System-wide Stormwater Management Implementation Blueprint 2022

Lake Simcoe Region conservation authority

Implementation Blueprint:
System-wide Stormwater Management

Report Prepared by:

Tracy Patterson, Principal, Freeman Associates
Barry Hasler, Freeman Associates
Mike Fortin, M Fortin Associates

Project Advisory Committee Members:

Conservation Authorities
Lake Simcoe Region Conservation Authority
Ben Longstaff
Bill Thompson
Don Goodyear
Glenn MacMillan
Mark Critch
Steve Auger
Kathy Hillis (administrative support)
Credit Valley Conservation
Phil James

Province of Ontario
Avril Bundale, Ministry of Municipal Affairs and Housing
Sabrina Ternier, Ministry of the Environment, Conservation and Parks
Tim Krsul, Ministry of the Environment, Conservation and Parks

Regions & Municipalities
Anca Mihail, Town of Aurora
Craig Schritt, Town of Newmarket
Daniel Wilkinson, Township of King
Hena Kabir, Town of Whitchurch-Stouffville
Kevin Brake, Town of East Gwillimbury
Mandy Paglia, Township of King
Margot Begin, Town of East Gwillimbury
Mike Mayes, Town of Newmarket
Rachel Prudhomme, Town of Newmarket
Thomas MacPherson, Region of York
Zaidun Alganabi, Town of Georgina

Private Sector
Luke Pallister, Marsh McLennan
Peter Murphy, DG Group
Tony DeGiovanni, Landscape Ontario

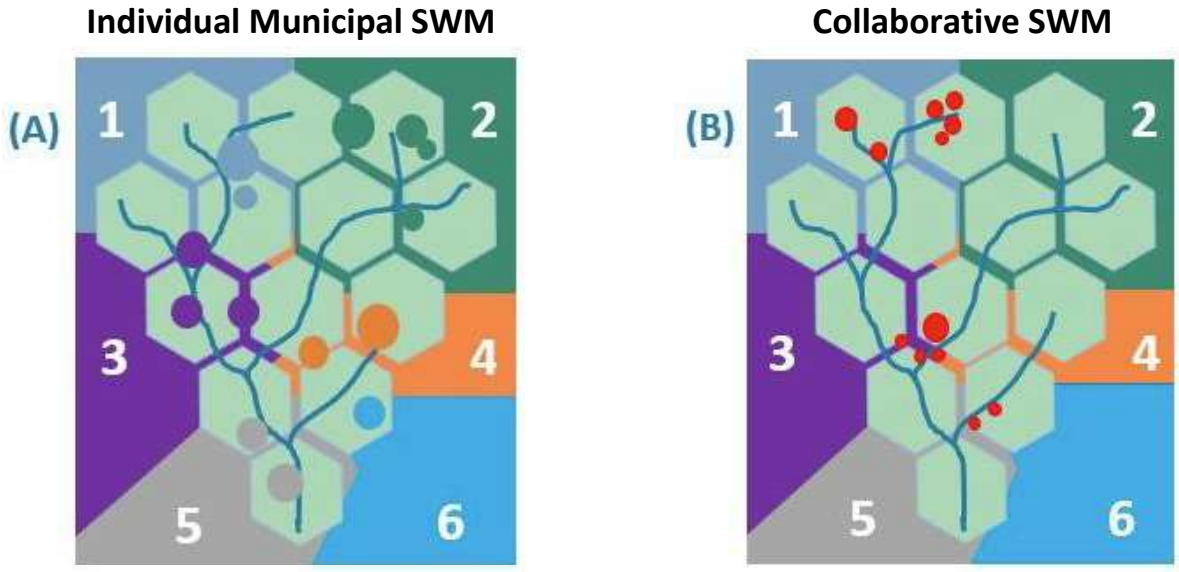
Lake Simcoe Region
conservation authority

1 Executive Summary

1.1 Introduction

In 2020, the Lake Simcoe Region Conservation Authority (herein Conservation Authority) and partner municipalities completed a thirty-month study comparing the current municipal boundary-based approach to planning and managing stormwater with an alternative, watershed-wide approach. Currently, municipalities site stormwater infrastructure on available public lands exclusively within their municipal borders. The alternative approach, modelled what would happen if municipalities in a shared watershed collaborate across political boundaries for watershed-level Stormwater Management (SWM) and consider both public and private lands to achieve 'optimal' siting of stormwater infrastructure (Figure 1-1: Current municipal approach to planning and managing stormwater vs a watershed-wide, collaborative approach (Source: Freeman Associates, 2022)). The watershed-wide, collaborative approach delivered not only better water quality and reduced stormwater runoff when compared with current municipal approach, it did so at significantly lower costs (refer to sections 1.4 and 4 for an explanation of achieved cost savings). The notable findings were the impetus for the development of this Implementation Blueprint. To develop the blueprint, all potential options for implementation and screening for what works and in what combination were assessed. The blueprint is intended as a roadmap to test the collaborative, watershed-wide approach to planning and managing stormwater.

Optimization analysis was used to comparatively evaluate:



Using six representative municipalities, the figure illustrates a comparison of the current approach to planning and managing stormwater with the proposed, watershed-wide approach.

In watershed (A), stormwater is planned and managed by individual municipalities with SWM infrastructure, represented by corresponding coloured dots, located exclusively on available public land within each individual municipality.

In watershed (B), municipalities in a common watershed, collaborate across their boundaries to plan and manage stormwater with shared SWM infrastructure, represented by red dots, located on public and private commercial land, optimally sited throughout the watershed.

Figure 1-1: Current municipal approach to planning and managing stormwater vs a watershed-wide, collaborative approach (Source: Freeman Associates, 2022)

1.2 Study Background & Rationale

Municipalities in Ontario and across Canada are grappling with limited budgets for managing stormwater, a legacy of insufficient stormwater control in older underserviced areas, mounting SWM infrastructure deficits, and urbanization and intensification of development in the face of an increasing frequency of severe weather resulting from climate change.

The goal of the study, entitled "*Equitable Responsibility for Sustainable Design: A Systems-based Approach to Stormwater Management*" (referred to as *System-wide SWM*), was to determine if an alternative approach to SWM would enable municipalities to achieve stormwater quality and quantity control targets at a lower cost.

