21. Summary of proposed capacity project alignment.

MSP#	Location	Cost Sharing (Growth Related)
1	Emil Kolb Parkway & De Rose Ave.	STS
2	Bovaird Drive & Conestoga Drive	No
3	Steeles Avenue West & Rivermont Road	LRTP & STS
4	Steeles Avenue West & Lancashire Lane	No
5	Derry Road & Dishley Court	STS

Table 22 provides a summary of the proposed LID-based projects and their alignment with either the Long Range Transportation Plan or Sustainable Transportation Strategy.

Table 22. Summary of proposed LID project alignment.

MSP#	Location	Cost Sharing (Growth Related)
1	Erin Mills north of Mississauga Road	LRTP & STS
2	Derry Road near McLaughlin	LRTP & STS
3	Derry Road east of Highway 410	LRTP & STS
4	Derry Road west of Highway 410	LRTP & STS
5	Mayfield Road east of Dixie Road	LRTP & STS
6	Erin Mills south of Mississauga Road	STS
7	Dixie Road south of Highway 401	STS
8	Erin Mills south of Highway 403	STS
9	Kennedy Road south of Queen Street	STS

11.3 Project Timing and Triggers

Some capacity-based projects and all LID based projects have alignments with either the Long Range Transportation Plan, Sustainable Transportation Strategy, or the 2020 Water and Wastewater Master Plan. As such, the synergies with other Region capital works projects will trigger the stormwater management projects to be completed concurrently. For the capacity-based projects which do not align with a current capital works program, the trigger for these projects will be replacement through the State of Good Repair program. **Table 23** provides the project timing and triggers for the capacity-based projects.

Table 23. Project timing and triggers for capacity-based projects.

MSP#	Location	Trigger	Timing
1	Emil Kolb Parkway & De Rose Ave.	STS	2038
2	Bovaird Drive & Conestoga Drive	Asset replacement	N/A
3	Steeles Avenue West & Rivermont Road	LRTP & STS	2024
4	Steeles Avenue West & Lancashire Lane	Asset replacement	N/A
5	Derry Road & Dishley Court	STS	2030
6	Erin Mills Parkway & QEW Ramp West	STS	2030

There are multiple potential project synergies and timelines for each LID based project location. As such, the project timing and triggers are summarized in the context of the LRTP and STS in **Table 24,** while additional project synergies with other Region capital programs are provided in **Appendix K.**

Table 24. Project timing and triggers for LID-based projects.

MSP#	Location	Trigger	Timing
1	Erin Mills north of Mississauga Road	LRTP & STS	2024
2	Derry Road near McLaughlin	LRTP & STS	2028
3	Derry Road east of Highway 410	LRTP & STS	2028
4	Derry Road west of Highway 410	LRTP & STS	2028
5	Mayfield Road east of Dixie Road	LRTP & STS	2023/2024 & 2039
6	Erin Mills south of Mississauga Road	STS	2028
7	Dixie Road south of Highway 401	STS	2038
8	Erin Mills south of Highway 403	STS	2028
9	Kennedy Road south of Queen Street	STS	2022

