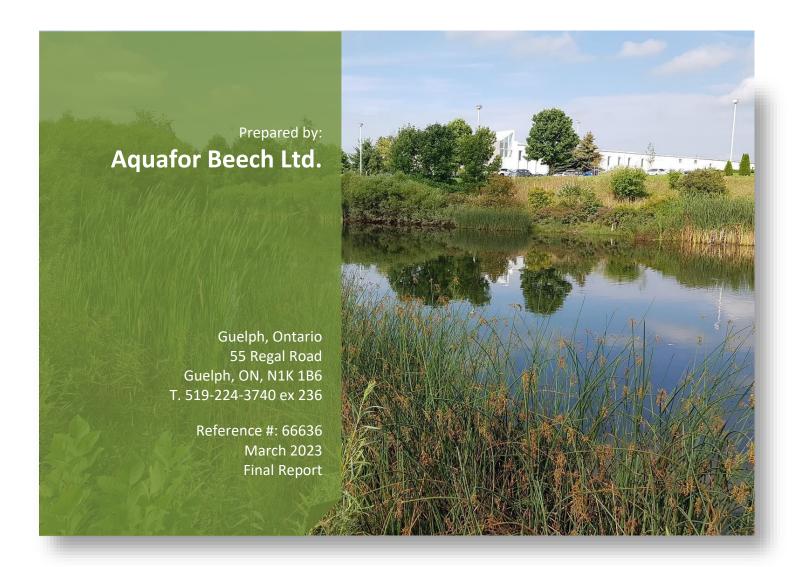


# Stormwater Management Master Plan: Municipal Class Environmental Assessment Final Report



## **Executive Summary**

# **Stormwater Management Master Plan**

#### **Municipal Class Environmental Assessment**

#### E-1 Introduction and Problem Identification

The City of Guelph's Stormwater Management Master Plan (SWM-MP) delivers a targeted approach to managing stormwater and serves as a decision support tool, providing direction for the prioritization of municipal stormwater management (SWM) projects and programs, the development of policy recommendations, consideration of climate change, and the allocation of financial and staffing resources over an implementation period from 2024–2051. The SWM-MP was completed as a Master Plan Environmental Assessment, an approved process under the Ontario Environmental Assessment Act.

The SWM-MP is intended to provide a comprehensive vision for the City which would address identified deficiencies within the existing SWM system, provide direction for new development, and enable the City to operate the SWM program at a sustainable level. To reach this end, a comprehensive set of projects and programs have been recommended as part of the SWM-MP Recommended Approach. The pace of implementation will ultimately be guided by the City's capital budgeting and human resourcing capacity in the context of all organizational priorities. As a result, the implementation timeline as outlined in the SWM-MP may be modified to reflect these priorities and resources.

The SWM-MP has six (6) elements which are detailed in a series of technical documents which make up the core of the plan. The elements include:

#### 1) Municipal Pollution Prevention, Operations & Maintenance Practices

This element focuses on pollution prevention and municipal practices that can help to prevent impacts before they occur.

#### 2) Private Property Strategies (Source Controls)

This element focuses on increasing LID implementation on private property through volume control requirements for new development, infill development, and re-development.

#### 3) Stormwater for the Capital Roads Program (Conveyance Controls)

This element focuses on improving the way municipal roads manage runoff by constructing SWM controls, including LID controls as part of routine road reconstruction programs to reduce stormwater volume and pollutant loading.



#### 4) Stormwater Management Facilities

This element focuses on maintaining and improving existing SWM facilities as well as constructing new stormwater management facilities in uncontrolled stormwater catchments.

#### 5) Watercourse and Erosion Restoration

This element focuses on opportunities for restoring local creeks suffering from erosion issues.

#### 6) Urban Flood Management & Stormwater Infrastructure

This element focuses on managing urban flooding associated with storm sewer surcharging with focus on the predicted impacts of climate change.

The projects identified in the SWM-MP will be undertaken per the Implementation Plan. The plan prioritizes the works which make up the recommended approach on a subwatershed basis. Projects within subwatersheds are prioritized based on the areas of greatest need.

#### **E-2 Study Purpose and Objectives**

The purpose of the SWM-MP study is to update the City of Guelph 2012 SWM-MP and serve as a decision support tool, as well as a methodology for the prioritization of works. The SWM-MP also serves as a transparent community consultation process by which the City can establish stormwater management guidelines and policies.

The SWM-MP primarily addresses the existing urban areas of the City and recommends remedial measures to improve overall environmental performance, increase efficiencies and reduce costs. The study focus is not new development; however, it does provide guidance in regards to future policies.

The objectives of the City of Guelph SWM-MP consider flood and erosion control, groundwater and surface water quality management, water balance/infiltration, natural heritage environment management and infrastructure, all in an integrated manner.

#### **E-3 Class EA Process**

The SWM-MP was conducted in accordance with the requirements for Master Plans under Section 4, Approach #2 of the Municipal Engineers Association Municipal Class Environmental Assessment Act (October 2000, as amended in 2007, 2011, 2015 & 2023), which is an approved process under the Ontario Environmental Assessment Act. As part of the Class EA process evaluation of alternatives, assessment of the potential environmental effects and identification of mitigation measures for potential adverse impacts has been conducted and presented through public and agency consultations.

The SWM-MP fulfills all of the Class EA requirements for Schedule B projects which can then proceed directly to detailed design and implementation (as required) and identifies any Schedule C projects for future studies.



Master plans, by definition, are long range plans which integrate infrastructure for existing and future land use with environmental assessment planning principles. In the case of the City of Guelph SWM-MP, implementation is projected until 2051. The SWM-MP concludes with a set of preferred alternatives which make up the recommended approach and, therefore, by its nature, the SWM-MP will limit the scope of alternatives which can be considered at the implementation stage. It is proper to revisit Master Plans on a 5-year to 10-year basis to ensure conditions (environmental, social, financial and technical) have remained unchanged. As such, if at the time of implementation, conditions have changed such that the preferred alternative cannot be implemented, an addendum may be prepared for the specific project. Amendments to the projects identified as part of the preferred alternatives can be made using the addendum procedures outlined in the Municipal Engineers Association Municipal Class Environmental Assessment Act (October 2000, as amended in 2007, 2011, 2015 & 2023) document and shall be posted for the required 30-day review period.

#### **E.4 Public Consultation and Indigenous Consultation**

A consultation plan was developed early in the study process, focusing on engaging approaches to get enhanced public input and improve participation of residents to secure feedback. The two (2) Public Open Houses and three (3) Pop-Ups offered opportunities for the community stay up to date with the SWM-MP process and to share how stormwater could be improved in their neighborhood, on their property and in their community.

During the project, the City consulted Six Nations of the Grand River, Mississaugas of the Credit First Nation, Haudenosaunee Development Institute, and Metis Nation of Ontario. This included project updates as the project progressed, as well as a meeting with Six Nations of the Grand River and Mississaugas of the Credit First Nation in July 2021 and October 2021, respectively.

### **E-5 Existing Conditions**

The City of Guelph covers approximately 88 km² of land. The City is composed of 23 subwatersheds with approximately 90 km of watercourses, and is characterized by a mixture of land-uses. SWM facilities within the City provide various levels of control to 2,899 ha (46.6 percent) of the City. Of this area, approximately 1,746 ha (28.1 percent) are controlled for water quality, and 2,335 ha (37.6 percent) are controlled for water quantity. Accordingly, there are approximately 3,318ha (53.4 percent of urban area) that do not have either water quality or quantity control, with much of this area built before current SWM requirements/ policies.

#### **E-6 Technical Studies**

For each of the six (6) categories of stormwater management measures and identified alternatives, where relevant, a series of technical assessments were undertaken to confirm feasibility and provide direction as to which types of measures should be implemented. For those measures within each category which are subject to the Class EA process, the feasibility was determined through examination of the constraints and opportunities at physical, social and environmental levels.



A series of technical reports have been prepared and included within the technical appendices of the SWM-MP, which are listed below:

- SWM Facilities, OGS and Catchments (November 2021)
- Preliminary Recommendations for Existing Stormwater Facilities and OGS Units (January 2022)
- Subwatershed Health Analysis (October 2022)
- Infiltration Policy Recommendations (November 2022)
- Stormwater Management Facility Maintenance Inspection Summary (September 2020)
- New End-of-Pipe SWM Facilities Opportunities Report (January 2023)
- Rainfall and IDF Curve Analysis (October 2021)
- Major/Minor System Hydrologic and Hydraulic Analysis (March 2023)
- Storm Sewers Under Private Property (January 2021)
- Erosion Assessment Technical Memorandum Field Investigations (August 2021)
- Geomorphic System Assessment Technical Memorandum Field Investigations (August 2021)
- Identification of Restoration Alternatives and Conceptual Design for Preferred Alternatives (October 2022)
- Stormwater Design Criteria and Targets (December 2022)
- LID Implementation Strategy (March 2023)
- Monitoring Plan (March 2023)
- Innovation Strategy (March 2023)

#### **E-7 Evaluation of Alternatives**

To select a preferred alternative for each of the six (6) categories of SWM measures identified previously, evaluation criteria were developed, an evaluation process was applied and of the preferred alternatives selected in fulfillment of the Class EA process. Each individual preferred alternative forms a component of the preferred SWM strategy or recommended approach. The following details the process undertaken per the Class EA process.

- Municipal Pollution Prevention, Operations & Maintenance Practices, is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.
- **Source control measures** fall outside of the Municipal Class EA process, since they are to be constructed on private property, often by the individual landowner as a retrofit or during development/ redevelopment (i.e. the City is not the proponent). This precludes source control measures from the requirements of the Class EA process.
- Stormwater for the Capital Roads Program (conveyance controls) is Exempt from the Municipal Class EA process based on the outcomes of the Archaeological Screening Process. If it is determined that the proposed project will have negative impacts on



- archaeological resources that cannot be appropriately mitigated, the project is not exempt, and must follow a Schedule B EA.
- **Stormwater Management Facilities** were evaluated using the following two (2) Class EA Schedules according to the project nature:
  - Sediment Removal for SWM Facilities is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.
  - Maintenance for SWM Facilities is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.
  - SWM Facility Retrofits is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.
  - New SWM Facilities preferred alternatives were selected for each of the
    identified locations using a series of evaluation criteria that were selected and
    include Physical/ Natural Environment, Social/ Cultural, Economic and
    Technical/Engineering criteria. A score was then established through a
    multidisciplinary evaluation process for each alternative design for each criterion
    established. This follows Schedule B of the Municipal Class EA process, and
    therefore can proceed directly to detailed design and implementation.
- Watercourse and Erosion Restoration preferred alternatives were selected for each of
  erosion sites and restoration reaches using a series of evaluation criteria that were
  selected and include Physical/ Natural Environment, Social/ Cultural, Economic and
  Technical/Engineering criteria. A score was then established through a multidisciplinary
  evaluation process for each alternative design for each criterion established. This
  follows Schedule B of the Municipal Class EA process, and therefore can proceed directly
  to detailed design and implementation.
- The **Urban Flood Management & Storm Sewer Infrastructure** Stormwater infrastructure implemented as part of regular road works is Exempt from the Municipal Class EA process, and therefore, are pre-approved. Locations for storm sewer upgrades were identified using four criteria:
  - City-identified areas of concern (frequent impact locations);
  - Density of flooding complaints;
  - Locations of storm sewer surcharge identified in existing conditions scenario;
     and
  - Upcoming road reconstruction projects identified in the City's capital budget.



#### E-8 Recommended Approach and Implementation Plan

An Implementation Plan has been developed in order to:

- Prioritize all the works based on the watersheds in the most need and where there are
  opportunities to maintain and/or improve conditions through the elements of the
  recommended approach,
- Recommend funding allocation and develop an implementation schedule using existing funding sources, and
- Develop supporting policy.

The SWM-MP Implementation Plan is a strategic document which outlines how and when each specific program or projects of the recommended approach are to be completed to achieve the project goals and objectives. The Implementation Plan is subject to available budget, staff resources and professional judgement, regulatory clearances, and Council approval (where required). Through a collaborative effort with multiple City departments and staff, an implementation schedule and budget forecast has been developed to guide future works from 2024 to 2051.

#### **E-8.1 Policy Development**

Two new policy documents have been prepared as part of the SWM-MP process. These include:

- 1. Stormwater Infiltration Policy Recommendations (November 2022); and
- 2. Stormwater Design Criteria and Targets (December 2022)

It is recommended that the City update the Development Engineering Manual (DEM) and other related guidelines and standards, as required, to account for these new policy documents. The DEM should also be updated to endorse the City's preferred external design guides that provide detailed guidance for the design, construction, inspection, operations, and maintenance of LID features.

The Implementation Plan also recommends the City complete two additional studies which may also be used to update the DEM:

• A study for the development of Cash-in-lieu policy including required by-laws, pricing schedules, internal process and Implementation Plan. The Cash-in-lieu policy is intended to focus on sites where the proponent cannot implement the required volume control to the MEP or "maximum extent possible" as confirmed by the City of Guelph Engineering. In such cases, the proponent would contribute to the cash-in-lieu program corresponding to all uncontrolled areas at the current per hectare rate as defined by the City of Guelph as amended from time to time. Collected funds would be collected by the City's Stormwater Utility and used to implement identified projects within the SWM-MP, prioritized using the subwatershed health analysis.

A study for the development of Direct Discharge to Receiver policy including required by-laws, internal process and Implementation Plan. The Direct Discharge to Receiver policy is intended to focus on sites located in close proximity to surface receivers (e.g., watercourse, wetland,



etc.) which present unique challenges for stormwater practitioners. The reduction of pollutant loads is essential before stormwater is discharged to these features in order to preserve or enhance ecological habitat.

#### **E-8.2 Priority Subwatersheds**

This Implementation Plan prioritizes the works recommended by the SWM-MP based on priority subwatershed. Prioritization is based on the watersheds in the most need and where there are opportunities to improve conditions through the elements of the recommended approach.

Prioritization is based on a hierarchical approach, beginning with the watersheds that have been designated Priority 1 and applying the identified opportunities (i.e. watercourse restoration and erosion repairs, source control pilot programs, conveyance controls, O&M, SWM facilities, flooding, etc.) as detailed within the Recommended Approach in order to improve overall subwatershed conditions. Subwatersheds are prioritized based on the areas of greatest need and opportunity to maximize the 'net-benefit' to the City, the environment and the community. **Figure E-1** presents the subwatershed health scores.

#### E-8.3 Implementation Synergies with City Plans and Policies

The recommended approach for City-wide stormwater management and implementation on a priority subwatershed basis is not intended to be addressed in isolation as part of the SWM-MP. The SWM-MP was developed with full consideration for other Strategic Plans, Subwatershed Studies, Master Plans, Secondary Plans, Environmental Assessments and Policies. More specifically, the elements of the recommended approach represent potential synergies with other studies and plans and should be considered as such.

The SWM-MP explicitly recommends that staff, as part of other City initiatives, plans, studies and programs, leverage potential synergies as the opportunities are identified in order to more efficiently achieve overall City goals to improve the natural heritage system, construct new trails and cycle lanes, improve transit and build transit capacity, rehabilitate parks, and reconstruct roads as well as improve stormwater management.

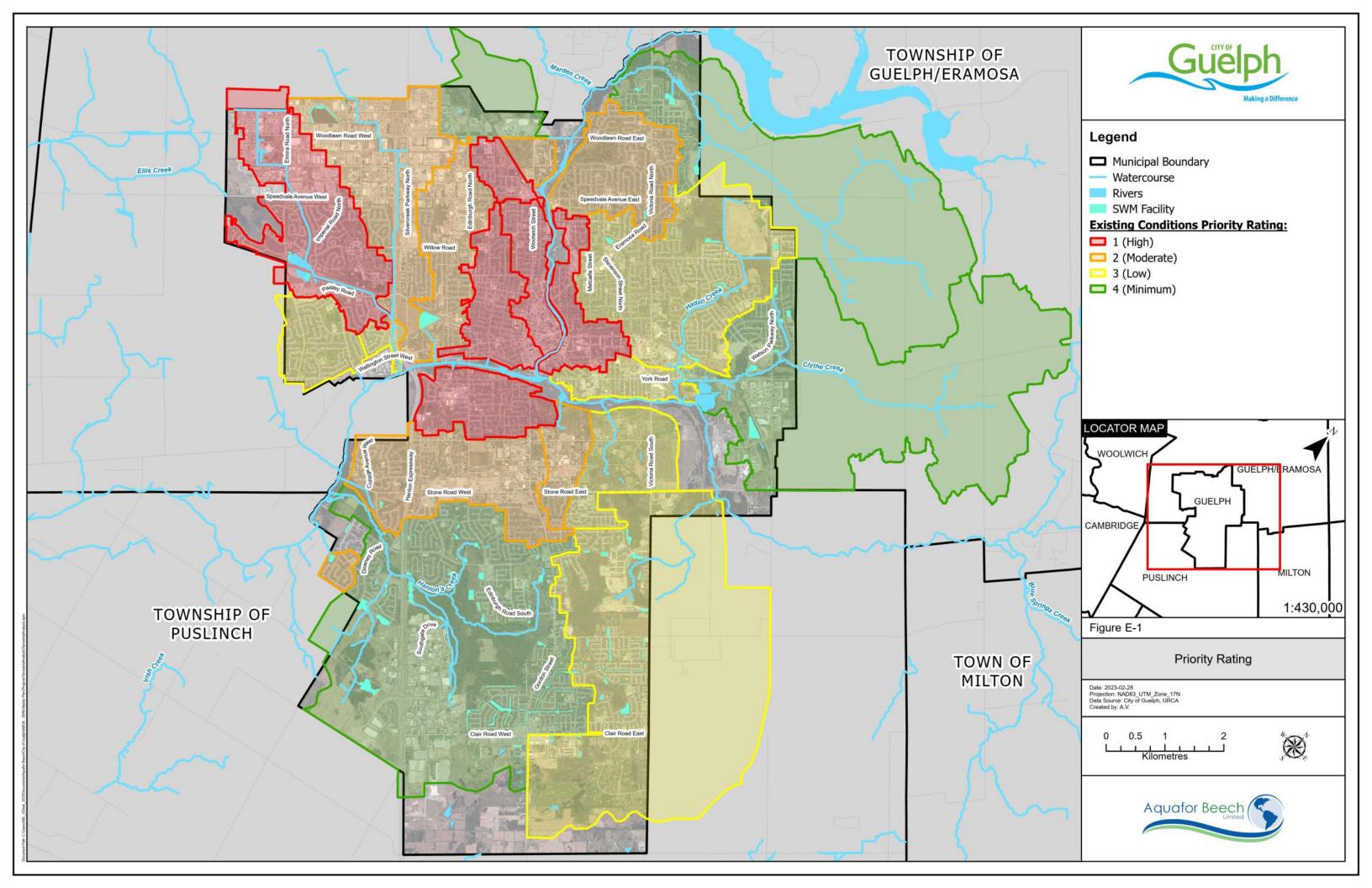
#### E-8.4 Recommended Approaches

The recommended approaches are described below. A plan was developed to implement all projects, programs, and policies that arise from these recommendations between 2024 to 2051. Prioritization of specific projects was generally based on the Subwatershed Health score, but for some approaches, projects were prioritized based on the technical assessment.

# E-8.4.1 Recommended Approach: Municipal Pollution Prevention, Operations & Maintenance Practices

The Recommended Plan for Municipal Pollution Prevention, Operations & Maintenance Practices involves sediment removal from OGS units in order to maintain performance. The City will continue to monitor each OGS unit annually, and will assume at least 55 units will need to be cleaned out each year.





#### E-8.4.2 Recommended Approach: Private Property Strategies (Source Controls)

For new nonlinear development, redevelopment, infill development, intensification, or adaptive re-use without restrictions and subject to the Stormwater Infiltration Policy Recommendations, stormwater runoff volumes will be controlled and the post-construction runoff volume shall be retained on site for runoff that is generated from the first 5mm of rainfall from all surfaces on the entire site. The subject site shall be entered into centralized tracking system to be developed and implemented by the City.

Implementing volume control does not prevent the proponent from meeting all other existing criteria outlined by the City. Volume control may contribute towards achieving these criteria.

#### E-8.4.3 Recommended Approach: Conveyance Control

As an element of the recommended approach, the City will apply volume control to capital roads projects as follows:

- a. New linear projects without restrictions and subject to the Stormwater Infiltration Policy Recommendations, that create 0.25 or greater hectares of new and/or fully reconstructed impervious surfaces, shall capture and retain the larger of the following:
  - i. The first 5mm of runoff from the new and fully reconstructed impervious surfaces on the site; or
  - ii. The first 5mm of runoff from the net increase in impervious area on the site.
- b. Roadway resurfacing, mill and overlay and other resurfacing activities are not considered new linear projects and shall achieve volume reduction to the maximum extent possible (MEP) subject to the Stormwater Infiltration Policy Recommendations.

The incorporation of a cost-effective ROW retrofit approach using a combination of traditional SWM controls (i.e. OGS and other treatment devices) and LID approaches as part of planned road reconstruction and resurfacing projects presents a significant opportunity to improve SWM control (water quality, water quantity, erosion mitigation and water balance) in a cost effective manner within existing urban areas of the City built prior to the implementation of modern stormwater management practices. In addition, ROW retrofits have the added benefit of providing an opportunity to enhance street aesthetics, mitigate and adapt to climate change conditions and reduce urban heat island effects.

#### E-8.4.4 Recommended Approach: Stormwater Management (SWM) Facilities

The Recommended Plan for Stormwater Management (SWM) Facilities includes four (4) primary components:

- 1) **Sediment Removal for SWM Facilities** sediment clean-outs were identified based on the 2014 Stormwater Management Facilities Inventory, Assessment, and Maintenance Needs Study Report. The following facilities require cleanout: 3, 35, 74, 87, 22, 36, 53, 109, 111, 37, and 107.
- 2) Maintenance for SWM Facilities SWMF maintenance activities to address pond deficiencies have been recommended through the 2021 Stormwater Management Facility Inspection Summary and through the 2014 SWMF Report. All maintenance



- recommendations from the 2014 SWMF Report were carried forward, unless the City confirmed these maintenance activities had been completed.
- 3) **SWM Facility Retrofits** Retrofits improve or enhance the water quality, quantity and erosion control performance of existing stormwater management facilities and bring them in-line with current standards. Some facilities did not have adequate information to determine need for retrofit; additional studies are recommended to determine whether these facilities need to be retrofitted. Four retrofit types were identified:
  - Level of Service: since the design level of service of these facilities doesn't meet the City's current standards, it is recommended that these facilities be retrofitted to meet the current standards, or the maximum extent possible. This includes the following facilities: 37, 53, 54, 56, 57, 58, 59, 60, 61, 82
  - Construction Issue: The 2014 SWMF Report identified several facilities where there were significant differences between the design plan and profile and the results of the bathymetry survey which were unlikely to be attributed to sediment accumulation. It is recommended that these deficiencies be corrected. This includes the following facilities: 33, 35, 36, 39, 55, 69, 73, 86, 87, 99, 100, 101, 106, 108, 109, 111
  - Dry to Wet Retrofit: Retrofitting dry ponds to wet ponds allows for the facility to provide water quality controls. The following facilities were recommended for wet to dry retrofit: 9, 18, 21, 23, 27, 32, 34, 38, 79, 96, 103
  - Performance Retrofit: the need for retrofit of these facilities arose from Aquafor's inspection or from the 2012 SWM-MP. These facilities include: 2, 3, 7, 10, 11, 20, 22, 25, 26, 75, 105
- 4) **New SWM Facilities** the recommended approach includes the construction of fifteen (15) new stormwater management facilities, eleven (11) of which will be completed as part of park rehabilitations. The details of the preferred alternatives are summarized in **Table E-1**.

Table E-1: New End-of-Pipe Opportunities as Part of Park Rehabilitations

Site ID	Location Name	Facility Type	Drainage Area (ha)
1	Golfview Park	Subsurface storage	46.8
2	Waverley Park	Subsurface storage	7.3
3	Victoria Road Recreation Centre	Subsurface storage	17.6
4	Green Meadows Park	Subsurface storage	81.5
5	Bailey Park	Subsurface storage	23.8
8	Exhibition Park	Subsurface storage	39.6



Site ID	Location Name	Facility Type	Drainage Area (ha)
14	Dunhill Place Park	Subsurface storage	9.9
16	Margaret Greene Park	Surface facility	85.8
18	Centennial Park	Subsurface storage	15.7
26	L-13 Windsor Park	Subsurface storage	105.9
27	Stevenson / Guelph Junction Railway	Surface facility	177.9
28	Dawn Avenue	1) Low Impact Development	8.63
		2) Surface facility	
30	606 Massey Road	Surface Facility	5.1
31	Springdale Park	Subsurface storage	33.62
32	Oak Street Park	Subsurface storage	29.65
34	End of Industrial Street	Surface facility	229.16

#### E-8.4.5 Recommended Approach: Watercourse and Erosion Restoration

The erosion sites represent the key watercourse and erosion restoration projects to be included as a component of the Recommended Plan. These projects include measures designed to address erosion and flooding problems and restore stream functions and stability. The primary erosion sites and restoration reaches are summarized in **Table E-2**.

**Table E-2: Summary of Stream System Opportunities** 

Site		Preferred Alternative
ES #1	Eramosa Outfall	Remove and Replace Local Works
ES #2	Bank Erosion	Local Works
ES #4	Elizabeth Street Outfall	Local Works
ES #5	Pedestrian Bridge	Removal of Risk
ES #7	Stop Log Dam	Local Works
ES #8	Outfall and Bank Erosion	Stabilization Works
ES #9	Failing Storm Outfall	Remove and Replace Works
ES #10	Stormwater Outfall	Local Replacement Works
ES #11	Outfall and Scoured Bank	Local Stabilization Works
ES #12/13	Retaining Wall	Reach Based Works
ES #14	Decommissioned Sewer Pipe	Removal of Risk
ES #15	Outfall and Retaining Wall	Replacement Works
ES #16	Weir Outflanked	Do Nothing
ES #17	Outfall and Bank Erosion	Stabilization Works
ES #18	Exposed Sanitary Sewer	Reach Based Works
ES #19	Corroded Outfall	Do Nothing
ES #20	Exposed Sanitary Sewer	Reach Based Works



	Site	Preferred Alternative
ES #25/21	Failed Retaining Wall	Replacement Works
ES #22	Slumped Headwall	Local Replacement Works
ES #23	Decommissioned Watermain	Removal of Risk
ES #24	Outflanked Weir and Wall	Local Works
ES #26/27	Dam and Slope Erosion	Removal of Risk
ES #28	Deteriorated CSP Outfall	Local Works
ES #29	Bank Erosion near Outfall	Local Repair Works
ES #30	Pedestrian Bridge Erosion	Replacement Works

#### E-8.4.6 Recommended Approach: Urban Flood Management & Stormwater Infrastructure

The quasi-calibrated model clearly demonstrates that climate change and intensification pose a risk to the level of service provided by the minor system. LIDs are recommended to mitigate this risk and build climate change resiliency into the City's storm sewer network. The recommended approach includes calibration of the existing sewer network model via monitoring. The model calibration will permit the City to more accurately evaluate and select the preferred remedial approaches to improve the level of service.

It is recommended that upcoming capital roads projects consider the outputs of the calibrated model when sizing storm sewer upgrades.

#### E-8.5 Monitoring Plan

In order to ensure the goals and objectives of the SWM-MP are accomplished over time, a refocused stormwater monitoring program has also been established as part of the Implementation Plan. The stormwater monitoring program has two (2) distinct phases. Monitoring has been phased to permit City staff to build capacity with the municipality, align with the Consolidated Linear Infrastructure Environmental Compliance Approval, vet the proposed monitoring program with partner agencies (specifically the GRCA) and permit the alignment of future budgets with the revised program needs. The two phases include:

Phase 1 - Refined Water Resources Monitoring Program (2024–2025) – As part of Phase 1, the City will transition away from pond-specific monitoring to subwatershed-based monitoring. Priority 1 subwatershed have been included in Phase 1 monitoring efforts as these areas have been prioritized for immediate implementation of the SWM-MP recommended approaches. Baseline data for each Priority 1 subwatershed will provide a benchmark against which future stormwater management efforts can be compared.

Phase 2 - Updated Water Quality and Flow Monitoring (2026 - ongoing) — As part of Phase 2, monitoring locations and protocols have been refined to align with the implementation approach of prioritizing works based on the watersheds in the most need and where there are opportunities to improve conditions but also recognizes the need to protect existing watershed health. Phase 2 monitoring also focuses on the collection of data within subwatershed that were determined to have insufficient data during the subwatershed prioritization analysis.



#### **Other Monitoring Obligations**

In addition, the stormwater monitoring program is recommended to include previous monitoring obligations including but not limited to ECA compliance monitoring for stormwater management facilities and other permit compliance monitoring as directed by the GRCA, MNRF, DFO or MECP, to be identified on a case-by- case basis.

#### **E-8.6 Innovation Strategy**

The City has indicated a desire to improve the lives of their residents and businesses through innovation, data and connected technology. An Innovation Strategy was developed to identify innovative, progressive and emerging ideas that can be applied to stormwater management. Innovations were grouped into the following categories: technological, social, and policy innovations. The City identified that Social Marketing and Market Transformation is an opportunity from the Innovation Strategy to include as part of the Implementation Plan. This goal would be to increase update of source LIDs by private property owners throughout the City, and consists of an initial study early in the implementation plan, followed by later implementation.

#### E-8.7 Staffing

In order to achieve the goals of the SWM-MP, it is recommended that the City's permanent staff resources are expanded by two to three full-time positions. These two positions are required permanently based on the findings of the SWM-MP. The work to be undertaken by the new positions includes:

- Provide design support for the implementation of low impact development techniques within the municipal right-of-way projects and create new design standards and specifications;
- Manage the LID tracking and inspection program;
- Review and approve LID designs on private property;
- Manage stormwater management pond projects;
- Manage watercourse rehabilitation and erosion control projects; and
- Develop the urban flood management strategy and further refine the hydraulic modelling to identify constraints in stormwater infrastructure.

#### E-8.8 Cost Estimates

Estimated capital costs estimates for each element are detailed in **Table E-3**.

#### E-8.9 Implementation Schedule and Budget Forecast

The implementation schedule and budget forecast consider three (3) implementation periods:

- 1) Immediate Term Implementation Priorities (2024–2028) \$98.26 million
- 2) Medium Term Implementation Priorities (2029-2033) \$120.06 million
- 3) Long Term Implementation Priorities (2033–2051) \$349.77 million

The implementation schedule and budget forecast illustrate the specific program or project elements of the recommended approach as well as the recommended year within which the



element is to be completed as well as the estimated costs. **Figure E-2** presents the geographic locations of the project recommendations.

The implementation schedule and associated costs does not include the replacement of all surcharging storm sewers in the City's network. It only includes those identified for upsizing in Scenario 4 of the model from 2024-2035. It is recommended that the 2032 SWM-MP reevaluate priority storm sewer upsizing for the rest of the implementation period.



Table E-3: Recommended Approach – Summary of Cost Estimates†

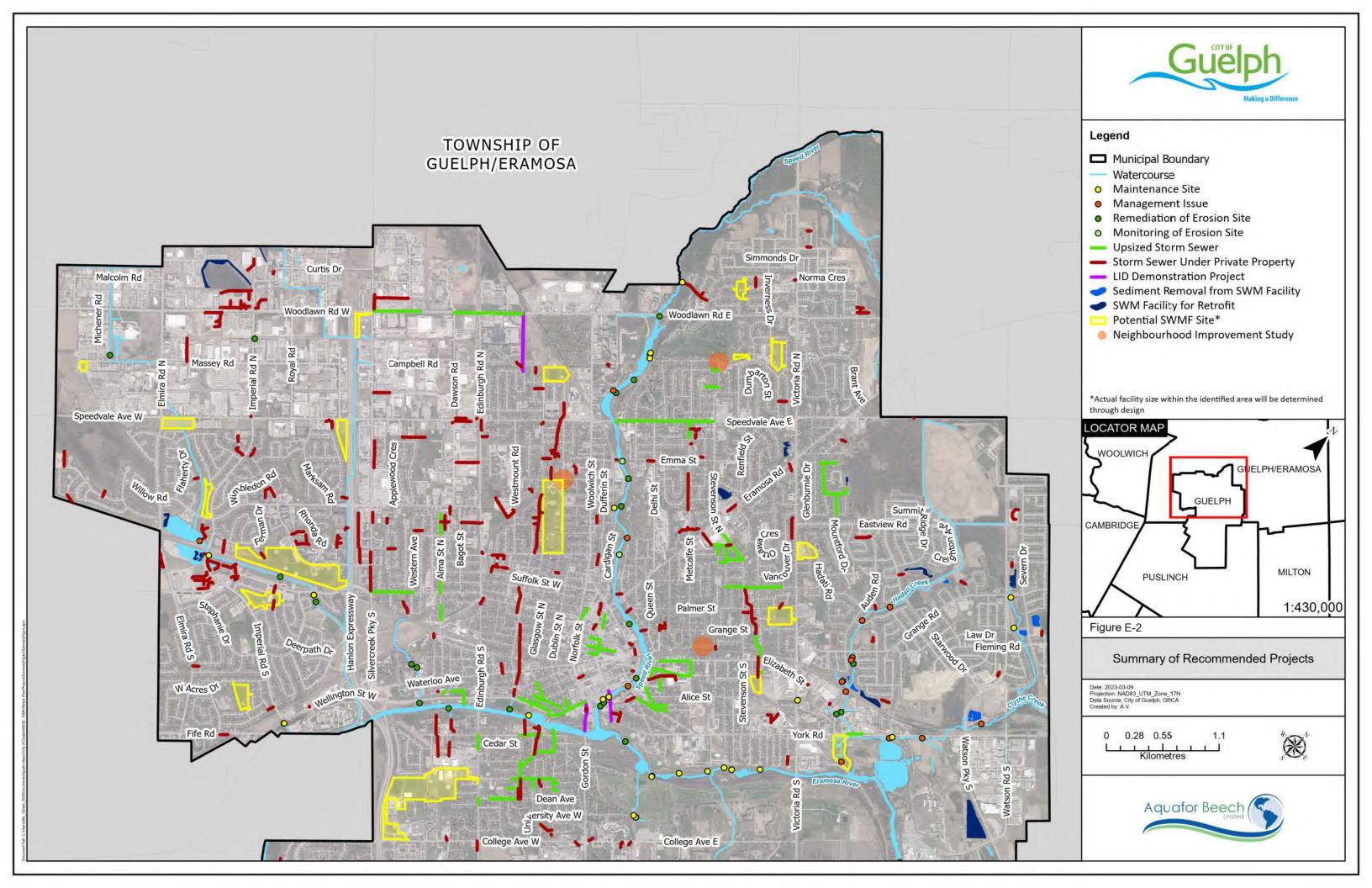
Recommended Approach Element	Cost Estimate (\$ millions)*			
1) Municipal Pollution Prevention, Management, Operations &				
Maintenance Practices				
a. OGS Maintenance	\$3.0			
b. Other Established Practices	\$0			
2) Private Property Strategies (source controls):				
a. Tracking Tool Development	\$0.2			
3) Stormwater for the Capital Roads Program (conveyance controls)				
a. Demonstration Projects	\$3.1			
b. LID in ROW Program	\$8.2			
c. Sediment Removal	\$0.4			
4) Stormwater Management (SWM) Facilities				
a. SWM Level of Service Study	\$2.8			
b. Sediment Removals	\$19.6			
c. Retrofits	\$78.6			
d. New SWM Facilities	\$77.1			
5) Watercourse and Erosion Restoration	\$15.1			
6) Urban Flood Management & Stormwater Infrastructure				
(Preliminary Estimated Cost Implications based on Quasi-				
calibrated model)				
a. Model Calibration	\$0.3			
b. Neighbourhood Improvement Studies	\$14.7			
c. Storm Sewer Replacement and Upgrade	\$291.3			
d. Investigation of Pipes Under Private Property	\$1.5			
Implementation				
a. DEM and Policy Update	\$0.03			
b. Cash-in-Lieu Study	\$0.1			
c. Direct Discharge to Receiver Study	\$0.1			
d. LID Policy Development	\$0.1			
e. SWM-MP, Subwatershed Health, and IDF Update	\$1.8			
f. SWM Monitoring Program	\$1.3			
g. Routine SWM Infrastructure Maintenance Program	\$35.8			
h. Social Marketing and Market Transformation Approach	\$4.0			
i. Staffing	\$9.6			
Total	\$568.7			
Total Yearly Expenditure‡	\$20.3			
‡ expenditure time frame is 2024-2051				

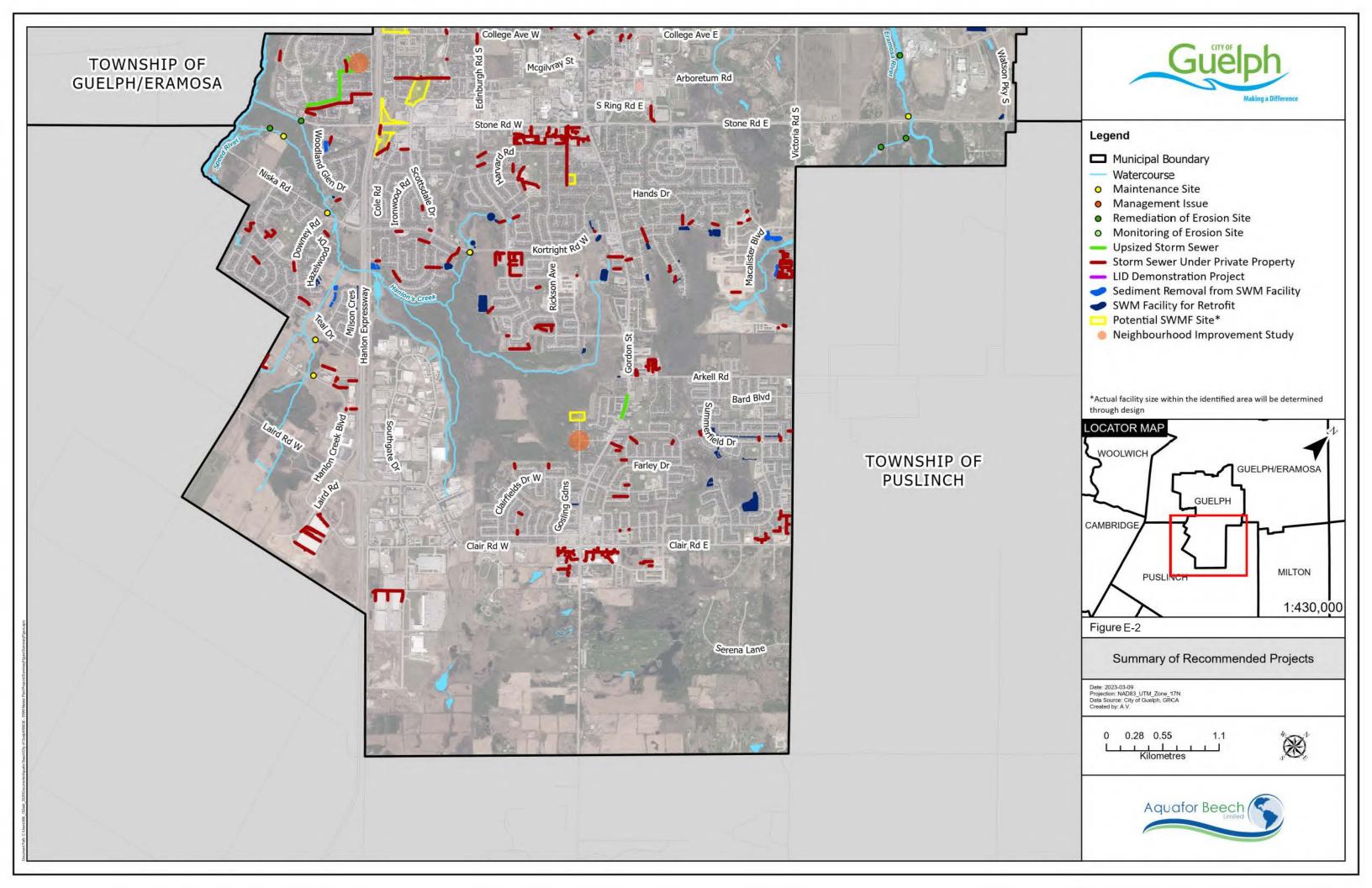
<sup>‡</sup> expenditure time frame is 2024-2051

<sup>\*</sup> Rounded to the nearest \$100,000



<sup>†</sup> Class 'C' cost estimate. Note: all values in 2023 CDN dollars





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#### **List of Terms, Definitions and Acronyms**

BMP Best Management Practice
CofA Certificate of Authorization
Cms Cubic Metres per Second

DFO Department of Fisheries and Oceans

EA Environmental Assessment

ECA Environmental Compliance Approval

EMC Event Mean Concentration

EOP End-of-Pipe

ERA Ecological Restoration Areas

ESPA Environmentally Sensitive Policy Area
GI Green 'Stormwater' Infrastructure
GIS Geographical Information Systems
GRCA Grand River Conservation Authority

ICA Issue Contributing Area
LID Low Impact Development

LOS Level of Service

MEA Municipal Class Environmental Assessment

NHS Natural Heritage System

MNDMNRF Ministry of Northern Development, Mines, Natural Resources and Forestry

MECP Ministry of the Environment, Conservation and Parks

MTCS Ministry of Tourism, Culture and Sport

NPS Urban Non-point Source
OGS Oil and Grit Separator

OWRA Ontario Water Resources Act

OP Official Plan

PICP Permeable Interlock Concrete Paver

PPS Provincial Policy Statement

PWQO Provincial Water Quality Objectives

SARA Species at Risk Act
SPP Source Protection Plan

STEP Sustainable Technologies Evaluation Program

SWM Stormwater Management SWM-MP Stormwater Master Plan

SWMPDM Stormwater Planning and Design Manual (MECP 2003)

SWS Subwatershed Study

WHPA Well Head Protection Area



#### 1 Introduction

The City of Guelph Stormwater Management Master Plan (SWM-MP) Environmental Assessment (EA) is a strategic document that provides direction for the management of stormwater runoff and related infrastructure. The SWM-MP identifies a preferred strategy to protect and enhance natural features, ecological function and biophysical integrity, and appropriately manage risks through the establishment of environmental targets, in the context of a changing climate.