1.2.1 Study Description

Currently, municipalities plan and site stormwater infrastructure on available public lands exclusively within their borders. The System-wide SWM study modelled what would happen if municipalities in a shared watershed, collaborated across political boundaries to plan and manage stormwater and considered both suitable public and private commercial property for siting Stormwater Control Measures (SCMs).

Recognizing that an integrated approach to water management considers SWM from a watershed perspective, where water quality impairment and flooding are related problems having potentially more effective and less costly shared solutions. Remedial measures are defined at a watershed-scale, crossing municipal boundaries where necessary. The measures are evaluated based on an accounting of all costs, public and private, and these costs are measured over the lifetime of each measure using a life cycle cost-efficiency analysis.

1.2.2 Location

The East Holland River watershed, located in the lower portion of Lake Simcoe Basin in south-central Ontario, (Figure 1-2) was the location selected for the study. The area is one of the fastest developing regions in Canada and with resident municipalities experiencing the same SWM challenges as other municipalities across the country, including flood-prone areas and impaired water quality in tributaries and the Lake due to non-point source pollution from stormwater runoff.

The watershed resides primarily within York Region and encompasses, in whole or in part, six local municipalities. The East Holland watershed is comprised of a mix of urban, suburban and rural agriculture lands with the majority privately owned. Having six resident municipalities and a significant percentage of Industrial, Commercial and Institutional (ICI) properties, heretofore referred to collectively as *commercial properties*, the watershed provided the necessary elements to support the comparative study.

Figure 1-2: Location of study area in the East Holland River watershed, Ontario, CAN (Source: adapted from the *East Holland Sub-watershed Plan*, Lake Simcoe Region Conservation Authority 2010)

1.2.3 Study Principles

The System-wide SWM study used process-based decision modelling and optimization analysis to test the following three main principles:

1) Using an optimization methodology for stormwater planning will significantly expand the scope and depth of evaluation of potential sites and measures for stormwater infrastructure, enabling the development more efficient SWM strategies.
2) Siting SCMs on private properties (vs municipal-owned properties only) will provide improved performance at greater cost-efficiency.
3) Intermunicipal collaboration in planning and managing stormwater using a watershed-scale framework will provide improved performance at greater cost-efficiency as compared with municipal-scale planning.

1.2.4 Lake Simcoe Protection Plan

The Lake Simcoe Protection Plan (LSPP), sets out a Dissolved Oxygen target in Lake Simcoe of 7mg/L. Dissolved Oxygen is the amount of oxygen dissolved in water that is available to aquatic organisms and is therefore a good indicator of water quality. The Dissolved Oxygen target for Lake Simcoe translates to a reduction in phosphorus loadings to the Lake of 51%. Phosphorus is a prevalent fertilizer or nutrient that is carried by stormwater runoff into streams, rivers, and lakes. In larger quantities, phosphorus reduces the levels of Dissolved Oxygen in water and therefore is a contaminant of concern. Given the focus of the study was the East Holland River watershed and reduction of phosphorus loadings to tributaries from urban runoff, a phosphorous reduction target of 40% was selected. With the focus on phosphorus reduction from urban runoff, other sources of phosphorus loadings, such as sewage treatment plants and agricultural practices, were excluded from the study. The reduction target of 40% applied specifically to phosphorus loadings from urban runoff in the East Holland River watershed and existing watershed conditions, as well as future state scenarios that considered planned growth and development, and climate change, were modelled.

1.2.5 Study Findings

The study results showed that intermunicipal collaboration for watershed-wide SWM that considers optimal public and private sites for locating SCMs provides improved stormwater control – better water quality and reduced runoff – at a lower cost than conventional, municipal boundary-based SWM. The 40% phosphorus reduction target was readily met via System-wide SWM at significantly lowers costs as compared with the conventional municipal-based approach using only public lands to site SCMs. Even when all available public land capable of hosting SCMs was modelled and no cost limitations were placed on achieving the phosphorus target, the municipal-based approach could only achieve a 14.8% reduction in phosphorus.

1.2.6 Peak Flow and Flood Reduction

The study analysed the impact of climate change-driven weather events on the East Holland River watershed. Increased precipitation and rapid snow melt are the primary impacts, hence the mitigation of peak flows under climate change were the focus of the modelling analysis. Runoff, overland flow of water during a rainstorm or from snow melt, reaches a peak or maximum rate of discharge during the event and is referred to as *peak flow*. A maximum *peak flow* reduction of 23.09% and 14.85% was achieved for a 10-year and 100-year storm event, respectively. These peak flow reductions are considered relatively large for such large storms – many flood control engineers are generally under the impression that water quality SCMs are unable to significantly mitigate flood storms, even at the 10-year level (20mm of rainfall in 12-hours).

1.3 Implementation Blueprint

The results of the 2017 study, specifically, improved water quality, reduced runoff and significantly lower costs established the value of municipalities in the East Holland River watershed collaborating to plan and manage stormwater watershed-wide and optimally siting SCMs on public and private commercial property. The study findings are the basis for the development of this Implementation Blueprint.

The question as to how to implement System-wide SWM amongst six local and one regional municipality in the East Holland River watershed is to be answered by the blueprint.

1.3.1 Developing the Blueprint

A detailed research and analysis process was used to identify, compile, evaluate and determine viable options for:

1) intermunicipal collaboration for watershed-wide stormwater planning and management; and,
2) incentivizing uptake of lot-level SCMs by commercial property owners/managers.

A project management and research & analysis framework (Figure 3-1 and Figure 3-2, respectively) were developed at the outset to guide the blueprint development process. As well, a Project Advisory Committee (P.A.C.) was established with member representatives from the six local municipalities – Aurora, East Gwillimbury, Georgina, King, Newmarket, and Whitchurch-Stouffville – York Region, the Conservation Authority, key business stakeholders representing the builder/developer, landscaping and insurance industries, and the Toronto and Region and Credit Valley conservation authorities. The P.A.C. provided guidance and feedback to the Project Team comprised of the Project Manager (Conservation Authority), a project coordinator, an economist, and a financial management specialist with support from the Conservation Authority's engineering and integrated watershed management specialists. The Project Team had the day-to-day responsibility for the development of the Implementation Blueprint.