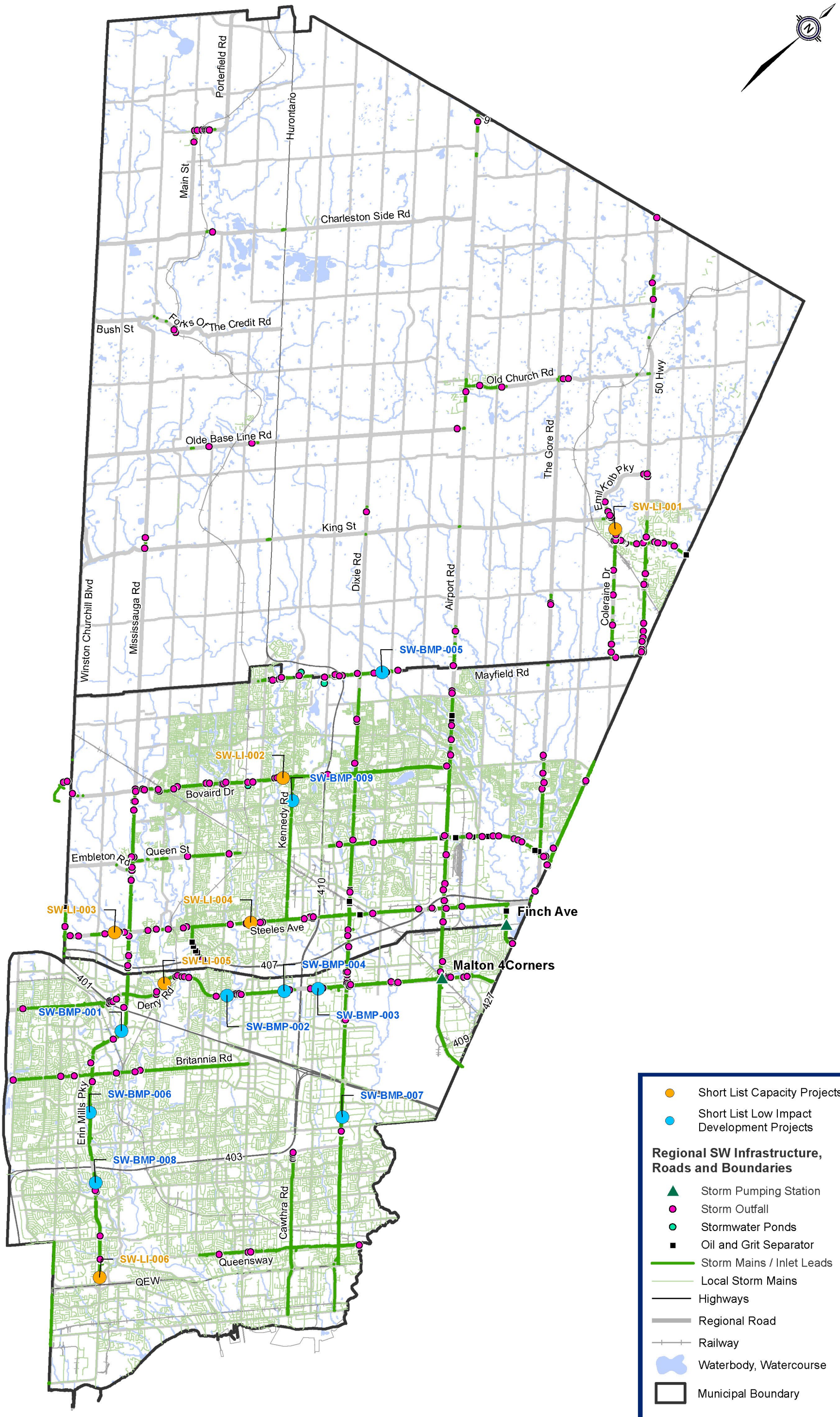
11.4 Recommendations: Capital Project Summary

Table 25 provides a summary of the capital program for both the capacity-based projects and the LID-based projects. There are six (6) capacity-based projects proposed with a total estimated cost of $5,298,000. There are nine (9) LID-based projects proposed with an estimated $1,000,000 held per LID project, totaling $9,000,000 in LID projects. These estimates are high-level planning estimates used for budget planning purposes. All proposed projects are Schedule A/A+. Detailed project costing sheets for capacity-based projects following the methodology outlined in **Section 11.1.1** are provided in **Appendix L**. **Figure 33** provides an overview of the associated project locations.

Table 25. Capital-program summary.