The SWM-MP establishes the stormwater management policies and guidelines up to 2051, serving as a decision support tool, and providing direction for the prioritization of municipal stormwater management (SWM) projects and programs, the development of policy recommendations, and the allocation of financial and staffing resources.

#### 1.1 Study Purpose

It is the intent of the SWM-MP to develop a preferred stormwater management strategy (Recommended Approach) for the City of Guelph following a Master Planning approach. The SWM-MP addresses primarily the existing urban areas of the City and recommends remedial measures to improve overall environmental performance, increase efficiencies and reduce costs. The study focus is not new development; however, it does provide guidance in regards to future policies and identified intensification areas, and carries forward stormwater recommendations from major development areas, including Clair Maltby and the Guelph Innovation District. It is understood that new development must follow the established processes and required approval under the Planning Act.

The purpose of the SWM-MP study is to update the City of Guelph 2012 SWM-MP and serve as a decision support tool, as well as a methodology for the prioritization of works. The SWM-MP also serves as a transparent community consultation process by which the City can establish stormwater management guidelines and policies.

When approved, the SWM-MP will provide direction for resource requirements and identified works relating to the following six (6) stormwater management program elements:

- 1) Municipal Pollution Prevention, Operations & Maintenance Practices,
- 2) Private Property Strategies (source controls),
- Stormwater for the Capital Roads Program (conveyance controls),
- 4) Stormwater Management Facilities,
- 5) Watercourse and Erosion Restoration, and
- 6) Urban Flood Management & Stormwater Infrastructure.

The SWM-MP is intended to provide a comprehensive vision for the City which would support a resilient SWM system in the face of a changing climate, address identified deficiencies within the existing SWM system, provide direction for new policies, and enable the City to operate the SWM program at a sustainable level. To reach this end, a comprehensive set of projects and



programs have been recommended as part of the SWM-MP Recommended Approach and Implementation Plan (Section 13). The pace of implementation will ultimately be guided by the City's capital budgeting and human resourcing capacity in the context of all organizational priorities. As a result, the implementation timeline as outlined in the SWM-MP may be modified to reflect these priorities and resources.

#### 1.1.1 Study Context - SWM Master Plan

This study has been completed as a Stormwater Master Pan (SWM-MP) under Section 4, Approach #2 of the Municipal Engineers Association Municipal Class Environmental Assessment (MEA) Act (October 2000, as amended in 2007, 2011, 2015 & 2023). The 2023 amendment was released in early March 2023 when the SWM-MP was substantially complete. A review of the amendment indicated that it does not impact Approach #2, and that the SWM-MP therefore still aligns with the MEA Act.

The SWM-MP has been completed in keeping with the Ontario Water Resources Act (OWRA) O.Reg. 525/98 which is designed to conserve, protect and manage Ontario's water resources for efficient and sustainable use relating to both groundwater and surface water throughout the province.

#### 1.2 Study Goals & Objectives

The SWM-MP focuses on runoff prevention, acknowledges the benefits provided by natural systems, recognizes rainwater as a resource to be managed rather than a waste, and uses the principles of Low Impact Development (LID) in combination with conventional SWM approaches to better and more efficiently manage stormwater. This will result in increased infiltration and will better maintain hydrologic functions for the Natural Heritage System and drinking water supply.

The study goals and objectives for the City of Guelph SWM-MP are informed by key documents, which have received support from City staff and Council and should be viewed as guiding documents, representing established commitments by the City of Guelph for the management of surface and ground water resources. These documents include:

- Grand River Water Management Plan (GRWMP)
- Best Practices Guide for Reducing Urban Non-point Source (NPS) Pollution in the Grand River Watershed
- Watershed and Subwatershed Studies:
  - Hanlon Creek Watershed Plan (1993)
  - Hanlon Creek State-of-the-Watershed Study (2004)
  - Torrance Creek Subwatershed Study (1998)
  - Clythe Creek Subwatershed Overview (1997, updated 1998). Note: The Clythe Creek subwatershed is currently undergoing an update, but was not yet completed at the time of this report.
  - Mill Creek Subwatershed Plan (1996)



#### 1.2.1 SWM-MP Study Goal

The goals of City of Guelph SWM-MP have been developed in keeping with the goals and objectives of the key guiding documents listed above and in compliance with existing guidance, acts and regulations. The goal of the study is to provide the City with a preferred SWM strategy (Recommended Approach) to identify, protect and enhance natural features, ecological functions and biophysical integrity. The plan will establish SWM policy and guidelines, address stormwater infrastructure, and identify and prioritize identified works.

#### 1.2.2 SWM-MP Study Objectives

The City of Guelph SWM-MP considers flood and erosion control, groundwater and surface water quality management, natural heritage management and infrastructure, all in an integrated manner. In addition, the SWM-MP integrates existing policies, regulations, acts and guidelines, and where appropriate, develops new policies to aid in implementation. The objectives of the City of Guelph SWM-MP include the following:

#### **Water Quantity**

- Maintain pre-development hydrologic processes to protect, restore and replenish surface water and groundwater resources
- Minimize risk to public health and safety as well as property damage due to flooding
- Establish water quantity criteria and targets for stormwater management

#### **Water Quality**

- Improve sediment, surface water and groundwater quality
- Minimize pollutant loadings, including road salt, to groundwater and surface water
- Establish water quality criteria and targets for stormwater management

#### **Natural Environment**

- Use stormwater management to assist in regulating the quantity and quality of stormwater run-off to receiving natural watercourses, wetlands and recharge facilities by replicating pre-development hydrologic processes
- Protect, maintain, enhance and restore natural features and functions such as wetlands, and watercourses
- Protecting downstream cool water and coldwater fisheries through the use of thermal mitigation measures

#### Water Balance/Infiltration

- To establish a groundwater infiltration strategy that maximizes infiltration of clean water without impacts to adjacent infrastructure in conformance with Source Water Protection Policies
- Maintain pre-development recharge rates under post development conditions to the extent possible
- To protect the sensitive groundwater features and their hydrologic functions to protect and enhance the municipal drinking water supply
- To minimize chloride infiltration into the groundwater system



 Establish water balance criteria and targets including criteria and targets specific to demonstrating wetland water balance, when a wetland is the receiver

#### Infrastructure

• Improve stormwater infrastructure resiliency and adaptation related to climate change.

#### **Policy and Implementation**

 Create and/or recommend SWM Policies for integration into the Development Engineering Manual and for use on SWM initiatives

#### 1.3 Background

In 2012, the City of Guelph completed a SWM-MP with a goal to "develop a long-term plan for the safe and effective management of stormwater runoff from urban areas while improving the ecosystem health and ecological sustainability of the Eramosa and Speed Rivers and their tributaries" (AMEC, 2012). The 2012 SWM-MP helped to understand the City's existing infrastructure, flood risk, and water quality issues. Since 2012, other studies have been completed to assess stormwater infrastructure requirements, and the 2012 SWM-MP at 10 years old is out of date due to new SWM technology and changes in key policies, acts, and regulation standards.

The field of stormwater management has evolved since the early 2000s (**Figure 1.1**) to include broader environmental objectives and targets for not only water quality, quantity and erosion control, but now include a greater focus on water budget (infiltration) considerations, as well as the protection of aquatic and terrestrial habitats and groundwater resources. In addition, climate change resiliency, adaptation and mitigation must now be considered as part of stormwater design and implementation.



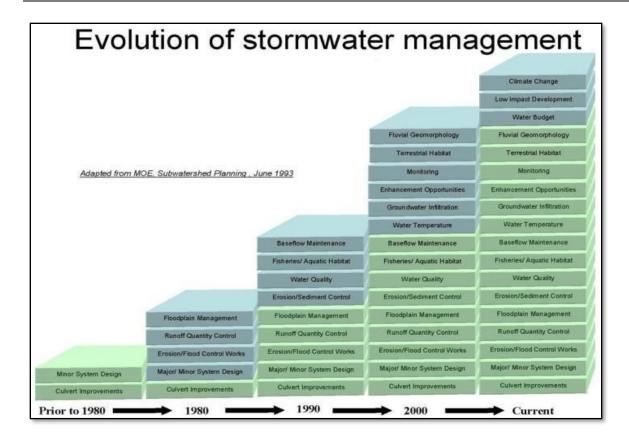


Figure 1.1: Evolution of Stormwater Management

#### 1.4 The Class Environmental Assessment Process

An approved Class Environmental Assessment (Class EA) document describes the process that a proponent must follow for a class or group of undertakings in order to satisfy the requirements of the *Environmental Assessment Act*, represents a method of obtaining an approval under the *Environmental Assessment Act* and provides an alternative to carrying out individual Environmental Assessments for each separate undertaking or project within the class.

The *Environmental Assessment Act* was legislated by the Province of Ontario in 1980 to ensure that an Environmental Assessment is conducted prior to the onset of development and development related (servicing) projects. Depending on the individual Class Environmental Assessments (Class EA) or Master Plan to be completed, there are different processes that municipalities must follow in order to meet Ontario's Environmental Assessment requirements.

These processes are defined within the Municipal Engineers Association Class Environmental (Class EA) (2000, as amended 2007, 2011, 2015, & 2023).

Class EAs (see **Section 1.4.1**) or Master Plan (see **Section 1.4.2**) are prepared for approval by the Minister of the Environment, Conservation and Parks and are approved planning documents that define: projects, groups of projects and / or activities and the Environmental Assessment (EA) process which the proponent commits to for each project undertaking. Provided the process is followed, projects and activities included do not require formal review



and approval under the *Environmental Assessment Act*. In this fashion the process expedites the Environmental Assessment of smaller recurring projects.

The Environmental Assessment process to be followed is illustrated in **Figure 1.2**, and may involve up to five phases of assessment. In partial fulfillment of Ontario's Environmental Assessment requirements, the process must satisfy at least the first two (2) phases of the Class Environmental Assessment process. Depending on the type of study to be completed, Phases 3 and 4 may also be required. Public and agency consultation is also an important and necessary component of the five phases.

#### 1.4.1 Class Environmental Assessment (Class EA)

The Municipal Engineers Association's Class EA document classifies individual projects as Exempt, or Schedule B or C depending on their level of environmental impact and public concern. Any project identified must be classified as to their level of complexity and potential level of environmental impact, which will in turn decide which Schedule process needs to be followed.

- Exempt projects were formerly identified as Schedule A or A+. The 2023 amendment to the MEA removed Schedule A and A+, replacing them with the Exempt class. Exempt projects include various municipal maintenance, operational activities, rehabilitation works, minor reconstruction or replacement of existing facilities, and new facilities that are limited in scale and have minimal adverse effects on the environment. These projects are exempt from the requirements of the Environmental Assessment Act.
- Eligible for Screening to Exempt projects may be eligible for exemption based on the results of a screening process. Proponents may choose to complete the applicable screening process to determine whether their project is eligible for exemption from the EAA or proceed with the applicable Schedule B or C process.
- Schedule 'B' projects have more environmental impact and do have public implications. Examples would be stormwater ponds, river crossings, expansion of water or sewage plants up to or beyond their rated capacity, new or expanded outfalls and intakes, and the like. If facilities are located in an existing utility corridor or road allowance, then works on stormwater ponds become Schedule 'A'. Schedule 'B' projects require completion of Phases 1 and 2 of the Class EA process.
- Schedule 'C' projects have the most major public and environmental impacts. Examples would be storage tanks and tunnels with disinfection, anything involving chemical treatment or expansion beyond a water or sewage plants rated capacity. Schedule 'C' projects require completion of Phases 1 through 4 of the Class EA process, before proceeding to Phase 5 implementation.



#### PHASE 2 PHASE 3 PHASE 4 PHASE 1 PHASE 5 ALTERNATIVE DESIGN PROBLEM OR **ALTERNATIVE ENVIRONMENTAL** CONCEPTS FOR IMPLEMENTATION **OPPORTUNITY** SOLUTIONS STUDY REPORT PREFERRED SOLUTION IDENTIFY ALTERNATIVE IDENTIFY SOLUTIONS TO PROBLEM PROBLEM OR IDENTIFY ALTERNATIVE COMPLETE EXEMPT OR OPPORTUNITY DESIGN CONCEPTS FOR COMPLETE CONTRACT ENVIRONMENTAL STUDY OPPORTUNITY MAY PROCEED PREFERRED SOLUTION DRAWINGS AND TENDER REPORT (ESR) DOCUMENTS SELECT SCHEDULE SCHEDULE A/A+ DISCRETIONARY PUBLIC (APPENDIX 1) DETAIL INVENTORY NATURAL SOCIAL NOTICE OF COMPLETION CONSULTATION TO PROCEED TO ECONOMIC ENVIRONMENT TO REVIEW AGENCIES & CONSTRUCTION AND REVIEW PROBLEM OR PUBLIC OPERATION OPPORTUNITY INVENTORY NATURAL SOCIAL ECONOMIC IDENTIFY IMPACT OF ENVIRONMENT ALTERNATIVE DESIGNS ON MONITOR ESR AVAILABLE FOR THE ENVIRONMENT AND **ENVIRONMENTAL IMPACTS** MITIGATING MEASURES 30 DAYS AND MITIGATING DETERMINE APPLICABILITY MEASURES IDENTIFY IMPACT OF OF MASTER PLAN ALTERNATIVE SOLUTIONS APPROACH ON THE ENVIRONMENT **EVALUATE ALTERNATIVE** (See Section A.2.7) MAY PROCEED AFTER ANY AND MITIGATING DESIGNS IDENITIFY RECOMMENDED DESIGN MAY PROCEED CONCERNS ARE MEASURES AFTER ANY ADDRESSED CONCERNS ARE (See Section A.2.8) ADDRESSED (See Section A.2.8) **EVALUATE ALTERNATIVE** CONSULT REVIEW SOLUTIONS IDENITIFY AGENCIES & PREVIOUSLY RECOMMENDED INTERESTED & DIRECTLY SOLUTIONS AFFECTED PUBLIC PROJECT FILE **Mandatory Events** AVAILABLE FOR DISCRETIONARY 30 DAYS PUBLIC CONSULT REVIEW Possible Events AGENCIES AND PUBLIC CONSULTATION TO SELECT PREFERRED DESIGN Re: PROBLEM OR REVIEW PREFERRED OPPORTUNITY AND **Public Contact** NOTICE OF DESIGN ALTERNATIVE SOLUTIONS **COMPLETION TO** REVIEW AGENCIES **Decision Points** & PUBLIC REVIEW AND CONFIRM SELECT PREFERRED CHOICE OF SCHEDULE SOLUTION SCHEDULE B MUNICIPAL ENGINEERS PRELIMINARY ASSOCIATION SCHEDULE C FINALIZATION OF REVIEW AND CONFIRM PREFERRED DESIGN CHOICE OF SCHEDULE June 2021

MUNICIPAL CLASS EA PLANNING AND DESIGN PROCESS NOTE: This flow chart is to be read in conjunction with Part A of the Municipal Class EA

Figure 1.2: MEA Flow Chart



#### 1.4.2 Master Plans

Master Plans are one form of Class EA document representing long range plans with Environmental Assessment planning principles. Master Plans provide a strategy for implementing a large number of projects of a similar nature where differences being primarily due to site specific conditions. The following characteristics distinguish the Master Planning Process from other processes:

- a) The scope of Master Plans is broad and usually includes an analysis of the system in order to outline a framework for future works. Master Plans are not typically undertaken to address a single site-specific problem.
- b) Master Plans typically recommend a set of works which are distributed geographically throughout the study area and which are to be implemented over an extended period of time. Master Plans provide the context for the implementation of the specific projects which make up the plan and satisfy, as a minimum, Phases 1 and 2 of the Class EA process (Figure 1.3). Notwithstanding that these works may be implemented as separate projects, collectively these works are part of a larger management system. Master Plan studies in essence conclude with a set of preferred alternatives and, therefore, by their nature, Master Plans will limit the scope of alternatives which can be considered at the implementation stage.

The Municipal Engineers Association Class Environmental Class EA document also identifies four different approaches to completing Master Plans corresponding to different levels of assessment. Regardless of the approach selected, all Master Plans must follow at least the first two phases of the Class Environmental Assessment process (Figure 1.3).

- Approach 1, the most common approach, is to follow Phases 1 and 2 as defined above, then use the Master Plan as a basis for future investigations of site-specific Schedule 'B' and 'C' projects. Any Schedule 'B' and 'C' projects that need specific Phase 2 work and Phase 3 and 4 work, usually have this Phase 2, 3 and 4 deferred until the actual project is implemented.
- Approach 2 is to complete all of the work necessary for Schedule 'B' site specific projects at the time they are identified. Using this approach, a municipality would identify everything it needed in the first five years and would complete all the site-specific work required, including public consultation to meet Class EA requirements. The Master Plan in such cases has to be completed with enough detail so that the public in site-specific locations can be reasonably informed, and so that the approving government Agencies (Conservation Authorities, Ministry of Natural Resources and Forestry, Federal Department of Fisheries and Oceans, Transportation Canada, etc.) can be satisfied, in principle, that their concerns will be addressed before construction commences.
- Approach 3 is to complete the requirements of Schedule 'B' and Schedule 'C' at the Master Plan stage.



Approach 4 is to integrate approvals under the EA and Planning Acts. For example, the
preparation of new or amended Official Plans could be undertaken simultaneously with
Master Plans for water, wastewater and transportation, and approval for both sought
through the same process.

#### 1.4.3 City of Guelph Stormwater Management Master Plan

The City of Guelph Stormwater Management Master Plan (SWM-MP) was conducted in accordance with the requirements for Master Plans under **Appendix 4, Approach #2** of the Municipal Engineers Association Municipal Class Environmental Assessment (October 2000, as amended in 2007, 2011, 2015 & 2023). As part of the Class EA process, evaluation of alternatives, assessment of the potential environmental effects and identification of mitigation measures for potential adverse impacts has been conducted and presented through public and agency consultations.

This SWM-MP fulfills all of the Class EA requirements for Schedule B projects which can then proceed directly to detailed design and implementation (as required) and identifies any Schedule C projects for future studies. Master plans by definition are long range plans. In the case of the City of Guelph SWM-MP, implementation is projected to occur from 2024-2051.

This SWM-MP concludes with a set of preferred alternatives which make up the Preferred SWM Approach (i.e. Recommended Approach). It is proper to revisit Master Plans on a 5-year to 10-year basis to ensure conditions (environmental, social, financial and technical) have remained unchanged. As such, if at the time of implementation, conditions have changed such that the preferred alternative cannot be implemented, an addendum may be prepared for the specific project. Amendments to the projects identified as part of the preferred alternatives can be made using the addendum procedures outlined in the Municipal Engineers Association Municipal Class Environmental Assessment (October 2000, as amended in 2007, 2011, 2015 & 2023) document and shall be posted for the required 30-day review period.

Prior to implementation, additional public consultation is recommended to be undertaken in support of further work carried out in the future for specific Schedule B projects. In addition, integration across city departments is fundamental to a modern approach to stormwater management and is essential for the City of Guelph in the implementation of the SWM-MP in order to meet the project goals and objectives. In this regard, potential synergies with other City Strategic Plans, Subwatershed Studies, Master Plans, Secondary Plans, Environmental Assessments and policies are considered essential.

#### 1.5 Report Organization

- **Section 1** Introduces the study, the study purpose, goals, objectives as well as an overview of the Class Environmental Assessment Process.
- **Section 2** Describes the Problem statement, opportunity and constraints.



- Section 3 Summarizes key Federal, Provincial, Regional and Local legislations, policies, and guidelines for the management of water resources and stormwater management.
- Section 4 Summarizes the existing environmental conditions and stormwater infrastructure within the City of Guelph based on available information extracted from background reports, GIS mapping and databases, including the baseline subwatershed health score and ranking for Terrestrial Subwatershed Health, Stormwater Management, Water Quality, Stream Channel and Riparian Health, Aquatic Ecology, as well as the Overall Subwatershed Condition.
- Section 5 11 Details the various stormwater management options relating to each of the six (6) elements of stormwater management practices included with the SWM-MP, and the study approach, analysis, and conclusions relating to each element. The elements include:
  - 1. Municipal Pollution Prevention, Operations & Maintenance Practices
  - 2. Private Property Strategies (Source Control Measures)
  - 3. Conveyance Control Measures
  - 4. End-of-Pipe Measures (SWM Facilities)
  - 5. Urban Flood Management and Stormwater Infrastructure Options
  - 6. Watercourse and Erosion Restoration
- Section 12 Describes the evaluation criteria, evaluation process and selection of the preferred alternatives which will form the Recommended Approach in fulfillment of the Class Environmental Assessment process (Class EA).
- **Section 13** Describes the Recommended Approach and Implementation Plan.
- **Section 14** Details the study recommendations.
- **Section 15** Provides references.

# 1.6 Study Process

The study process that has been followed in this study is illustrated in **Figure 1.3.** The study has been broken down into three (3) stages. Stages 1 and 2 represent the completion of the Stormwater Management Master Plan (SWM-MP) Municipal Class Environmental Assessment per the Municipal Class Environmental Assessment Master Planning process, as described by the Municipal Engineers Association (2000, as amended 2007, 2011, 2015 & 2023) and are included in **Sections 1 to 12** of this report. The third stage is the Implementation Plan, included in **Section 13** of this report.



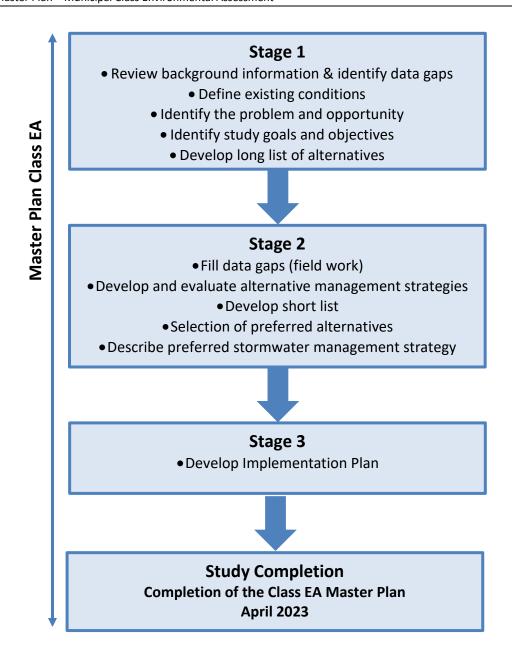


Figure 1.3: City of Guelph Stormwater Master Plan Study Process

#### 1.7 Public Consultation

This section summarizes the Public Consultation component of the study per the Consultation Plan. Recognizing the mandatory requirements for Public Consultation under the Municipal Class EA process, the Consultation Plan ensured all mandatory requirements were met while providing a more innovative approach that provides for enhanced public input and ultimately lays the foundation for improved participation of residents to secure feedback. It was the intent of the SWM-MP to move public consultation beyond a process of presentation and feedback to a community visioning opportunity and a chance to create excitement, secure valuable insights



and ideas and encourage public support. A complete record of public consultation is included as **Appendix T.** 

In advance of Public Open houses, key messaging was developed and advertising was undertaken via the City's website. To ensure full transparency and public involvement, the public consultation completed for the SWM-MP included:

1. Notice of Study Commencement (Notice was issued on March 19, 2020)

# 2. Public Open Houses

- Public Open House No. 1 An online Public Open House was held from October 28, 2020 to November 30, 2020. An online format was selected due to the COVID19 pandemic.
- Public Open House No. 2 An in-person and online Public Open House was held on Tuesday November 29, 2022 from 5:30 to 7:30 pm in Guelph City Hall, 1 Carden Street, Guelph. Online commenting was open from November 29, 2022 to December 20, 2022.

# 3. Pop-Ups

To generate additional public engagement, several pop-ups were held at various locations through the City during summer 2022. These popups included:

- Pop-up #1 August 6, 2022 (1 pm to 7 pm) at Guelph Civic Museum patio
- **Pop-up #2** August 27, 2022 (1 pm to 5 pm) at Riverside Park
- Pop-up #3 September 10, 2022 (1 pm to 5 pm) outside Guelph City Hall

### 4. Project Team

A core project team was established which consisted of City staff from relevant departments.

### 5. Community Stormwater Management Working Group

A group of local technical subject matter experts were invited to participate in the Community Stormwater Management Working Group (CSWMWG). This working group provided input and expertise on the various technical aspects of the study, and included representatives from the University of Guelph; Grand River Conservation Authority; commercial/industry/landowners; development; and environmental groups. This group met three times:

- 1. February 9, 2021 (virtual meeting)
- 2. November 15, 2021 (virtual meeting)
- 3. November 22, 2022 (virtual meeting)

# 1.8 Indigenous Consultation

The City consulted Six Nations of the Grand River, Mississaugas of the Credit First Nation, Haudenosaunee Development Institute, and Metis Nation of Ontario. This included project updates as the project progressed, as well as a meeting with Six Nations of the Grand River and



Mississaugas of the Credit First Nation in July 2021 and October 2021, respectively. Consultation records are presented in **Appendix U.** 

# 2 Problem Statement and Opportunity Identification

#### 2.1 General

In 2012, the City of Guelph completed a SWM-MP with a goal to "develop a long-term plan for the safe and effective management of stormwater runoff from urban areas while improving the ecosystem health and ecological sustainability of the Eramosa and Speed Rivers and their tributaries" (AMEC, 2012). The 2012 SWM-MP helped to understand the City's existing infrastructure, flood risk, and water quality issues. Since 2012, other studies have been completed to assess stormwater infrastructure requirements, and the 2012 SWM-MP at 10 years old is out of date due to new SWM technology and changes in key policies, acts, and regulation standards. A new SWM-MP is thus being completed, following a Master Planning approach in accordance with the *Environmental Assessment Act* as outlined by the Municipal Engineer's Association Municipal Class Environmental Assessment (MEA), October 2000, as amended in 2007, 2011, 2015 & 2023.

### 2.2 Problem Statement

Areas of urban land use may degrade the environment in many ways. Degradation may occur at the onset as lands are stripped of topsoil and vegetation during the construction process. This may result in pollutants such as excessive sediment loads being discharged to the receiving bodies of water.

Sediment loading typically decreases as development of an area is completed, but different pollutants from the urban area can emerge at this stage. Common sources of pollutants include heavy metals from automobiles and air emissions, nutrients from fertilizers, bacterial contamination from animal wastes within stormwater runoff and toxic contaminants from a variety of residential, commercial and industrial sources.

The pollutants from developed urban areas, when conveyed to the receiving bodies of water, impact the environment in many ways. The particulate (settleable) and dissolved contaminants stress aquatic ecosystems by depleting oxygen, raising ambient water temperature, covering habitat or through the bioaccumulation or bioconcentration of contaminants in the tissues of various aquatic species. Similar to urban areas, rural areas may also degrade the environment as a result of increased bacterial, nutrient and suspended solids loadings from farms, golf courses and nurseries.

Urban development within the lands draining to streams also results in a transformation of the hydrologic characteristics within subwatersheds. Large amounts of previously permeable soils, which allowed rainwater to soak into the ground, are covered with impervious materials and structures such as concrete, asphalt and buildings. Rainfall events that previously contributed little or no runoff to streams now cause flow to occur in the channels. Consequently, the amount of water draining to streams increases significantly in volume.



Commensurate with the increase in the volume of runoff is a decrease in the time it takes for the runoff to reach the channels. Storm sewers were constructed to rapidly convey the rainwater to streams resulting in higher peak flow rates in the receiving channels.

Climate change is also expected to result in more extreme rain events and increased climate variability. Modeled increases in high-intensity rain events, including those used for design purposes, could result in more flooding events. The City has committed to addressing climate change policies throughout the Official Plan. This includes protection of the natural heritage and water resource systems, resilient infrastructure that increases urban vegetation, and preparing for extreme weather events.

As a result of existing land uses, together with proposed changes in land use within the urban core and a changing climate, a number of potential environmental problems have been identified. These include:

- Degraded surface water and groundwater quality
- Thermal enrichment of surface water
- Increased sediment loads to surface water
- Adverse effects on human and animal health
- Loss and degradation of fish and wildlife habitat, natural features and processes
- Increased flooding and erosion
- Disruption of the pre-development hydrologic process (reduction in groundwater recharge and stream baseflow)
- Urban flooding (overwhelming of the municipal storm sewer system)

The SWM-MP therefore proposes alternatives to ensure stormwater is sustainably managed in a way that helps protect Guelph's water supply and environment, and to support growth to 2051 in alignment with Guelph's Municipal Comprehensive Review (OPA 80). It accounts for government legislation; technological advances and infrastructure needs; and works to mitigate the environmental problems outlined above.

# 3 Policy Framework & Technical Direction

As a component of the SWM-MP, a Stormwater Policy Review was completed to identify existing policies, guidelines, and legislation that relate to stormwater management in the City of Guelph.

In Canada, environmental issues including stormwater planning and management are predominantly regulated through a multi-level legislative framework. Under the legislative framework for stormwater planning and management within the City of Guelph, there are several jurisdictions that interact and apply based on many factors including geographical scale, and administration role. These jurisdiction levels include: Local (Watershed or Municipal), Provincial, and Federal.



**Appendix A** summarizes the relevant multi-level legislative framework in order to guide and direct future stormwater management activities in the City of Guelph. It also is intended to inform this SWM-MP to ensure future municipal policy development is in full compliance with the necessary policies, statutes, regulations, plans and guidelines. In addition to the information provided in **Appendix A**, the following section outlines the way in which the SWM-MP addresses cultural heritage resources.

# 3.1 Cultural Heritage

The Ontario Ministry of Tourism, Culture and Sport (MTCS) mandates the conservation of Ontario's cultural heritage, including:

- Archaeological resources, including land-based and marine,
- Built heritage resources, including bridges and monuments, and
- Cultural heritage landscapes.

The MTCS notes that, while some cultural heritage resources may have already been formally identified, others may be identified through screening and evaluation. Furthermore, Indigenous communities may have knowledge that can contribute to the identification of cultural heritage resources, and the MTCS suggest that any engagement with Indigenous communities includes a discussion about known or potential cultural heritage resources that are of value to these communities. The MTCS notes that Municipal Heritage Committees, historical societies and other local heritage organizations may also have knowledge that contributes to the identification of cultural heritage resources.

Under the Municipal Class Environmental Assessment (EA) process, the proponent is required to determine a project's potential impact on cultural heritage resources. The MTCS notes that developing and reviewing inventories of known and potential cultural heritage resources within the study area can identify specific resources that may play a significant role in guiding the evaluation of alternatives for subsequent project-driven EAs and/or on implementation.

### 3.1.1 Cultural Heritage: SWM-MP Implementation

Given that a Master Plan, such as the subject SWM-MP, is a high-level planning document, whose study area is the entirety of the City of Guelph, it is not practical to carry out technical heritage studies for such a broad geographic scope the way an EA proponent would when the "study area" is the footprint of a single proposed undertaking. However, as part of subsequent studies and /or prior to implementation during detailed design, the more detailed processes stipulated by the archaeology and cultural heritage landscape shall be applied to the individual projects. In other words, consideration based on such heritage screenings or technical studies as are required must be applied prior to implementation and the approaches modified as required.

Prior to the implementation of individual projects which comprise the preferred stormwater management strategy of this SWM-MP, the City shall review each site-specific project for the potential to impact known or potential cultural heritage resources and complete heritage



screenings or technical studies in compliance with the heritage policies of the Guelph Official Plan as well as other policies and procedures using the resources below relating to:

- Archaeological resources, including land-based and marine,
- Built heritage resources, including bridges and monuments, and
- Cultural heritage landscapes.

# 4 Study Area Existing Conditions

The following section provides a summary of the existing environmental and stormwater infrastructure conditions. The summary is based on available information extracted from background reports such as watershed studies and monitoring programs, GIS mapping and City databases.

# 4.1 Summary of Background Documents

In preparation of the existing conditions, the following background studies were reviewed and summarized wherever relevant information existed:

# **Region and Agency**

- 1. Grand River Water Management Plan (GRCA, 2014)
- 2. Grand River Fisheries Management Plan (GRCA, 2005)
- 3. Grand River Watershed Characterization Report (2008)
- 4. Grand River Source Protection Area Approved Assessment Report (2022)
- 5. Grand River Source Protection Plan (SPP) (2022)
- 6. Water Quality Targets to Support Healthy and Resilient Aquatic Ecosystems in the Grand River Watershed (2013)
- 7. Nutrient and Sediment Sources in The Grand River Watershed (2013)
- 8. Assessment of Future Water Quality Conditions in the Grand and Speed Rivers (2012)

# **Subwatershed Studies and Master Drainage Plans**

- 1. Clythe Creek Subwatershed Study Overview (1997)
- 2. Hanlon Creek State of the Watershed Study (2004)
- 3. Hanlon Creek Watershed Plan (1993)
- 4. Mill Creek Subwatershed Plan (1996)
- 5. Upper Hanlon Creek Watershed Management Strategy Infrastructure Report (1993)
- 6. Eramosa-Blue Springs Watershed Study Report (1999)
- 7. Torrance Creek Subwatershed Study (1998)
- 8. Ward One Stormwater Management Study Class Environmental Assessment (2007)

# City of Guelph – Master Plans and Technical Documents

- 1. Development Engineering Manual (2019)
- 2. Parks and Recreation Master Plan Update (under development)
- 3. Stormwater Management Master Plan (2012)
- 4. Transportation Master Plan (2022)
- 5. Water and Wastewater Servicing Master Plan (under development)



- 6. Clair-Maltby Secondary Plan (2021)
- 7. Climate Adaptation Plan (under development)
- 8. Guelph Innovation District Secondary Plan (2020)
- 9. City of Guelph Strategic Plan 2019-2023
- 10. Shaping Guelph: Official Plan Review Policy Paper (2021)
- 11. Downtown Servicing Study (2021)
- 12. Natural Heritage Action Plan (2018)
- 13. Urban Forest Management Plan (2012)
- 14. Core Asset Management Plans (2021)
- 15. Guelph Trail Master Plan (2021)
- 16. Stormwater Service Rebate and Credit Program IDE-2017-142 (2017)
- 17. Stormwater Fees or Charges Credit Application Guidance Manual (2017)

# 4.2 Existing Conditions Summary

The City of Guelph covers approximately 88 km<sup>2</sup> of land. As of 2021, the City of Guelph had a population of 143,740<sup>1</sup> with an expectation to increase to 208,000 by 2051.<sup>2</sup> The City is composed of 23 subwatersheds with approximately 90 km of watercourses. Watersheds are listed **Table 4.1** and shown on **Figure 4.1**.

Table 4.1: Subwatersheds in the City of Guelph

Subwatershed	Drainage Area (ha) within Municipal Boundaries	Stream Length (km) within Municipal Boundaries
Arboretum Tributary	259	1,519
Bailey Drain	74	0*
Clythe Creek	382	6,110
Cutten Tributary	123	681
Eramosa Urban Catchment 1	124	1,515
Hadati Creek	759	6,385
Hanlon Creek	1654	20,052
Imperial Drain	166	0*
Kortright Hills Tributary	31	248
Mill Creek	341	8
Northern Tributary	203	4,023
Northwest Drain	37	1,204
Riverside Drain	107	2
Silver Creek	287	1,298
Speed Urban Catchment 1	165	0*
Speed Urban Catchment 2	151	0*

<sup>&</sup>lt;sup>1</sup> Statistics Canada, 2021 Census.

<sup>&</sup>lt;sup>2</sup> Amendment Number 80 to the Official Plan for the Corporation of the City of Guelph: Shaping Guelph. Adopted by Council July 11, 2022.