1.3.2 Research & Analysis

A literature review and subsequently, research into leading jurisdictions and Best Management Practices (BMPs) was undertaken by the Project Team to identify potential measures and approaches for intermunicipal collaboration on planning and management of stormwater and incentivizing commercial property hosting of lot-level SCMs (see Appendix 1 for a compendium of the research). Relevant data and information from the six local municipalities and York Region were reviewed, including stormwater master plans, official plans, budget and financial plans, Council reports, agreements, etc. Criteria (Section 3.0, Table 3-1) were developed to screen and filter findings from the secondary research (Figure 1-3). Those measures and approaches that met screening criteria were further assessed for applicability with the six municipalities in the East Holland River watershed.

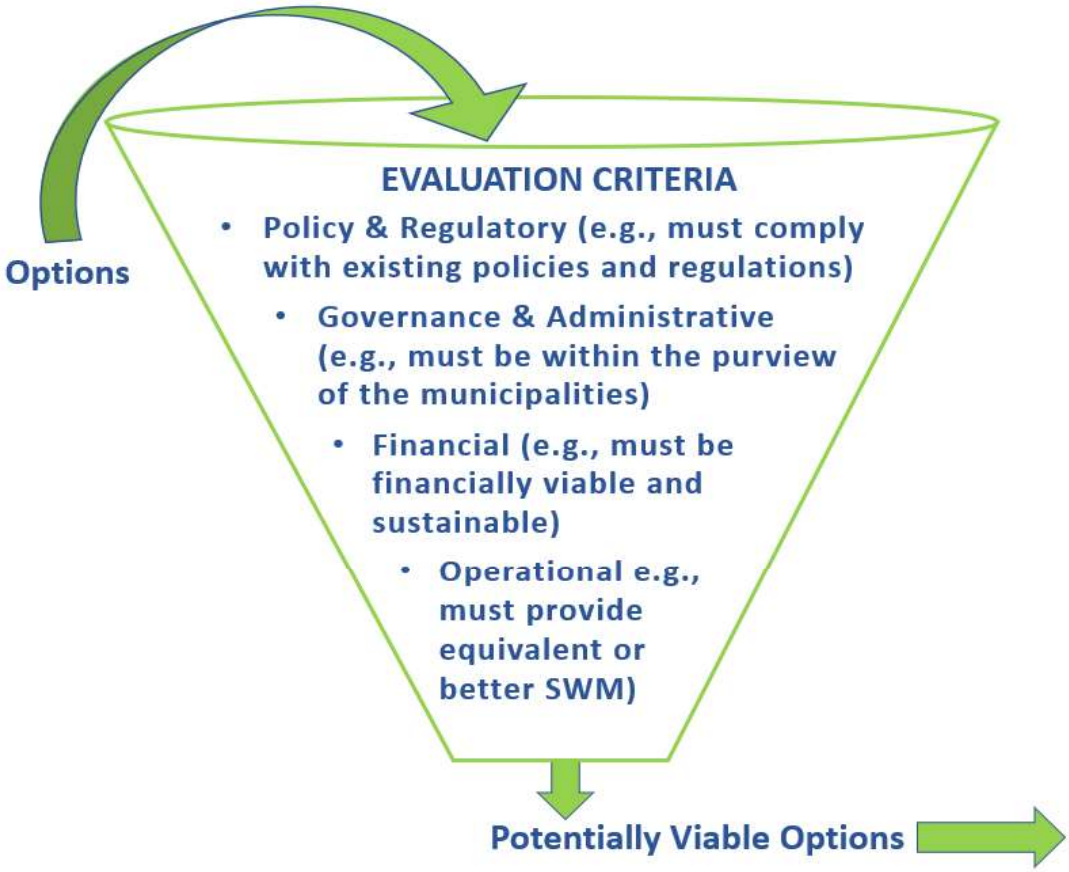


Figure 1-3: Evaluating and distilling viable options (Source: Freeman Associates Ltd., 2022)

Key informant interviews with local municipal staff from relevant departments were conducted via web conferencing. Questionnaires tailored to the specific functional areas (e.g., engineering, finance, planning, operations and maintenance, etc.) were used to guide the interviews (refer to Appendix 2 for a copy of the research guidance and questionnaires). The findings from the interviews and York Region staff responses to the questionnaires were compiled and distilled to identify themes. Themes are indicative of common or shared constraints or opportunities that require further exploration to determine the options and viability of the options to overcome the identified constraints or capitalize on the opportunities.

Financial and economic data for each of the local municipalities were collected via on-line research and key informant interviews with local municipal finance staff. The collective research and analysis process enabled the culling and scoping of viable measures for the implementing System-wide SWM (Figure 1-4).

.

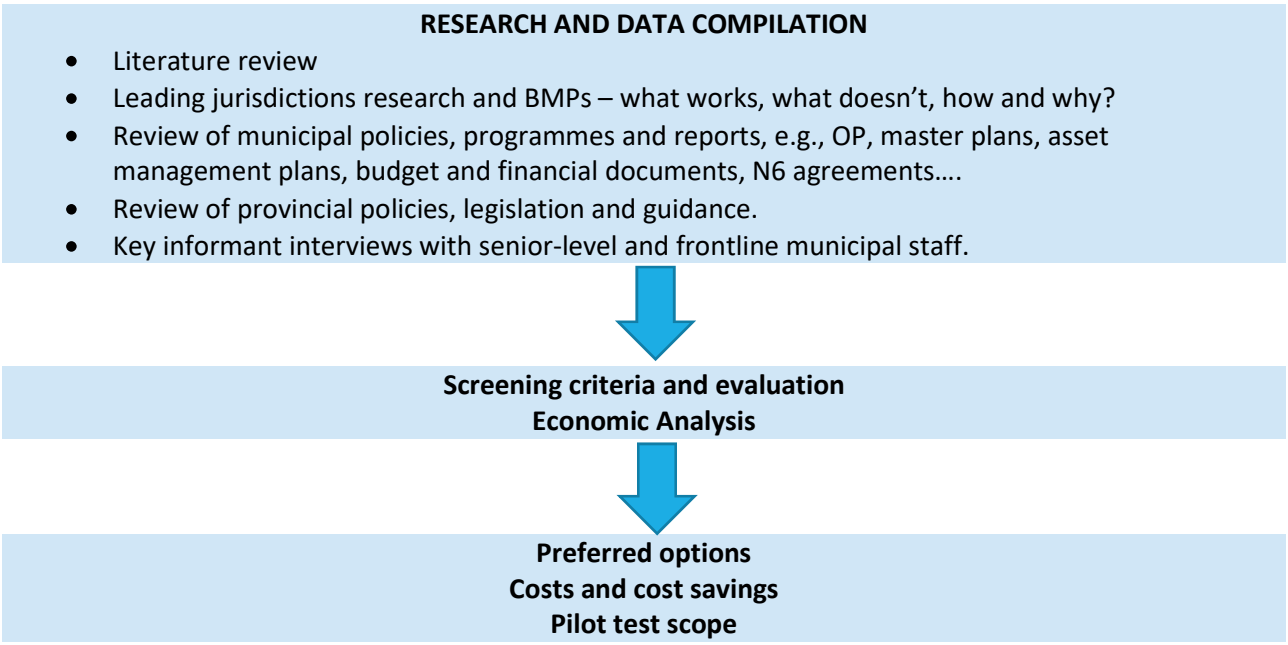


Figure 1-4: Process for determining preferred options, cost considerations and pilot test design and scope