Capital Program ID	Name	Class EA Schedule	Project Type	Size (mm)	Length (m)	Class Estimate Type	Project Complexity	Accuracy Range	Area Condition	Total Estimated Cost (2022$)	Timeline
SW-LI-001a	Emil Kolb Parkway and De Rose Avenue	A+	Linear Infrastructure	375 mm	70 m	Class 4	Low	30%	Suburban	$112,000	2038
SW-LI-001b	Emil Kolb Parkway and De Rose Avenue	A+	Linear Infrastructure	450 mm	115 m	Class 4	Low	30%	Suburban	$201,000	2038
SW-LI-001c	Emil Kolb Parkway and De Rose Avenue	A+	Linear Infrastructure	525 mm	120 m	Class 4	Low	30%	Suburban	$226,000	2038
SW-LI-001d	Emil Kolb Parkway and De Rose Avenue	A+	Linear Infrastructure	600 mm	130 m	Class 4	Low	30%	Suburban	$315,000	2038
SW-LI-002a	Bovaird Drive and Consetoga Drive	A+	Linear Infrastructure	450 mm	289 m	Class 4	Low	30%	Suburban	$506,000	Opportunistic
SW-LI-002b	Bovaird Drive and Consetoga Drive	A+	Linear Infrastructure	525 mm	144 m	Class 4	Low	30%	Suburban	$1,183,000	Opportunistic
SW-LI-002c	Bovaird Drive and Consetoga Drive	A+	Linear Infrastructure	600 mm	97 m	Class 4	Low	30%	Suburban	$234,000	Opportunistic
SW-LI-003a	Steeles Avenue West and Rivermont Road	A+	Linear Infrastructure	375 mm	101 m	Class 4	Low	30%	Suburban	$161,000	2024
SW-LI-003b	Steeles Avenue West and Rivermont Road	A+	Linear Infrastructure	450 mm	309 m	Class 4	Low	30%	Suburban	$1,453,000	2024
SW-LI-004	Steeles Avenue West and Lancastershire Lane	A+	Linear Infrastructure	375 mm	196 m	Class 4	Low	30%	Suburban	$315,000	Opportunistic
SW-LI-005a	Derry Road and Dishley Court	A+	Linear Infrastructure	375 mm	100 m	Class 4	Low	30%	Suburban	$160,000	2030
SW-LI-005b	Derry Road and Dishley Court	A+	Linear Infrastructure	450 mm	77 m	Class 4	Low	30%	Suburban	$135,000	2030
SW-LI-005c	Derry Road and Dishley Court	A+	Linear Infrastructure	525 mm	13 m	Class 4	Low	30%	Suburban	$25,000	2030
SW-LI-006	Erin Mills Parkway and QEW Ramp West	A+	Linear Infrastructure	375 mm	170 m	Class 4	Low	30%	Suburban	$272,000	2030
SW-BMP-001	Erin Mills north of Mississauga Road	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2024
SW-BMP-002	Derry Road near McLaughlin	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2028
SW-BMP-003	Derry Road east of Highway 410	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2028
SW-BMP-004	Derry Road west of Highway 410	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2028
SW-BMP-005	Mayfield Road east of Dixie Road	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2024 or 2039
SW-BMP-006	Erin Mills south of Mississauga Road	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2028

Capital Program ID	Name	Class EA Schedule	Project Type	Size (mm)	Length (m)	Class Estimate Type	Project Complexity	Accuracy Range	Area Condition	Total Estimated Cost (2022$)	Timeline
SW-BMP-007	Dixie Road south of Highway 401	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2038
SW-BMP-008	Erin Mills south of Highway 403	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2028
SW-BMP-009	Kennedy Road south of Queen Street	A+	LID	-	-	Class 4	Low	30%	Suburban	$1,000,000	2022
									Total	**$14,298,000**	



Region of Peel
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Stormwater Servicing Plan for Regional Road Infrastructure

Capital Program

BluePlan Engineering

Figure 33
November 2022
719020-SW-014
NAD 1983 UTM Zone 17N

Document Path: W:\GTA\719000\719020 SW Servicing Plan for Regional Road Infrastructure\5 Work in Progress\GIS and Data\719020-SW-014-Capital Program.mxd

11.5 Recommendations: Implementation Plan

In order to successfully plan for future Stormwater Master Plan updates, an implementation plan has been developed to guide next steps that will provide the Region with a clearer picture in the future. The following subsections propose programs and studies which fit into the following categories:

- Investigations & Data Collection
- Tools & Frameworks
- Studies & Consultation

The categories above provide a linear process for implementing future stormwater capital projects and planning studies. First, crucial data is collected and investigations conducted to provide more in-depth system context. The collected data and results of the investigations are then used to build tools and framework which can better quantify the system performance, deficiencies, and areas of interest. Once these tools and framework are developed, they can be utilized in future studies and consultation projects to build a more detailed and comprehensive understanding of the system and individual capital projects. These steps are essential for effective and cost-efficient implementation of stormwater projects in the Region of Peel.

Each proposed component of the implementation plan will include high-level costs for budgeting purposes as well as timelines for initiation and any dependencies with existing or proposed Region programs, studies, or projects.

11.5.1 Investigation and Data Collection

There are currently gaps in the Region's understanding and interactions with their stormwater management and conveyance system. As such, it is important to initiate the data collection and investigation as soon as budget permits (0 – 5 years). The following is a list of recommended data to be either collected on an ongoing basis or collected in the aforementioned timelines:

- Rural ditch survey
    - At the onset of the Stormwater Master Plan, a comprehensive asset inventory of the Region owned and managed ditches was not available. Currently, the Region have quantified the schematic locations of their ditch infrastructure; however, a survey of ditch grade and geometry will allow for the development of a more comprehensive hydraulic model and confirm connectivity assumptions.
- Flow monitoring program
    - The Region currently has a flow monitoring program in place; however, it has been used to target a specific problem areas or areas of interest in the Regional network. Given the make-up of the Regional stormwater management system, consisting of over 400 independent minor system networks, a flow monitoring program will support calibration and validation of the InfoWorks ICM model. It is recommended that flow monitoring be prioritized to some of the larger networks, environmentally sensitive locations, and those identified in this master plan as proposed project locations. This will support project implementation and benefit overall system understanding.