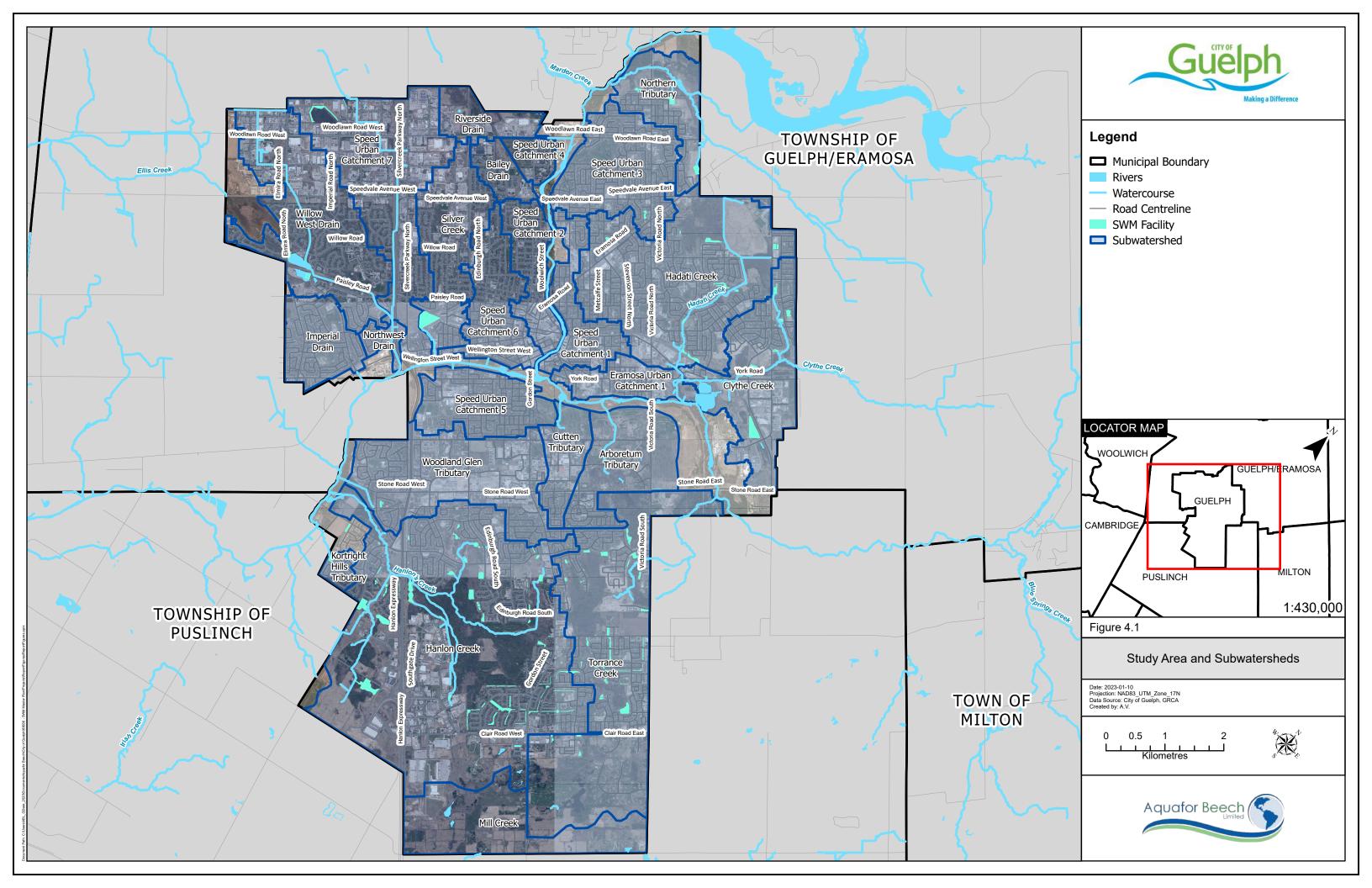


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Subwatershed	Drainage Area (ha) within Municipal Boundaries	Stream Length (km) within Municipal Boundaries
Speed Urban Catchment 3	322	0*
Speed Urban Catchment 4	52	0*
Speed Urban Catchment 5	219	6
Speed Urban Catchment 6	215	0*
Speed Urban Catchment 7	556	6,089
Torrance Creek	870	2,343
Willow West Drain	521	8,649
Woodland Glen Tributary	466	926
Total	8,083	61,058

<sup>\*</sup>no watercourses present in these urbanized subwatersheds





#### 4.2.1 Land-Use

The City of Guelph is characterized by a mixture of land-uses. Generally, agricultural lands remain only along the periphery of the City at its south end, although these lands will be developed under the Clair Maltby Secondary Plan. Lands that are zoned industrial are clustered primarily in the northwest part of the City between Speedvale Avenue and the northern City boundary, as well as along the Hanlon Expressway in the south end of the City. Approximately, 29 per cent of the City is occupied by private residential property (i.e. residential development areas excluding the municipal right-of-way).

The City is home to a large area of lands zoned as institutional, which are mostly associated with the University of Guelph, but also include Conestoga College, Guelph General Hospital, Homewood Health Centre, and St. Joseph's Health Centre.

Guelph's commercial lands are primarily located along Woodlawn Road and Speedvale Avenue, with other commercial hubs at major intersections and along major transitways. Mixed-use corridors and commercial mixed-use centres follow similar trends, especially along Stone Road and Silvercreek Parkway.

Existing land-use as broken down by The City's Official Plan is illustrated in **Figure 4.2**. Mapping showing the distribution of land-use as well as greenfield areas and strategic growth areas can be found in **Figure 4.3** and **Figure 4.4**, respectively.

# 4.2.2 Physiography

There are two (2) dominant physiographic regions within the City's municipal boundary per Chapman and Putman (1984) as reported in the Grand River Source Protection Area Assessment Report (2022). Most of the City is located within the Guelph Drumlin Field, but the southern limits of the City are within the Horseshoe Moraines. The Guelph Drumlin Field contains approximately 300 drumlins, which are generally separated by swampy valleys.

#### 4.2.3 Surficial Soils & Infiltration Potential

Surficial geology mapping (**Figure 4.5**) shows the presence of high permeability materials throughout the City, including gravel and sand deposits across much of the City. These permeable, coarse-grained deposits allow for extensive infiltration and recharge. The northern portions of the City also have significant diamicton deposits, which have varied infiltration potential.

#### 4.2.4 Hydrogeology

Within the City, the largest concentration of significant recharge areas can be found in the south in the Hanlon Creek, Torrance Creek, and Mill Creek subwatersheds, as well as in Clythe Creek, Willow West Drain, and along the northern boundary of the City. Significant recharge areas, as identified by the GRCA, are illustrated on **Figure 4.6.** Within the City of Guelph there are two (2) creeks that are classified as coldwater streams as a result of groundwater discharge, including Hanlon Creek and Clythe Creek.



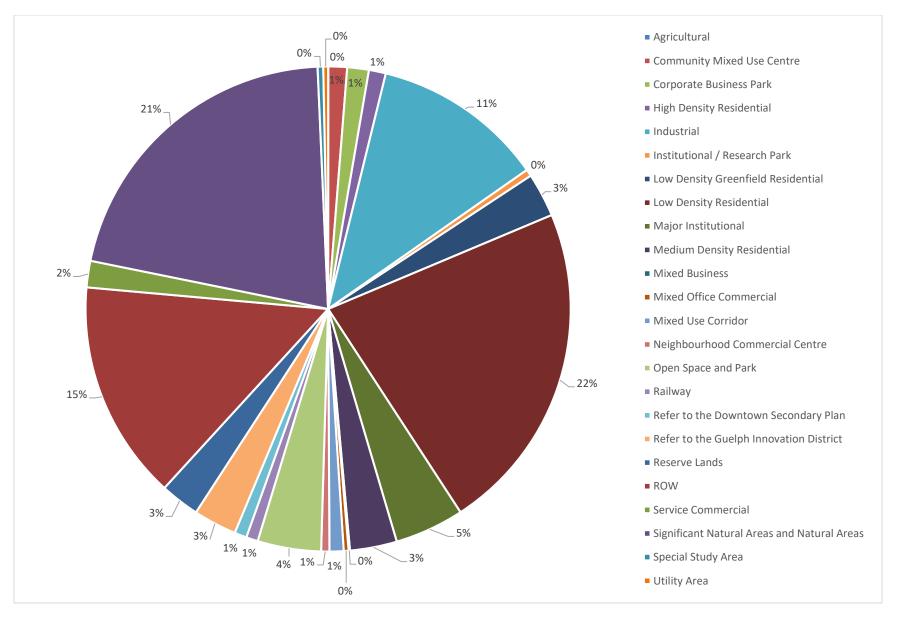
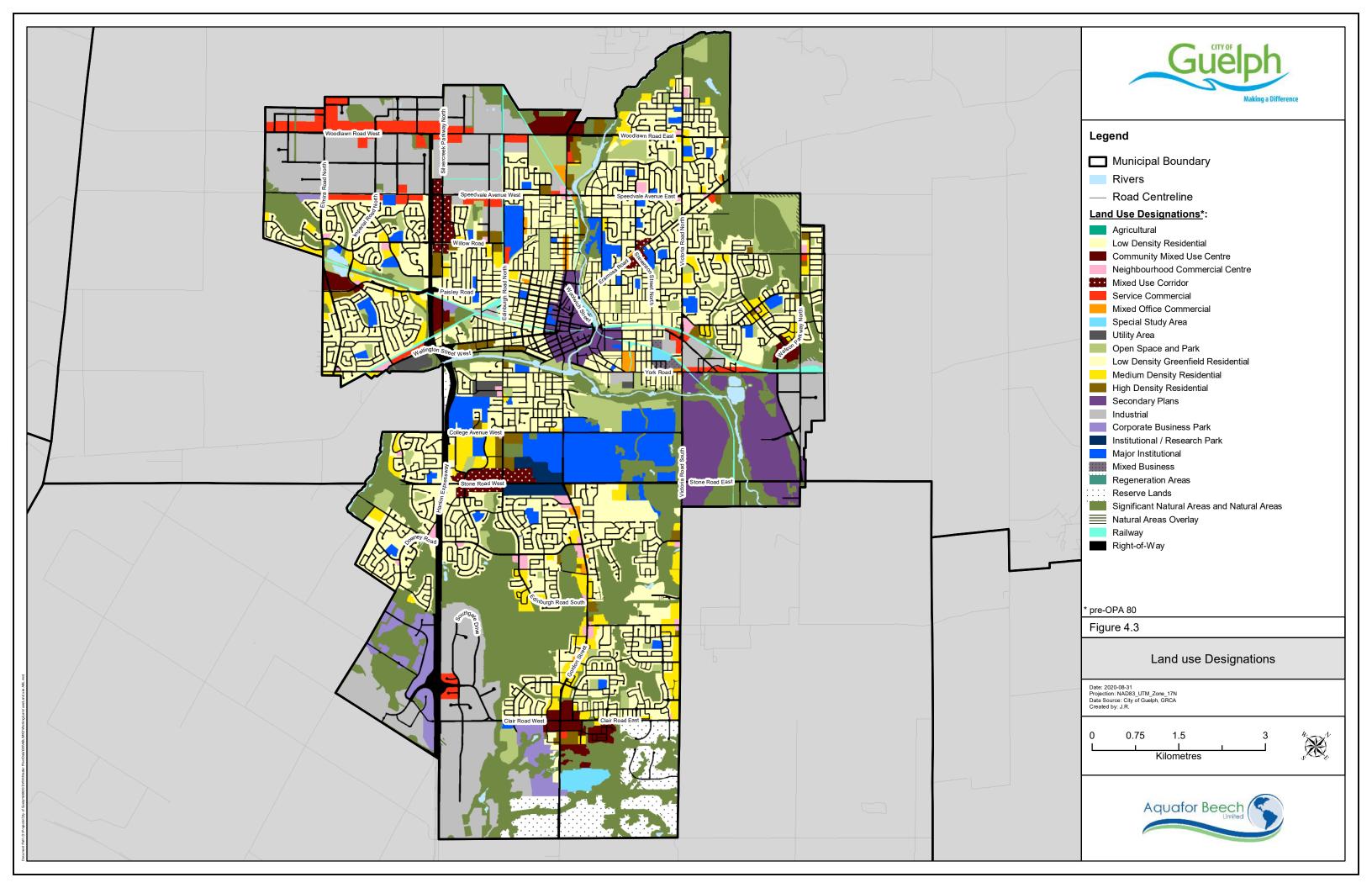
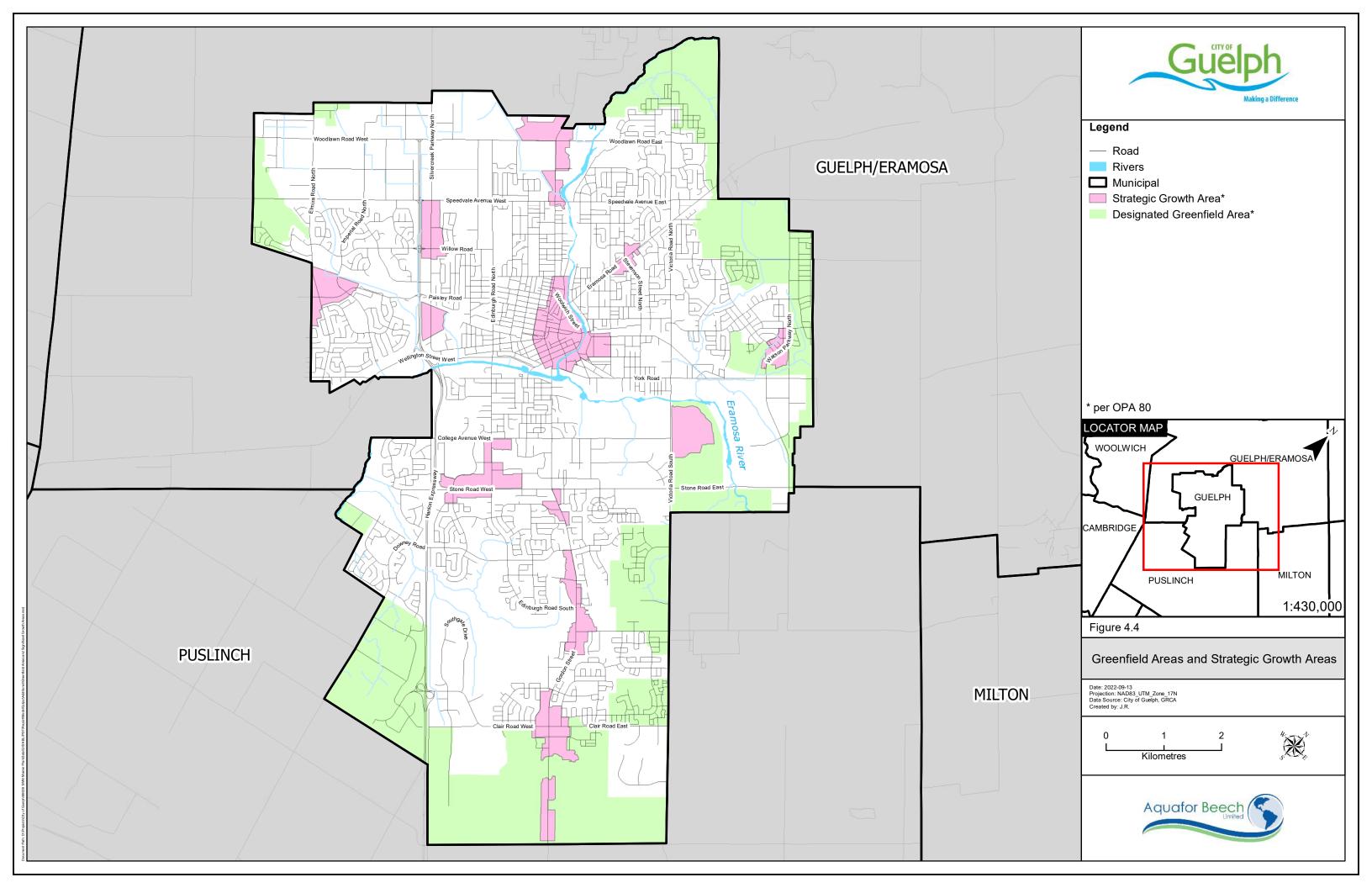
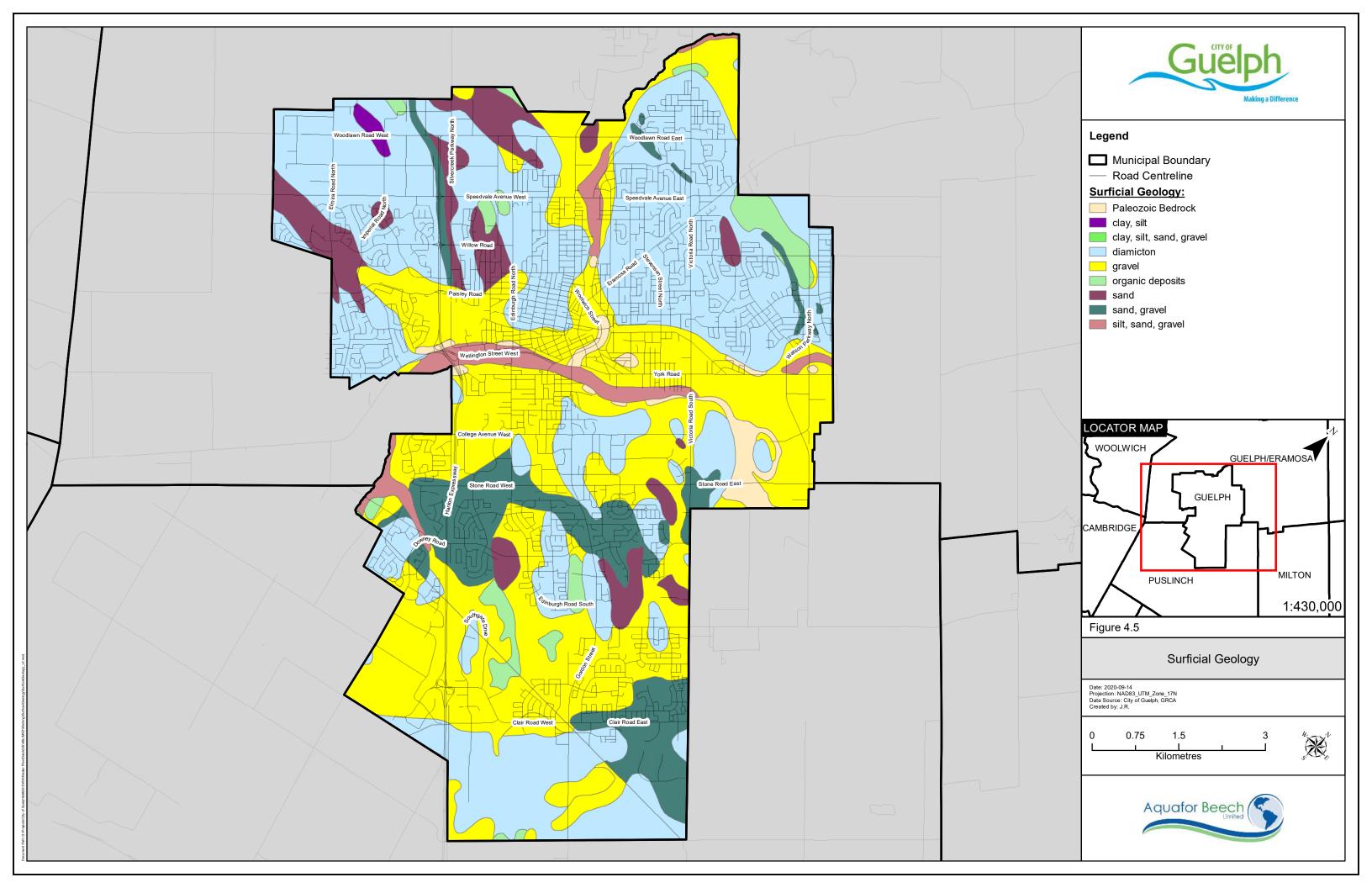


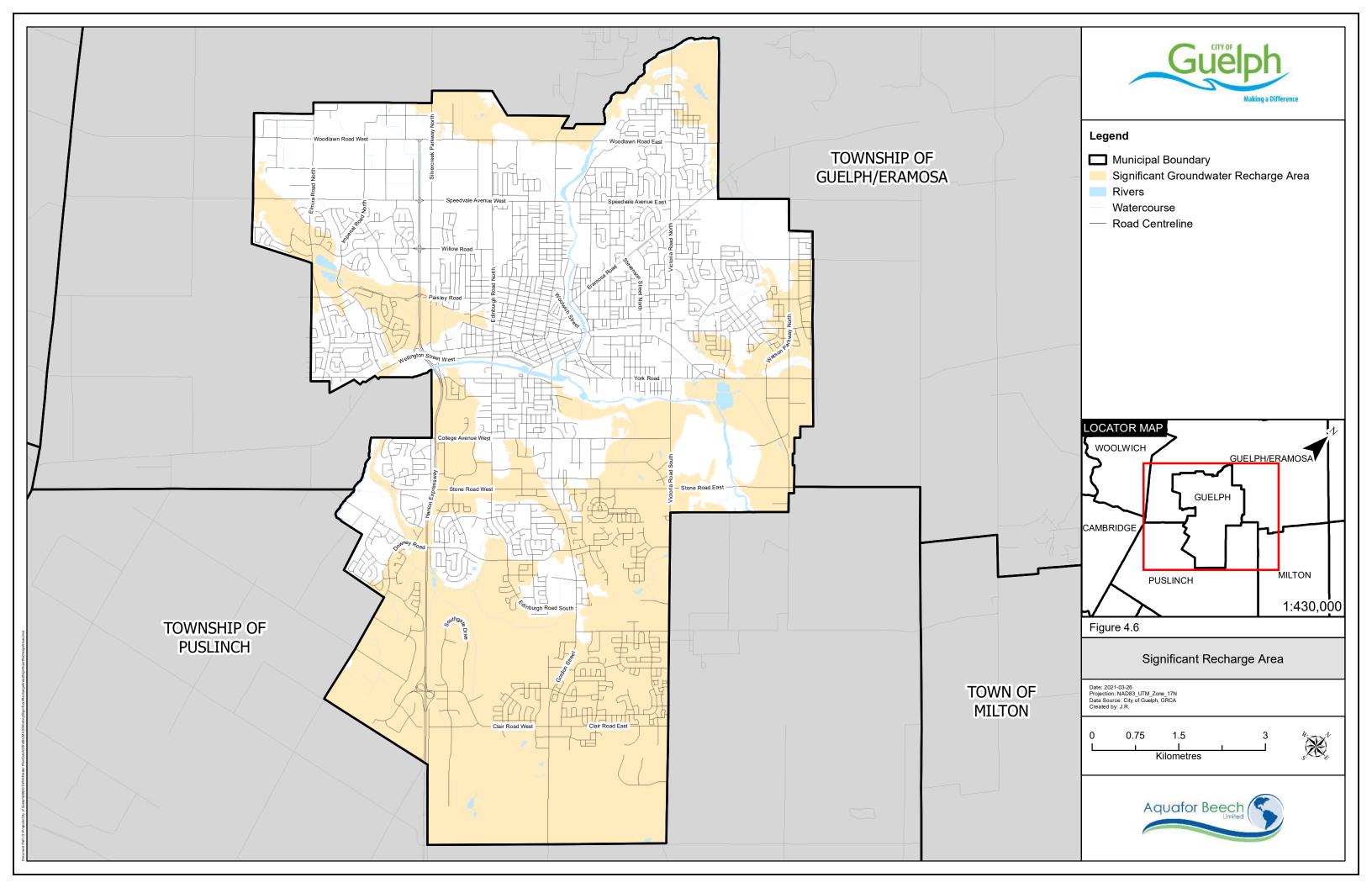
Figure 4.2: Existing City of Guelph Land Use Designations Per Official Plan











# 4.2.5 Hydrology

The City of Guelph's surface water system consists of several watercourses discharging into the Speed River or the Eramosa River. The Speed and Eramosa Rivers converge in downtown Guelph and continue west as the Speed River before discharging into the Grand River approximately 25km downstream. Of the smaller watercourses in the City, the most prominent include Hanlon Creek, Torrance Creek, Clythe Creek, and Hadati Creek. The catchments of these watercourses include the southern and eastern parts of the City. Watercourses in the centre, north, and west of the City have been generally been channelized or piped.

### 4.2.5.1 Flow Control

Flows in the Speed River are regulated from the upstream reservoir at the Guelph Dam. Spring flows are greatly reduced by the reservoir, which captures the spring snow melt, and can therefore reduce flood peaks by 50 percent or more in the City of Guelph. In addition, flow regulation provides for flow augmentation during the summer months.

Within City limits, the Ontario Dam Inventory, provided by the Ministry of Natural Resources and Forestry (MNRF), shows three dams on the Speed River upstream of its confluence with the Eramosa River, and two dams downstream of the confluence. The Wellington Street Dam, downstream of the confluence, is owned by the GRCA, but like the other four privately-owned dams within the City, is not operated to manage flows.

The summer minimum flow target for the Speed River is 1.7 m<sup>3</sup>/s at the Edinburgh Road gauge. Minimum flows are set to support the operation of municipal wastewater plants, and to ensure there is enough water for other uses and the ecosystem.

# 4.2.5.2 Flow Monitoring

The GRCA monitors flow in the Eramosa River at Watson Road and in the Speed River at Edinburgh Road. Additionally, the Water Survey of Canada operates a gauge in the Eramosa River at Victoria Road. Both the GRCA and Water Survey of Canada monitor the Speed River above and below Guelph.

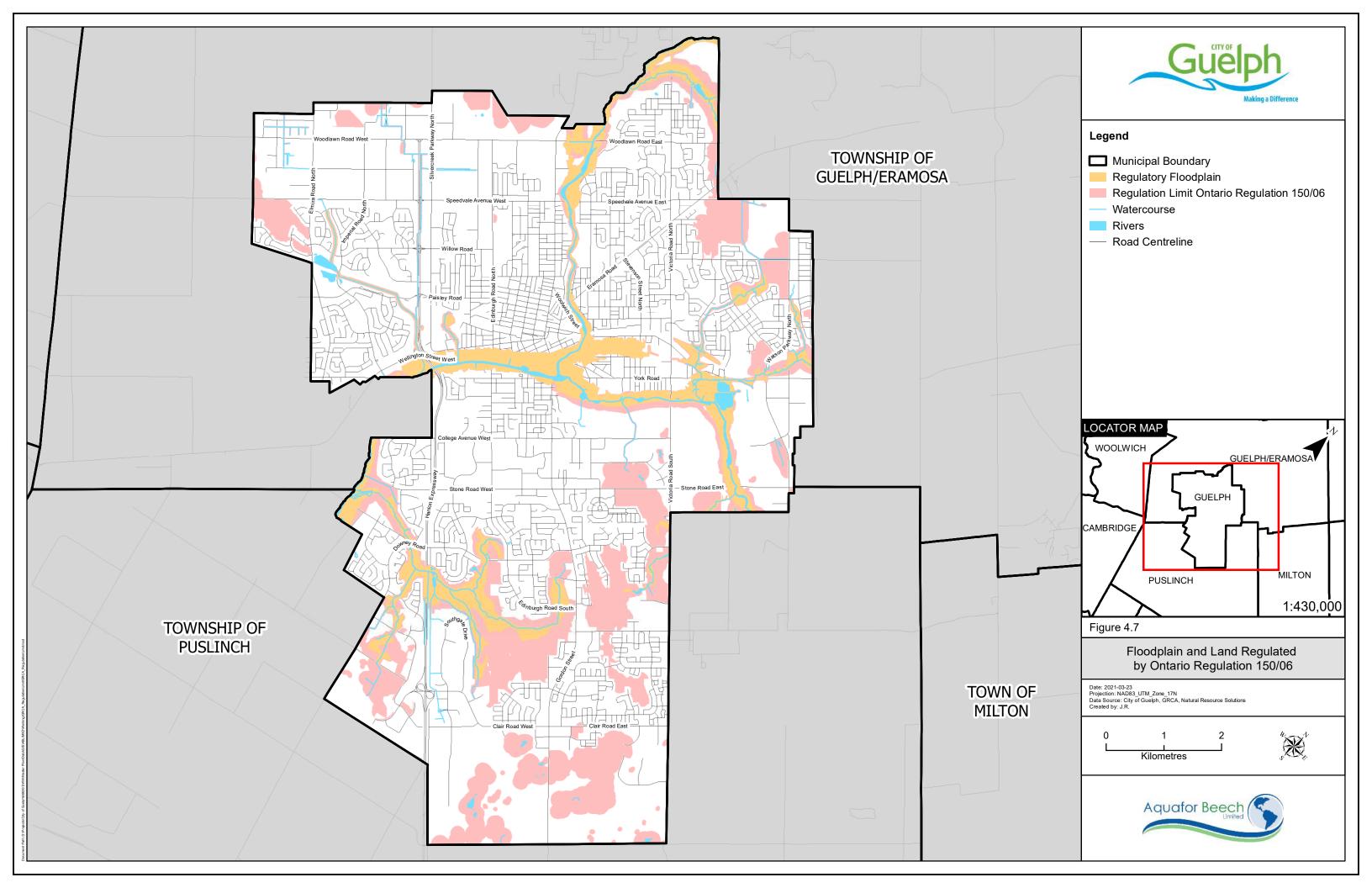
# 4.2.5.3 Hydraulics

Within the City of Guelph, several hydraulic studies have been conducted to delineate the limits of flooding. Floodplain mapping coverage is illustrated in **Figure 4.7**, which also includes the regulation limit under O.Reg. 150/06.

#### 4.2.6 Fluvial Geomorphology

In the City of Guelph, approximately 90 km of stream systems flow through 24 distinct subwatersheds or catchment areas, which drain into the Speed River or Eramosa River, with the exception of Mill Creek Subwatershed. Most of these subwatersheds or catchments are highly urbanized. Associated with urbanization are both direct and indirect factors of human activity on stream morphology. Direct impacts include changes of channel form, alignment, bank and bed materials, and instream structures (weirs, culverts, and dams), whereas indirect impacts relate primarily to changes in adjacent land use which can significantly influence the rate and method of water and sediment routing to a creek or river.





# 4.2.7 Aquatic Ecology

The Grand River watershed is incredibly diverse and is home to 80 confirmed, 12 probable, and 6 possible fish species, which represents 62 per cent of all fish species found in Ontario. Six (6) fish species are classified as vulnerable or threatened in Canada (Grand River Fisheries Plan Implementation Committee, 2005).

Much of the 61 km of streams in the City of Guelph (not including the Speed River or Eramosa River) are classified as cold or cool water streams. Two watercourses, including Hanlon Creek and Clythe Creek, are classified as coldwater streams. Most watercourses in the City of Guelph are highly urbanized with significant portions of them showing channelization and bank hardening. Channels lined with concrete limit the burrowing depth of fish, having negative impacts on habitat, forage, and spawning.

Current stream thermal regime classification (commonly referred to as stream classification) was obtained from the City of Guelph Official Plan, and is illustrated in **Figure 4.8**. Each stream classification is related to Ministry of Natural Resources and Forestry (MNRF) aquatics/ fisheries timing windows for in-water works and is detailed below:

- Warm Water Timing Window no in-water works should occur between March 31 and June 30 of any given year.
- Cold Water Timing Window no in-water works should occur between October 1 and June 30 of any given year.

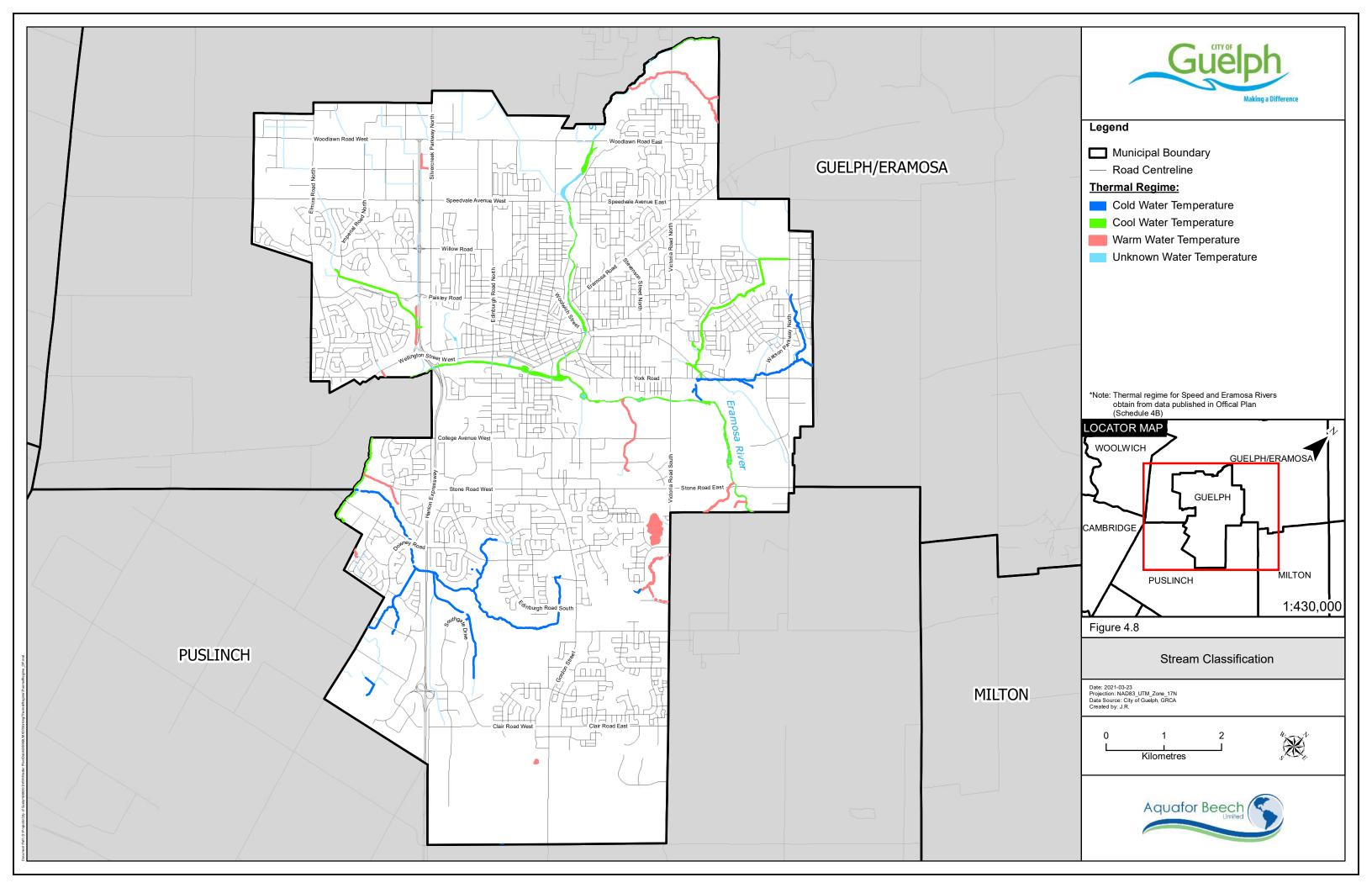
# 4.2.8 Natural Heritage System

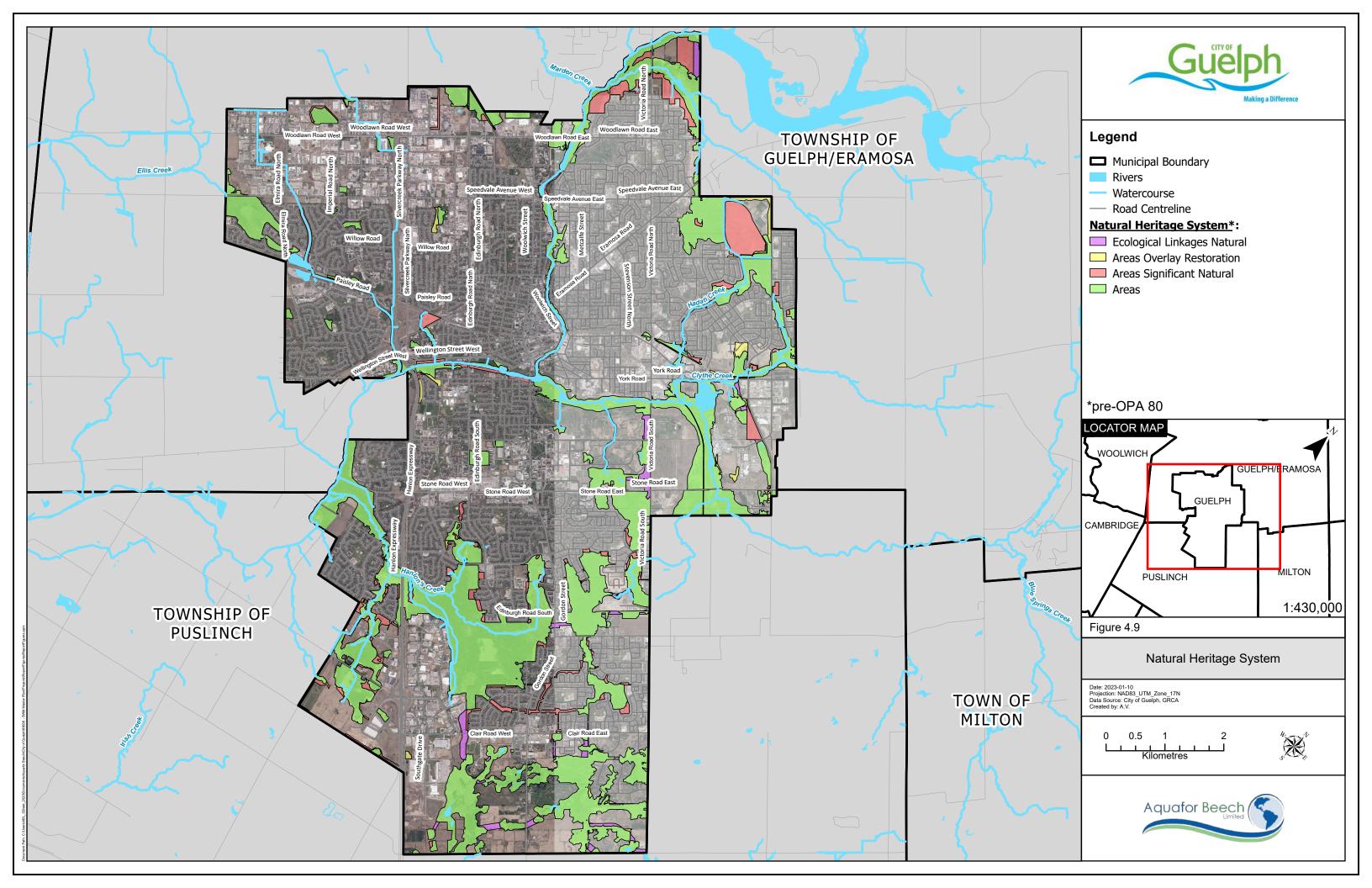
The City of Guelph's Official Plan (OP) provides a framework to guide the development of lands so that ecological processes, functions and significant natural features are protected, maintained, restored, and enhanced. The City is committed to:

- a) Protecting, maintaining, enhancing and restoring the diversity, function, linkages, and connectivity between and among natural heritage features and areas and surface and ground water features within the city over the long term;
- b) Maintain, restore, and, where possible, improve the Natural Heritage System (NHS) and will recognize the linkages between natural heritage features and areas, surface water, and groundwater features. Development will be prohibited within defined features in accordance with the provisions of the City's Official Plan; and
- Ensure that water quality and quantity is protected, improved or restored;

The City of Guelph's Natural Heritage System includes a combination of natural heritage features and areas, including Significant Natural Areas and minimum buffers, Natural Areas, Ecological Linkages, Restoration Areas, and Wildlife Crossings. The components of the City of Guelph's Natural Heritage System are included in **Figure 4.9**.