1.3.2.1 Secondary Research Findings

Findings from the literature review and leading jurisdictions and BMP research identified potential measures and approaches for intermunicipal collaboration, watershed-level management and incentivizing commercial property uptake of lot-level SCMs.

1.3.2.1.1 Intermunicipal Collaboration

Formal and informal collaboration arrangements covering a range of policy and service areas are used by municipalities to reduce costs and improve levels of service. Emergency services, transportation, administration, and water/wastewater are the top policy areas for which collaborative agreements are negotiated. Intermunicipal collaboration arrangements for SWM are uncommon and usually are not stand-alone agreements, but are included in collaborative arrangements for water/wastewater management. Several municipalities in Alberta have agreements for collaborative SWM resulting from provincial legislation requiring neighbouring municipalities to investigate options for shared planning and implementation of infrastructure and municipal services. Interestingly, the literature review and leading jurisdictions and BMP research indicated that decentralized, voluntary means of intermunicipal collaboration may better ensure service and policy continuity.[1] This is the type of collaborative arrangement the East Holland River watershed municipalities adopted in 2006. The Northern 6 (N6) Municipal Partnership, which includes the towns of Aurora, East Gwillimbury, Georgina, King, Newmarket, and Whitchurch-Stouffville, is an informal arrangement whereby opportunities for cost-savings and improved delivery are assessed and where warranted, the member municipalities collaborate on implementation.

Intermunicipal collaboration offers numerous benefits, in particular cost-savings; reduced administrative- and staffing-related burdens due to sharing of staff resources and administration functions; improved planning of undertakings that typically beneficial from wider-scale implementation, such as public transportation, roads and road maintenance, waste collection, emergency services, and water supply and

[1] Spicer, Z.; Cooperation and Capacity: Inter-Municipal Agreements in Canada; Institute on Municipal Finance and Government, University of Toronto; 2015. https://tspace.library.utoronto.ca/bitstream/1807/81247/1/imfg_paper_19_spicer_may_11_2015.pdf

wastewater treatment. Although the positives of intermunicipal collaboration are significant, such arrangements are not without potentials risks. The research identified three main areas of risks as follows[2]:

1) Coordination problems or challenges involving one or more municipal partners failing to effectively deliver on their contractual responsibilities.
2) Issues pertaining to the division of costs and benefits between or amongst one or more municipal partners.
3) Defection problems with one or more municipalities reneging on a collaboration agreement.

These potential risks and corresponding management strategies or contingencies are discussed in greater detail in Section 5.1.1. By establishing agreed upon objectives, the potential downsides, or risks of intermunicipal collaboration can be effectively mitigated. Recommended objectives include defined roles and responsibilities, solid financial management and administration systems, tracking and assessment processes, defined lines of communications, clearly defined budgets and budgetary obligations, and a dispute resolution mechanism at the outset and delineated in an agreement.

1.3.2.1.2 The N6 Partnership

The N6 Partnership has effectively collaborated on multiple service initiatives, including fire services master planning, emergency services, waste management, insurance, animal control, economic development and more. Memoranda of understanding or letters of agreement are entered into by participating municipalities with one municipality responsible for leading a given initiative. Given the challenges of cost-effectively planning and managing stormwater – infrastructure deficits, insufficient revenues and resources for sustainable SWM, rapid urbanization and intensification, and increasing risks of flooding and associated liabilities resulting from more frequent severe weather events due to climate change – the N6 partnership could be an ideal model for cost-effective and collaborative SWM.

1.3.2.1.3 Integrated Watershed Management

An emerging trend in leading jurisdictions throughout the world is towards an integrated approach to watershed management. As understanding of the complex and interrelated dynamics of watersheds has evolved so too has the recognition of the impacts of urbanization and human activity on hydrologic functions, source waters and ecosystems. Integrated Watershed Management (IWM) provides a more holistic and coordinated approach to planning and managing human and environmental needs within a watershed. In Ontario, IWM monitoring, analysis and planning are undertaken by conservation authorities. Although IWM plans inform municipal master planning for SWM, there is no formal mandate or legislative requirement for planning and managing stormwater on a watershed basis in this province. As watersheds become more urbanized and development intensifies, a watershed-based approach is critically important. IWM holistically balances human needs and hydrology through progressive SWM planning, effective use of green infrastructure and protection of natural assets, such as wetlands and forests to reduce risk of flooding, protect water quality and sources of drinking water, and ensure resilient and healthy communities.

In leading jurisdictions, such as the Okanagan Basin in British Columbia; Chesapeake Bay, which crosses the three states of Maryland, Pennsylvania, and Virginia; and Auckland, New Zealand; collaboration

[2] *Travares, A., Feiock, R.; Applying an Institutional Collective Action Framework to Investigate Intermunicipal Cooperation in Europe* (Nov 2017). https://www.researchgate.net/publication/321013730_Applying_an_Institutional_Collective_Action_Framework_to_Investigate_Intermunicipal_Cooperation_in_Europe

frameworks for IWM are used to facilitate collective and coordinated management amongst watershed municipalities and stakeholders. Common elements of these frameworks are:

- a formalized structure;
- Involve multiple municipalities, other levels of government and watershed stakeholders;
- focus on source water protection, development planning, water allocation and infrastructure planning (flood mitigation, flow management, and water quality);
- agreements are more formal in nature and longer term; and
- clearly defined roles and responsibilities for participating levels of government and other stakeholders.