- LID maintenance program (in progress)
    - The Region recently applied for their Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA). As a requirement of this, an operations and maintenance program is required for all linear assets. The Region have recently developed Standard Operating Procedures (SOPs) for the operation, inspection, and maintenance of LID assets. It is recommended that the Region use the recently developed SOPs to implement a maintenance program to ensure proper function of their expanding asset inventory of LIDs.

11.5.2 Tools and Framework

Upon completion of the data collection, the existing tools and framework in place will need to be updated or modified to account for the newly available information and data. Additionally, there are new tools and framework or policies which will benefit the Region's existing and future stormwater management and conveyance systems. The proposed new and to-be-updated tools and framework include:

- Stormwater model update and calibration
    - Following collection of flow monitoring data as well as further inventorying assets such as the rural ditch system, the current InfoWorks ICM model will require update. This update will expand the Region's understanding of the stormwater network, as well as validate existing assumptions or calibrate specific networks to flow monitoring data.
    - For specific areas of concern, it may be prudent to undertake 2D hydraulic model. 2D models simulate the overland flow of stormwater through the major system and above ground flow paths. The model also has the capability to incorporate fluvial aspect and could be enhanced, in partnership with other parties (lower tier municipalities and conservation authorities) to create holistic models to address multi-faceted constraints.
- Future climate change IDF analysis
    - Although the overlay of the Region's 2019 updated IDF curve performed in Section 8.1 indicated that the current IDF curve for the 10-year, 4-hour event is representative of the Climate Change storm event; however, future analysis should be performed to confirm that Peel's IDF curve is appropriate and in-line with Climate Change projections for higher intensity and longer duration events.
- Stormwater funding study/policy
    - The Region of Peel currently does not have a comprehensive cost-sharing policy or user rate implemented. As such, there are budgetary constraints which limit the ability to maintain critical infrastructure and plan for environmental factors such as climate change. A draft policy document, intended to initiate discussion on the subject, is included in **Appendix B**.
- Stormwater management policy updates
    - The Region recently completed a comprehensive update of their Public Works Stormwater Design Criteria and Procedural Manual, which includes important factors such as updated IDF curves and accounting for climate change. On an ongoing basis, the Region will need to ensure that stormwater policies are up to date or current with industry best practice as well as localized needs. This includes:

        - Storm events
        - Climate change
        - Low impact development
        - Policy surrounding private connections
        - Policy in line with Conservation Authority regulated watercourses and outfalls
    - These aspects should be included in future updates to this stormwater master plan, which in turn, is recommended to be completed at the same time as the transportation master plan.

11.5.3 Studies and Consultation

Lastly, it is important to conduct the appropriate studies and consultation to confirm stormwater system needs and requirements in the future. This includes the initiation of specific EAs to support stormwater projects, as well as updating existing studies and consultation. This includes:

- Long Range Transportation Plan and Sustainable Transportation Strategy EAs/Studies
    - Per **Section 11.2.1,** a majority of the capacity based and LID based projects are aligned with either proposed Region of Peel capital program projects or projects supporting the Sustainable Transportation Strategy. It is crucial that the Region include stormwater management components in the studies associated with the Long Range Transportation Plan and Sustainable Transportation Strategy projects.
- Stormwater Master Plan Update
    - Given the alignment of stormwater management with roadworks capital projects, it is recommended that future Stormwater Master Plan updates be completed concurrently with the Long Range Transportation Plan updates. Best practices consider these updates approximately every 5 years.
- Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA)
    - The CLI ECA compiles all Regional Road stormwater assets under one ECA umbrella. The CLI ECA requires a comprehensive update to include all new assets meeting the Schedule D requirements or approved by Schedule C Notices 5-years from the date of issuance. At this time, the anticipated update to the CLI ECA is June, 2026.

APPENDIX A:
Communications and Consultation Plan

APPENDIX B:
Development Charges Draft Policy Document

APPENDIX C:
Level of Service Framework

APPENDIX D:
Preliminary Infiltration Constraints Assessment

APPENDIX E:
Hydraulic and Fluvial Geomorphic Hazard Assessment

APPENDIX F:
Hydrogeological and Geotechnical Desktop Study

APPENDIX G:
Natural Environment Report

APPENDIX H:
Stage 1 Archaeological Assessment

APPENDIX I:
Cultural Heritage Screening

APPENDIX J:
2020 Water and Wastewater Master Plan – Capital Program Costing Methodology

APPENDIX K:
Summary of Project Synergies

APPENDIX L:
Detailed Capital Program Costing Sheets