#### 4.2.8.1 Species at Risk

Components of the City of Guelph's NHS include Significant Habitat for Provincially Endangered and Threatened Species, Significant Wildlife Habitat, and Habitat of Significant Species. A comprehensive screening and assessment of Species at Risk (SAR) and other significant species and their habitat must take place as part of site-specific evaluations (e.g., EIS) in support of detailed design, future development or site alteration. Based on a preliminary review of background information, there are multiple rare or at-risk species that previously have been found within or in proximity to the City of Guelph. Although some of these species are likely to be restricted to existing greenspaces and NHS lands, some may be associated with anthropogenic structures, and others (e.g., Butternut, Black Ash, Snapping Turtle) occur in habitats that may overlap with SWM infrastructure and the connected drainage systems. Species associations, habitat impacts, and related regulatory/mitigation requirements must be evaluated as part of the detailed design and implementation of individual projects.

# 4.2.9 Stormwater Management Infrastructure

Municipal stormwater management infrastructure includes all SWM facilities (dry ponds, wet ponds, wetlands, hybrid facilities, greenways, and end-of-pipe infiltration facilities), oil & grit separators and holding tanks, and storm pipe networks and associated appurtenances, such as manholes, catch basins, leads, and outfalls responsible for the capture, conveyance, and control (water quality and quantity) of stormwater runoff.

#### 4.2.9.1 Storm Sewer Network

The stormwater conveyance network within the City includes storm sewers that are owned by the City, Province, Township of Guelph-Eramosa, or are within private property. **Table 4.2** identifies the ownership, size and installed quantities of all storm sewers within the City. The table shows that pipes of sizes less than 450 mm diameter represent the bulk of the storm sewer within the City.

Table 112. Existing Scottin Server Buttu 161 Gity and 1 11 table 1 1965						
Pipe Sizes (mm)	City of Guelph		Other			
	km	%	km	%		
Unknown size	0.00	0.0%	1.31	3.9%		
Less than 450	194.20	45.7%	7.21	21.3%		
450 - 550	78.02	18.4%	5.57	16.5%		
575 - 750	65.50	15.4%	2.74	8.1%		
800 - 1000	41.09	9.7%	3.28	9.7%		
1050 - 1200	21.64	5.1%	2.07	6.1%		
Greater than 1200	24.63	5.8%	11.59	34.3%		
Total	425.07	100.0%	33.77	100.0%		

Table 4.2: Existing Storm Sewer Data for City and Private Pipes

### 4.2.9.2 Stormwater Management Facilities

According to the City's GIS database, a total of 123 SWM facilities exist within the City of Guelph. Upon review of background information, another three (3) stormwater management facilities were identified within the City. Other revisions included: combining SWMF 118 and



119 into one facility (SWMF 118/119) and combining SWMF 16 and 113 into one facility (SWMF 113), as most of SWMF 16 was incorporated into SWMF 113. This results in a total of 124 facilities owned and operated by the City. Additional privately-owned facilities were not accounted for in this SWM-MP.

While the City's GIS layers, spreadsheets and database identified three types of SWM facilities (wet pond, dry pond, and greenway), the SWM reports identified two additional types, including infiltration facility and wetland. There were also several facilities that combined a wet or dry pond with an infiltration facility. A total of 36 facilities were re-classified based on the information available within the available design reports, design drawings, and as-built drawings. This reclassification is summarized in Table 4.1 of **Appendix B.** 

Of the 124 facilities, 95 provide both quality and quantity control, 20 provide only quantity control, and 7 provide only quality control. These 124 SWM facilities provide some level of control to 2,899 ha (46.6 percent) of the City. Of this area, approximately 1,746 ha (28.1 percent) are controlled for water quality, and 2,335 ha (37.6 percent) are controlled for water quantity.

Accordingly, there are approximately 3,318ha (53.4 percent of urban area) that do not have either water quality or quantity control. **Figure 4.10** summarizes the urban coverage of SWM facilities and OGS units.

**Figure 4.11** shows the location of the existing stormwater management facilities within the City of Guelph, including the contributing drainage area for each of the existing facilities as determined through GIS analysis. Within **Appendix B**, Appendix A summarizes the existing SWM facilities including their type, drainage areas, catchment imperviousness, and basic design features.

### 4.2.9.3 Oil Grit Separators (OGS)

There are 150 City-owned and 42 privately-owned OGS units currently in operation throughout the city. Many of these units are located within the catchments of SWM facilities which provide quality control, and therefore act as pre-treatment. However, the remaining OGS units are located in areas with no SWM control or areas with quantity control only, in which case they provide important water quality controls. City-owned OGS units provide standalone water quality treatment to 325 ha while private units provide 30 ha. **Figure 4.12** shows the location of the existing OGS units owned by the City.

#### 4.2.9.4 Source Control Facilities

Since its establishment in 2017, the City of Guelph has issued over credits to six applicants as part of its stormwater credit program. In 2019, the City approved 25 residential rain gardens through the rain garden rebate program.



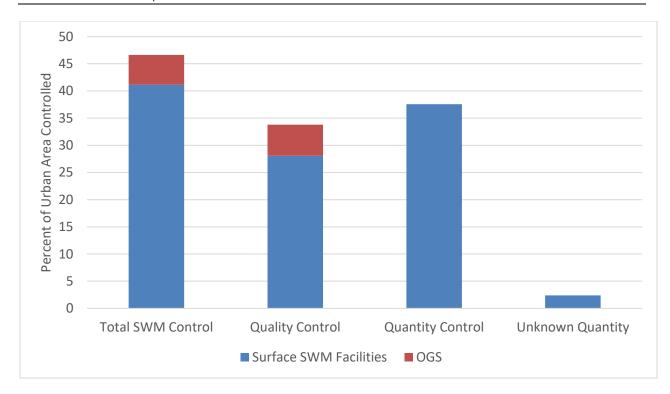
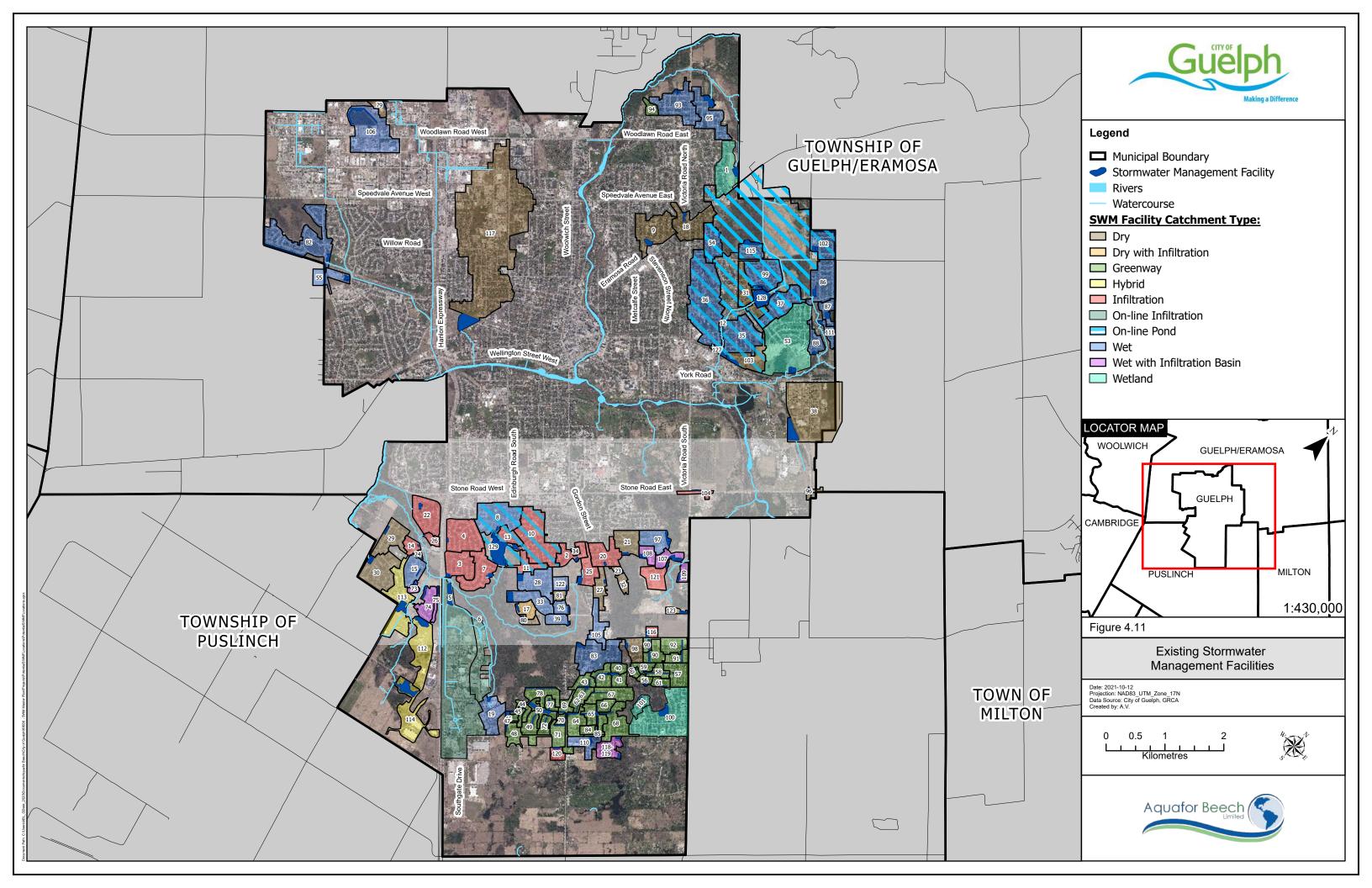


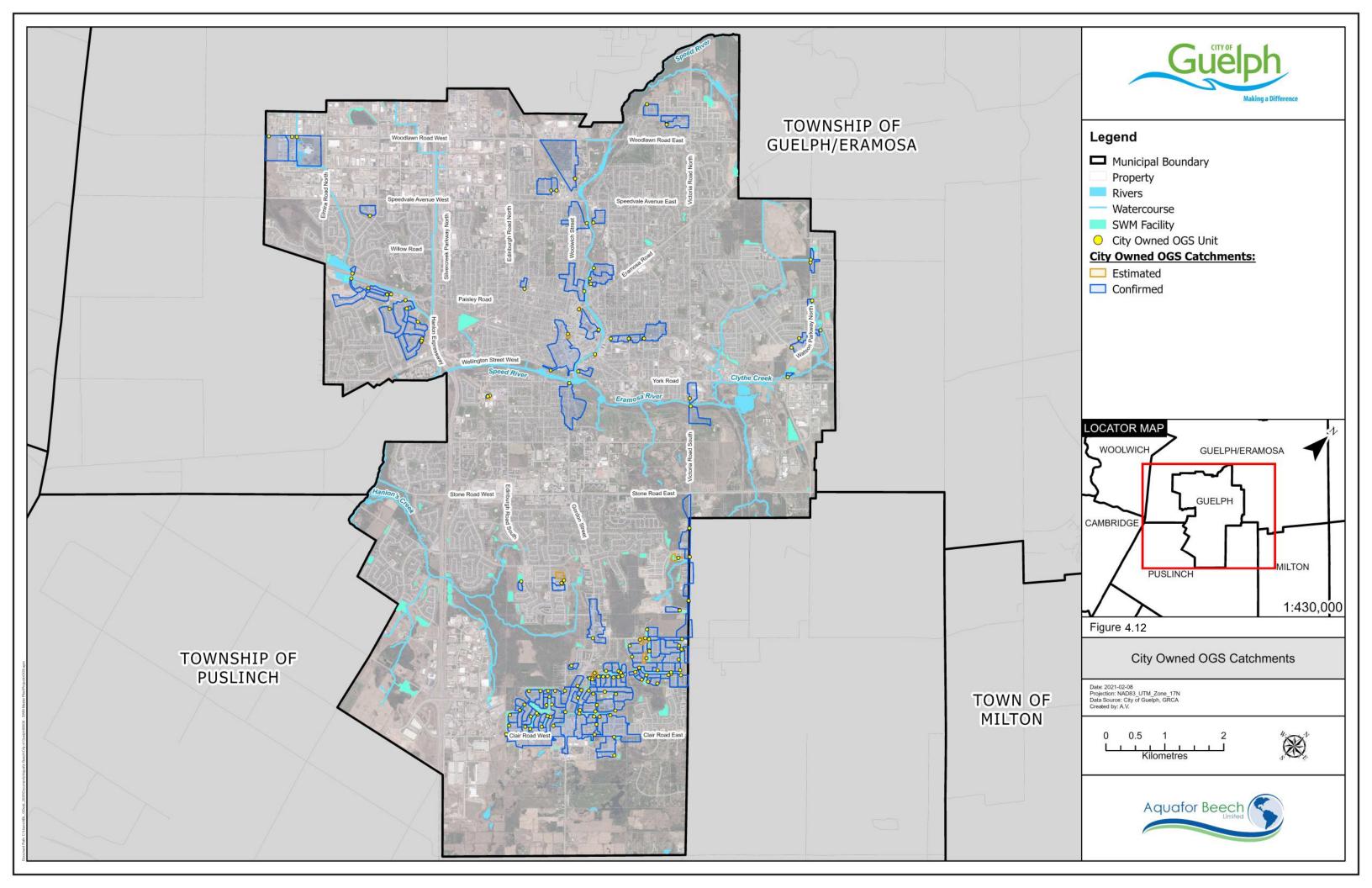
Figure 4.10: Percentage of City Controlled by SWM Infrastructure

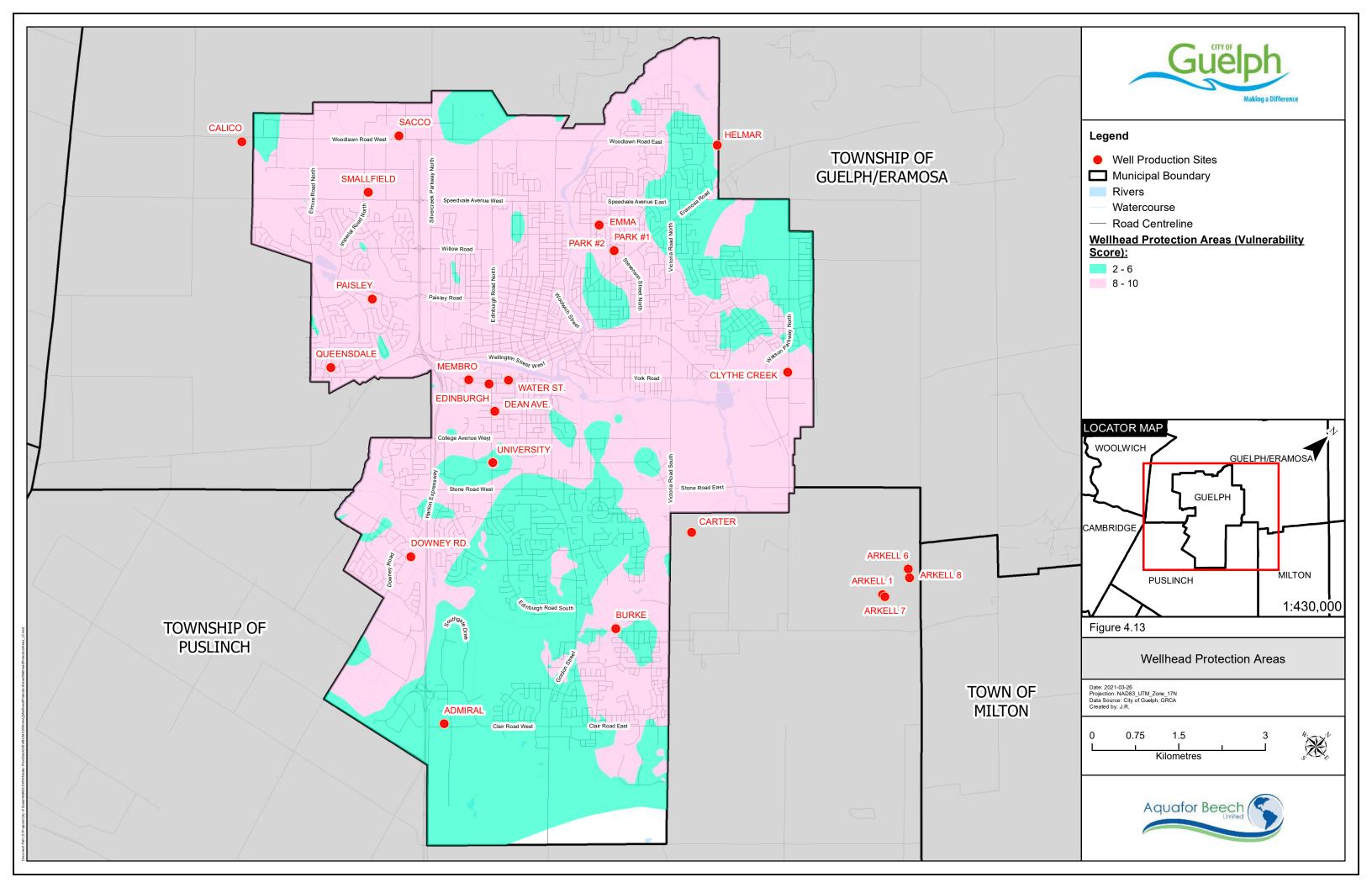
# 4.2.10 4.2.10 Water Supply

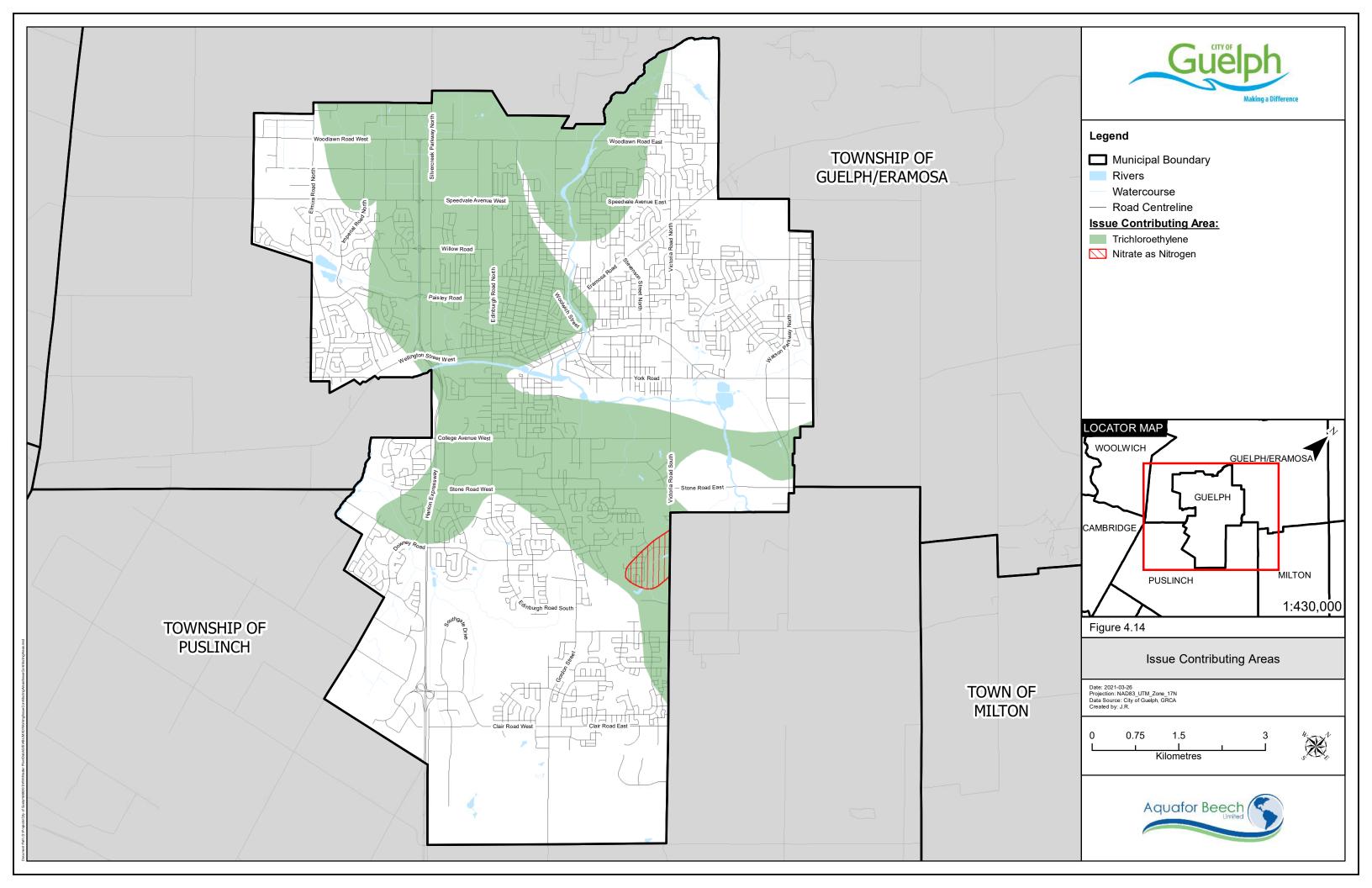
The City of Guelph is served by 21 operational groundwater supply wells and a shallow groundwater collector system called the Glen Collector System. Wellheads and associated Wellhead Protection Areas within or partially within the City are illustrated on **Figure 4.13.** Two Issue Contributing Areas (ICA) have been developed through Grand River Source Protection Planning in response to the identified levels and/or water quality trends associated with nitrate and trichloroethylene (TCE). These ICAs are shown on **Figure 4.14.** 











# 4.3 Existing Subwatershed Health

In order to evaluate the health of the subwatersheds within the City of Guelph, a report titled "Subwatershed Health Analysis (October 2022)" was prepared. This supporting technical document to the SWM-MP is included as Appendix C.

From the background information gathered and synthetized through the assessment of existing conditions, baseline subwatershed health has been developed for twenty-three (23) subwatersheds within the City of Guelph according to four (4) categories and their associated metrics, as described below:

- Terrestrial Ecology: wetland habitat; forest habitat; natural cover; and connectivity
- Aquatic Ecology: SWM quality control; SWM quantity control; and imperviousness
- Stormwater Management: erosion sites; management sites; and maintenance sites
- Erosion Condition: species richness; species intolerant of disturbance; habitat sensitivity;
   and channel habitat type

Existing conditions subwatershed scores were calculated by adding evaluation scores for each of the categories listed above. Existing conditions subwatershed scores are used to establish potential prioritization hierarchy to be confirmed through further assessment as part of the Implementation Plan (see **Section 13**). Four (4) levels of subwatershed priority were established, with thresholds delineated based on natural breaks in the data. The proposed Priority Subwatersheds 1 to 4 with associated scoring are graphically presented in **Figure 4.15**. **Figure 4.16** presents the proposed prioritization of subwatersheds.

#### 4.3.1 Priority Subwatersheds Synergies with City Plans and Policies

Priority subwatersheds are not intended to be addressed in isolation as part of the SWM-MP. The SWM-MP has been developed with full consideration for other Strategic Plans, Subwatershed Studies, Master Plans, Secondary Plans, Environmental Assessments and Policies. More specifically, many of the proposed SWM opportunities represent potential synergies with other studies and plans and should be considered as such. Implementation of SWM approaches should have regard for the following:

- Development Engineering Manual (2019) which outlines policies, procedures and standards governing the development process. Of relevance to the SWM-MP are the requirements for grading, stormwater management, maintenance and acceptance of SWM facilities, SWM monitoring, and site servicing.
- Parks and Recreation Master Plan (under development) will establish a vision for the
  next 10-20 years for activities that affect open space planning, parks operations and
  forestry, and recreation services, and will develop the action plans needed to achieve
  the vision. In developing the City of Guelph's Park Strategy, it will be crucial to
  recognize the opportunity for stormwater retrofits that parks can present.
   Stormwater management can be incorporated into existing and future parks via
  subsurface stormwater chambers, bioswales and bioretention facilities, and dry



stormwater management facilities. The SWM-MP considers opportunities to install new stormwater management facilities in existing parks.

- Transportation Master Plan (2022) provides direction for local transportation
  planning and decision-making. Integrating stormwater management functions is
  crucial to properly functioning transportation networks. Of relevance to the SWM-MP
  is the recommendation to develop a Complete Streets Design Guide to guide all future
  street design by 2023. The recommendations from the SWM-MP regarding LID
  implementation can be integrated into the Complete Streets Design Guide, including
  the development of standard cross-sections.
- Water and Wastewater Servicing Master Plan (under development) evaluates the
  City's water distribution and wastewater collection infrastructure. The Plan accounts
  for Guelph's projected population growth, defines needed increases to the current
  system's capacity, identifies technological advances and opportunities for improving
  efficiency, and addresses changes in government legislation. The recommendations
  from the SWM-MP may impact certain active or decommissioned water and/or
  wastewater infrastructure.
- Asset Management Plan (2021) contains corporate asset inventories and conditions
  rating, and allows for illustration of how planned expenditures to renew assets effects
  the performance of the asset during a 10-year and 25-year forecast. Stormwater
  Management (SWM Facilities) and storm collection (storm sewers) are each identified
  as asset groups in the AMP. The Asset Management Plan identifies that the SWM-MP
  will be needed to confirm technical levels of service regarding resiliency to the 5-year
  and 100-year storms. The AMP identifies that the present funding allocation for
  stormwater capital, operations and maintenance is insufficient to complete all
  identified required work.
- **Stormwater Rate By-Law (2021)** imposes a stormwater charge on property owners within the City. This stormwater fee funds the stormwater program at a rate of approximately \$10 million annually in 2022-2023.
- Stormwater Service Rebate and Credit Program (2017) provides an opportunity for property owners to receive a rebate or reduce their stormwater charge by applying best management practices.
- Natural Heritage Action Plan (2018) identifies the management of stormwater runoff as crucial to protecting ecosystems, and encourages effective management of stormwater to maintain or enhance the water resources of the city. Opportunities identified in the Action Plan include improved management of the natural heritage system and water resources based on increased knowledge and capacity to integrate effective green infrastructure principles. The Action Plan recommends the development of Guelph-specific LID standards for stormwater management to assist development and capital projects in integrating alternative designs for supporting



water quality and quantity. It also recommends an expansion of the stormwater management monitoring program, which includes monitoring the downstream health of receiving watercourses. Lastly, the Action Plan recommends creek restoration opportunities to help restore water quality and fish habitat. The approaches of the SWM-MP represent an opportunity in regard to areas designated for restoration.

- Grand River Source Protection Plan (Effective February 15, 2022) Drinking water source protection plans identify the risks to municipal water quality and water supplies, and the policies and programs that will reduce the risks. Volume II of the Grand River Source Protection Plan covers the Region of Waterloo including the City of Guelph. Specific policies relating to Stormwater Management within Wellhead Protection Areas (WHPA) and Issue Contributing Areas (ICA) can be found from policy CG-MC-15.
- **Grand River Water Management Plan (2014)** addresses the issues faced by the Grand River watershed. The goals of the plan are to: improve water quality to maintain river health and reduce the impact of the Grand River on Lake Erie; ensure water supplies for communities and ecosystems, reduce flood damage potential, and increase resiliency to deal with climate change. Many agencies share the responsibility for managing water resources. In 2009, they agreed to develop a new plan to address today's most important issues: population growth, climate change and the impacts of extensive agriculture. The plan was developed through a collaborative process.
- City-led Subwatershed Studies The City is currently developing the Clythe Creek Subwatershed Study, and has plans to complete additional subwatershed studies in the coming years, in addition to those studies already completed (see Section 4.1). These studies will also develop implementation plans which should be considered by the City.
- Wastewater As part of the study entitled Assessment of Future Water Quality Conditions in the Grand and Speed Rivers (Water Management Plan Assimilative Capacity Working Group, January 2012), a number of water management scenarios were developed which incorporated wastewater treatment plant upgrades in current municipal wastewater master plans, wastewater treatment plant optimized performance targets and, most relevant to the City of Guelph SWM-MP, urban non-point source load reductions ranging from 20 per cent to 40 per cent. The report notes the need for integration of watershed resources as it relates to wastewater and stormwater. The SWM-MP provides insight, options and management approaches to address the above noted needs and deficiencies.

Throughout the SWM-MP and supporting technical documents (**Appendix A to T**), the potential synergies with the above noted plans and policies are noted and the methods and approaches for integration with the objectives of this master plan are discussed.



Integration across City departments is the corner stone of a modern approach to stormwater management and will be essential for the City of Guelph in the implementation of the SWM-MP in order to maintain and improve the condition and health of the City's subwatersheds.



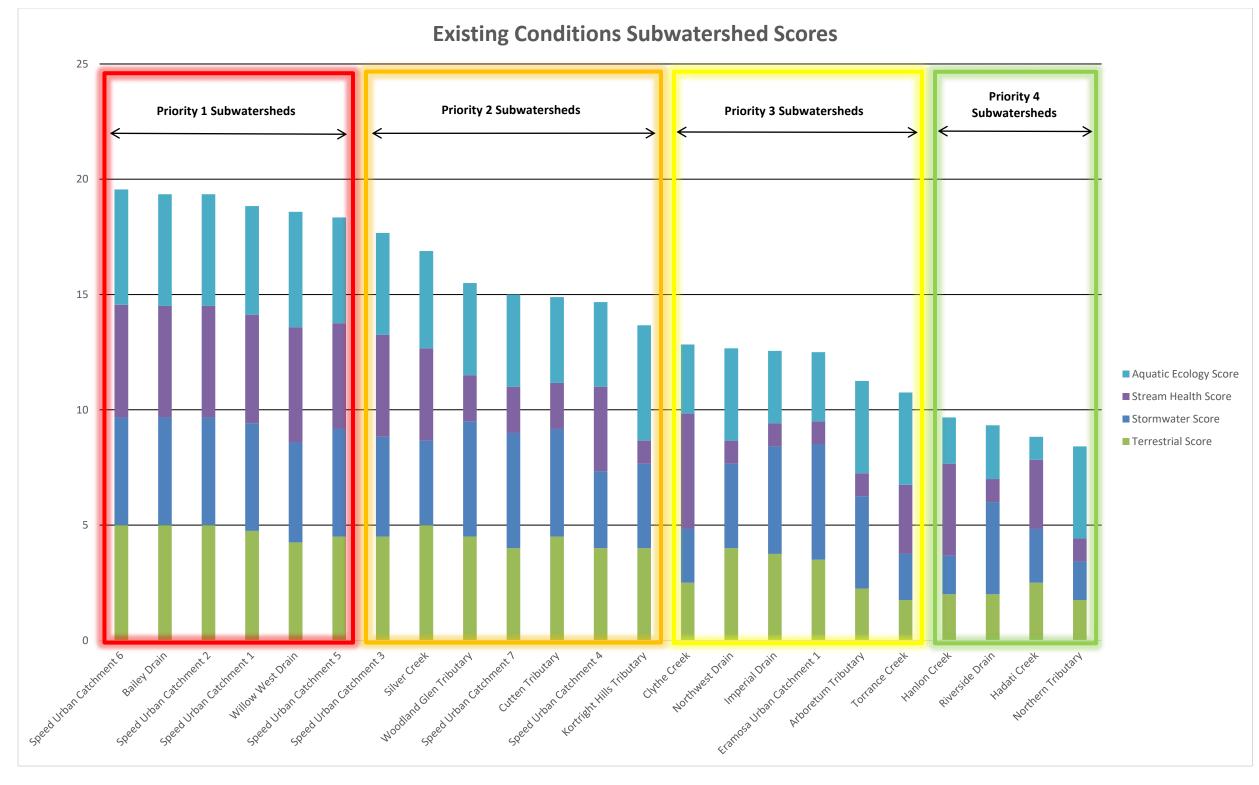
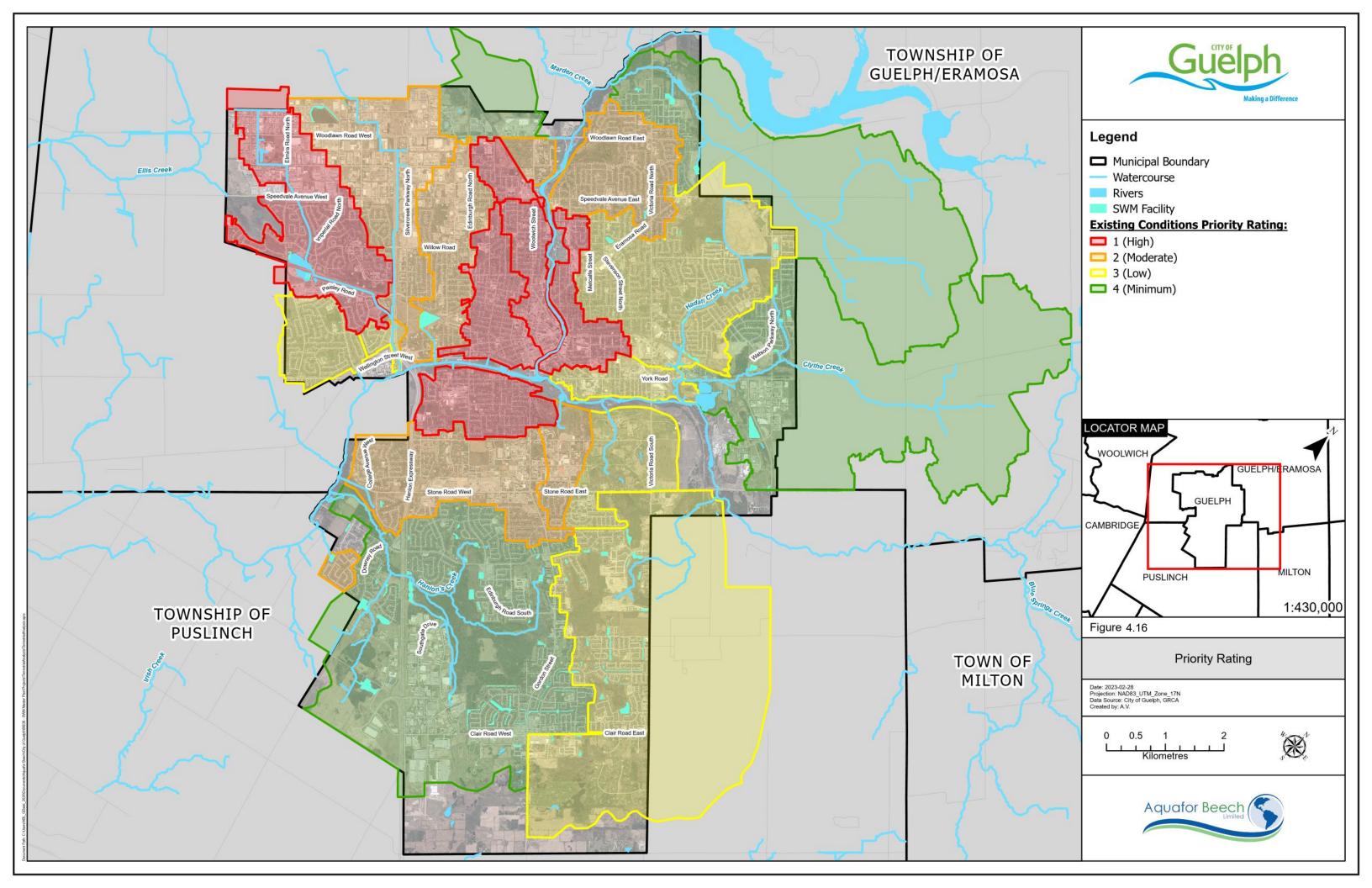


Figure 4.15: Evaluation of Existing Conditions Priority Rating





# 5 Development of Stormwater Management Options

The approach for developing and evaluating alternatives is consistent with the requirements of the planning process for Master Planning projects as outlined by the Municipal Engineer's Association Municipal Class Environmental Assessment (MEA), October 2000, as amended in 2007, 2011, 2015 & 2023. That is, any problems or opportunities identified during the Master Planning process will have alternatives prepared to address them and a preferred alternative, strategic or approach selected for each deficiency.

The EA involves reviewing Phase 1 work (i.e. Identification of the Problem) and undertaking Phase 2 (i.e. Establishing Existing Conditions, Identification of a Long List of Alternatives, Development and Assessment of Alternative Management Strategies and Selection of a Preferred Strategy). Consultation with stakeholders is also a necessary and important component of this process.

When looking to address the problem statement and any identified deficiency, stormwater management practices and options can be used to:

- Improve surface water and groundwater quality,
- Prevent thermal enrichment of surface water,
- Decrease sediment loads to surface water,
- Reduce adverse effects on human and animal health,
- Prevent the loss and degradation of habitat, natural features and processes,
- Reduce flooding and erosion,
- Prevent disruption of the pre-development hydrologic process (reduction in groundwater recharge and stream baseflow), and
- Reduce the occurrence of Urban flooding.

# 5.1 Municipal Pollution Prevention, Operations & Maintenance Practice Options

Municipal Pollution Prevention Measures, Management and Operational Practices are methods that have the intent to improve operation and maintenance of privately and publicly owned land, buildings, and infrastructure that will reduce pollution generation. Certain municipal programs such as road salt management, street sweeping and parks maintenance activities (elimination of the broad use of herbicides and pesticides) are known to improve water quality.

Applying Municipal Pollution Prevention Measures, Management and Operational Practices measures often include changing behavior, altering current practices and providing educational programs. These measures and practices are not site-specific and can be generally applied over a subwatershed or municipal boundary to prevent sources of pollution from entering the drainage system. Several Municipal Pollution Prevention Measure, Management and Operational Practices are described below.

**Pollution Prevention Plans** - Promote pollution prevention techniques that are applied in collaboration with the GRCA and the MECP to minimize the potential for spills and contaminated runoff from entering the storm drainage network, and ultimately to local watercourses and/or groundwater, the source of Guelph's drinking water.



**Control of De-icers** - Sensible and conservative use of de-icing compounds, e.g. reducing de-icing chemical application rates to minimum amounts necessary to perform the job and use of alternative de-icing materials (to sodium chloride) that can be more effective and can be used in lesser amounts. This includes the development and use of Salt Management Plans and applicator training through such programs as the Region of Waterloo's smart about salt™ program. The City of Guelph currently has a salt management plan in place.

**Control of Pesticides and Fertilizers** – Can include alternatives for pest and weed control, including the use of beneficial insects, companion plantings, alternative spray compounds and non-toxic substances. In regard to existing laws:

- Per O.Reg 63/09 and the Pesticides Act (R.S.O 1990, C. P.11), it is illegal in Ontario to use Class 9 pesticides to kill weeds and insects on lawns, vegetable and ornamental gardens, patios, driveways, parks and schoolyards. Class 9 pesticides ingredients include 2,4-D, Diazinon and glyphosate. Class 9 pesticides are banned for cosmetic purposes because they may pose an unnecessary risk to human health, particularly children's health.
- A provincial fertilizer ban currently does not exist, however several nutrient limited watersheds in North America, including the Lake Simcoe watershed, have implemented or are considering fertilizer bans for non-agricultural purposes.