1.3.2.1.4 Incentivizing SCMs on Commercial Properties

The use of incentives, both financial (e.g., stormwater fee rebates, grants, property tax discounts, land leasing arrangements, credit trading markets, etc.) and non-monetary (by-laws/ordinances, expedited development review, awards and improved *Environmental, Social and Governance* credit rating), to secure private property uptake of SCMs is more commonly used in leading jurisdictions in the US and Europe. With much of the land in urban and urbanizing watersheds privately-owned there is limited municipal lands on which to site SCMs. Available municipal land is typically restricted to municipal parks, community centres and other facilities, and road Right-of-Ways. Siting GI/L.I.D. in the municipal Right-of-Way is often more costly than the adjacent, privately-owned setback land due to the confined space and the need to accommodate electric, gas and tele-communications infrastructure within the Right-of-Way. With limited available public land available to site SWM infrastructure, leading jurisdictions have established incentive programs to support private property uptake of SCMs. Natural infrastructure such as wetlands and forests, as well as created green space, such as municipal parks and sports fields, further expand the network of SCMs to provide enhanced resiliency to extreme weather events and improved water quality protection.

In Ontario, there are several impediments to incentivizing commercial property owners/managers to establish SCMs on their properties. Given the limited and strained SWM budgets and prevalence of stormwater infrastructure deficits amongst municipalities in this province, there are not sufficient financial resources to support incentives. As well, existing commercial properties are not covered by Ministry of the Environment, Conservation and Parks (MECP) new Consolidated Linear Environmental Compliance Approval (Consolidated ECA) and therefore, existing commercial property-owners currently must obtain an ECA for any lot-based stormwater works. This potential requirement for an ECA creates a logistic and financial barrier to uptake. Lastly, increased costs and reduced revenues for assessing SWM plans for new development further reduces municipalities' capacities to fund, in-whole or in-part, an incentive program.

In the absence of regulatory requirements for enhanced SWM, there is nothing compelling commercial property owners to make such investments. Business and homeowners are not required by law to implement energy conservation measures; rather, incentives combined with dollar savings on energy costs create a sufficient Return on Investment (ROI) to warrant the investment. Securing investment in enhanced SWM by existing commercial property owners will require a combination of, 1) a substantial increase in stormwater fees and associated rebates and, 2) additional financial incentives to provide a reasonable ROI to justify the investment.

1.3.2.2 Primary Research Findings

Interviews with N6 municipal staff and questionnaire responses from York Region staff provided a good picture of SWM currently. The responses from staff in different departments within the same municipality

had differing perspectives and experiences around stormwater planning and management. Interestingly, responses from staff in the same functional area (e.g., operations, engineering/capital works, finance), but from different N6 municipalities had notable similarities. When compiling the interview responses and those provided in writing from York Region staff, themes or areas where there was a high degree of correlation in responses were identified and summarized (Figure 3-3). Based on the themes that emerged, key constraints and opportunities were identified and are summarized below.

1.3.2.2.1 Primary Constraints

The primary constraints identified or verified through the key informant interviews, are as follows:

- Limited stormwater budgets for capital and Operations and Maintenance (O&M) with longer-term implications for budgeting and increasing stormwater revenues.
- Most of the municipalities have identified substantial stormwater deficits, but not comparable as SWM asset condition assessments vary amongst the municipalities.
- Capital SWM projects and O&M are prioritized based on available dollars and areas of greatest need making systemic planning a challenge and, in some cases, leading to a reactive vs proactive approach to SWM.
- Majority of stormwater budgets directed toward maintenance and upgrades of existing SWM infrastructure, particularly SWM ponds.
- SWM is a lower priority in comparison to other areas – roads, community infrastructure, water supply and wastewater treatment.
- No dedicated full-time operations staff for on-going maintenance and management of stormwater infrastructure – pull from other operations staff/areas.
- Varying degree of expertise in areas of stormwater planning, Green Infrastructure (GI)/Low Impact Development (L.I.D.), and O&M of stormwater infrastructure.
- Challenge siting GI/L.I.D. in municipal Right-of-Way due to presence of utilities and more difficult where there is intensified development.
- Varying degree of support for investments in GI/L.I.D./natural assets, climate change mitigation and adaptation, and resiliency planning and approaches.
- Concerns over liability, financing, performance, and upkeep of SWM infrastructure, and the potential requirement for an ECA for siting/incentivising SCMs on commercial and institutional properties.
- Uncertainty over how Councils would respond to investing stormwater funds in infrastructure located outside of the municipality, several indicating the need for a strong business case and/or pilot testing.
- Liability exposure and need to assess and mitigate risks (due diligence) a recognized concern.

1.3.2.2.2 Primary Opportunities

The primary opportunities identified or verified through the key informant interviews, are as follows:

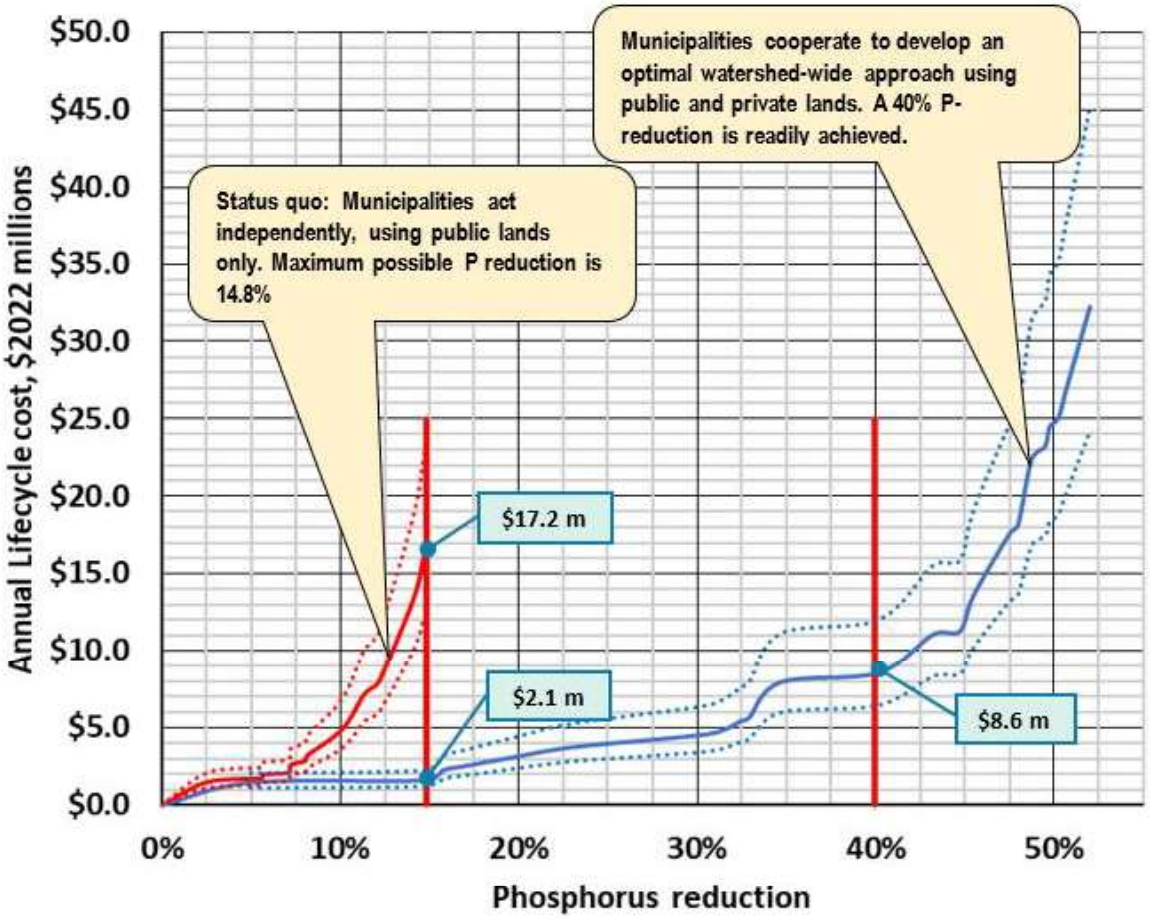
- Highly knowledgeable staff managing with limited resources and having significant insights into the challenges and potential solutions to SWM constraints.

- Universal recognition of need to address stormwater deficits and consider alternative financing and increased SWM revenue for long-term sustainability.
- Universal recognition of the need to increase SWM revenues and consider alternative fee structures to secure needed revenues and build reserves.
- Recognition of the need to act and plan ahead for the combined impacts of urbanization and more severe storms associated with climate change.
- Good support for building resiliency and reducing risk and liability through strategic SWM infrastructure investment.
- See value of the N6 Partnership for more than a decade and see it as a proven effective mechanism for municipal collaboration with potential application for watershed-wide SWM.
- Support working collaboratively amongst the N6 partnership for planning and managing stormwater on a watershed-wide basis while maintaining local-directed SWM within their individual municipalities, noting many stormwater-related issues are of a localized nature.
- Support for joint tendering, sharing resources, equipment, and training, collaborative SWM planning, and shared capital investment (with business case).
- Support for collaborating and leveraging municipal SWM budgets to access funding.
- Some municipalities have comprehensive SWM planning with strong emphasis on GI/L.I.D. and natural asset investment and climate change adaptation, and although some municipalities have limited support in these areas, there is growing recognition of the importance to consider more than grey infrastructure and to build resiliency.
- Majority of respondents support and recognition of the potential benefits of working collaboratively with the Conservation Authority for improved SWM.
- Many respondents identified the Region as potential collaborator for stormwater planning and management, particularly given the Region's role in source water protection and managing wastewater and their work on GI/L.I.D. and Inflow and Infiltration (I&I).

Applying the screening criteria to filter options and approaches for implementing System-wide SWM in the East Holland River watershed, highlighted the value of intermunicipal collaboration and the potential for the N6 partnership framework to be adapted for delivery of SWM planning and management.

1.4 Finance: The Cost of Stormwater Management

The financial analysis discusses the costs of enhanced SWM and options for cost savings, shows how these costs are distributed across municipalities under status quo and optimal strategies for SCM implementation, presents options for cost sharing and finally discusses SWM funding gaps in each municipality. Storm water management scenarios combine centralized infrastructure, such as hybrid stormwater ponds and distributed infrastructure, such as, GI/L.I.D. measures and hybrid storm water ponds. To be implemented on developed lands in towns, villages, and rural subdivisions. Growth-related SWM costs in new developments are not included because we assume these to be incurred by developers. SCM costs from the System-wide SWM study are summarized in Figure 1-5.



Dotted lines indicate upper and lower bounds for estimated costs.

Figure 1-5: Comparing status quo to an optimal watershed-wide approach to SWM (Source: Adapted, based on modelling analysis for the 2021 report, Equitable Responsibility for Transformative Design: A systems-based approach to Stormwater Management).

Costs for the optimal watershed-wide strategy are much lower than the status quo strategy while P-removal and flood control performance is much better. The poor performance of the Status Quo option reflects the inability to select lower cost L.I.D. measures and to site SCMs in optimal locations. Optimal planning of SCMs therefore provides the greatest opportunity for cost savings by municipalities, but further opportunities exist for instance by introducing P control measures on rural lands and by collaboration on SWM investments and programs across the N6 municipalities. This collaboration will likely call for some form of cost sharing across the municipalities since the relocation of SCMs required for optimal results in unequitable distributed cost savings across municipalities.

1.5 Intermunicipal Collaboration: The N6 Municipal Partnership

A detailed review of existing N6 agreements, the results of collaborative arrangements taken together, and general agreement amongst N6 staff on the potential benefits of collaborating on SWM, support the use of the N6 Municipal Partnership as the management model. Given the issues, existing and future, around planning and managing stormwater, specifically; limited resources; insufficient revenue for longer-term sustainable SWM; significant infrastructure deficits and limited reserves; development and intensification pressures in the face of reduced development fees; and increasing climate variability leading to more severe weather and associated flood risks; N6 collaboration could substantially improve SWM at lower cost for the member municipalities.

1.5.1 N6 System-wide SWM Management Framework

An enhanced N6 partnership framework is recommended to effectively deliver on collaborative, watershed-wide SWM. Providing a more defined framework based on comparable frameworks used in leading jurisdictions for the delivery of capital projects for roads, water supply/wastewater would provide improved oversight and coordination of administration actions and processes. A more prescribed management framework that retains the current N6 structure and function and the attendant benefits of the partnership is outlined in Figure 1-6.

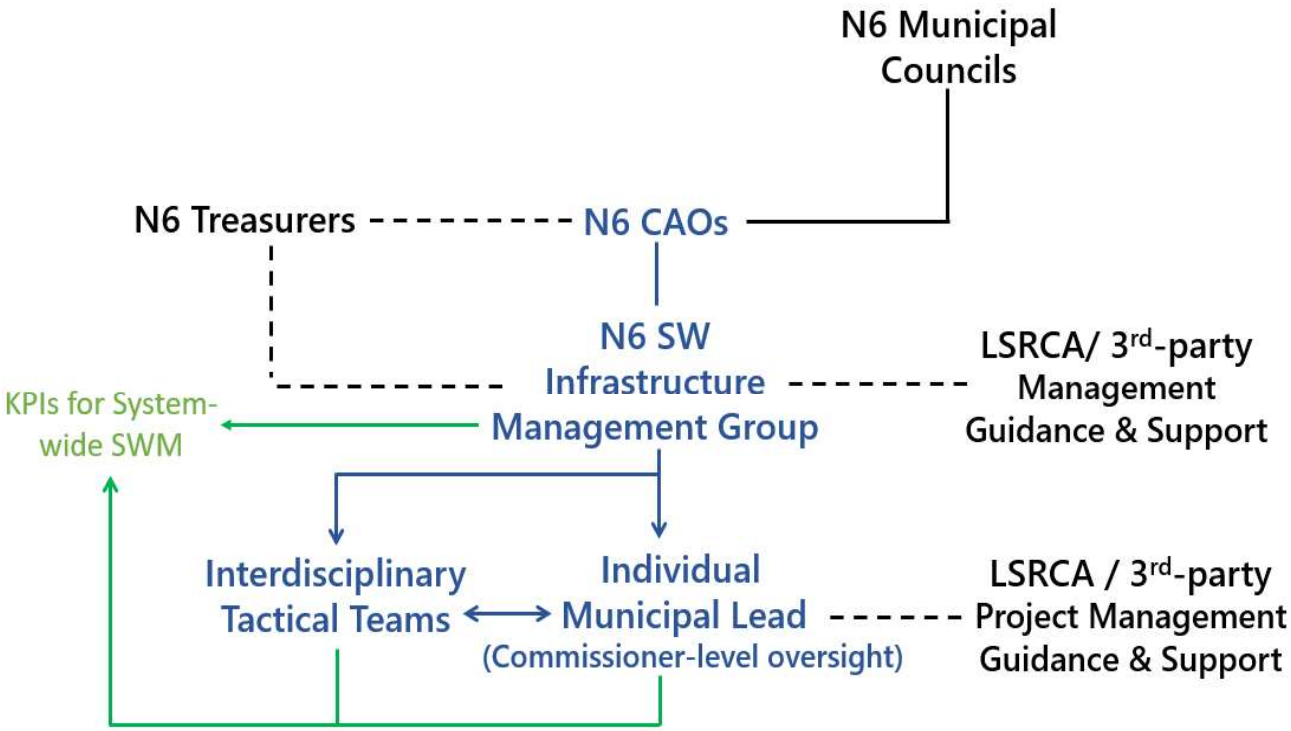


Figure 1-6: Potential N6 municipal partnership collaboration framework for watershed-wide SWM

Budgetary and financing support would be collectively provided by the N6 treasurers/directors of finance. The N6 Chief Administrative Officers (CAOs) would have oversight and decision-making authority for undertakings approved by their respective municipal councils. A Stormwater Infrastructure Management Group reporting to the N6 CAOs would direct the implementation of approved undertakings. Consistent with the current N6 partnership arrangements, individual municipal leads would have responsibility for implementation and day-to-day management of specific undertakings, but would be supported by interdisciplinary tactical teams. Depending on the size and scope of a given undertaking, a tactical team could be responsible for implementing one or more undertaking. Tactical teams would be made up of municipal staff from relevant areas of responsibility (e.g., operations, engineering, finance, planning, etc.) at applicable municipalities (i.e., participating in the undertaking). Table 5-2 provides a summary of the roles and responsibilities for the Infrastructure Management Group and the Interdisciplinary Tactical Teams, the latter headed by the Individual Project Lead.

Examples of areas in which the N6 municipalities could collaborate on watershed-wide SWM are, asset management planning, tendering, financial and budgetary guidance, funding submissions, training and professional development, natural asset planning, construction guidance and compliance, asset condition assessments and numerous others.

1.5.2 Incentivizing Stormwater Control Measures on Commercial Properties

Incentivizing improved SWM and environmental management practices on private residential, agricultural, industrial, commercial and institutional properties has been a growing trend amongst leading jurisdictions over the past decade. The primary drivers of this evolution are:

- a high percentage of land, typically 70% or more, in urban and peri-urban watersheds is privately-owned/managed;
- older developed areas often lack SWM infrastructure and available public space in which to locate it;
- the advantages of managing stormwater at the lot-level, specifically enhanced treatment and control, reduced runoff and loadings to the municipal SWM system, improved maintenance of hydrologic functions and lower overall costs; and,
- the cost to for the construction of SCMs on private property are often lower than the cost for construction of equivalent SCMs on public property, primarily due space-related issues.[3]

However, given the current barriers to incentivizing SCMs on commercial properties, specifically lack of sufficient revenues and provincial requirements for an ECA for SWM works on commercial properties, it will be necessary to undertake further analysis of potential strategies to address these specific barriers.

1.5.3 Pilot test: N6 Collaboration for System-wide SWM

A pilot test to test and evaluate the feasibility and efficacy of N6 collaboration on watershed-wide stormwater planning and management is a recommended next step. Table 1-1 provides a summary of a suggest four-phase process for completing a pilot test.