**Enforcement of By-Laws** - Prevents impact to the quality of water resources through enforcement of municipal by-law such as: City of Guelph property standards, weed control, and garbage. They can also include: Debris and Anti-Litter policies to prohibit, for example, the illegal throwing of refuse and debris; Storm Sewer By-Laws to prevent the discharge of harmful substances to municipal and private storm sewer systems which ends up in our creeks and rivers; and Erosion and Sediment Control By-laws to prevent sediment from entering a body of water.

Household Hazardous Waste Collection & Used Oil Recycling - Collection of deleterious chemicals such that they are disposed of in a manner that does not threaten stormwater quality and the environment. Used oil recycling is a responsible alternative to improper disposal practices. Arrangement must be made for collection and delivering wasted oil to a recycling facility. Hazardous household waste and used oils is currently accepted at the City's Waste Innovation Centre. In addition, many commercial retailers accept used motor oils at no charge.

**Safer Alternative Products** – Promotes the use of less harmful and environmentally damaging products which can reduce the amount of toxic and deleterious substances entering stormwater and reaching receiving waters.

**Materials Storage Controls** - Concerns material delivery and storage for municipal and commercial operations. This can include reducing the storage of hazardous materials on site, storing materials in designated areas, installing secondary containment, conducting regular inspections and training employees and subcontractors.

**Pool Drainage** - Drawdown of pools prior to winter may release a large volume of water, chlorine and salt (with the increase in the use of salt water pools) that may be toxic to aquatic



life. Actions can include providing advice or requiring pool drainage to be undertaken in an environmentally acceptable ways (e.g. emptying pool at least 3 days after the last chemical application).

**Modifying Engineering Standards** - Reduces pollutant loading near the source through filtering or absorbing of pollutants, and reduces runoff by encouraging infiltration. Changes to engineering standards can serve to promote the use of Low Impact Development (LID) techniques which include provisions for surface storage and directing drainage through vegetated areas.

## **5.1.1** Municipal Management & Operational Practices

The following details municipal management and operation practices.

**Storm Sewer Flushing** - a storm drain is "flushed" with water to suspend and remove deposited materials. Flushing helps ensure pipes convey design flows and removes pollutants from the storm sewer system. The City of Guelph currently undertakes storm sewer flushing on an asneeded-basis.

**Catch Basin Cleaning** - catch basin and stormwater inlet maintenance is typically done on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system and restore the catch basin's sediment-trapping capacity. Maintenance program can reduce loadings to existing stormwater management ponds and surface water. The City of Guelph currently undertakes catch basin cleaning on an as-needed-basis.

**Sediment Removal** – involves the regular removal of sediment from municipal stormwater infrastructure such as oil and grit separators (OGS) and SWM facilities. The City of Guelph is legislatively required to perform regular inspection and maintenance, including sediment removals, of all city owned OGS and SWM facilities, per the conditions of the respective MECP Environmental Compliance Approval (ECA).

**Street Sweeping** - Regular street sweeping can reduce the build-up of pollutants on street surfaces and prevent mobilization during rainfall events. The City of Guelph currently has a street sweeping program.

**Erosion and Sediment Control** - For construction sites where erosion and sedimentation rates are usually very high, this approach aims at the prevention of erosion and containment of sediment from leaving the site boundary. The City of Guelph currently has an erosion and sediment controls program as part of the normal development process.

**Leaf Pick-up and Removal** – Reduces the discharge of nutrients and pollutants to stormwater from street surfaces by leaf clearing and removal during the fall and/or spring periods. This municipal action reduces the nutrient load in the storm sewers, stormwater ponds, and the creek system, which enhances overall water quality. The City of Guelph currently has a leaf pick-up and removal program.



**Cross Connection Control Program** - Prevents unwarranted physical connections to the storm drain system from the sanitary and floor drains through regulation, regular inspection, testing and education. The City of Guelph currently has a cross connection control program as part of building inspection, permitting and normal development process.

**Public Education** - Informs the public about pollution prevention and stormwater management issues, solutions, regulations and related financial incentives. This approach involves the public in remedial actions to achieve cost savings though volunteerism, and increase political support. In addition, the City has offered public education through REEP Green Solutions and the RAIN program (a stormwater education and action program created by Green Communities Canada).

**Business Education and Awareness** - promotes education of the business and industrial community as to the impact of pollution on the environment and the runoff pathways of pollution in an industrialized watershed. This approach fosters an environment where expertise and information can be shared on pollution prevention at source.

**Yellow Fish Road Program** - Stenciling of storm drain system with warnings/advisories and graphic icons discourages the illegal dumping of unwanted materials. The City of Guelph currently participates in the Yellow Fish Road Program in partnership with Trout Unlimited Canada.

**Snow Plowing and Storage** – The City is responsible for removing snow when accumulated snow exceeds the onsite storage capacity of road rights-of-way and municipal properties. Snow can be contaminated with salt, oil, grease, and heavy metals so it must be handled and stored in ways that protect water sources. The City has established a licenced snow storage facility.

#### **5.1.2 Summary**

The Municipal Pollution Prevention Measures, Management and Operational Practices listed above have been included here to promote better housekeeping. Many measures and practices listed above are part of existing municipal programs by the City of Guelph and/or are preventative rather than treatment measures and therefore are not considered further for the purposes of the Class Environmental process followed in this report.

Specific measure and practices which are discussed further within the SWM-MP include:

Sediment removal (OGS and SWM facilities).

## **5.2 Source Control Measure Options**

Source control measures are small-scale stormwater management techniques located at the beginning of a drainage system where stormwater is captured and treated on-site or close to where the rainfall lands. Due to the relatively small area treated by an individual measure, source controls must be well distributed to treat stormwater runoff effectively.

These measures are generally installed on private property within residential, commercial, industrial and institutional land uses, but can also be installed within municipal lands such as



parks, trails, municipal buildings and facilities. Source control measures provide treatment for the stormwater generated by roof, driveway, landscape and parking areas.

Source control measures remove pollutants from stormwater through a variety of mechanisms, including mechanical filtration, biological uptake, adsorption, infiltration and settling/detention. These measures can exhibit a wide variability in their ability to remove pollutants, generally ranging between 60 per cent and 80 per cent in efficiency depending on the particular measure and the type of pollutant being analyzed.

Despite the emphasis on source control in most recent stormwater policy and guidelines documents, systematic implementation of these measures throughout a municipality has not yet occurred in Canada. The implementation of a variety of source control measures has however become more common in the last decade as is exemplified in the City of Guelph through the Stormwater Credit program. Acceptance and promotion of this approach to stormwater management offers considerable promise in achieving the goals and objectives of the SWM-MP.

#### Source control measures include:

- **Disconnection of roof leaders:** A relatively simple source control measure is to disconnect the roof leader from the municipal sewer so that the relatively clean rooftop drainage can be treated on a permeable ground surface and/or used as a resource for on-site purposes. The simplest forms of roof leader disconnection are to the lawn or garden; to a depressed area in the lawn or garden; or to another SWM practice such as a rain barrel.
- Absorptive landscapes: In residential and commercial land uses, absorptive landscape
  areas can be placed in the front or back of building where they will capture
  'disconnected' rooftop and yard drainage and in doing so will prevent relatively clean
  stormwater from entering the conventional stormwater infrastructure system and
  mixing with more contaminated stormwater.
- **Bioretention areas**: Bioretention facilities capture, temporarily store, and treat stormwater runoff by passing it through an engineered filter media.
- **Reduced lot grading**: The grading in manicured yards or other green space areas can be reduced from the standard 2 per cent or can incorporate micro-grading (creation of small depressions or circuitous drainage pathways) to encourage infiltration.
- Permeable pavements: Driveways, parking lots, trails and sidewalks can be designed
  using permeable pavements to allow rain water to drain through the pavement and into
  the ground.
- Soakaway pits / infiltration trenches: These techniques provide for infiltration of roof drainage into the ground by directing the rain water from roof leaders to an underground infiltration trench referred to as a 'soakaway pit'.



- **Green roof technology**: Are constructed on top of buildings to reduce runoff volume (via increased evapotranspiration), improve water quality and reduce energy usage.
- **Rainwater harvesting**: Rainwater harvesting (RWH) is the practice of intercepting, diverting and storing rainfall in an above- or below-ground storage tank for future use.
- Soil amendments: Compost amendments are tilled or mixed into existing soils thereby
  enhancing or restoring soil absorption and infiltration properties by reversing the loss of
  organic matter and compaction.
- Conservation of trees and other areas of natural vegetation: A mature tree canopy can reduce stormwater runoff volume, peak flows, improve water quality, generate organic soils, absorb greenhouse gases, create wildlife habitat, and provide shading to mitigate temperature increases at development sites. Other areas of natural vegetation can provide similar benefits.
- Oil and grit separators (OGS): OGS units are a pre-manufactured device used to trap and retain oil and/or sediment in detention chambers. These units are located either at the beginning of a storm sewer (pre-treatment or source control) or at the end of a storm sewer (end-of-pipe control).

## **5.3** Conveyance Control Measure Options

Conveyance control measures are measures that are designed to treat stormwater as it travels overland or through pipes to the downstream outlet.

Traditional conveyance systems are typically comprised of curbs, gutters and buried concrete (or other) piping systems that carry stormwater away from a development area to a water body generally along the road network. In appropriate applications, alternative conveyance control measures can be used to improve water quality conditions at lower cost to the municipality. Because the municipal right-of-way (ROW) account for a significant share of a community's impervious surfaces, conveyance control measures present an important opportunity to improve downstream water quality conditions (e.g. sediment, nutrient, bacteria, oil/grit, thermal impact reduction, etc.), promote groundwater recharge and minimize watercourse erosion.

Non-traditional conveyance control such as Low Impact Development (LID) measures can provide stormwater treatment for the collected drainage concentrated within the ROW of a municipal road (or regional road). LID conveyance controls are linear stormwater transport systems that are generally located within the road right-of-way (ROW) of private and public roads where they encourage infiltration of water into the ground, improve water quality and reduce runoff. The suitability of LID conveyance controls depends on many environmental and planning considerations, including soil conditions, ROW size and characteristics, and implementation considerations.



Traditional conveyance controls are well understood, are regularly applied within the City of Guelph and are part of the existing City standards. LID conveyance control measures, however have had limited application in the City. LID conveyance controls are described in the following sections which include:

- **Bioretention** As a stormwater filtration and infiltration practice, bioretention temporarily stores, treats and infiltrates runoff. Bioretention in the ROW can be further separated into:
  - Boulevard Bioretention
  - Bioretention Bump Outs (Curb Extensions)
  - Bioretention Planters
- **Bioswales** Bioswales are vegetated open channels designed to convey, filter, and attenuate stormwater runoff.
- **Perforated Pipe** Perforated pipe systems are long infiltration trenches that are designed for both conveyance and infiltration of stormwater runoff.
- Permeable Pavements Permeable pavement includes pervious concrete, porous asphalt and permeable interlocking concrete pavers (PICP). Permeable pavement can be used in place of conventional asphalt or concrete pavement.
- Vegetated and Enhanced Swales Grass channels allow infiltration, discharge at a lower rate, and reduce pollutant loads. Swales are most frequently applied for drainage alongside roads, highways, and parking lots however they are also well suited for use in conjunction with drive-lanes and rooftop drainage as well as within pervious surfaces, such as parks and landscaped areas.
- Proprietary Stormwater Quality Treatment Devices Proprietary stormwater quality treatment devices cover a broad range of technologies that can be used to treat runoff from the municipal ROW.

## 5.4 End-of-Pipe Measures (SWM Facilities) Options

End-of-pipe measures are the most commonly used stormwater management measure in most municipalities. These measures provide treatment for the collected drainage at the end of conveyance system prior to the discharge of stormwater to a watercourse. End-of-pipe measures are typically implemented in urbanizing areas as a requirement of development. Typical end-of-pipe measures used to treat stormwater include stormwater ponds (dry or wet), wetlands, hybrid facilities and/or subsurface storage facilities.

In end-of-pipe measures which have a wet component, a permanent pool of water provides the water quality treatment. This permanent pool promotes the settling of sediments and pollutants to the bottom of the facility as stormwater travels through the facility. Provided the facility is functioning properly and is well maintained, sediments and pollutants will not be transported downstream of the facility. To optimize pollutant removal capacities, design



engineers usually aim to maximize the distance that stormwater must travel through these facilities so that a larger percentage of the suspended solids will fall out of suspension. In general, a larger volume of water utilized for water quality storage will enhance performance; however, suspended solids removal performance becomes asymptotic with increasing design storage (there is a limit to storage beyond which there are negligible increases in suspended solids settling).

Reductions in construction, operations and maintenance costs can be realized when end-ofpipe measures are designed as large centralized facilities that treat the collected drainage from as much upstream development area as is realistically possible. It should be noted that this approach is not always feasible in existing urban areas.

End-of-pipe (SWM facilities) measures include:

- Wet Ponds Wet ponds contain a permanent pool of water and store a specific volume of water to provide water quality treatment and also address issues related to erosion and flooding.
- **Constructed Wetlands** –These facilities may be effective in improving water quality and reducing downstream erosion potential, but their role in water quantity control is limited because of their limited storage volume and shallow water depth.
- Hybrid Wet Ponds / Wetlands A system design using a combination of wet ponds and constructed wetlands. Hybrid facilities require a wet pond to be constructed in series with a wetland.
- Dry Ponds Stormwater dry ponds, which are dry except during rainfall events, are
  designed for erosion and flood control. These facilities may not provide water quality
  control.
- **Subsurface storage facilities** capture and store stormwater collected from surrounding impervious areas. Storm sewers direct runoff to subsurface vaults or systems of large-diameter interconnected storage pipes or chambers.
- Oil and Grit Separators (OGS) Discussed previously in Section 5.3, when located
  upstream of a storm sewer outfall at the terminus of the storm sewer network, OGS
  units can be considered an end-of-pipe treatment facility.

# **5.5 Watercourse and Erosion Restoration Options**

Watercourse and erosion restoration measures are designed to address erosion and flooding problems and restore stream functions and stability. They are generally applied on a stream reach basis and include stream rehabilitation using natural or engineered channel design principles and naturalization of stream riparian zones using native materials. They may also include individual approaches such as streambank re-grading, gradient controls and floodplain contouring to address specific erosion and flooding problems. This approach can also include instream practices, such as outfall restoration, riparian plantings, and open space re-vegetation



to improve the function of stream corridors. These approaches improve water quality, slow runoff, moderate stream temperatures, reduce erosion and improve aquatic and terrestrial habitat conditions.

Ecological restoration measures enhance the ability of the natural environment to improve water quality and to prevent watercourse erosion from further degrading water quality. Existing natural areas provide valuable ecological services, such as quality and quantity treatment of stormwater at no cost. If an existing natural area is degraded, it may be possible to restore the area and regain lost ecological services. Restoration of degraded habitats may be done in a number of ways. Representative restoration / enhancement programs are summarized below.

Watercourse and erosion restoration measures can include:

- Local Bank or Slope Stabilization Works Local works reduce the level of risk by applying local bank or slope stabilization treatments using either hardened (engineered) type treatments, or more natural (vegetation and biotechnical engineered) type treatments. The intent of these works is to protect the adjacent features at risk (i.e., residential properties and infrastructure), both now and in the future, by anticipating channel activity that may occur in the vicinity of the at-risk areas.
- Reach-Based Works These include measures designed to address erosion and flooding problems and restore stream functions and stability. They are applied on a stream reach basis. Stream restoration programs include stream rehabilitation using Natural Channel Design (NCD) and Geomorphic Referenced River Engineering (GRRE) generally referred to as a hybrid type design. An important component of these projects is naturalization of stream riparian zones using native materials. They may also include individual structures, such as streambank re-grading, gradient controls and floodplain contouring to address specific erosion and flooding problems. These programs are often integrated with components for aquatic habitat enhancement such as spawning habitat creation, refuge pool construction, undercut bank structures, boulder placements, half log cover structures, and flow deflectors.
- Removal of Risk These measures involve the removal of risk (i.e., infrastructure) away
  from the channel. This alternative addresses the reoccurring issues associated with
  infrastructure and watercourse interactions, and looks at possible approaches of
  removing the interaction to provide the creek with sufficient space to naturally adjust
  and migrate without posing risks to municipal infrastructure or private property.

#### 5.6 Urban Flood Management & Stormwater Infrastructure Options

These include a variety of structural and non-structural measures associated with the storm sewer system to alleviate urban flooding resulting from capacity issues within the existing storm sewer network. Structural and non-structural approaches include:



- Local Remedial Measures These measures, if properly implemented, can be highly
  effective in reducing urban flooding and can provide a high level of protection for
  individual properties. They are typically recommended for isolated cases of urban
  flooding. They include but are not limited to:
  - Backflow Prevention with or without Sump Pump is an effective solution for individual properties to prevent basement flooding due to sewer surcharge.
     They require installation within individual properties and also require sporadic maintenance by home owners. Implementation can require financial assistance.
  - Sump Pump for Foundation Drains involves the disconnection of foundation drains from the sewer system to prevent hydrostatic pressure due to sewer surcharge. Also reduces inflow and infiltration (I/I) in cases of drain connections to sanitary sewer. They require installation within individual properties and also require electrical backup supply to work under power failure.
  - Lot Regrading effective in reducing local flooding and high inflow and infiltration (I/I) to foundation drains. Care must be taken due to the potential increase in overland flow and potential flooding to adjacent properties.
  - Rain Barrel reduces storm runoff by promoting re-use of roof runoff (also thus reduces municipal water consumption). Requires co-operation of home owner, so implementation may require financial assistance.
- System Storage (in-line/off-line sewers) involves the construction of off-line sewers parallel to the existing storm sewer or underground storage facilities to provide additional storage and flood relief. Effective in regulating/moderating peak flows at locations where the capacity of a storm sewer is inadequate. This approach allows some flexibility regarding location of construction, which is generally less extensive than a full storm sewer replacement. Operations and maintenance requirements are less than for underground storage tanks. This approach does not require open space for implementation but does require favorable hydraulic conditions of the existing sewer for optimal operation and minimal maintenance.
- Inlet Control Devices are used to control flow into the storm sewer during peak flow events. They are designed to allow a specified flow volume out of an individual catch basin at a specified head and cause the excess stormwater to be temporarily stored above ground. This approach is effective in controlling the storm water entering the storm system provided an adequate major system exists.
- **Pipe Upgrade (pipe replacement/ twinning)** highly effective in preventing surcharge of existing combined sewer system, however often represents the highest capital cost due to significant construction requirements.
- **Internal Diversion** this approach focuses on balancing flows within the existing storm sewer system by utilizing spare capacity in other parts of system to accommodate more intensive storms. Internal diversion typically requires minimal construction.



# 6 Technical Assessment: Municipal Pollution Prevention/ Management/Operational Practices

Municipal Pollution Prevention, Management and Operational Practices are important to ensure pollutants are prevented from impacting the environment and to ensure stormwater infrastructure maintain their effectiveness. In order to understand and assess the existing and future Municipal Pollution Prevention, Management and Operational Practices, a technical analysis was completed regarding OGS units. This technical report is included within the report's appendices and is summarized in the following sections.

Sediment accumulation within City of Guelph Oil and Grit Separators (OGS) units was assessed in a memo titled "Preliminary Recommendations for Existing Stormwater Facilities and OGS Units (January 2022)". This supporting technical document to the SWM-MP is included as Appendix D.

The SWM-MP explored approaches to manage pollutants and sediment within the City's stormwater management infrastructure in the most cost-effective manner. The following studies and resulting recommended works are Exempt from the Municipal Class EA process, and therefore, are pre-approved.

## **6.1** Existing Practices

The should continue the use and implementation of existing programs including, but not limited to:

- Control of de-icers;
- By-law enforcement;
- Household Hazardous Waste Collection & Used Oil Recycling;
- Storm sewer flushing;
- Street sweeping;
- Erosion and sediment control;
- Leaf Pick-up and Removal;
- Cross Connection Control Program;
- Public and business education;
- · Yellow Fish Road Program; and
- Snow Plowing and Storage.

Other practices, not investigated by the SWM-MP, which could be implemented by the City include:

- Fertilizer bans for non-agricultural purposes; and
- City-wide catch basin cleanouts on a regular schedule (e.g., every 5 years).

#### 6.2 Sediment Removal from OGS Units

The following summarizes the study findings and recommendations based on the OGS results. For full details regarding the study and results refer to **Appendix D**.



- The City inspects each OGS unit on an annual basis and records sediment depth. Based on the measured depth, cleanouts are triggered.
- On average, OGS units are cleaned out every three years. Allowing for a contingency of 5 OGS units, it is recommended that the City clean out at least 55 OGS units per year, not counting any new OGS units which may be recommended as part of the SWM-MP.

# 7 Technical Assessment: Private Property Strategies (Source Controls)

In order investigate the opportunities and constraints of private property source controls, and determine an integration strategy within the City of Guelph, three technical reports were prepared in support of the SWM-MP, including:

- Stormwater Infiltration Policy Recommendations (November 2022) Appendix E
- Stormwater Design Criteria and Targets (December 2022) Appendix F
- LID Implementation Strategy (March 2023) Appendix G

Source control measures fall outside of the Municipal Class EA process, since they are to be constructed on private property, often by the individual land owner as a retrofit or during development/ redevelopment (i.e. the City is not the proponent). This precludes source control measures from the requirements of the Class EA process.

## 7.1 Background and Context

Securing at-source control of stormwater and pollution prevention requires the participation of private property owners in the residential and business sectors. Toward this end, with the approval of council in 2017, the City established a stormwater utility fee. The City also established a credit program of up to 50% of the fee for industrial, commercial, institutional, and multi-residential properties (ICI) to encourage land-owners to implement on-site stormwater mitigation and pollution prevention measures. A rain garden and rainwater harvesting rebate program was also implemented, which is also available to all residents.

Uptake of the stormwater credit and/or rebate programs has been limited. As of 2020, only 16 properties had applied for and received payment through the rain garden rebate program. Similarly, only 6 applicants (representing 18 utility accounts) have applied for and received stormwater credits between April 30, 2018 and January 4, 2020.

### 7.2 Policy Considerations & Decision Framework

To protect local groundwater resources from contamination, constraints have been placed on the use of infiltration-based practices to treat runoff within Wellhead Protection Areas (WHPAs). The permitted use of infiltration-based practices relates directly to the source of runoff, and the Vulnerability Rating of the WHPA within the project area (if applicable). Additional details regarding infiltration constraints are available in **Appendix E**.

A minimum Volume Retention Target of **5mm** has been established in light of the pending MECP LID Volume control targets, to address the identified issues relating to increases in



impervious surfaces and drainage area contributing to existing stormwater facilities, conveyance capacity of the stormwater piping systems, and predicted climate change impacts. However, if a site-specific water balance or subwatershed study indicates an infiltration target greater than 5mm, the higher target will apply. This volume retention target acts to drive atsource actions by private landowners and new development through the City's development process. Additional details regarding the selection of the Volume Retention Target can be found in **Appendix F**. A **Low Impact Development Strategy** is presented in **Appendix G**.

# 8 Technical Assessment: Conveyance Controls & the Municipal Right-Of-Way

In order investigate the opportunities and constraints of right-of-way (ROW) retrofits and determine an integration strategy within the City of Guelph, three reports were prepared in support of the SWM-MP, including:

- Stormwater Infiltration Policy Recommendations (November 2022) Appendix E
- Stormwater Design Criteria and Targets (December 2022) Appendix F
- LID Implementation Strategy (March 2023) Appendix G
- Major/Minor System Hydrologic and Hydraulic Analysis (March 2023) Appendix K

## 8.1 Background

Targeting roads for municipal SWM improvements is an important method of mitigating the stormwater impact of urban development, since the ROW consists of approximately 22 percent of the City's land use (**Figure 4.3**). The incorporation of a cost-effective ROW retrofit approach using a combination of traditional SWM controls (OGS and proprietary stormwater treatment devices) and Low Impact Development (LID) approaches as part of road reconstruction and resurfacing projects presents a significant opportunity to improve SWM control (water quality, water quantity, erosion mitigation, and water balance).

ROW retrofits using traditional SWM controls and LID have the ability to significantly improve stormwater quality by reducing the pollutant loading from uncontrolled urban catchments because of the large volume of sediment and other pollutants that wash off of these surfaces on an annual basis, as well reducing runoff volumes and reducing thermal impacts to receiving waters. In addition, ROW retrofits have the added benefit of providing an opportunity to enhance street aesthetics, mitigate and adapt to climate change, and reduce heat island effects.

## 8.2 Policy Considerations & Decision Framework

To protect local groundwater resources from contamination, constraints have been placed on the use of infiltration-based practices to treat runoff from road ROWs within Wellhead Protection Areas (WHPAs). Based on the Infiltration Policies, the permitted use of infiltration-based practices relates directly to the City of Guelph's road classification system.

The permitted use of infiltration practices within the municipal ROW is dependent on whether the potential infiltration practice location is within a Wellhead Protection Area (WHPA), the



Vulnerability Rating of the WHPA within the project area, and the road classification and cross-section.

#### 8.2.1 Wellhead Protection Areas

WHPAs have been designated around all municipal wells by the Drinking Water Source Protection Assessment Reports. Vulnerability scores have been established within WHPAs based on technical analysis to support the Drinking Water Source Protection Plan. Travel times to the wellhead from areas with vulnerability scores of 8 or greater are short and it is within the best interest of the City of Guelph to limit the implementation of infiltration practices from paved surfaces within these areas in order to protect drinking water sources from de-icer contamination. While some infiltration is acceptable within WHPAs having vulnerability scores less than 8, the infiltration of runoff from roads that are heavily salted should be avoided in these areas in order to protect local drinking water sources. Additional details regarding opportunities and constraints for infiltration are available in **Appendix E**.

#### **8.2.2** Volume Control Requirements

The Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA) is being implemented across the province. The City of Guelph recently received its CLI ECA. Appendix A of the Stormwater CLI ECA outlines the compliance criteria which must be met. These criteria include the use of volume control, consisting of the following hierarchical order, with each step exhausted before proceeding to the next:

- 1. Retention (infiltration, reuse or evapotranspiration),
- 2. LID filtration, and
- 3. Conventional stormwater management.

Step 3, conventional stormwater management, should proceed only once Maximum Extent Possible has been attained for Steps 1 and 2 for retention and filtration.

In light of the MECP CLI ECA LID Volume control targets, the identified issues relating to increases in impervious surfaces and drainage area contributing to existing stormwater facilities, conveyance capacity of the stormwater piping systems and in light of predicted climate change impacts, for the purposes of the City of Guelph SWM-MP, an interim minimum Volume Retention Target of **5mm** has been established, including for municipal ROWs. However, if a site-specific water balance or subwatershed study indicates pre-development infiltration is greater than 5mm, the higher target will apply.

Additional details regarding the selection of the Volume Retention Target can be found in **Appendix F**. A **Low Impact Development Strategy** is presented in **Appendix G**.

## 8.3 Integration with Municipal Programs

Public transportation, active transportation, the pedestrian realm, utilities, and the street trees are all components of the municipal ROW. Road reconstruction projects, including those that incorporate LID features into the ROW, should be designed with consideration of these systems.



## **8.3.1** Public Transportation

Public transit within the City of Guelph is provided by Guelph Transit. Due to the flexible nature of conveyance control measures, they can be integrated with transportation infrastructure during the design phase. These may include permeable pavements, bioretention, bioswales etc. A series of examples where conveyance control measures have been integrated into Public Transit projects are depicted below.







Figure 8.1: Left to Right: Bioswale part of a surface Light Rail Transit; Bioretention Planters as are part of a surface Light Rail Transit; and bioretention bump outs as part of bus lay-bys

#### 8.3.2 Active Transportation

Active transportation tends to focus on a reduced demand for car use in favour of alternative modes of travel, especially walking and cycling within the municipal right-of-way. The development of a city-wide active transportation network was highlighted as part of the City's Transportation Master Plan. While active transportation components such as bikes lanes are competing for the same space within the ROW as conveyance control features, there are several ways that LID practices can be integrated into active transportation systems, these include:

- Using permeable pavements (permeable concrete, porous asphalt, permeable unit pavers etc.) for sidewalks, multi-use pathways, trails and to distinguish on-road bikeways from driving lanes;
- Using bioretention units or bioswales to create a separation between on-road bikeways and driving lanes; or
- Enhancing pedestrian features with highly aesthetic vegetated LID facilities.

## 8.3.3 Urban Forestry/ Street Trees

Trees provide many benefits to communities, such as improving water quality, reducing stormwater runoff, lowering summer temperatures, reducing energy use in buildings, reducing air pollution, enhancing property values, improving human health, and providing wildlife habitat and aesthetic benefits. It is recommended that where possible, road retrofits maintain or improve the long-term sustainability of the City of Guelph's tree canopy. This can be done by avoiding disturbance to the critical root zone of mature trees during ROW projects and encouraging the planting of trees within the ROW in neighbourhoods with a canopy deficit. Where a need is identified it is recommended that the LID design include the simple



modification of increased planning depth to include the ability for tree plantings during construction or in the future as part of City initiatives.

# 9 Technical Assessment: Stormwater Management Facilities (End-of-Pipe Controls)

Stormwater management (SWM) facilities are an important component of the City of Guelph's current stormwater infrastructure. The management of existing facilities and the construction of new SWM facilities remains a central course of action to ensure stormwater infrastructure maintain their effectiveness and that pollutants are prevented from impacting the environment.

In order to assess conditions of existing SWM facilities and identify opportunities for new SWM facilities a series of four (4) technical reports and memoranda have been prepared in support of the SWM-MP. These technical reports are included within the SWM-MP appendices and are summarized in the following sections and include:

- SWM Facilities, OGS and Catchments (November 2021) (Appendix B)
- Preliminary Recommendations for Existing Stormwater Facilities and OGS Units (January 2022) (Appendix D)
- Stormwater Management Facility Maintenance Inspection Summary (October 2021)
   (Appendix H)
- New End-of-Pipe SWM Facility Opportunities Report (November 2021) (Appendix I)

Based on the analysis undertaken in the above reports and described in **Sections 9.2** through **9.5**, there are four (4) general approaches to improving the City of Guelph's end-of-pipe stormwater treatment network, these are:

- 1. Complete required maintenance works for facilities, where noted.
- Remove sediment from existing facilities that have water quality and water quality control significantly impacted by sediment accumulation and maintain the facility in a state of good repair in keep with the legislative requirement of the respective Environmental Compliance Approval (ECA).
- 3. Retrofit existing ponds to improve water quality treatment where feasible.
- 4. Construct new SWM facilities in urban areas of opportunity which are typically associated with public parks/trails and vacant lands.

In addition, SWM catchment areas can be enhanced with conveyance and source controls to mitigate the impact of infill development and intensification on existing end-of-pipe facilities and the natural environment. These enhancements are discussed in **Sections 7** and **0**.

Note: the management of sediment within City-owned OGS units is discussed in **Section 6.1.** 



## 9.1 Stormwater Facilities Catchment Analysis

In order to understand the impact of changes to the area and impervious percentage of stormwater catchment areas within the City of Guelph a report titled "SWM-MP - Stormwater Management Facilities, OGS and Catchments Report (November 2021)" was prepared. This supporting technical document to the SWM-MP is included as Appendix B.

Infill development and redevelopment of areas within the City of Guelph's Urban Boundary can have a negative impact on the performance of end-of-pipe storm water management (SWM) facilities. SWM facilities are designed based on the surface area of the catchment, catchment impervious percentage and the required level of water quality and water quantity control. New development and/or redevelopment within an urban catchment can increase the impervious percentage resulting in greater volumes of both runoff and pollutants suspended in the water column. Expanding the area draining to a SWM facility beyond the original catchment delineation can have a similar effect.

Infill development throughout the City was analyzed by identifying which parcels in the city have received permits for construction. Approximately 3.4% of the urban built area has been intensified based on construction permits received from 2006-2021.

According to the City's database, there are a total of 123 active SWM facilities that are owned and operated by the City of Guelph. Subsequent analyses indicated that there are an additional three (3) SWM facilities that need to be added to the City's database, for a total of 126 SWM facilities. SWM facilities within the City include those designed for water quality and/or water quantity. The briefs were used to assess the design criteria of each where available.

Where information was available, the SWM facilities were evaluated to determine whether changes to catchment parameters (area and imperviousness) put the SWM facility at risk of no longer achieving design objectives.

SWM facility catchment analysis has indicted that changes to the catchment areas including directing unplanned subcatchments to SWM facilities and increases in the imperviousness of the catchment areas has resulted in some City of Guelph SWM facilities no longer being able to provide the designed level of quality control.

Changes to SWM facility catchment areas also have the potential to impact how SWM facilities function during flood events. Most SWM facilities including dry ponds (designed without a permanent pool for water quality) are designed to temporarily detain runoff during flood events and release without exacerbating flooding and erosion on downstream lands. Increases in impervious surfaces and/or catchment areas draining to SWM facilities can overwhelm these facilities with larger volumes and higher peak flowrates entering the facility. Due to the unique stage-storage-discharge relationship at each SWM facility, it is not feasible at this level to identify the flood volume deficit for each SWM facility. It is however, likely that those facilities with the highest combined risk score are the most susceptible to failing their flood control requirements, and should be subject to a subsequent study.



The SWM facility catchment analysis has indicted that changes to the catchment areas including directing unplanned subcatchments to SWM facilities and increases in the imperviousness of the catchment areas has resulted in some City of Guelph SWM facilities no longer being able to provide the design level of quality control. These facilities have been recommended for additional study and/or retrofit (**Appendix B**).

#### 9.2 Maintenance Needs

The 2014 Stormwater Management Facilities Inventory, Assessment, and Maintenance Needs Study Report (CH2M HILL, 2015) completed a maintenance needs assessment of 115 SWM facilities. These maintenance needs are summarized in **Appendix D**. While some maintenance has been completed for some facilities since 2015, this has not been documented. As such, it is recommended that the City assume all maintenance suggestions have not been completed, and going forward should document maintenance activities once completed.

As part of this SWM-MP, Aquafor Beech performed a maintenance inspection on the forty-one (41) stormwater management facilities noted as Dry Ponds within the City of Guelph's records and GIS database. This inspection report is provided in **Appendix H**. While initially the facilities assessed were classified as dry ponds, upon inspection and review of available records (design drawings, reports and approval records) the forty-one facilities were found to include wet ponds, constructed wetlands, infiltration basins, dry ponds or hybrid combinations.

The inspection categorized each facility based on the urgency of maintenance activities. The categories are based upon the inspection form and were defined by the following descriptions:

- 1. High (Immediate) Facility is in poor condition. Functional issues to be prioritized. The identified issues can or are currently leading to a high risk of significant financial, environmental, or health and safety costs under significant rainfall events.
- 2. Moderate Facility is in fair condition. Less significant issues identified in a pond facility but can still impact the pond's functionality. The identified issues have a moderate risk for an occurrence relating to pond function or accessibility and potentially a significant financial or environmental risk if not remediated.
- 3. Low Facility is in good condition. Minimal risk that will not greatly affect a pond's functional performance.

The inspections resulted in the conclusions outlined below. Additional details for each facility can be found in **Appendix H**.

- Nine (9) of the forty-one (41) assessed facilities were identified as high priority and were therefore recommended for retrofit (Section 13.6). All of the high priority facilities that were assessed were designed as dry or infiltration ponds.
- With the exception of SWM #103, all high priority ponds were built between 1975 and 1981, or prior to the implementation of any provincial standards for stormwater management facility design. These facilities may require more detailed analysis to determine if current quantity and quality control standards are being met.



#### 9.3 Sediment Removal for Ponds

In order to ensure long-term operational effectiveness of SWM facilities, it is crucial to remove accumulated sediment periodically per the legislative requirements and conditions of the respective MECP Environmental Compliance Approval (ECA). The maintenance frequency depends on several aspects, such as type of facility, design storage volume, characteristics of the catchment area and municipal practices. Sediment accumulation compromises the effective storage volume and the long-term efficiency of suspended solids retention.

The SWM-MP explored approaches to manage pollutants and sediment within the City's SWM facilities in the most cost-effective manner. The recommended works are exempt from the Municipal Class EA process, and therefore, are pre-approved.

The 2014 Stormwater Management Facilities Inventory, Assessment, and Maintenance Needs Study Report (CH2M HILL, 2015) completed bathymetry on many of the City's SWMF, and identified which facilities required sediment removal (i.e., clean-out of all sediment accumulation within the pond). These facilities were cross-checked against the City's spreadsheet identifying sediment removal, and the remaining facilities were included in the recommendation for sediment removal activities. Sediment removal is therefore recommended for the following facilities: 3, 22, 35, 36, 37, 53, 74, 87, 107, 109, and 111. Additional facilities may require sediment removal; however, without the completion of additional bathymetric studies these additional facilities cannot be identified.

# 9.4 SWM Facility Retrofits

As described in **Section 9.1**, many SWM facilities require additional study to confirm level of service and/or efficiency of facilities at high risk of failure. The additional studies are summarized in **Appendix D**.

As many facilities were designed before modern SWM standards, or are now undersized due to changes in the catchment, it is recommended that these facilities be scheduled for retrofit. Multiple purposes of retrofit exist, including upgrading to achieve the City's current level of service (10 facilities); addressing construction issues (16 facilities); converting dry facilities to wet facilities (11 facilities); or due to general function issues that indicate the pond is not operating as designed (11 facilities). An additional 42 facilities could not be assessed for retrofit, and may therefore be added to the above list once the additional investigations are complete.

Specific recommendations for each facility, including additional studies, maintenance, sediment removal, and/or retrofit are included in **Appendix D**.

#### 9.5 New SWM Facilities

A significant portion of the City of Guelph was developed prior to the development of current stormwater management (SWM) criteria. As such, there are areas within the city where uncontrolled and untreated stormwater runoff is directly discharged to the receiving streams. Industry experience has shown that these uncontrolled discharges are responsible for a



significant portion of the contaminant loadings to receiving streams as well as increasing the potential for downstream erosion and flooding.

The end-of-pipe facility opportunities study (**Appendix I**) was initiated to provide a framework for a long-term strategy to implement stormwater quality and quantity control within the existing urbanized areas of the City of Guelph. The SWM-MP explored and assessed the feasibility of constructing new stormwater management facilities as part of park rehabilitations and/or other areas in the city, including vacant lands.

The principle objective was to identify locations where new end-of-pipe SWM facilities could be implemented within existing urban areas of the City without stormwater control to increase the proportion of SWM controlled drainage areas in the City to improve:

- Water quality control (primary objective);
- Water quantity control (secondary objective);
- Erosion control (secondary objective).

As such a list of potential sites which represent opportunities for new end-of-pipe SWM facilities was. Sites were identified and assessed using a four (4) phase process, including:

- Phase 1 Geographic Information Systems (GIS)/Land Assessment
- Phase 2 Field Reconnaissance and Impact Assessment
- Phase 3 Performance Assessment
- Phase 4 Consultation with City Staff

Sixteen (16) SWM opportunities (**Table 9.1**) were confirmed by City staff. As many of these are located in City parks, SWMF design and construction should be completed as part of overall park rehabilitation and enhancement.

The following study and resulting recommended works have been completed following Schedule B of the Municipal Class EA process and therefore can proceed directly to detailed design and implementation.



Table 9.1: Feas	ible SWM Fa	cility Opportunities
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Site ID	Location Name	Recommended Facility Type			
1	Golfview Park	Subsurface Storage Facility			
2	Waverley Park	Subsurface Storage Facility			
3	Victoria Road Recreation Centre	Subsurface Storage Facility			
4	Green Meadows Park	Subsurface Storage Facility			
5	Bailey Park	Subsurface Storage Facility			
8	Exhibition Park	Subsurface Storage Facility			
14	Dunhill Place Park	Subsurface Storage Facility			
16	Margaret Greene Park	Surface Facility			
18	Centennial Park	Subsurface Storage Facility			
26	L-13 Windsor Park	Subsurface Storage Facility			
27	Stevenson / Guelph Junction Railway	Surface Facility			
28	Dawn Avenue	1) Low Impact Development			
28	Dawii Aveilue	2) Surface facility			
30	606 Massey Road	Surface Facility			
31	Springdale Park	Subsurface Storage Facility			
32	Oak Street Park	Subsurface Storage Facility			
34	End of Industrial Street	Surface Facility			

# 10 Technical Assessment: Urban Flood Management & Storm Sewer Infrastructure

As part of the SWM-MP, in order to understand and assess the capacity of the existing municipal storm sewers, the environmental benefits, as well as technical and financial implications relating to urban flooding within the City of Guelph, two reports were prepared in support of the SWM-MP. These technical reports are included within the SWM-MP appendices and are summarized in the following sections and include:

- Rainfall and IDF Curve Analysis (October 2021) (Appendix J)
- Major/Minor System Hydrologic and Hydraulic Analysis (February 2023) (Appendix K)

As part of the SWM-MP, a city-wide storm sewer model was developed to assess the existing level of service of the City's stormwater infrastructure. The assessment of the existing stormwater conveyance systems considers the effectiveness of the City's infrastructure at reducing the impacts of urban runoff on infrastructure, property and the environment including the:

- Ability to more closely match pre-development hydrologic conditions by reducing urban peak flows at storm sewer outfalls, maintaining groundwater recharge, and mitigating in-stream and overland erosion;
- Ability to provide conveyance of a 1:5-year precipitation event within the minor system per the City standard level-of-service;
- Ability to improve water quality of stormwater runoff; and



Resiliency of the existing stormwater system in the context of climate change.

## 10.1 Rainfall and IDF Analysis

The intensity-duration-frequency (IDF) curves currently used by the City of Guelph were created in the 1970s based on 16 years of rainfall data from the Guelph Arboretum rain gauge between 1954 and 1970. It has been eight years since the last rainfall analysis was conducted, and the effects from climate change are ongoing, so an analysis of historical rainfall trends and projected impacts of climate change on IDF curves was completed.

A trend analysis was conducted on all years with available rainfall data to determine whether any statistically significant trends are occurring. While increasing trends were observed for many of the short-duration events, this increase was only significant for the 1-hour event (Appendix J).

A mid-range climate-adjusted IDF curve was developed using the IDF\_CC RCP 4.5 scenario. The RCP 4.5 scenario assumes global emissions are stable and then begin to decline by 2050, and is therefore a middle-of-the-road scenario. The RCP 4.5 IDF curve generated by the aggregated models in the IDF\_CC tool generally predicts lower precipitation than the existing IDF curve for most events, although it does predict higher precipitation for the events used for designing the City's major and minor flows. From this projection, a series of IDF curves can be calculated using the following equation:

Intensity 
$$(mm/hr) = At^B$$

where t is the storm duration (minutes) and A and B are parameters from **Table 10.1**. All  $R^2$  values are greater than 0.99, indicating a good fit between the data points and the line of best fit.

Table 10.1: Recommended IDF	Parameters -	- Mid-Range Scenario

	Α	В	R <sup>2</sup>	
2-year	475.61	-0.738	0.9883	
5-year	632.75	-0.741	0.9794	
10-year	721.92	-0.736	0.9706	
25-year	r 822.74 -0.725		0.9513	
50-year	893.80	-0.719	0.9365	
100-year	953.29	-0.711	0.9199	

# 10.2 Hydrologic and Hydraulic Analysis

The model will help City staff anticipate needs regarding infrastructure capacity upgrades or capital improvements as well as to provide direction as to where spare capacity for future development may exist. Along with the existing conditions assessment, the City's existing infrastructure was run against various performance scenarios including:

1. Intensification (urban infill development and increased impervious surfaces);



- 2. Climate change;
- 3. Intensification and climate change; and
- 4. the implementation of Low Impact Development (LID) SWM controls as part of volume retention strategy (5mm, 14mm, 28mm volume control).

The model was constructed using the stormwater conveyance network within the City, including storm sewers that are owned by the City, Province, Township of Guelph-Eramosa, or within private property. The modeled network is comprised of approximately 425 km of storm sewers of varying sizes.

The hydrologic model selected for application in this study was PCSWMM 2022. PCSWMM 2022 has the capacity of using a number of versions of EPA SWMM5 for performing the hydrologic and hydraulic calculations. For the existing condition model, SWMM 5.1.015 was selected, as it is the latest official version of SWMM currently available.

A total of eight scenarios were modeled for the City using the PCSWMM model. These scenarios are summarized in **Table 10.2**.

**Table 10.2: Model Scenarios** 

Scenario	Scenario Name	IDF	Land Use
1	Existing Conditions	Existing	Existing
2	Future Growth	Existing	Future
3	Future Growth & Climate Change	Climate Change (RCP4.5)	Future
4	Grey Infrastructure Only	Climate Change (RCP4.5)	Future
5	Green Infrastructure Only	Climate Change (RCP4.5)	Future
	(28mm Volume Control)		
6	Grey/Green Hybrid	Climate Change (RCP4.5)	Future
	(5mm Volume Control)		
7	Grey/Green Hybrid	Climate Change (RCP4.5)	Future
	(14mm Volume Control)		
8	2D Model of Top 10 Flood Prone Areas	Climate Change (RCP4.5)	Future

The development of the model, detailed description of scenarios, and figures discussing the results of each scenario, is detailed in **Appendix K.** 

The minor system model results were assessed in terms of length of sewers which reached became surcharged. The major system model results were assessed in terms of the length of road right of way (ROW) which exceeded depths of 0.15m and 0.3m. The continuous model results were used to assess water balance.

The results show that intensification and climate change demonstrate an increased risk of sewers which are at full capacity or surcharged. Scenario 6, Green Infrastructure (5mm volume control), was adopted for use by the City. Scenario 6 considers the predicted impacts of climate change as well as the application of a mitigation strategy through the use of a 5mm volume control. Key findings from Scenario 6 include:



- A decrease of 190km (68 percent decrease) of surcharging sewers as compared Scenario
   3, suggesting that the proposed upgrades will reduce surcharging;
- A decrease of 0.1km (8 percent decrease) of ROW has a flow depth greater than 0.3m as compared to the Scenario 3, suggesting that the proposed upgrades will reduce ROW flooding.

Results are based on a quasi-calibrated model using stream flow data and not in-sewer monitoring (sewer hydraulics) and therefore results may be conservative. Additional monitoring and calibration is recommended to verify results.

## **10.3 Storm Sewers Under Private Property**

Public input into the SWM-MP brought to light the storm sewer or underground creek that runs beneath private properties in a north-south direction between Yorkshire St N and Glasgow St N. As a result, Aquafor Beech completed a GIS analysis of the City's storm sewer network to identify where pipes pass beneath private property throughout the City. The results of this analysis can be found in the **Storm Sewers Under Private Property Technical Memo (June 2021)** in **Appendix L**.

## 10.4 Neighbourhood Studies

During the completion of the SWM-MP, issues of chronic flooding in certain neighbourhoods were raised. To properly address these chronic flooding issues, neighbourhood-specific feasibility studies would be needed. Descriptions of each neighbourhood flooding issue are provided below.

#### 10.4.1 Division Street and Exhibition Street

The City has received numerous notifications from residents that flooding has occurred at the intersection of Division Street and Exhibition Street. Most notably, heavy rain in July 2020 and July 2021 led to flooding that extended outside of the right-of-way, affecting resident's basements, the arena parking lot and the convenience store. It was determined that the rain event that caused flooding in July 2021, was less than the 2-year event.

In 2021-2022, Aquafor Beech completed a preliminary investigation, separate from the SWM-MP, to identify any interim flooding solutions to mitigate flooding issues in this neighbourhood. The preferred solution to mitigate the impact of flooding within the Exhibition Street and Division Street intersection was a hybrid of Alternatives 6, 7, and 9:

- Alternative 6: Off-line subsurface storage beneath the parking lot at Exhibition Park
- Alternative 7: Inline subsurface storage along the Royal Recreation Trail
- Alternative 9: Upgrade storm sewers, including along the Royal Recreation Trail, Exhibition Street, and Division Street.

The preferred solution would be phased such that Alternative 6 is installed first to provide an interim control of the 5-year water quantity volume, followed by the addition of Alternative 7 in coordination with the forthcoming Parks and Recreation Master Plan. Further modelling will be



needed to determine the total level of service achieved using the hybrid approach of Alternatives 6 and 7. Finally, Alternative 9 can completed per the final solution indicated in the 2012 Stormwater Master Plan and in coordination with planned capital works projects over the next 10 years to ensure a 100-year level of service is achieved for the major system.

#### 10.4.2 Waverley Drive and Stevenson Street North

The City has received numerous complaints from residents in the area generally bounded by Waverley Drive, Stevenson Street North, Speedvale Avenue East, and Metcalf Street, although most complaints are regarding the intersection of Waverley Drive and Stevenson Street North. This intersection is a low point, where flows from the north, east and west converge to flow south down Stevenson Street. Resident complaints indicate that there are significant flows through the ditch west of 64 Waverley Drive. To date, no studies have been completed here.

#### 10.4.3 Grove Street

Grove Street connects Regent Street and Stevenson Street in a general east-west direction. Properties on the north side of the street are at a significantly higher elevation than those on the south side of the street. A retaining wall on the north side of the street extends along much of Grove Street, maintaining the sidewalk at a higher elevation than the road. On the south side of the street, many residences are at or below street level. Curb height on the south side of the street varies, but is generally very low, and therefore does not keep major system flows within the road right-of-way. Instead, flows leave the ROW and enter private property, causing flooding issues. To date, no studies have been completed in this area.

#### 10.4.4 Lowes Road West and Dawn Avenue

Dawn Avenue has a rural cross-section, with ditches on the west side of the street, although no driveway culverts are present to convey flows further down the street. Instead, the grassed ditches appear to be acting as infiltration facilities. Water which remains in the road carriageway is generally conveyed north to the cul-de-sac end of Dawn Avenue, where it ponds until water levels are high enough to enter a naturally-occurring wetland north of cul-de-sac. Infill development along Lowes Road West increased the housing density in this area, and formalized the use of the carriageway to direct overland flows to Dawn Avenue, as well as reconstructing the roadside ditches.

The parcel north of the Dawn Avenue cul-de-sac was evaluated as part of the SWM-MP, to determine whether a new end-of-pipe stormwater facility was feasible here (**Section 9.5**). However, the constraints associated with the parcel were extensive, and converting the roadside ditches to bioretention facilities was preferred. However, this solution may not address the water quantity/flooding issues in the neighbourhood; as such, additional studies are recommended.

At the time of writing this report, a short-term, temporary solution is under development for this area until a long-term, permanent solution can be designed and constructed.



#### 10.4.5 Knevitt Place

Knevitt Place connects Crane Avenue and Kendrick Avenue. The road cross-section is rural, with shallow roadside ditches. Residents indicate that a vacant parcel was the low point of the street, which historically acted to store runoff after rain events without causing flooding of the neighbourhood. A dry well was located on the south side of Knevitt Place. The proposed development included new catchbasins and a new 600mm storm sewer to convey the minor system to Kendrick Avenue. Resident complaints indicate that this new storm sewer was ultimately not required for development to proceed, and that flooding is now an ongoing issue along the Knevitt Place.

## 11 Technical Assessment: Stream System Understanding

In order to understand the existing stream conditions, as well as the relevant conditions of past river engineering and stream rehabilitation projects within the City of Guelph, a series of three (3) technical reports and one inventory appendix have been prepared in support of the SWM-MP. These technical reports are included within the SWM-MP appendices and are summarized in the following sections and include:

- Erosion Assessment Technical Memorandum Field Investigations (August 2021)
   (Appendix M)
- Geomorphic System Assessment Technical Memorandum Field Investigations (August 2021) (Appendix N)
- Identification of Restoration Alternatives and Conceptual Design for Preferred Alternatives (October 2022) (Appendix O)
- Outfall and Retaining Wall Inventory (Appendix P)

Over 61 km of stream systems extend through at least 15 of the City's sub-watersheds or catchment areas, all of which ultimately drain into the Speed River or Eramosa River. Associated with urbanization are both direct and indirect factors of human activity on stream geomorphology. Direct impacts include changes of channel form, alignment, bank and bed materials; as well as in-stream structures including weirs, culverts, and dams. Indirect impacts relate primarily to changes in catchment land use which significantly influences the pathways and rates of water and sediment routing through the drainage networks.

Stream reaches were identified as part of the 2012 SWM-MP. These reaches and sub-reaches represent convenient watercourse management units that are typically divided by road crossings, pedestrian bridges, or other infrastructure markers within the drainage network (e.g. major outfalls). While these stream reach boundaries often correspond with geomorphically significant changes in channel conditions, these management units are not perfectly consistent with stream morphology reaches and thus may or may not encompass reach-based variations in natural processes. Aquafor re-evaluated the reach divisions (i.e., where one reach ends and another begins) based on similarity of channel type, surficial material, degree of channelization, and hydraulic conditions. Six reaches were redelineated, as described in **Appendix N**.



#### 11.1 Methods

To complete the erosion inventory and assessment for watercourses within the City of Guelph, all watercourses identified during the background review were walked and visually assessed over the period of June-September 2020. Of the estimated 90km of watercourses measured from the City's GIS mapping database, about 75km was walked continuously. The balance of the watercourses were assessed by walking in and out from road crossings, were not accessible due to private property restrictions, or were not visually located in the field as per the referenced mapping information. This field assessment includes the reaches that were identified and assessed during the 2012 SWM-MP, but aims to expand on the work completed for the 2012 SWM-MP which was primarily done using desktop analysis. Further details of the methods used can be found in **Appendices M** and **N**.

#### 11.2 Erosion Assessment

Erosion sites were identified as locations with erosional issues that pose risk to surrounding infrastructure or public health that would require intervention to be mitigated. Furthermore, erosion sites were in some cases also identified as having an impact on the larger reach-scale health of the stream system. A total of 30 erosion sites were visually identified in the field and recorded on maps. The approximate extents of the erosion sites were measured and photographs of the sites were taken. To standardize the erosion and risk, and environmental opportunity during the field assessments, a semi-quantitative technical scoring methodology was developed and which is presented in **Appendix M**.

## 11.3 Maintenance Site Identification and Other Management Issues

During the field walks, maintenance sites were identified as localized erosion, deposition, structural failures or disrepairs, or flow obstructions. The maintenance sites differ from the erosion sites in that the effects of the maintenance sites were very localized and/or associated with city infrastructure included within regular operations and maintenance responsibilities.

In addition to maintenance sites, other issues identified as "management issues" were identified throughout the field walks. These issues did not fit consistently into the erosion inventory or maintenance site frameworks, but were identified as issues the City should be aware of for consideration in the integrated stormwater and watercourse management plans. Examples of management issues include, but are not limited to, fish barriers, hydraulic "pinch-points", and noxious weeds (e.g. Giant Hogweed). Summary sheets and mapping for each maintenance site identified are provided in **Appendix M**.

## 11.4 Management Issues

Sixteen (16) management issues covering a range of different managerial issues were identified and documented as part of the field walks. Summary sheets for each management issue identified are provided in **Appendix M**.



## 11.5 Outfall Inventory

During the field walks retaining walls lining watercourse banks, and two-hundred forty-three (243) stormwater outfalls that drain into the watercourses were identified and assessed. The condition of the outfalls identified was classified as good, fair or poor based on their structural integrity and functionality (e.g. if there were any obstructions). The information collected during this inventory has been consolidated into an Outfall and Retaining Wall Inventory, which includes a GIS layer with the inventory data (**Appendix P**). Out of all those identified, 56% of the outfalls were classified as being in "good" condition, 34% were classified as being in "fair" condition and 10% were classified as being in "poor" condition.

## 11.6 Geomorphic Assessment

During the field walks, the geomorphology of each watercourse was analyzed to characterize the stream system within the context of the erosion assessment. Erosion is a natural process and natural streams and rivers should be considered dynamic allowing for gradual and long-term channel adjustments that may occasionally include more dramatic changes due to high magnitude flood events.

Sediment aggradation and degradation are processes that create and maintain geomorphic features within a river. However, changes within a watershed (such as deforestation or urbanization) can create an imbalance within these processes resulting in erosion that is unnatural, or unhealthy for the system. Therefore, completing a geomorphic assessment is important in order to identify the natural processes and areas of excessive erosion or sedimentation.

Of the 101 assessed reaches, 67 were found to be in regime, 11 reaches were in transition, 2 reaches were in adjustment and the Rapid Geomorphic Assessment tool did not apply to 21 of the study reaches (**Table 11.1**). It is notable that the only catchments to have reaches in adjustment were located in Hanlon Creek and immediate tributaries to the Speed River.

**Table 11.1: Channel Assessment Definitions** 

Stable/In Regime	Channel morphology is within the expected range of variance for stable channels of similar type. Channels are in good condition with minor adjustments that do not impact the function of the watercourse.				
In Transition	Channel morphology is within the expected range of variance but with evidence of stress. Significant transition has occurred and additional erosion indicators may occur.				
In Adjustment	Metrics are outside of the expected range of variance for channels of similar type. Significant channel adjustments have occurred and are expected to continue under current conditions.				



## 11.7 Additional Investigations

City staff identified flooding issues where Edinburgh Road crosses the wetland near the intersection of Edinburgh Road and Gordon Street. To address this issue, it is recommended that the City complete a hydraulic analysis and capacity study of the culvert crossing at this location.

#### 12 Evaluation of Alternatives

**Section 5** of this SWM-MP details the development of a long list of alternative measures, while **Sections 6** through to **Section 11** describe the feasibility of the six (6) stormwater management program elements in the context of the different opportunities/constraints within the City. The following section describes the evaluation criteria, evaluation process and selection of the preferred alternatives which will form the recommended approach in fulfillment of the Class Environmental Assessment process (Class EA).

The SWM-MP was conducted in accordance with the requirements for Master Plans under Appendix 4, Approach #2 of the Municipal Engineers Association Municipal Class Environmental Assessment (October 2000, as amended in 2007, 2011, 2015 & 2023), which is an approved process under the Ontario Environmental Assessment Act. As part of the Class EA process evaluation of alternatives, assessment of the potential environmental effects, analysis of problems or opportunities, and identification of mitigation measures for potential adverse impacts has been conducted and presented through public and agency consultations. The SWM-MP fulfills all of the Class EA requirements for Schedule B projects which can then proceed directly to detailed design and implementation and identifies any Schedule C projects for future studies. Schedule C projects would have to fulfill Phases 3 and 4 prior to filing an Environmental Study Report (ESR) for public review.

A key component of the SWM-MP is to define and describe each type of proposed measure, followed by an evaluation in the context of identified evaluation criteria in order to develop a preferred strategy. This chapter explains this process in detail.

## 12.1 Categories of Alternatives

A summary of the six (6) stormwater management program elements and the relevant Class EA Schedule associated is detailed below.

- 1. **Municipal Pollution Prevention, Operations & Maintenance Practices**, is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.
- 2. **Private Property Strategies (source controls)** fall outside of the Class EA process since they are to be constructed on private property, by the individual land owner as a retrofit or during development/ redevelopment (i.e. the City is not the proponent).
- 3. **Stormwater for the Capital Roads Program (conveyance controls)** is Exempt from the Municipal Class EA process based on the outcomes of the Archaeological Screening Process. If it is determined that the proposed project will have negative impacts on



archaeological resources that cannot be appropriately mitigated, the project is not exempt, and must follow a Schedule B EA. Archaeological screening was not completed as part of the SWM-MP, and will therefore need to be completed as each project is brought to design.

- 4. **Stormwater Management Facilities** were evaluated using according to the project nature:
  - a. Sediment Removal for SWM Facilities is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.
  - b. **Maintenance for SWM Facilities** is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.
  - c. **SWM Facility Retrofits** is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.
  - d. **New SWM Facilities** follows Schedule B of the Municipal Class EA process, and therefore can proceed directly to detailed design and implementation. Selection of the preferred alternative in fulfillment of Phase 2 of the Class EA process is detailed in **Section 12.2.**
- 5. Watercourse and Erosion Restoration follows Schedule B of the Municipal Class EA process, and therefore can proceed directly to detailed design and implementation. Selection of the preferred alternative in fulfillment of Phase 2 of the Class EA process is detailed in Section 12.3.
- 6. **The Urban Flood Management & Stormwater Infrastructure** Stormwater infrastructure implemented as part of regular road works are Exempt from the Municipal Class EA process, and therefore, are pre-approved.

The following sections will therefore focus primarily on the fulfillment of Phase 2 of the Class EA process for elements:

- Stormwater Management Facilities (Element 4c above), and
- Watercourse and Erosion Restoration, (Element 5 above)

### **12.2 Evaluation of New Pond Opportunities**

As discussed in **Section 9.5**, sixteen (16) SWM opportunities were identified as feasible for the construction of new stormwater management facilities as part of park rehabilitations based on the four (4) phase technical assessment.

For each of the SWM opportunity sites, five (5) alternative solutions were evaluated using baseline information collected as part of the technical evaluation process and a list of evaluation criteria. These alternatives are described below with specifics dependant on each particular site:

- **Alternative 1: Do Nothing** This alternative involves leaving the site as it is, and not pursuing any SWM improvements at the location.
- **Alternative 2: Wet Pond** This alternative involves the construction of a stormwater quality control pond at each site.



- **Alternative 3: Constructed Wetland** This alternative would involve the construction of a large constructed wetland.
- Alternative 4: Hybrid SWM Facility This alternative would involve the construction of a facility that consists of a wet pond element and a wetland element, connected in series.
- Alternative 5: Subsurface Storage Facility This alternative would involve the construction of an underground facility that captures, stores, and releases stormwater.

Scoring of the criteria produced a preferred alternative based on the highest score, which was then developed into a conceptual design. A description of the evaluation criteria and the evaluation of alternatives can be found in **Appendix Q**.

## 12.3 Evaluation of Stream System Alternatives

As previously detailed in **Section 11**, the thirty (30) erosion sites identified during the field walks were classified as first-order groupings of individual and composite erosion sites. The resulting twenty-four (24) primary assessment opportunities (local and grouped sites) represent the key projects to be considered within system-wide prioritization and implementation plan of the SWM-MP. The evaluation of alternative solutions was completed for these twenty-four (24) opportunities.

For each of the sites, four (4) preliminary alternative solutions were evaluated using baseline information and a list of evaluation criteria. A series of alternatives was developed to address erosion concerns for the primary erosion issues. These alternatives are described below with specifics dependant on each particular site:

- Alternative 1: Do Nothing This alternative involves leaving the site as it is and allowing
  erosive processes to continue within the watercourse corridor. Maintenance will have
  to be undertaken to address damage to infrastructure caused by the continued erosion
  as the damage occurs.
- Alternative 2: Local Works This alternative consists of localized channel bank and/or bed work to address erosion issues at the site.
- Alternative 3: Full Channel Restoration This alternative consists of a reach-based approach to address erosion issues at the site.
- Alternative 4: Removal of Risk This alternative consists of moving the infrastructure at risk and allowing channel processes to continue at the site.

Scoring of the criteria produced a preferred alternative based on the highest score, which was then developed into a conceptual design. Cost estimates for engineering services (i.e., design, background studies such as geotechnical investigations) and construction costs for each of the preferred alternatives was estimated for each of the preferred alternatives for each site.

A description of the evaluation criteria and the evaluation of alternatives can be found in **Appendix O**.



# 13 Recommended Approach and Implementation Plan

The Implementation Plan has been prepared to provide guidance with respect to key next steps, future study considerations, facilitators and contributors, costs and funding considerations, operations and maintenance, integration with other studies, and the prioritization of works based on the identified priority subwatersheds within the City of Guelph.

Integration across City departments is the cornerstone of a modern approach to stormwater management and will be essential for the City of Guelph in the implementation of the SWM-MP in order to maintain and improve the condition and health of the City's subwatersheds. This Implementation Plan has been developed as such.

Recommended projects, as described in the subsections below, have also been consolidated into one figure, as presented in **Figure 13.1**.

#### **13.1 Stormwater Policies**

In general, the SWM-MP, including its supporting technical reports and this Implementation Plan, shall provide the overarching policy direction for stormwater management with the City of Guelph. Individual policy development is detailed below.

#### **13.1.1 Stormwater Infiltration Policy**

This policy component defines where and how infiltration-based stormwater management controls, commonly referred to as Low Impact Development (LID) controls, can safely be planned and constructed in the context of the approved source protection planning policy.

A detailed report which outlines this policy component, including all mapping, is included as **Attachment E.** 

#### **13.1.2 Stormwater Design Criteria and Targets**

This policy component outlines the newly established minimum stormwater volume criteria as well as the application of general stormwater management targets as part of:

- New development,
- Redevelopment, reurbanization and residential intensification, and
- Linear projects (roadways, trails and transit infrastructure etc.)

A detailed report which outlines this policy component including all mapping is included as **Attachment N.** 

## 13.1.3 Development Engineering Manual and Policy Update

The City periodically updates its Development Engineering Manual (DEM) on an as-needed basis. It is recommended that the City update the DEM and other policies, as needed, in 2024 to account for the recommendations arising from the Infiltration Policy and Stormwater Design Criteria and Targets. Additional studies have been recommended through the SWM-MP, which may require future updates to the DEM and other policies. These studies include:

Cash-in-lieu study;



- Direct discharge to receiver study; and
- Future SWM-MP, Subwatershed Health, and IDF updates.

## 13.1.3.1 Low Impact Development Policy

It is recommended that the City proceed with developing an LID policy that builds on the recommendations from within the **LID Implementation Strategy (Appendix G)**. This policy should be prioritized in 2023, as the SWM Criteria will become operational once the SWM-MP is finalized. A budget of approximately \$75,000 is recommended for the development of this policy. This policy should include, but not be limited to:

- LID approvals process for private property;
- Assumption protocols for LID BMPs that will become part of the City's SWM system;
- City oversight of private property LID BMPs;
- Operations and maintenance processes for private property;
- City operations and maintenance approach during design, construction, and postconstruction for LID BMPs that are part of the City's SWM system; and
- Any updates/revisions to the City's DEM and/or by-laws that arise from the above.

#### 13.1.3.2 Cash-in-Lieu

The City of Guelph does not currently have a cash-in-lieu program. This program would require a development proponent to provide a designated financial contribution at the current per hectare rate as defined by the City, as amended from time to time, towards the off-site stormwater management, in conformance with the recommended approaches of the SWM-MP, elsewhere in the City in lieu of providing on-site stormwater management should the requirements of the **Stormwater Infiltration Policy Recommendations (November 2022)** and **Stormwater Design Criteria and Targets (December 2022)** not be fully achieved.

Funds would be collected by the City of Guelph SWM Utility until such time as a suitable project or program is identified for partial or full funding.

The Implementation Plan includes \$100,000 in 2026 to complete a study to determine the logistics for how the City would implement a cash-in-lieu program.

#### 13.1.3.3 Direct Discharge to Receiver Study

The Infiltration Policy Recommendations restrict infiltration based on land use, road classification, and Wellhead Protection Area (WHPA) Vulnerability Score. This is to protect groundwater resources which are used for municipal drinking water purposes. However, this approach assumes that all water infiltrated within a WHPA ultimately reaches groundwater. Infiltrated water from some areas, especially those in proximity to surface water features, actually discharges to the surface water feature, and therefore does not reach groundwater. In these cases, the City may choose to relax infiltration restrictions. It is recommended that the City complete a modeling study to determine the ultimate receiver for water infiltrated across the City, and then update the Infiltration Policy in accordance with the results of this study.



The Implementation Plan includes \$100,00 in 2028 to complete a study to identify where infiltrated water actually discharges to surface water, and to subsequently update the Infiltration Policy.

### 13.1.3.4 Future SWM-MP, Subwatershed Health, and IDF Updates

A SWM-MP needs reviewing and/or updating on a regular basis, as do several of its components, including the Subwatershed Health analysis and Intensity-Duration-Frequency (IDF) Curve. The Implementation Plan includes \$905,000 for each time these documents need to be updated, including in 2032 and 2042.

## **13.1.4 Storm Sewers Under Private Property**

As part of the assessment of storm sewers under private property, it was found that both old and new developments had storm sewers beneath private property without easements. It is therefore recommended that the City develop and implement a policy to require permanent access easements in the following situations:

- Where a storm sewer needs to pass beneath private property;
- Where an overland flow path passes above private property; and
- Where any other drainage requirements are present on private property.

It is also recommended that the City undertake a subsequent investigation into these storm sewers, consisting, at a minimum, of the following next steps:

- Ensure that all City-owned property is correctly identified within the GIS layers to confirm the identification of storm sewers beneath privately-owned property;
- Review easement records to determine whether additional easements have been put in place beyond those currently identified. It is expected that more easements should be in place in many of the newer subdivisions;
- Complete a review of all available as-built drawings for pipes identified as beneath private property;
- Complete a conditions assessment of these storm sewers, especially the five highlighted above. This should include CCTV of each storm sewer, where feasible;
- Update the GIS storm sewer network with the results found through the background search; and
- Provide recommendations for reducing the risks associated with each storm sewer.

#### 13.1.5 Downspout Disconnection Strategy

It is known that there are downspouts in Guelph which are directly connected to the storm sewer system, but the City does not have an accurate inventory of downspout connections in the City. As such, the SWM-MP has not evaluated the impacts of downspout disconnection on the system performance. It is recommended that the City develop a Downspout Disconnection Strategy, which may consist of the following:

Property owners are encouraged to disconnect their downspouts throughout the city;



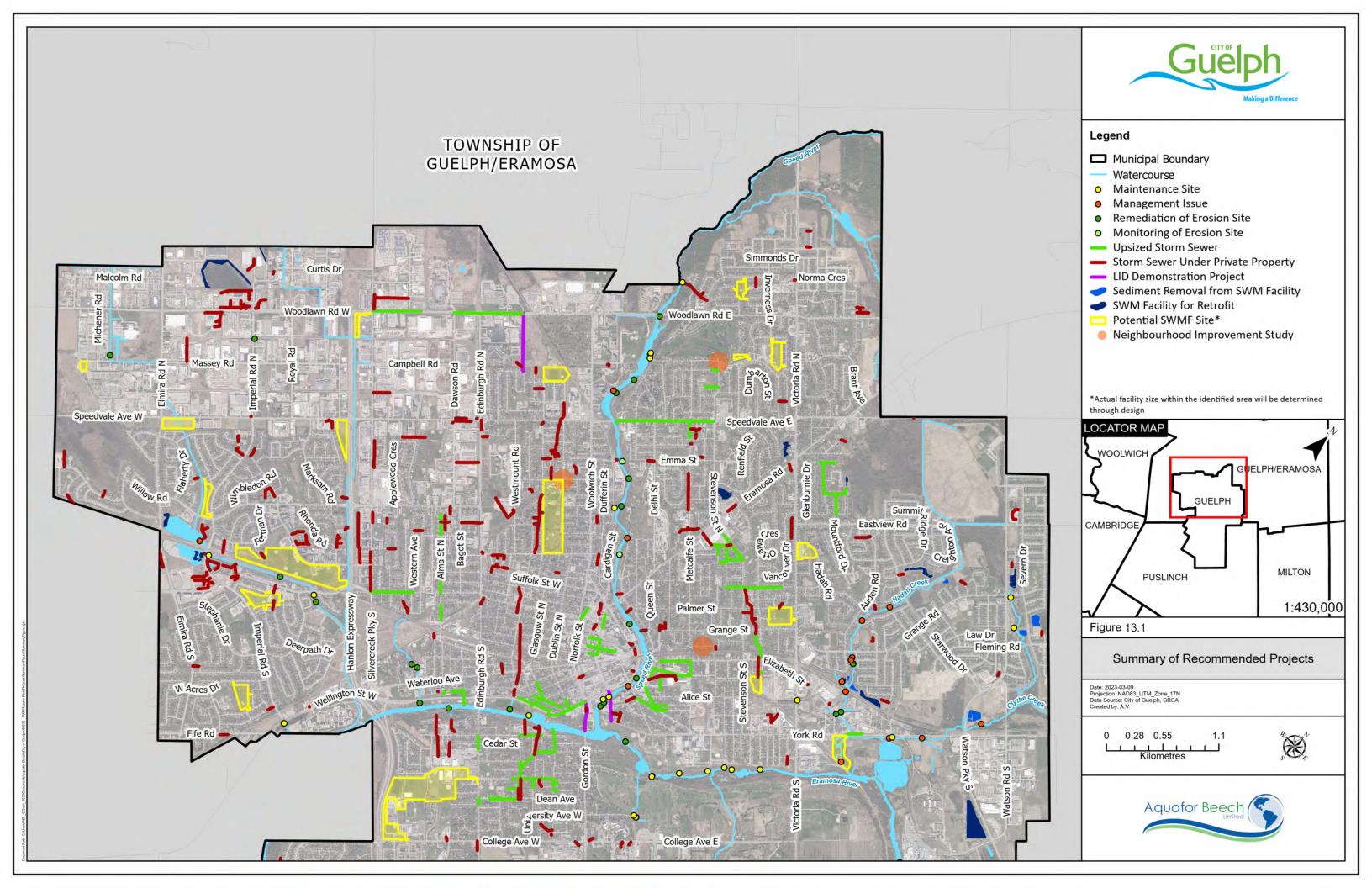
- The City undertake an inventory of downspout connections and then evaluate the benefits on a neighborhood by neighborhood basis as part of a future study using the PCSWMM model developed as part of this study; and/or
- Develop a policy that the City will mandate downspout disconnections as part of the capital roads program and or drainage improvements (i.e. disconnect it when the City does work on that road or storm sewer).

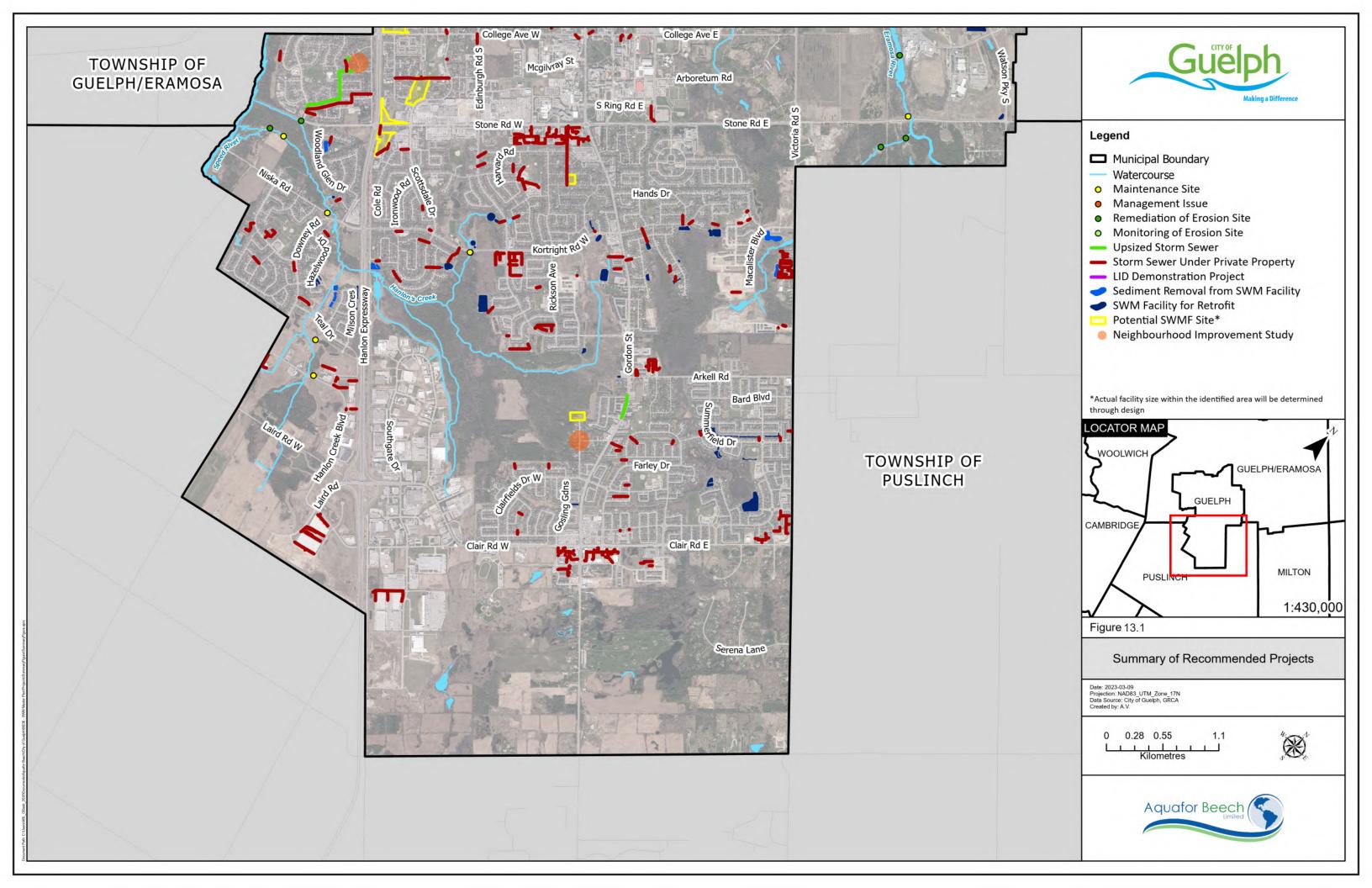
## 13.2 Priority Subwatersheds

This Implementation Plan prioritizes the works recommended by the SWM-MP based on priority subwatersheds as well as recommend funding allocation and policy development. Prioritization is based on the watersheds in the most need and where there are opportunities to improve conditions through the elements of the recommended approach.

Prioritization is based on a hierarchical approach, beginning with the watersheds that have been designated Priority 1 and applying the identified opportunities (i.e. watercourse restoration and erosion repairs, conveyance controls, O&M, SWM facilities, flooding, etc.) as detailed within the Recommended Approach in order to improve overall subwatershed conditions. Subwatersheds are prioritized to maximize the 'net-benefit' to the City, the environment and the community. **Table 13.1** summarizes the priority subwatersheds in the context of identified projects per the SWM-MP recommended approaches.







**Table 13.1: Subwatershed Prioritization and Number of Identified Projects** 

Subwatershed	SWM Facilities		Watercourse						
	Priority Rating	New EOP	Sediment Management	Retrofits	Erosion Restoration	Maintenance	Management	Storm Sewer Upgrades (km)	Neighbourhood Study
	1			Priority 1 S	ubwatersheds	5			
Speed Urban Catchment 6	1				1			1.420.89	
Bailey Drain	1	1							
Speed Urban Catchment 2	1	1						0.87	1
Speed Urban Catchment 1	1							1.73	1
Willow West Drain	1	1		2		2	1		
Speed Urban Catchment 5	1	1						2.55	
			•	Priority 2 S	ubwatersheds	5			
Speed Urban Catchment 3	2	1		1				1.28	1
Silver Creek	2				1			0.44	
Woodland Glen Tributary	2	1	2	1				0.92	1
Speed Urban Catchment 7	2			2	1				
Cutten Tributary	2					3			
Speed Urban Catchment 4	2								
Kortright Hills Tributary	2								
				Priority 3 S	ubwatersheds	5			
Hadati Creek	3	2	3	7	2	1	6	3.41	
Northwest Drain	3								
Imperial Drain	3	1				1	1		
Eramosa Urban Catchment 1	3	1						0.04	
Arboretum Tributary	3								
Torrance Creek	3		2	14	1	1			
				Priority 4 S	ubwatersheds	<b>.</b>			
Hanlon Creek	4		2	14	3	6		0.23	1
Riverside Drain	4							0.67	
Clythe Creek	4		3	6		3	1	0.11	
Northern Tributary	4								



# 13.3 Pollution Prevention/ Municipal Management/Operational Practices

Municipal Pollution Prevention, Management and Operational Practices are important to ensure pollutants are prevented from impacting the environment and to ensure existing stormwater infrastructure maintain their effectiveness. The SWM-MP explored approaches to manage pollutants and sediment within the City's stormwater management infrastructure in the most cost-effective manner. The study and resulting recommended approaches are Exempt from the Municipal Class EA process, and therefore, are pre-approved.

The technical assessment completed as part of City of Guelph's SWM-MP focuses on Sediment Removal from Oil and Grit Separators. OGS units use hydrodynamic separation to remove sediment and hydrocarbons from urban runoff. These units require regular inspection and maintenance in order to function as designed. The SWM-MP explored approaches to manage pollutants and sediment within the City's OGS units in the most cost-effective manner as described in "Preliminary Recommendations for Existing Stormwater Facilities and OGS Units" (Appendix D).

### 13.3.1 Key Next Steps

The City is responsible for the operation and maintenance of one hundred fifty (150) OGS units per the conditions of the respective MECP Environmental Compliance Approval (ECA), with new ones often added as part of road reconstruction projects where technically feasible. Ultimately, all of the units will require maintenance service at some point as a condition of the Environmental Compliance Approval for their installation.

The City inspects each OGS unit on an annual basis and records sediment depth. Based on the measured depth, cleanouts are triggered. On average, OGS units are cleaned out every three years. Allowing for a contingency of 5 OGS units, it is recommended that the City clean out at least 55 OGS units per year, not counting any new OGS units which may be recommended as part of the SWM-MP.

#### 13.3.2 Cost

Based on an analysis of the priority OGS units and considering additional related costs, an average clean-out cost of \$1,400 per unit. At 55 OGS units per year, this would total \$76,800 annually, rounded to the nearest \$100. It was assumed that additional OGS units will be installed by the City as part of future road works, and that one (1) additional OGS unit would require cleaning each year.

### **13.3.3 Funding**

All funds for the OGS programs will come from the general Stormwater Utility Revenue. No one-time funding sources or external funding sources will be used for this program.

## 13.3.4 Timeframe

Sediment removal from priority OGS units will begin in the spring of 2024 with approximately fifty-five (55) units cleaned out, and will occur after street sweeping operations are conducted.



#### 13.3.5 Recommendations

It is recommended that the City continue and optimize all existing practices that they currently implement, as outlined in the long list of alternatives in **Section 5.1** and in the summary of existing practices in **Section 6.1**. The City will continue to monitor sediment accumulation in each OGS unit on an annual basis, and will remove sediment as needed, assuming that one third of all units will require clean-out each year.

# 13.4 Private Property Strategies (Source Controls)

Source control measures fall outside of the Municipal Class EA process, since they are to be constructed on private property, often by the individual land owner as a retrofit or during development/redevelopment (i.e. the City is not the proponent).

## 13.4.1 Key Next Steps

There are multiple external design guides that provide detailed guidance for the design, construction, inspection, operations, and maintenance of LID features. It is recommended the City endorse their preferred documents, and update the DEM and other policies accordingly. This update should also include revisions from the Infiltration Policy Recommendations (Appendix E) and Stormwater Design Criteria and Targets (Appendix F).

City staff will need to review LID submissions, including design and operations and maintenance, to ensure they adhere to City standards. The City's existing approvals process can be modified to include these reviews and approvals. An LID tracking system should be developed at the same time that the approvals process is updated to ensure that applications include sufficient detail for the City to track. The City will need to develop protocols for providing oversight of private property LID features, to ensure LID features are properly designed, constructed, and maintained.

As more LID features are constructed throughout the city, it is expected that the City will begin to receive more applications for Stormwater Management Fee credits. It is recommended that the City continue to operate the Stormwater Management Fee Credit program.

Details regarding LID implementation on private property are included in the **LID Implementation Strategy (Appendix G).** 

#### 13.4.2 Approvals, Policy, By-law or Design Standards Consideration

The LID approvals process, tracking system, and protocols for oversight of private property LID features should be developed, and then formalized into an LID Policy (combined with the municipal ROW recommendations outlined in **Section 13.5.3**). Recommendations for these processes are included in the **LID Implementation Strategy (Appendix G).** 

It is recommended that a review of the City of Guelph Property Standards Bylaw (2000)-16454, the Standing Water Bylaw (2003)-17192, and the Yard Maintenance Bylaw (2008)-18552 be conducted to ensure wording allows for the use of plant growth in LID facilities and unconventional grading which permit the 'temporary ponding' of water.



#### 13.4.3 Cost

There are two primary costs associated with LID implementation on private property, including:

- The development of the LID Tracking Tool, and associated training of City staff to operate the tool, is estimated to cost \$150,000;
- As more LID features are installed on private property, is anticipated that the City will receive more applications for Stormwater Management Fee credits.

Any other tasks are assumed to be completed internally, and will not have any additional costs.

### **13.4.4 Funding**

All funding associated with the above costs will be allocated from the general stormwater utility fee revenue.

#### 13.4.5 Timeframe

The tracking tool development and staff training is prioritized to occur in 2024.

## 13.4.6 Integration

Operating a program for LID implementation on private property will require collaboration between various City departments to ensure a smooth operation of the program. At a minimum, this is expected to include: Planning and Building Services; Engineering and Transportation Services; Environmental Services; and Operations.

# 13.4.7 Operation and Maintenance

**Table 3.3** in the **LID Implementation Strategy (Appendix G)** provides a summary of the various municipal tools and approaches being employed related to O&M of LID BMPs on private property. It is recommended that the mechanisms and approaches be included, modified and / or adapted by the City of Guelph, as responsible for approval based on the local context and existing legal framework.

### 13.4.8 Recommendations

- It is recommended that the City continue to offer the credit and rebate programs.
- It is recommended that the City implement 5mm of volume control on private property according to the expectations outlined in the Infiltration Policy Recommendations (Appendix E) and Stormwater Design Criteria and Targets (Appendix F).
- It is recommended that the City develop an LID Policy, an approvals process, a tracking system, and a process for providing oversight of private property LID best management practices (BMPs).

# 13.5 Stormwater for the Capital Roads Program (Conveyance Controls)

The incorporation of a cost-effective right-of-way (ROW) retrofit approach using a combination of traditional SWM controls (OGS and proprietary stormwater treatment devices) and Low Impact Development (LID) approaches as part of road reconstruction projects presents a significant opportunity to improve SWM control (water quality, water quantity, erosion mitigation, water balance) within the City of Guelph.



### 13.5.1 Key Next Steps

The City is in the process of developing a Complete Streets Design Guide. It is recommended that LID integration into the ROW be included. This can include the development of preferred cross-sections for City streets which include LID features, and how LID features will fit with the other infrastructure included in the ROW (where permitted by the Infiltration Policy).

There are multiple external design guides that provide detailed guidance for the design, construction, inspection, operations, and maintenance of LID features. It is recommended the City endorse their preferred documents, and update the Development Engineering Manual accordingly. This update should also include revisions from the Infiltration Policy Recommendations (Appendix E) and Stormwater Design Criteria and Targets (Appendix F), including the requirement for providing 5mm of volume control as follows:

- c. New linear projects without restrictions and subject to the Stormwater Infiltration Policy Recommendations, that create 0.25 or greater hectares of new and/or fully reconstructed impervious surfaces, shall capture and retain the larger of the following:
  - i. The first 5mm of runoff from the new and fully reconstructed impervious surfaces on the site; or
  - ii. The first 5mm of runoff from the net increase in impervious area on the site.
- d. Roadway resurfacing, mill and overlay and other resurfacing activities are not considered new linear projects and shall achieve volume reduction to the maximum extent possible (MEP) subject to the Stormwater Infiltration Policy Recommendations.

The LID tracking system developed to track source control features on private property should also include tracking of municipal conveyance control features.

The Implementation Plan includes three demonstration projects in 2024 and 2025 to provide an opportunity for the City to develop their LID implementation process. These projects include:

- Nicklin Road rural to urban right of way transition (2024 design)
- Wyndham Street urban full-road reconstruction (2025 design)
- Gordon Street bike lanes urban boulevard conversion (2025 design)

In order to ensure the City assumes only LID practices that are viable in the short and long-term, the City's maintenance period for all ROW LID approaches should be reviewed in the context of standard City of Guelph tender and special provisions. Of importance are the requirement for extended contractor maintenance periods and enhanced guarantees. The City should also develop and/or review LID design, inspection, and assumption protocols.

Details regarding LID implementation in the municipal ROW are included in the **LID Implementation Strategy (Appendix G).** 

### 13.5.2 Future Studies

In order to facilitate the implementation of conveyance controls within municipal rights-of-way, site-specific hydrogeological investigations will be required for certain applications, per the considerations included in the **Infiltration Policy Recommendations (Appendix E)**.



## 13.5.3 Approvals, Policy, By-law or Design Standards Consideration

The City's processes for the design, assumption, operations and maintenance should be developed, and then formalized into an LID Policy (combined with the private property recommendations outlined in **Section 13.4.2**). The LID Policy should also account for the City's approach to comply with the CLI ECA. Recommendations for these processes are included in the **LID Implementation Strategy (Appendix G).** 

Per the 2023 amendments to the *Municipal Class Environmental Assessment (MEA) Act (October 2000, as amended in 2007, 2011, 2015 & 2023)*, the MEA Archaeological Screening Process must be to completed in order to "establish new or modify, retrofit or improve LID features within an existing road allowance or an existing utility corridor" without completing a Schedule B Environmental Assessment (EA). The outcomes of the screening will identify whether the project is exempt, or whether a Schedule B EA is required.

The City's Development Engineering Manual should be updated to include revisions from the Infiltration Policy Recommendations (Appendix E) and Stormwater Design Criteria and Targets (Appendix F).

It is recommended that a review of the City of Guelph Standing Water Bylaw (2003)-17192 and the City's boulevard garden guidelines be conducted to ensure wording allows for the use of plant growth within the ROW and unconventional grading which permit the 'temporary ponding' of water.

## 13.5.4 Mechanisms for Implementation

Conveyance controls will be integrated into road works at the detailed design stage for all capital roads projects such that the project can incorporate new SWM infrastructure to achieve SWM objectives. All conveyance control projects incorporated into roads will be implemented as components of capital roads projects through the stormwater utility fee revenue, or partially through Development Charges if the road works are growth-driven.

Routine re-assessment of the roads scheduled for reconstruction allows for prioritization of which streets to target for the installation of conveyance controls. The preferred control alternative can be identified based on the constraints identified in the **Infiltration Policy Recommendations (Appendix E)**.

### 13.5.5 Cost

The City will implement three demonstration projects in 2024 and 2025 to provide an opportunity for the City to develop their LID implementation process. These projects include:

- Nicklin Road rural to urban right of way transition (2024) \$800,000
- Wyndham Street urban full-road reconstruction (2025) \$800,000
- Gordon Street bike lanes urban boulevard conversion (2025) \$1,500,000

There is an increase in road replacement costs when LID features are incorporated into the design. Other southern Ontario municipalities have found that construction of conveyance controls during road reconstruction projects increases the capital cost of the road work by approximately 3%. LID in the road right-of-way was therefore estimated at an additional 3% of



the annual Capital Roads Program. This ranged from \$95,800 in 2028 to \$541,100 in 2026, depending on the scope of work in the Capital Roads Program.

Maintenance of conveyance controls was assumed conservatively at \$10/linear meter annually for vegetated practices. It was assumed that the length of conveyance controls to be maintained would increase at a rate of 500m/year, starting in 2024 with 500m to be maintained. Annual maintenance costs therefore increased from \$5000 in 2024 to \$140,000 in 2051. It was assumed that sediment removal from conveyance controls will only be required after 25 years, and will cost \$250/linear metre at 500 metres per year.

#### 13.5.6 Timeframe

Three demonstration projects have been identified for design in 2024 and 2025 to build the City's capacity for LID implementation. It is expected that inclusion of conveyance controls will continue through to 2051 as the City complies with the **Stormwater Design Criteria and Targets** (Appendix F).

# 13.5.7 Integration

Public transportation, active transportation, and street trees are all components of the municipal ROW. Road reconstruction projects, including those that incorporate LID features into the ROW, should be designed with consideration of these systems.

Other municipal programs that provide opportunities for integration with the conveyance control strategy are:

- Complete Streets Design Guideline (under development)
- Parks and Recreation Master Plan Update (under development)
- Transportation Master Plan (2022)
- Water and Wastewater Servicing Master Plan (under development)
- Climate Adaptation Plan (under development)
- Natural Heritage Action Plan (2018)
- Urban Forest Management Plan (2012)
- Guelph Trail Master Plan (2021)
- Clair-Maltby Secondary Plan (2022)
- Guelph Innovation District Secondary Plan (2020)

#### 13.5.8 Prioritization

It is important to note that implementation of conveyance controls within the municipal ROW is opportunistic in that they are incorporated into planned road reconstruction projects. When deciding between funding conveyance control retrofits of equal feasibility, subwatershed prioritization (Section 13.2) should be used to determine retrofit priority.

#### 13.5.9 Operation and Maintenance

The **LID Implementation Strategy (Appendix G)** outlines recommendations for an operations and maintenance program for LID practices implemented within the municipal ROW. The City has indicated they prefer to pursue a hybrid approach, consisting of both public and private entities responsible for various inspection, maintenance and repair tasks:



- City inspects and maintains BMPs on public land, and within rights-of-way or easements on private property;
- Property owner responsible for performing some inspection and maintenance tasks and record keeping;
- City responsible for an inventory of all BMPs that qualify for inclusion in their program, and periodic inspections to verify maintenance and performance;
- City responsible for educating property owner about the BMP and inspection and maintenance needs; and
- City responsible for legal tools to require/enforce maintenance of regulated BMPs on private property.

#### 13.5.10 Recommendations

- The City is in the process of developing a Complete Streets Design Guide. It is recommended that LID integration into the road right of way (ROW) be included as part of this guide. This can include the development of preferred cross-sections for City streets which include LID features, and how LID features will fit with the other infrastructure included in the ROW of local, collector, and arterial streets (where permitted by the Infiltration Policy).
- The City will apply volume control to capital roads projects as follows<sup>3</sup>:
  - New linear projects without restrictions and subject to the Stormwater Infiltration Policy Recommendations, that create 0.25 or greater hectares of new and/or fully reconstructed impervious surfaces, shall capture and retain the larger of the following:
    - The first 5mm of runoff from the new and fully reconstructed impervious surfaces on the site; or
    - The first 5mm of runoff from the net increase in impervious area on the site.
  - Roadway resurfacing, mill and overlay and other resurfacing activities are not considered new linear projects and shall achieve volume reduction to the maximum extent possible (MEP) subject to the Stormwater Infiltration Policy Recommendations.
- That the City initiate a Low Impact Development Implementation Program, that includes:
  - Development of a tracking tool
  - Municipal training in use of tracking tool, and LID design, construction, operations, and maintenance
  - Demonstration projects for municipal ROW

<sup>&</sup>lt;sup>3</sup> Note that per the Infiltration Policy Recommendations (Appendix E) and Stormwater Design Criteria and Targets (Appendix F), these requirements may be superseded by those developed by a Subwatershed Study, Master Drainage Plan, Secondary Plan or other planning study. The Clair-Maltby Secondary Plan requires capture of 20mm, while the Guelph Innovation District Stormwater Management Study requires capture of 27mm.



- Operations and maintenance of municipally-owned LID features
- Investigate whether access agreements with other utilities (i.e., Bell, Rogers, etc.) may need to be altered to ensure that the installed LIDs are restored or consider implementing enhanced road cut permits which include rectification bonds.
- Ensure proper oversight during construction and warranty periods by trained and experienced professionals in LID design and construction.
- Proceed with 'multiple objectives' at the detailed design stage for each capital roads
  project such that the project can incorporate new SWM infrastructure to achieve SWM
  objectives as well as achieving objectives relating to Urban Forestry, transit, cycling,
  trails etc.
- That the City review the maintenance period for all ROW LID in the context of standard City of Guelph tender and special provisions, specifically the requirement for extended contractor maintenance periods and enhanced guarantees.

# 13.6 Stormwater Management Facilities

Stormwater management (SWM) facilities are an important component of the City's stormwater infrastructure. The management of existing facilities and the construction of new SWM facilities is critical to ensure stormwater infrastructure maintain their effectiveness and that pollutants are prevented from impacting the environment.

### 13.6.1 Key Next Steps

## **Sediment Removals**

In order to ensure long-term operational effectiveness of SWM facilities, it is crucial to remove accumulated sediment periodically per the conditions of the respective MECP Environmental Compliance Approval (ECA). The City last completed a bathymetry study of its SWM facilities in 2014, and there are still eleven (11) facilities where sediment removal was recommended, but has yet to be completed (**Figure 13.1**). These facilities should be prioritized for clean-out.

#### **SWMF Maintenance**

Maintenance requirements of the City's SWMF were identified in 2014, while additional maintenance requirements for 41 facilities were identified in 2020. The City already maintains a budget for SWMF maintenance; as such, the maintenance recommendations from 2014 and 2020 are to be included as part of the existing maintenance program. It is further recommended that the City develop a tracking protocol to document when recommended maintenance activities have been completed.

### **SWMF Retrofits**

Retrofits improve or enhance the water quality, quantity and erosion control performance of existing stormwater management facilities and bring them in-line with current standards. Since there was not sufficient information for all facilities to determine retrofit need, additional investigations will be required to determine need for retrofit. The final list of facilities to be



retrofitted may therefore change pending the results of these investigations. Facilities currently recommended for retrofits are listed below and presented in **Figure 13.1**:

- Level of Service: since the design level of service of these facilities doesn't meet the City's current standards, it is recommended that these facilities be retrofitted to meet the City's current standards, or the maximum extent possible. This includes the following facilities: 37, 53, 54, 56, 57, 58, 59, 60, 61, 82
- Construction Issue: The 2014 SWMF Report identified several facilities where there
  were significant differences between the design plan and profile and the results of the
  bathymetry survey which were unlikely to be attributed to sediment accumulation. It is
  recommended that these deficiencies be corrected. This includes the following facilities:
  33, 35, 36, 39, 55, 69, 73, 86, 87, 99, 100, 101, 106, 108, 109, 111
- **Dry to Wet Retrofit:** Retrofitting dry ponds to wet ponds allows for the facility to provide water quality controls. The following facilities were recommended for dry to wet retrofit: 9, 18, 21, 23, 27, 32, 34, 38, 79, 96, 103
- **Performance Retrofit:** the need for retrofit of these facilities arose from Aquafor's inspection or from the 2012 SWM-MP. These facilities include: 2, 3, 7, 10, 11, 20, 22, 25, 26, 75, 105

The following facilities could not be assessed for retrofit, and may therefore be added to the above list once the additional investigations are complete: SWMF 4, 5, 6, 8, 12, 13, 14, 15, 17, 19, 24, 28, 31, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 66, 67, 70, 71, 72, 74, 77, 78, 80, 83, 88, 93, 64, 121, 122, 127, 128, 129.

#### **New SWM Facilities**

New end-of-pipe SWM facilities are to be constructed in parks and vacant lots within existing urban areas of the City without SWM controls to increase the proportion of SWM controlled drainage areas in the City and improve water quality control, water quantity control, and erosion control. The recommended approach includes the construction of fifteen (15) new SWM facilities, eleven (11) of which are to be completed as part of park enhancements. The locations for these SWM opportunities are illustrated within **Figure 13.1**.

#### 13.6.2 Future Studies

### **SWM Facility Level of Service Study**

To address deficiencies in information about various SWM facilities, it was recommended that additional investigations be completed, as recommended for each facility (**Appendix C**). These Level of Service investigations include topographic and bathymetric surveys, modeling, monitoring, and quantity control retrofit feasibility studies, as required for each facility.

### 13.6.3 Approvals, Policy, By-law or Design Standards Consideration

### **SWM Facility Sediment Removal**

Public consultation is not required for sediment removal projects; instead, public notice will be issued prior to these activities. In cases where facilities are within habitat of Species at Risk, MECP permitting under the Endangered Species Act will be required.



## **SWM Facility Retrofits and New SWM Facilities**

The study and resulting recommended retrofit works are exempt from the Municipal Class EA process and therefore can proceed directly to detailed design and implementation.

The study and resulting recommended works for new SWM facilities have been completed following Schedule B of the Municipal Class EA process and therefore can proceed directly to detailed design and implementation. It is strongly recommended that the City utilize neighbourhood design charrettes or other collaborative public engagement approaches at the earliest possible stage of planning for SWM in public parks. Early and on-going participation of residents in the design and planning of SWM projects on public lands results in projects that reflect the values and aesthetics of local neighbourhoods and builds support amongst area residents and businesses.

MECP Environmental Compliance Approval (ECA) per Section 53 of the Ontario Water Resources Act / Application for Approval of Municipal and Private Sewage works will be required prior to the construction of new SWM facilities. Where existing facilities are to be retrofitted, the City will need to update the Consolidated Linear Infrastructure ECA.

Permits from the MECP may also be required where projects may impact Species at Risk. Under the Endangered Species Act, the MECP can grant permits or other authorizations for activities that would otherwise not be allowed, with conditions that are aimed at protecting and recovering species at risk.

Fisheries and Oceans Canada (DFO) administers development requirements relating to aquatic habitat under the Fisheries Act. This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fishery. A self-assessment will need to be undertaken for all pond retrofits and new park projects involving works in wetlands and watercourses.

A permit under Ontario Regulation 150/06 - Development, Interference with Wetlands and Alterations to Shoreline Watercourse will be required through the GRCA for any facilities within regulations limits, impacts a wetland or requires the establishment of an outlet. Permits for the maintenance of SWM facility blocks are not generally required from GRCA.

Prior to the implementation of an individual project, the City shall review each site-specific project for the potential to impact known or potential cultural heritage resources and complete heritage screenings or technical studies in compliance with the heritage policies of the Guelph Official Plan as well as other policies and procedures using the resources below relating to:

- Archaeological resources, including land-based and marine,
- Built heritage resources, including bridges and monuments, and
- Cultural heritage landscapes.

### 13.6.4 Cost

To address deficiencies in information about various SWM facilities, it was recommended that additional investigations be completed, as recommended for each facility (**Appendix C**). These



Level of Service investigations include topographic and bathymetric surveys, modeling, monitoring, and quantity control retrofit feasibility studies, as required for each facility. The total cost of these investigations is \$2,781,500. However, this study has been broken into four phases throughout the implementation period, for a cost of \$695,375 per study phase.

# **SWM Facility Sediment Removal**

The overall cost of sediment removal from the identified priority SWM facilities is summarized in **Table 13.2**. City-supplied costs for sediment removal in 2017 and 2019 were reviewed, and the median cost of \$150/m³ of sediment was used to estimate costs to remove, haul, and dispose of sediment. Environmental chemical testing for compliance with the Excess Soil Regulations (O.Reg. 406/19) was also included in the cost estimate, assuming an additional cost of \$15,000 per facility. It is assumed that the bathymetric and topographic survey would be completed concurrently, otherwise an additional \$10,000 per facility would be included to complete the survey prior to sediment removal. Once the facilities identified in the 2014 SMWF Report have been cleaned out, it is recommended the City remove sediment from five SWMF per year, to be prioritized based on the results of the phased Level of Service studies. These were assumed to cost \$150,000 per facility to clean out.

**Table 13.2: Sediment Removals** 

SWM Facility #	Year of Construction	Percent Capacity Remaining	Control Type	Cost Estimate†
3	1975	71%	Infiltration	\$321,000
22	1981	74%	Infiltration	\$167,000
35	1997	33%	Wet	\$242,000
36	1997	75%	Wet	\$111,000
37	1997	79% Wet		\$123,000
53	1999	77%	Wetland	\$212,000
74	2001	75%	Wet with Infiltration Basin	\$94,000
87	2003	72%	Wet	\$62,000
107	2009	79%	Wet with Infiltration Basin	\$167,000
109	2009	79%	Wet with Infiltration Basin	\$45,000
111	2011	75%	Wet	\$42,000
			Total	\$1,586,000

<sup>†</sup> Class "C" Cost estimate, all values in 2023 CDN dollars. Rounded to the nearest \$1,000.

#### **SWMF Maintenance**

Maintenance costs estimated in 2014 have been carried forward, with additional maintenance added based on the 2020 inspections, for a total maintenance cost of \$610,000. All maintenance costs are a one-time cost associated with remedial measures to address issues identified during site visits in 2014 or 2020. As the City already maintains a budget line for SWMF maintenance, no additional costs were allocated for these works, as it is assumed these works will be implemented through the existing budget.



## **SWM Facility Retrofits**

**Appendix C** includes a list of each SWMF, the retrofit recommendations, and the associated cost. The total retrofit cost estimate is \$78.6 million.

#### **New SWM Facilities**

The implementation of fifteen (15) proposed SWM facility opportunities is estimated to cost approximately \$77.1. Implementation costs for the proposed SWM facility opportunities are summarized in **Table 13.3**.

**Table 13.3: SWM Facility Opportunities Costs** 

Site ID	Location Name	EA Schedule	Recommended Facility Type	Total Cost†
1	Golfview Park	В	Subsurface Storage Facility	\$8,303,000
2	Waverley Park	В	Subsurface Storage Facility	\$2,668,000
3	Victoria Road Recreation Centre	В	Subsurface Storage Facility	\$3,358,000
5	Bailey Park	В	Subsurface Storage Facility	\$4,290,000
8	Exhibition Park	В	Subsurface Storage Facility	\$6,843,000
14	Dunhill Place Park	В	Subsurface Storage Facility	\$2,208,000
16	Margaret Greene Park	В	B Surface Facility	
18	Centennial Park	В	Subsurface Storage Facility	\$3,059,000
26	L-13 Windsor Park	В	Subsurface Storage Facility	\$5,382,000
27	Stevenson / Guelph Junction Railway	В	Surface Facility	\$8,027,000
28	Dawn Avenue	В	Low Impact Development	\$518,000
30	606 Massey Road	В	Surface Facility	\$472,000
31	Springdale Park	В	B Subsurface Storage Facility	
32	Oak Street Park	В	B Subsurface Storage Facility	
34	End of Industrial Street	В	Surface Facility	\$6,841,000
			Total	\$77,626,000

<sup>†</sup> Class 'C' cost estimate, all values in 2023 CDN dollars

### **13.6.5 Funding**

In all years, all funding for the sediment removals, maintenance, retrofits, and implementation of new facilities will be allocated from the general Stormwater Fee revenue. Federal funding for new SWM facilities may be available through the Disaster Mitigation and Adaptation Fund.

#### 13.6.6 Timeframe

The Level of Service study has been divided into four (4) phases throughout the implementation period, with higher priority facilities to be investigated in earlier phases. The study phases will occur in 2025, 2034, 2039, and 2045.

### **SWM Facility Sediment Removal**



High priority sediment removals are scheduled to begin in 2024 and continue 2027. As the City builds capacity, it is recommended that sediment removal be completed for five (5) facilities annually, beginning in 2028.

#### **SWMF Maintenance**

SWMF maintenance is already an existing City program, and should therefore be continued throughout the entire implementation period.

### **SWM Facility Retrofits**

SWMF retrofits are scheduled to begin in 2026 and continue through 2051. In early years of the implementation period, only one (1) or two (2) facilities will be retrofitted each year, increasing to up to four (4) facilities towards the end of the implementation period.

#### **New SWM Facilities**

New facility design and construction in municipal parks will begin in 2024, and will continue until 2044. On average, one facility will be under design or construction each year.

## 13.6.7 Integration

SWM facilities are often in or adjacent to public open spaces such as parks and trail networks. As a result, there is a potential synergy with parks rehabilitation and enhancements within many SWM facility projects. It has been shown through previous Master Plans for other Ontario municipalities that 'broader community benefits' are required when implementing new SWM facilities in established neighbourhoods in order to gain community support and ensure the project success.

The retrofit of existing SWM facilities and design of new SWM facilities should respect the objectives of the **Guelph Parks and Recreation Master Plan Master Plan** (under development) which establishes a vision for the next 10-20 years for activities that affect open space planning, parks operations and forestry, and recreation services, and will develop the action plans needed to achieve the vision. It will be crucial to recognize the opportunity for stormwater retrofits that parks can present. Stormwater management can be incorporated into existing and future parks via subsurface stormwater chambers, bioswales and bioretention facilities, and dry stormwater management facilities.

Additional municipal programs that provide opportunities for integration with the stormwater management facility strategy are:

- Climate Adaptation Plan (under development)
- Natural Heritage Action Plan (2018)
- Urban Forest Management Plan (2012)
- Guelph Trail Master Plan (2021)
- Clair-Maltby Secondary Plan (2022)
- Guelph Innovation District Secondary Plan (2020)



### 13.6.8 Prioritization

## **SWM Facility Sediment Removal**

Sediment removal projects were generally prioritized based on the percentage of sediment storage capacity remaining compared to the design storage capacity.

# **SWM Facility Retrofits**

In general, the sequencing of the remaining SWM facility retrofits was prioritized based on subwatershed priority.

#### **New SWM Facilities**

Where feasible, new facilities were prioritized by subwatershed priority.

#### 13.6.9 Recommendations

- It is recommended that the City continue to complete sediment removal from SWM facilities as needed. The following facilities require cleanout: 3, 35, 74, 87, 22, 36, 53, 109, 111, 37, and 107. After these facilities have been cleaned out, it is recommended the City clean out an average of five (5) facilities per year;
- It is recommended that the City incorporate the maintenance recommendations from 2014 and 2020 as part of the existing maintenance program. It is further recommended that the City develop a tracking protocol to document when recommended maintenance activities have been completed;
- It is recommended that the City complete the recommended SWM facility Level of Service study to confirm retrofit requirements;
- It is recommended that the City complete the recommended SWM facility retrofits and the construction of new SWM facilities;
- It is recommended that the City utilize neighbourhood design charrettes at the earliest
  possible stage of planning for SWM in public parks. Early and on-going participation of
  residents in the design and planning of SWM projects on public lands results in projects
  that reflect the values and aesthetics of local neighbourhoods and builds support
  amongst area residents and businesses;
- In light of the risks associated with increases in SWM catchments areas, it is
  recommended that the City prohibit the expansion of SWM facility catchment
  boundaries beyond the limits described in original designs. Where it is feasible for
  retrofits to meet Enhanced quality control for the new catchment area, SWM facility
  catchment areas may be expanded.

#### 13.7 Watercourse and Erosion Restoration

A total of 30 erosion sites were identified along the City's watercourses, with an additional 31 maintenance issues, and 16 management issues.



### 13.7.1 Key Next Steps

The Identification of Restoration Alternatives and Conceptual Design for Preferred Alternatives (Appendix O) identifies the erosion site and reach restoration opportunities, including the evaluation of the preliminary alternatives, the selection of the preferred solution, and the development of the preliminary conceptual designs (including cost estimates). Erosion sites are identified in Table 13.4, and graphically in Figure 13.1. Maintenance and management issues are also presented in Figure 13.1.

### 13.7.2 Policy, By-law or Design Standards Consideration

Expected permitting requirements for each erosion site have been summarized in **Table 13.4**.

MECP permits will only be required where projects may impact Species at Risk. Under the Endangered Species Act, the MECP can grant different types of permits or other authorizations for activities that would otherwise not be allowed, with conditions that are aimed at protecting and recovering Species at Risk.

DFO administers development requirements relating to aquatic habitat under the Fisheries Act. This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fishery. DFO approval will be required for works at most sites.

MNRF permits under the Lakes and Rivers Improvement Act are required for works on dams. MNRF permits may also be required under the Ontario Fish and Wildlife Conservation Act, where fish and wildlife collection and relocation will be required.

A permit under Ontario Regulation 150/06 - Development, Interference with Wetlands and Alterations to Shoreline Watercourse will be required through the GRCA for in-water works.

Prior to the implementation of an individual project, the City shall review each site-specific project for the potential to impact known or potential cultural heritage resources and complete heritage screenings or technical studies in compliance with the heritage policies of the Guelph Official Plan as well as other policies and procedures using the resources below relating to:

- Archaeological resources, including land-based and marine,
- Built heritage resources, including bridges and monuments, and
- Cultural heritage landscapes.

#### 13.7.3 Cost

The implementation costs associated with each primary erosion site project are identified in **Table 13.4.** Since a range of costs was provided for each project, the upper cost was assumed, for a total of \$13.8 million (2023 costs).

The following costs have been assumed for non-EA eligible tasks:

- Edinburgh Wetland Crossing Hydraulic Analysis and Capacity Study: \$80,000
- Edinburgh Wetland Crossing Construction: \$100,000
- Watercourse Erosion Site Monitoring: \$24,000/year



Watercourse Maintenance: \$15,000/year

#### 13.7.4 Timeframe

The Implementation Plan assumes erosion works will continue from 2027 to 2051. Watercourse monitoring and maintenance works will continue through the implementation period.

### **13.7.5 Funding**

The funding for the Watercourse Improvement Program comes from the general stormwater fee revenue.

## 13.7.6 Integration

The erosion assessment, including identified erosion site and restoration reach opportunities, will ultimately need to consider potential projects which align with the Restoration Areas identified within the City of Guelph's Official Plan. Specific municipal programs that provide opportunities for integration with the Watercourse Improvement Program are:

- Climate Adaptation Plan (under development)
- Natural Heritage Action Plan (2018)
- Urban Forest Management Plan (2012)
- Guelph Trail Master Plan (2021)
- Clair-Maltby Secondary Plan (2022)
- Guelph Innovation District Secondary Plan (2020)

#### 13.7.7 Prioritization

The erosion sites have been prioritized based on the ranking completed as part of the **Erosion Assessment Technical Memorandum – Field Investigations (August 2021)**.

#### 13.7.8 Recommendations

The following summarizes the recommendations in the Recommended Approach (**Section 13.7**):

- It is recommended that the City implement the recommended alternatives for each of the identified erosion sites;
- It is recommended that the City complete the recommended maintenance and management activities; and
- It is recommended that the City complete a hydraulic analysis and capacity study for the wetland crossing of Edinburgh Road near the intersection with Gordon Street.



# **Table 13.4: Preferred Alternatives for Erosion Sites**

Site		Preferred Alternative	Permitting†	EA Schedule	Cost
ES #1	Eramosa Outfall	Remove and Replace Local Works	GRCA, MECP-SAR	В	\$240,000
ES #2	Bank Erosion	Local Works	GRCA, DFO, MNRF, MECP- SAR	В	\$360,000
ES #4	Elizabeth Street Outfall	Local Works	GRCA, DFO, MNRF, MECP- SAR	В	\$1,200,000
ES #5	Pedestrian Bridge	Removal of Risk	GRCA, DFO, MNRF, MECP- SAR	В	\$960,000
ES #7	Stop Log Dam	Local Works	GRCA, DFO, MNRF, MNRF LIRA, MECP-SAR	В	\$1,800,000
ES #8	Outfall and Bank Erosion	Stabilization Works	GRCA, DFO, MNRF, MECP- SAR	В	\$240,000
ES #9	Failing Storm Outfall	Remove and Replace Works	GRCA, DFO, MNRF, MECP- SAR	В	\$480,000
ES #10	Stormwater Outfall	Local Replacement Works	GRCA, DFO	В	\$120,000
ES #11	Outfall and Scoured Bank	Local Stabilization Works	GRCA, DFO	В	\$240,000
ES #12/13	Retaining Wall	Reach Based Works	GRCA, DFO, MNRF, MECP- SAR	В	\$600,000
ES #14	Decommissioned Sewer Pipe	Removal of Risk	GRCA, DFO, MNRF, MECP- SAR	В	\$1,800,000
ES #15	Outfall and Retaining Wall	Replacement Works	GRCA, DFO	В	\$600,000
ES #16	Weir Outflanked	Do Nothing	n/a	N/A	N/A
ES #17	Outfall and Bank Erosion	Stabilization Works	GRCA, MECP-SAR	В	\$240,000
ES #18	Exposed Sanitary Sewer	Reach Based Works	DFO, GRCA, MNRF	В	\$250,000
ES #19	Corroded Outfall	Do Nothing	n/a	N/A	N/A
ES #20	Exposed Sanitary Sewer	Reach Based Works	DFO, GRCA, MNRF	В	\$475,000



	Site	Preferred Alternative	Permitting†	EA Schedule	Cost
ES #25/21	Failed Retaining Wall	Replacement Works	GRCA, DFO, MNRF, MECP- SAR	В	\$180,000
ES #22	Slumped Headwall	Local Replacement Works	GRCA	В	\$150,000
ES #23	Decommissioned Watermain	Removal of Risk	GRCA, DFO, MNRF, MECP- SAR	В	\$1,200,000
ES #24	Outflanked Weir and Wall	Local Works	GRCA, DFO, MNRF, MECP- SAR	В	\$1,080,000
ES #26/27	Dam and Slope Erosion	Removal of Risk	GRCA, DFO, MNRF, MNRF LIRA, MECP-SAR	В	\$1,080,000
ES #28	Deteriorated CSP Outfall	Local Works	GRCA	В	\$240,000
ES #29	Bank Erosion near Outfall	Local Repair Works	GRCA, DFO, MNRF, MECP- SAR	В	\$180,000
ES #30	Pedestrian Bridge Erosion	Replacement Works	GRCA, DFO	В	\$120,000
				Total	\$13,835,000

† DFO – Fisheries and Oceans Canada

GRCA – Grand River Conservation Authority

MECP-SAR – Ministry of the Environment, Conservation and Parks Species at Risk

MNRF – Ministry of Natural Resources and Forestry

MNRF-LIRA – Ministry of Natural Resources and Forestry Lakes and Rivers Improvement Act



# 13.8 Urban Flood Management & Storm Sewer Infrastructure

In order to understand and assess the capacity of the existing municipal storm sewers and SWM ponds, the environmental benefits, as well as technical and financial implications relating to urban flooding within the City, a PCSWMM model was developed using various scenarios.

# 13.8.1 Key Next Steps

#### **Model Calibration**

The Storm Sewer Capacity analysis was completed with a quasi-calibrated model. It is recommended that the City undertake monitoring of select storm sewer outfalls, both uncontrolled and SWM facility outlets where stage discharge relationships are not available, in order to calibrate the storm sewer model developed as part of this study. Recommendations for this monitoring program are presented in **Appendix K**.

### **Neighbourhood Improvement Studies**

Issues of chronic flooding in five neighbourhoods were identified through the SWM-MP, which are more complex to address than solely through storm sewer upgrades. To properly address these chronic flooding issues, neighbourhood-specific feasibility studies would be needed. **Table 13.5** summarizes the recommended works.

**Table 13.5: Neighbourhood Studies Recommended Approach** 

	Works Completed	Recommended Works
Division Street and	<ul> <li>Interim Flooding Solution at</li> </ul>	<ul> <li>Preliminary Design</li> </ul>
Exhibition Street	Division and Exhibition – Design	<ul> <li>Detailed Design</li> </ul>
	Alternatives	
Waverley Drive and	N/A	<ul> <li>Capacity Study and</li> </ul>
Stevenson Street		Preliminary Design
North		<ul> <li>Detailed Design</li> </ul>
Grove Street	N/A	Preliminary and
		Detailed Design
Lowes Road West	New EOP Evaluation as part of	Detailed Design
and Dawn Avenue	SWM-MP	
	<ul> <li>Preliminary investigation initiated</li> </ul>	
	2023	
Knevitt Place	N/A	<ul> <li>Feasibility Study and</li> </ul>
		Preliminary Design
		<ul> <li>Detailed Design</li> </ul>

### **Storm Sewer Replacement and Upgrade**

High priority storm surcharge locations were identified in Major/Minor System Hydrologic and Hydraulic Analysis (Appendix K) where upgrades are recommended. These locations are also presented in Figure 13.1. Storm sewers from roads scheduled in the Capital Roads Program were also upsized, where necessary, to mitigate surcharging during the City's storm sewer



design event. It is recommended that the City proceed with upgrading storm sewers as roads are scheduled for reconstruction, and also upgrade storm sewers in the high priority locations.

# **Investigation of Pipes Under Private Property**

A GIS analysis found there are numerous storm sewers throughout the City which are located beneath private property, including many that don't have easements. It is recommended that the City undertake a subsequent investigation into these storm sewers (Appendix L).

#### 13.8.2 Future Studies

### **Model Calibration**

A storm sewer monitoring program is recommended to enable full hydraulic calibration of the model. **Appendix K (Major/Minor System Hydrologic and Hydraulic Analysis, March 2023)** includes a recommended monitoring program that is targeted towards the model calibration.

## **Neighbourhood Improvement Studies**

To resolve flooding issues at each of the five neighbourhoods, it is recommended that the City complete additional capacity and/or feasibility studies that lead towards preliminary and detailed design, as outlined in **Table 13.5**.

### **Investigation of Pipes Under Private Property**

It is recommended that the City complete an investigation of all storm sewers under private property.

#### 13.8.3 Cost and Timeframe

### **Model Calibration**

The model developed as part of the SWM-MP is only quasi-calibrated based on flow monitoring completed in watercourses. Monitoring, calibration, and validation is expected to cost \$300,000, and is scheduled to occur in 2024 and 2025.

#### **Neighbourhood Improvement Studies**

Class C cost estimates and schedule associated with the neighbourhood studies and subsequent construction are summarized in **Table 13.6**.



**Table 13.6: Estimated Cost Summary and Schedule of Neighbourhood Studies** 

Neighbourhood	Project Task	Schedule	Cost Estimate
Division Street and	Preliminary and Detailed Design	2025	\$350,000
Exhibition Street	Construction	2027	\$7,500,000
Waverley Drive and	Capacity Study and Preliminary	2025	\$250,000
Stevenson Street North	Design		
	Detailed Design	2026	\$300,000
	Construction	2028	\$1,500,000*
Grove Street	Preliminary and Detailed Design	2029	\$250,000
	Construction	2032	\$1,250,000*
Lowes Road West and	Preliminary and Detailed Design	2030	\$250,000
Dawn Avenue	Construction	2031	\$1,500,000*
Knevitt Place	Feasibility Study and Detailed	2033	\$250,000
	Design		
	Construction	2034	\$1,300,000*
	Total		\$14,700,000

<sup>\*</sup> Cost estimates are budgetary placeholders only, and are not based on a technical evaluation. Construction costs can only be estimated once preliminary studies and/or design are complete.

# **Storm Sewer Replacement and Upgrade**

The City's stormwater fee has an existing allocation towards the City's Capital Roads Program. From 2024-2051, this is estimated at \$273 million. All costs presented below are in addition to this base cost. Cost implications are based on the uncalibrated model results and as such may not represent the actual cost implications.

The anticipated cost to replace the total length of surcharged pipes under Scenario 6 (5mm Volume Control) is estimated to be \$111.4 million based on a unit cost of \$1,250 per linear metre. There are also financial implications to the installation of LID measures throughout the City. The costs to implement LID measures on all 425km of the City's road network are summarized in **Table 13.7**.

**Table 13.7: LID Implementation Costs** 

Treatment Measure	Unit Cost (\$/m of LID)	City-Wide Implementation (\$ millions)		
Perforated Pipe	\$1160*	\$493.2*		
Bioretention (Boulevard or Bump Out)	\$287**	\$122.1**		
Bioswales	\$402**	\$170.9**		

<sup>\*</sup> includes cost of road reconstruction typically attributed to stormwater

<sup>\*\*</sup> in addition to cost of road reconstruction typically attributed to stormwater



It is not assumed that the City will replace 100 per cent of all surcharging storm sewers or implement LIDs on all roads during the 28-year Implementation Plan.

Scenario 4 of the model included upsizing of a limited number of storm sewers, including those in the upcoming Capital Roads program, as well as high priority storm sewer upgrade recommendations. Upsizing storm sewers in the Capital Roads program will add an additional \$1.7 million beyond what has already been allocated in the City's Capital Roads budget. The high priority storm sewer upgrades are estimated at \$7.7 million.

## **Investigation of Pipes Under Private Property**

It is estimated that approximately \$1,500,000 will be needed to complete an investigation into storm sewers beneath private property, excluding any costs associated with easement or property acquisitions, or storm sewer upgrading. This investigation is scheduled to take place over three years, from 2029-2031.

### **13.8.4 Funding**

All funding for the Urban Flood Management & Storm Sewer Infrastructure program comes from the general stormwater fee revenue.

#### 13.8.5 Recommendations

- 2. It is recommended that the City undertake monitoring of select storm sewer outfalls, both uncontrolled and SWM facility outlets where stage discharge relationships are not available, in order to calibrate the storm sewer model developed as part of this study.
- 3. It is recommended that the City calibrate the storm sewer model developed as part of this study. Calibration to 20% of peak flows and 20% of event volumes are recommended.
- 4. It is recommended that upcoming capital roads projects consider the outputs of the calibrated model when sizing storm sewer upgrades.
- 5. It is recommended that the City complete an investigation of all storm sewers under private property, including, but not limited to the following:
  - a. Ensure that all City-owned property is correctly identified within the GIS layers to confirm the identification of storm sewers beneath privately-owned property;
  - Review easement records to determine whether additional easements have been put in place beyond those currently identified. It is expected that more easements should be in place in many of the newer subdivisions;
  - c. Complete a review of all available as-built drawings for pipes identified as beneath private property;
  - d. Complete a conditions assessment of these storm sewers, especially the five highlighted above. This should include CCTV of each storm sewer, where feasible;
  - e. Update the GIS storm sewer network with the results found through the background search; and



- f. Provide recommendations for reducing the risks associated with each storm sewer.
- 6. A neighbourhood-specific study is recommended for each of the five locations identified in **Section 10.4**, as summarized in **Table 13.5**.

# 13.9 Innovation Strategy

An Innovation Strategy was developed for the City of Guelph in a memo titled "Innovation Strategy (March 2023)". This supporting technical document to the SWM-MP is included as Appendix S.

The City has indicated a desire to improve the lives of their residents and businesses through innovation, data and connected technology. This was recently represented in 2019 when the City of Guelph and Wellington County received \$10 million in federal grant funding through the Smart Cities Challenge, with the vision of Our Food Future, Canada's first circular food economy. The SWM-MP continues in the spirit of the Smart Cities Challenge which is to pursue innovative, progressive and emerging ideas touching on the economy, environment, governance and people in order to achieve a high quality of life for all the residents and businesses of Guelph.

Some innovations outlined in the report have already been integrated into the SWM-MP, including:

- Subwatershed Health Analysis
- LID Implementation
- Infiltration Policy
- Leveraging Infrastructure

Additional innovations have been identified through this report, providing next steps that City may choose to pursue at a later date, and including:

- Technological Innovations:
  - o Real-Time Remote Controls
  - Predictive Modeling
  - Smart City Opportunities
- Social Innovations:
  - Equity, Diversity and Inclusion
  - Circular Economy
  - Public Education
- Policy Innovations:
  - Asset Management Considerations
  - Integrated Subwatershed Monitoring Program
  - Credit Trading
  - Infiltration Policy Update
  - Social Marketing and Market Transformation
  - One Water



### Non-Traditional Policy Alternatives

The City identified that they wanted to pursue Social Marketing and Market Transformation as part of the Implementation Plan, which is described below.

## 13.9.1 Social Marketing and Market Transformation

Market-Based Instruments (MBIs) are used to secure at-source SWM measures and practices by residential, non-residential, and multi-residential property owners. Non-residential and multi-residential properties are recommended to be more specifically targeted as they represent the greatest potential to meet identified SWM objectives as part of the SWM-MP.

### 13.9.1.1 Future Studies

In order to generate uptake of at-source SWM and pollution prevention practices and measures by residential and industrial/commercial property owners, a "made in Guelph" market-strategy needs to be developed. A preliminary Market Research Study is therefore recommended to determine viable alternatives to current SWM programming. Market-based research involves market segmentation and analysis to determine constraints and opportunities in each market segment and across market segments or sectors. It is recommended that single-detached dwellings and industrial and commercial property owners/managers are the target sectors for the primary market research.

Once the Market Research Study is complete, a Market-Based Strategy can be developed and implemented, with specific components of the strategy to be outlined by the study.

### 13.9.1.2 Facilitators and Contributors

The City of Guelph has previously partnered with REEP Green Solutions to support landowners implementing stormwater mitigation measures. REEP continues to provide the public with information, resources and direct expert guidance to residential and industrial, commercial and institutional (ICI) property owners. The City may choose to partner with REEP to implement the Market-Based Strategy.

#### 13.9.1.3 Cost

The preliminary Market Research Study is estimated to cost approximately \$80,000.

Implementation costs for a Market-Based Strategy have been estimated in **Table 13.8** for a 5-year implementation period for the Preferred Market Based Strategy. This cost estimate is based on Aquafor's experience working with other municipalities, but is expected to change based on the outcomes of the City of Guelph Market Research Study, and is only provided here as a place-holder in the implementation budget. The estimated costs reflect resource requirements including staffing, overhead expenses, consulting services, advertising and promotion, and miscellaneous program related expenses.



Table 13.8: Cost Estimate for Potential Market-Based Strategy

DESCRIPTION	Person Hours	Costs (\$) Year 1†	Costs (\$) Years 2 – 5†
Set up and administration of financing program	10,400	\$365,000	\$446,000
On-line application process	715	\$28,000	\$27,000
Set-up of incentive program for new ICI development	10,400	\$334,000	\$476,000
Administration of incentive program	9,360	\$183,000	\$547,000
Set up and administration of site consultation visits and support	6,240	\$96,000	\$390,000
Site visits and support for both programs	2,928	\$45,000	\$183,000
Advertising and promotional materials for both programs	n/a	\$108,000	\$87,000
Advertising and promotion for both programs	n/a	\$162,000	\$244,000
Miscellaneous	n/a	\$81,000	\$162,000
TOTAL COST		\$3,9	964,000

<sup>†</sup> Class "C" Cost estimate, all values in 2023 CDN dollars.

### **13.9.1.4 Funding**

All funding associated with the Market-Based Strategy will be allocated from the general stormwater utility fee revenue.

### **13.9.1.5** Timeframe

The Market Research Study is scheduled for 2033, with implementation of the Market-Based Strategy in 2035 to 2039.

### 13.9.1.6 Integration

Integration of City policies and programming across water management and related portfolios provides an opportunity for co-operation; economies of scale; risk management; enhancing program effectiveness (business decisions are not made in isolation with benefits to one portfolio coming at the expense of another); and ultimately, integration enables greater organizational responsiveness and adaptability.

Specific municipal programs that provide opportunities for integration with the Market-Based Strategy are:

- Climate Adaptation Plan (under development)
- Natural Heritage Action Plan (2018)
- Urban Forest Management Plan (2012)
- Guelph Trail Master Plan (2021)
- Clair-Maltby Secondary Plan (2022)
- Guelph Innovation District Secondary Plan (2020)



#### 13.9.1.7 Prioritization

It is proposed that the City focus on Priority 1 (and potentially Priority 2) subwatersheds for full implementation of the market-based strategy. These priority subwatersheds are primarily located in the urban core. During the first year of the market-based strategy (2035), it is recommended that key neighbourhoods in priority subwatershed be targeted.

### 13.9.1.8 Operation and Maintenance

The public willingness to maintain landscape-based stormwater infrastructure is far more realistic when simple source control features that share maintenance regiments with conventional landscape features are implemented. Maintenance of bioretention practices (rain gardens) generally involves maintenance of the vegetative cover similar to a garden bed. Pilot projects such as the Lakeview Neighborhood ROW Retrofit project in Mississauga identified that area private landowners were willing to participate in regular maintenance activities. It suggests that the willingness of homeowners and businesses to take ownership of LID measures is possible if the stormwater measures speak to the vision of the public and /or the business. Given homeowner and business motivations for the design and maintenance of their landscape are based on a deeply held, traditional aesthetic perception of what makes a beautiful landscape, the marketing program must first address this perceptual constraint before lot-level SWM modifications will be voluntarily undertaken.

#### 13.9.1.9 Recommendations

It is recommended that the City pursue a preliminary Market Research Study to determine viable alternatives to current SWM programming, and then to subsequently develop and implement a Market-Based Strategy based on the results of the study.

# 13.10 Annual Stormwater Monitoring Plan

In order to ensure the goals and objectives of the SWM-MP are accomplished over time, a refocused stormwater monitoring program is recommended. Stormwater monitoring helps to identify any existing or emerging water quality and quantity issues, allowing the City to identify when maintenance and/or infrastructure upgrades are required. The City of Guelph has an existing Stormwater Monitoring Program, however it is recommended that this program be revised, as described in the **Annual Stormwater Monitoring Program (Appendix R)**. Subwatershed study monitoring programs, also completed by the City, can be developed with consideration for the City's annual monitoring plan.

The proposed monitoring plan includes a transition away from monitoring SWMF to monitoring larger outfalls throughout the city. This proposed plan will still align with the NHAP objectives, focusing more on the receiving water bodies and their response to upstream SWM techniques, instead of on individual ponds. By monitoring outfalls, the baseline water quality can be identified, and changes in water quality can indicate issues in the upstream catchment that may warrant additional detailed investigations and remedial work. The proposed monitoring plan also considers the forthcoming MECP monitoring requirements as part of the CLI ECA.



In addition, the stormwater monitoring program is recommended to include previous monitoring obligations including but not limited to:

- ECA compliance monitoring. Once the CLI ECA Monitoring Program is implemented, the current ECA compliance monitoring is expected to shift to the CLI ECA monitoring program.
- Other permit compliance monitoring as directed by the GRCA, MNRF, DFO or MECP. To be identified on a case-by- case basis.
  - o This includes the Hanlon Creek Business Park monitoring program.

# **13.11 Staffing Recommendations**

In order to achieve the goals of the SWM-MP, it is recommended that approximately three (3) FTE will be required, with roles to be defined through benchmarking. Tasks for these staff are expected to include, but not be limited to:

- Review and approve LID BMP designs on private property;
- Run the new City LID tracking system using GIS software;
- Perform operations and maintenance for City-owned and operated vegetated LIDs;
- Inspect private LID BMPs to ensure ongoing compliance;
- Provide design support for the implementation of LID techniques within the municipal ROW projects and create new design standards and specifications;
- Manage stormwater management pond rehabilitation projects;
- Manage design and construction of new stormwater management facilities;
- Manage watercourse rehabilitation and erosion control projects;
- Further refine the hydraulic modelling to identify constraints in SWM infrastructure; and
- Operate and maintain the City's PCSWMM model.

# **13.12 Cost Summary**

A summary of the estimated implementation costs for each element of the recommended strategy is provided below and includes a summary of all assumptions. Class C costs estimates for each element of the Recommended Approach are detailed in **Table 13.9** below.



Table 13.9: Recommended Approach – Summary of Cost Estimates†

Recommended Approach Element	Cost Estimate (\$ millions)*
7) Municipal Pollution Prevention, Management, Operations &	
Maintenance Practices	
a. OGS Maintenance	\$3.0
b. Other Established/ Existing City Practices	\$0
8) Private Property Strategies (source controls):	
a. Tracking Tool Development	\$0.2
9) Stormwater for the Capital Roads Program (conveyance controls)	
a. Demonstration Projects	\$3.1
b. LID in ROW Program	\$8.2
c. Sediment Removal	\$0.4
10) Stormwater Management (SWM) Facilities	
a. SWM Level of Service Study	\$2.8
b. Sediment Removals	\$19.6
c. Retrofits	\$78.6
d. New SWM Facilities	\$77.1
11) Watercourse and Erosion Restoration	\$15.1
12) Urban Flood Management & Stormwater Infrastructure	
(Preliminary Estimated Cost Implications based on Quasi-	
calibrated model)	
a. Model Calibration	\$0.3
b. Neighbourhood Improvement Studies	\$14.7
c. Storm Sewer Replacement and Upgrade	\$291.3
d. Investigation of Pipes Under Private Property	\$1.5
mplementation	·
a. DEM and Policy Update	\$0.03
b. Cash-in-Lieu Study	\$0.1
c. Direct Discharge to Receiver Study	\$0.1
d. LID Policy Development	\$0.1
e. SWM-MP, Subwatershed Health, and IDF Update	\$1.8
f. SWM Monitoring Program	\$1.3
g. Routine SWM Infrastructure Maintenance Program	\$35.8
h. Social Marketing and Market Transformation Approach	\$4.0
i. Staffing	\$9.6
Total	\$564.0
Total Yearly Expenditure‡	\$20.1

<sup>†</sup> Class 'C' cost estimate. Note: all values in 2023 CDN dollars

<sup>\*</sup> Rounded to the nearest \$100,000



# 13.13 Implementation Schedule and Budget

The implementation schedule and budget forecast illustrate the specific program or project elements of the recommended approach as well as the recommended year within which the element is to be completed as well as the estimated costs. **Table 13.10** summarizes the implementation schedule and budget forecast.

- Program: Within the proposed stormwater budget forecast, a program requires
  perpetual or long-term annual funding to sustain an acceptable level of service.
  Programs may have defined start dates and projected program periods; however, it is
  expected that these programs will continue until program components are integrated
  into new programs or replaced by more efficient strategies.
- **Project:** Within the proposed stormwater budget forecast, a project requires a short-term capital expenditure typically for construction. A goal of the stormwater budget forecast is to allocate start and completion dates for these projects that take into consideration budget opportunities and constraints as well as watershed prioritization.

The implementation schedule and associated costs have been distributed over the 28-year implementation period (2024-2051) in order to manage staff and equipment requirements, build municipal capacity, align with other municipal projects and programs and provide the City with information required to acquire adequate funding. Beyond the specified implementation period, the following expenditures have been deferred:

- Only \$9.4 million of the estimated \$111.4 million for storm sewer upgrades was allocated within the implementation period. Additional storm sewers may be upgraded during the implementation period, but these capital projects have not yet been specified.
- Only \$8.2 million has been allocated for LID implementation in the road ROW as part of the Capital Roads Program. The total financial implications of LID implementation depend on which LID treatment measures are installed, but range from \$122.1 million (in addition to cost of road reconstruction typically attributed to stormwater) to \$493.2 million (including cost of road reconstruction typically attributed to stormwater).

Implementation of the remaining storm sewer upgrades and LID measures will continue as part of the City's ongoing Capital Roads Program beyond the 2051 implementation period.

The SWM-MP is intended to provide a comprehensive vision for the City which would address identified deficiencies within the existing SWM system, provide direction for new development, and enable the City to operate the SWM program at a sustainable level. The pace of implementation will ultimately be guided by the City's capital budgeting and human resourcing capacity in the context of all organizational priorities. As a result, the implementation timeline as outlined in **Table 13.10** may be modified to reflect these priorities and resources.



Should implementation of the Recommended Approach per the Implementation Plan be significantly delayed, the City risks impacts to infrastructure through flooding and/or erosion; and continued negative impacts to water quality in the City's surface water features.



		Immediate	Term Implementation	n Priorities			Mediu	m Term Implementati	on Priorities			
	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Projects/Studies												
Neighbourhood Improvement Studies		Division/ Exhibition Flood Study - Design Waverly and Stevenson Capacity Study \$600,000	Waverly and Stevenson Detailed Design \$300,000	Division/ Exhibition Flood Study - Construction \$7,500,000	Waverly and Stevenson Capacity Study and Retrofits - Construction \$1,500,000	Grove Street Flood Remediation and Major Overland System - Design \$250,000	Lowes and Dawn LID and Major Outlet Retrofit - Design \$250,000	Lowes and Dawn LID and Major Outlet Retrofit - Construction \$1,500,000	Grove Street Flood Remediation and Major Overland System - Construction \$1,250,000	Knevitt Minor System Upgrade, LID Feasibility Study and Detailed Design \$250,000	Knevitt Minor System Upgrade, LID Construction \$1,300,000	
CMMA Database Lindate	Update SWM	+000,000	+223/223	<b>+</b> 1/2 2 2/2 2 2	+ =/= = =/===	<del>+</del>	<b>+===</b>	+=/200/200	+=/===/	<b>+</b>	+-,000,000	
SWM Database Update	Database											
SWM Facility Retrofits			Design: 20, 22 Construct: \$1,042,400	Design: 103 Construct: 20, 22 \$4,471,400	Design: 25 Construct: 103 \$1,004,000	Design: 2 Construct: 25 \$2,770,600	Design: 10 Construct: 2 \$1,237,200	Design: 11 Construct: 10 \$2,832,600	Design: 3 Construct: 11 \$1,562,200	Design: 7 Construct: 3 \$2,687,600	Design: 55 Construct: 7 \$2,454,000	Design: 18 Construct: 55 \$1,746,400
New EOP and Park Enhancements	Design: GJR, Industrial \$707,000	Design: Exhibition	Design: Windsor  Construct: GJR,  Industrial  \$5,109,000	Construct: Exhibition \$2,320,000	Construct: Windsor \$2,660,000	Design: Massey	Design: Margaret Greene Construct: Massey \$7,852,000	Construct: Margaret Greene \$12,680,000	Design: Centennial	Design: Dunhill Place  Construct: Centennial  \$4,168,000	Design: Bailey  Construct: Dunhill  Place \$4,003,000	Construct: Bailey \$7,220,000
DCCIMINADA NA - d - l		ling and Calibration	<b>\$3,103,000</b>	<i>\$2,320,000</i>	<i>\$2,000,000</i>	<del>7033,000</del>	<i>\$7,032,000</i>	<b>\$12,000,000</b>	<del>γ300,000</del>	ψ 1,100,000	<b>\$ 1,003,000</b>	ψ1,220,000
PCSWMM Model	\$200,000	\$100,000										
Watercourse Erosion Site Monitoring	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000
Watercourse Maintenance	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000
Capital Watercourse Remediation	Capital Watercourse Remediation SW0095 North-West Well Channel Natura		laturalization	Design: 4, 10  Construct: 10	Construct: 4	Design: 28, 29, Edinburgh Crossing Construct: 28, 29	Design: 8, 12, 13, 18, 20  Construct: 8, 18, 20,	Construct: 12, 13	Design: 14	Construct: 14	Design: 9  Construct: 9	Design: 2  Construct: 2
	\$200,000	\$500,000	\$500,000	\$320,000	\$1,000,000	\$500,000	Edinburgh Crossing \$1,165,000	\$500,000	\$300,000	\$1,500,000	\$480,000	\$360,000
Update Development Engineering Manual and Policy Update	Update DEM Develop LID Policy \$100,000											
City-Wide Studies		SWMF Level of Service (1) \$695,375	Cash-in-Lieu Study \$100,000	SW0100 Cost of Service Study \$25,000	Direct Discharge to Receiver Study \$100,000	Investigatio \$500,000	n of Pipes Under Priv \$500,000	ate Property \$500,000	SWM-MP, SWS Health, IDF Update \$905,000	Market Research Study \$80,000	SWMF Level of Service (2) \$695,375	
Low Impact Development Implementation Program	Tracking Tool Development & Municipal Training \$150,000											1,402,000
LID Demonstration Projects	Nicklin Road \$800,000	Gordon Street & Wyndham Street \$2,300,000										
Programs (SWM) COS LID	C)4/0.4E-2.2E-74.2E	CM/AF 22 2C	CVA/DATE E2 400 411	C)4/0.4E.27_4.2E	5.61.11.15	E 61/19 15	F ()+()+5	E 614 11 4 E	F CW (2.45	E C) ( ) 4 E	F CW !! * F	E 6)4/1 45
Sediment Management Program (SWMF, OGS, LID, catchbasins)	SWMF 3, 35, 74, 87	SWMF 22, 36 \$279,000	\$300,000 \$300,000	SWMF 37, 107 \$292,000	5 SWMF \$750,000	5 SWMF	5 SWMF \$750,000	5 SWMF	5 SWMF \$750,000	5 SWMF	5 SWMF	5 SWMF
catchbashis	\$721,000 55 OGS	\$279,000 56 OGS	\$300,000 57 OGS	\$292,000 58 OGS	\$750,000 59 OGS	\$750,000 60 OGS	\$750,000 61 OGS	\$750,000 62 OGS	\$750,000 63 OGS	\$750,000 64 OGS	\$750,000 65 OGS	\$750,000 66 OGS
	\$87,000	\$88,400	\$89,800	\$91,200	\$92,600	\$94,000	\$95,400	\$96,800	\$98,200	\$99,600	\$101,000	\$102,400
Routine SWM Infrastructure Maintenance Program	\$1,224,000	\$1,345,000	\$1,350,000	\$1,273,800	\$1,277,400	\$1,281,000	\$1,284,600	\$1,288,200	\$1,241,800	\$1,245,400	\$1,249,000	\$1,252,600
SWM Monitoring Program	\$117,000	\$71,000	\$75,000	\$79,000	\$83,000	\$87,000	\$62,000	\$62,000	\$32,000	\$32,000	\$32,000	\$32,000
LID in ROW Program	\$216,471	\$301,722	\$541,074	\$232,971	\$94,848	\$290,235	\$190,707	\$430,284	\$300,000	\$419,532	\$287,289	\$287,289
Storm Sewer Replacement and Upgrade Program	\$7,925,700	\$10,917,400	\$19,495,800	\$9,375,700	\$4,621,600	\$10,984,500	High Priority Storm S	ewer Upsizing (Scenar \$15,652,800	io 4) \$10,950,015	\$15,084,385	\$10,526,300	\$10,676,300
Amusel Total Funance												
Annual Total Expenses	\$12,487,171	\$17,584,897	\$28,942,074	\$26,020,071	\$13,222,448	\$18,439,335	\$20,942,807	\$36,331,684	\$17,988,215	\$26,355,517	\$21,916,964	\$23,867,989

	Long Term Implementation Priorities											
	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
Projects/Studies		1		ı	ı	ı		ı		ı	ı	ı
Neighbourhood Improvement Studies												
SWM Database Update												
SWM Facility Retrofits	Design: 36, 9 Construct: 18 \$3,984,400	Design: 54 Construct: 36, 9 \$6,363,800	Design: 21, 23, 27 Construct: 54 \$1,096,200	Design: 56, 58, 59 Construct: 21, 23, 27 \$3,050,800	Design: 26, 34, 57 Construct: 56, 58, 59 \$2,160,000	Design: 75, 105 Construct: 26, 34, 57 \$2,422,000	Design: 69, 82, 87 Construct: 75, 105 \$1,919,400	Design: 79 Construct: 69, 82, 87 \$5,570,400	Design: 37, 106 Construct: 79 \$1,383,400	Design: 35 Construct: 37, 106 \$4,903,200	Design: 32, 61, 99 Construct: 35 \$2,421,800	Design: 60, 109 Construct: 32, 61, 99 \$2,143,800
New EOP and Park Enhancements	Design: Waverley \$1,767,000	Design: Oak Street  Construct: Waverley \$12,482,000	Construct: Oak Street \$4,680,000	Design: Golfview \$288,000	Construct: Golfview \$1,920,000	Design: Victoria Road \$1,047,000	Construct: Victoria Road \$6,980,000	Design: Springdale \$935,000	Construct: Springdale \$6,230,000			
PCSWMM Model												
Watercourse Erosion Site Monitoring	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000
Watercourse Maintenance	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000
Capital Watercourse Remediation	Design: 23  Construct: 23  \$150,000	Design: 11  Construct: 11  \$240,000	Design: 17  Construct: 17  \$240,000	Design: 15, 22  Construct: 22  \$280,000	Construct: 15 \$500,000	Design: 26, 27	Construct: 26, 27 \$900,000	Design: 7	Construct: 7 \$1,500,000	Design: 1, 5  Construct: 1  \$400,000	Construct: 5 \$800,000	Design: 21, 25 \$180,000
Update Development Engineering Manual and Policy Update	\$130,000	3240,000	\$240,000	\$250,000	\$300,000	\$160,000	\$300,000	\$300,000	\$1,300,000	\$400,000	\$500,000	\$180,000
City-Wide Studies				SWMF Level of Service (3) \$695,375			SWM-MP, SWS Health, IDF Update \$905,000			SWMF Level of Service (4) \$695,375		
Low Impact Development Implementation Program		t Transformation Imple	ementation 640,500	l 640 500								
LID Demonstration Projects	010,300	0 10,300	0.0,000	0.0,000								
Programs Sediment Management Program (SWMF, OGS, LID, catchbasins)	5 SWMF \$750,000 67 OGS \$103,800	5 SWMF \$750,000 68 OGS \$105,200	5 SWMF \$750,000 69 OGS \$106,600	5 SWMF \$750,000 70 OGS \$108,000	5 SWMF \$750,000 71 OGS \$109,400	5 SWMF \$750,000 72 OGS \$110,800	5 SWMF \$750,000 73 OGS \$112,200	5 SWMF \$750,000 74 OGS \$113,600	5 SWMF \$750,000 75 OGS \$115,000	5 SWMF \$750,000 76 OGS \$116,400	5 SWMF \$750,000 77 OGS \$117,800	5 SWMF \$750,000 78 OGS \$119,200
Routine SWM Infrastructure Maintenance Program	\$1,256,200	\$1,259,800	\$1,263,400	68, SW0102, SWMF Ma \$1,267,000	\$1,270,600	\$1,274,200	\$1,277,800	\$1,281,400	\$1,285,000	\$1,288,600	\$1,292,200	\$1,295,800
SWM Monitoring Program LID in ROW Program	\$32,000 \$287,289	\$32,000 \$287,289	\$32,000 \$287,289	\$32,000 \$287,289	\$32,000 \$287,289	\$32,000 \$287,289	\$32,000 \$287,289	\$32,000 \$287,289	\$32,000 \$287,289	\$32,000 \$287,289	\$32,000 \$287,289	\$32,000 \$287,289
Storm Sewer Replacement and Upgrade Program				\$287,289 r Investigation, SW0094		Ş287,28 <del>9</del>	Ş28 <i>1</i> ,289	Ş281,28 <del>9</del>	Ş28 <i>1</i> ,289	Ş287,28 <del>9</del>	Ş287,28 <del>9</del>	Ş287,28 <del>9</del>
	\$9,776,300	\$9,926,300	\$9,776,300	\$9,926,300	\$9,776,300	\$9,926,300	\$9,776,300	\$9,926,300	\$9,776,300	\$9,926,300	\$9,776,300	\$9,926,300
Annual Total Expenses	\$18,786,489	\$32,125,889	\$18,911,289	\$17,364,264	\$16,844,589	\$16,068,589	\$22,978,989	\$19,234,989	\$21,397,989	\$18,438,164	\$15,516,389	\$14,773,389

Table 13.10: Implementation Schedule and Budget Forecast

Projects/Studies	2048	2049	2050	2051
Tojects, stadies				
Neighbourhood Improvement Studies				
SWM Database Update				
	Design: 39, 100, 101, 108	Design: 33, 73	Design: 86, 111	Design: 53, 86
SWM Facility Retrofits	Construct: 60, 109 \$2,241,000	Construct: 39, 100, 101, 108 \$4,477,200	Construct: 38, 96, 86, 111 \$2,860,000	Construct: 33, 38, 9 \$9,823,800
	\$2,241,000	\$4,477,200	\$2,800,000	\$9,625,600
New EOP and Park Enhancements				
PCSWMM Model				
	\$24,000	\$24,000	\$24,000	\$24,000
Watercourse Erosion Site Monitoring Watercourse Maintenance	\$15,000	\$15,000	\$15,000	\$15,000
aterious indirectione	<b>\$13,000</b>	<b>Ç13,000</b>	<b>\$13,000</b>	<b>713,000</b>
		Design: 30	Design: 24	
Capital Watercourse Remediation	Comptonet 24, 25	Country 20		Comptoned 24
	Construct: 21, 25	Construct: 30		Construct: 24
	\$900,000	\$120,000	\$200,000	\$1,000,000
Update Development Engineering Manual and				
Policy Update				
City-Wide Studies				
on, muc statics				
Low Impact Development Implementation Program				
LID Demonstration Projects				
Programs				
sediment Management Program (SWMF, OGS, LID,	5 SWMF	5 SWMF	5 SWMF	5 SWMF
atchbasins)	\$750,000	\$750,000	\$750,000	\$750,000
	79 OGS	80 OGS	81 OGS	82 OGS
	\$120,600	\$122,000	\$123,400	\$124,800
		500m LID \$125,000	500m LID	500m LID
Routine SWM Infrastructure Maintenance Program		\$125,000	\$125,000	\$125,000
Service in a service in a service in ografie	\$1,299,400	\$1,303,000	\$1,306,600	\$1,310,200
SWM Monitoring Program	\$32,000	\$32,000	\$32,000	\$32,000
ID in ROW Program	\$287,289	\$287,289	\$287,289	\$287,289
Storm Sewer Replacement and Upgrade Program				
	\$9,776,300	\$9,926,300	\$9,776,300	\$9,926,300
	ψυ,υ,υυυ	<del>42,220,000</del>	<i>40,1.10,000</i>	<b>45,520,000</b>
Annual Total Expenses	\$15,445,589	\$17,181,789	\$15,499,589	\$23,418,3

## 14 Recommendations

The final study recommendations for consideration by the City of Guelph are as follows:

- 1. That the City update its policies, manuals and guidelines, as appropriate, to align with the recommendations put forth in the SWM -MP technical reports, including:
  - a. Stormwater Design Criteria and Targets (November 2022)
  - b. Stormwater Infiltration Policy Recommendations (November 2022)
  - c. Innovation Strategy [pending completion]
  - d. LID Implementation Strategy (February 2023)
  - e. IDF Curve from the IDF and Rainfall Trends Analysis (October 2021)
  - f. That the City use a climate stress scenario in the design of new trunk stormwater infrastructure to determine risks of undersizing infrastructure over its lifetime.
- 2. That the City review historical rainfall trends and future IDF projections every 10 years as global climate models are updated, and update design standards as needed.
- 3. That to the City implement the Recommended Approach per the Implementation Plan for all Projects, Programs with an operational and maintenance strategy, resource requirements, and supporting policies and by-laws to permit the implementation of the Recommended Approach;
- 4. That the City incorporate elements of the Recommended Approach into the 2024-2027 Multi-Year Budget.
- 5. That the City use the cost estimates from the SWM-MP as well as the conclusions from the ongoing Utility Rate Study to determine any future updates to the Stormwater Service Fee.
- 6. That the City apply the Recommended Approach of the SWM-MP as part of other City initiatives, plans, studies and programs to leverage potential synergies as the opportunities are identified in order to more efficiently achieve overall City goals to increase urban tree canopy, construct new trails and cycle lanes, improve transit and build transit capacity, rehabilitate parks, reconstruct roads as well as improve stormwater management.
- 7. That the City undertake comprehensive monitoring in order to fully calibrate the PCSWMM storm sewer model developed as part of this Master Plan. The model calibration will permit the City to evaluate and select the preferred remedial approaches to improve the level of service. Monitoring should include:
  - a. Select stormsewer outfalls per the Enhanced Stormwater Runoff Monitoring Program Report (July 2022); and
  - b. SWM facility outlets where stage discharge relationships are not available.
- 8. To ensure implementation of the Master Plan can proceed efficiently and per the Implementation Plan schedule, that the City review staffing levels, specifically:



- a. For the creation of a City Stormwater Utility with dedicated stormwater staff, including approximately three (3) FTE, with roles to be defined through benchmarking.
- b. That the City conduct a review of best practices within Ontario municipalities who currently have a stormwater utility and/or dedicated stormwater rate or fee to provide recommendations on the potential organization of dedicated stormwater staff within the City.
- 9. That the City review existing storm sewers beneath privately-owned property, complete a conditions assessment of these storm sewers, evaluate easements associated with these storm sewers, and determine approaches to reduce the risks associated with each storm sewer beneath private property.
- 10. That the City refine existing stormwater monitoring approaches as part of the Implementation Plan to reflect the recommended strategy, including:
  - a. Align monitoring approaches with the CLI ECA monitoring requirements;
  - b. Stay current in the review of monitoring reports and data as required by subwatershed plans and other policies;
  - c. Analyze and complete Phase 4 of the adaptive environmental management (AEM) feedback loop of subwatershed plans, environmental studies and other policies. The four (4) phase AEM approach requires Characterization; Impact Assessment; Implementation; and Monitoring and Refinement of the management strategy. The analyzed data from the follow-up monitoring is used to test the assumptions made during earlier studies phases to evaluate the performance of the selected management strategies and make necessary adjustments. When all four (4) phases of the AEM process are not completed the process cannot ensure project goals and objectives are being met.
- 11. That the City consider a study for the development of a Cash-in-Lieu policy, whereby an equivalent fee is collected from proponents who have demonstrated that they cannot achieve the required stormwater targets.
- 12. That the City initiate a Low Impact Development Implementation Program, that includes:
  - a. Tracking Tool
  - b. Standard Road Cross-section Development that includes LID (ongoing as part of the Complete Streets Design Guideline Project)
  - c. Municipal Training
  - d. Demonstration Projects for Municipal ROW
- 13. That the City review the SW Service Fee Credit and Rebate Programs with consideration for the public feedback received through the Master Plan process to optimize, incentivize and enable the community to implement stormwater measures to assist the City in achieving the broader study goals and objectives.



## 15 References

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