Table 1-1: Summary of Pilot test Phases and Key Actions

Preparation	Planning	Deployment	Evaluation
• Establish a pilot test working group • Membership from N6 municipalities • Develop initial pilot test scope • Preliminary feasibility assessment • Identify funding and financing options • Draft pilot test framework • Secure necessary N6 CAO and Council approvals	• Establish Pilot test Project Team • N6 membership may be same as working group, add reps from the Conservation Authority and York Region • Development of a detailed pilot test plan • Detailed feasibility analysis • Detailed budget and pilot test schedule • Complete risk assessment and contingencies • Develop and submit funding proposals • Establish monitoring, reporting and evaluation process. • Secure necessary N6 CAO and Council approvals	• Implement pilot test plan • Monitor progress against deliverables • Modify and adjust pilot plan as required	• Complete an efficiency and effectiveness evaluation, including analysis of strengths, weaknesses, opportunities, and threats (SWOT). • Present results and recommendations to N6 senior management and CAOs • Prepare report to be presented to N6 Councils (if required)

[3] A 2017 analysis of the Philadelphia Water Department's (PWD) Green Acres program, that provides grants and stormwater fee credits to ICI property owners in target areas to implement GI/L.I.D. measures on their properties, determined that it costs the City $250,000-$300,000 per green acre managed on public property vs about $120,000 per green acre managed on private property.
Ref: https://www.nrdc.org/sites/default/files/philadelphia-green-infrastructure-retrofits-IB.pdf
https://www.cogitatiopress.com/urbanplanning/article/view/1039

1.5.3.1 Pilot test Schedule

A suggested schedule for undertaking a pilot test and setting up for scaled implementation of System-wide SWM in outlined in Figure 1-7. Should the N6 municipalities support testing a collaborative approach to planning and managing stormwater to determine the level of cost-savings and improved stormwater control, both in terms of water quality protection and flood mitigation, a feasibility assessment and plan for the pilot test should be developed. The plan would provide the necessary details and guidance for implementation of the pilot as well as the basis for funding applications to secure the required support. Measurement metrics covering stormwater quantity and quality management, costs, risks, processes and functions (e.g., experience of staff, governance and administration, etc.) would be developed at the outset of the pilot test to assess the value of N6 collaboration for SWM.

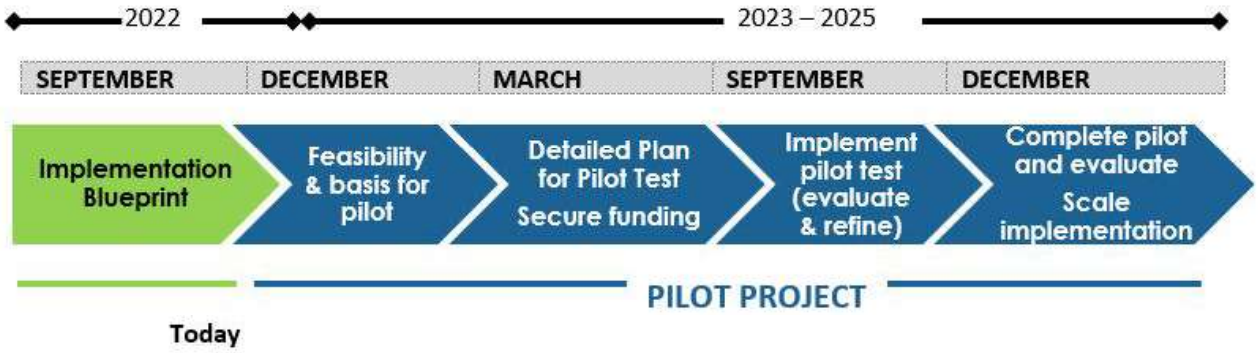


Figure 1-7: Possible implementation schedule

1.6 Summary

The N6 partnership is an effective model for collaborative delivery of shared municipal services with a proven track record of success and demonstrated cost-savings and improved levels of service. Given the challenges facing the N6 municipalities to sustainably plan and manage stormwater currently and into the future – limited resources, stormwater infrastructure deficits, insufficient SWM revenues to build necessary reserves, competing demands for dollars and resources, increasing development and intensification, and growing risks for flooding posed by more frequent and severe storms due to climate variability – it is recommended that a pilot test to evaluate N6 collaboration for watershed-wide SWM be undertaken.

With the current barriers to existing private commercial property hosting of SCMs, specifically, the need for an ECA for all stormwater works to be constructed on existing properties, the limited municipal stormwater budgets and demands on those budgets making municipal incentives for private property owners cost-prohibitive at this time, it is recommended that the following four-part study be undertaken to examine the value and potential options for incentivizing existing private commercial property-owners/managers to implement SCMs on their properties:

1) Examine options and criteria for exempting certain commercial properties from requiring an ECA or for incorporating certain properties, that meet specific criteria, under a municipal Comprehensive ECA.
2) Determine the structure and measures require to ensure the viability and sustainability of private commercial property hosting of SCMs that addresses potential risk and liability, performance, and effectiveness considerations.
3) Determine the value and options for funding/financing incentives to drive uptake of SCMs by commercial property owners/managers.
    a. Identify potential funding/financing sources.

   b. Identify potential stormwater fee structures and measures to provide a sufficient SWM revenues to municipalities while supporting a fee credit or rebate sufficient to drive uptake of SCMs by commercial property owners.

4) Complete a comparative life-cycle cost-benefit analysis, including risk and liability, of incentivizing commercial property owners to host SCMs.

Table of Contents

1 Executive Summary I
1.1 Introduction I
1.2 Study Background & Rationale II
1.2.1 Study Description II
1.2.2 Location II
1.2.3 Study Principles III
1.2.4 Lake Simcoe Protection Plan III
1.2.5 Study Findings IV
1.2.6 Peak Flow and Flood Reduction IV
1.3 Implementation Blueprint IV
1.3.1 Developing the Blueprint IV
1.3.2 Research & Analysis V
1.3.2.1 Secondary Research Findings VI
1.3.2.1.1 Intermunicipal Collaboration VI
1.3.2.1.2 The N6 Partnership VII
1.3.2.1.3 Integrated Watershed Management VII
1.3.2.1.4 Incentivizing SCMs on Commercial Properties VIII
1.3.2.2 Primary Research Findings VIII
1.3.2.2.1 Primary Constraints IX
1.3.2.2.2 Primary Opportunities IX
1.4 Finance: The Cost of Stormwater Management X
1.5 Intermunicipal Collaboration: The N6 Municipal Partnership XI
1.5.1 N6 System-wide SWM Management Framework XII
1.5.2 Incentivizing Stormwater Control Measures on Commercial Properties XIII
1.5.3 Pilot test: N6 Collaboration for System-wide SWM XIII
1.5.3.1 Pilot test Schedule XIV
1.6 Summary XIV
Table of Contents i
Appendices iii
List of Figures iv
List of Tables v
ACROYNYMS & ABBREVIATIONS vi
2 Background & Context 1
2.1 System-wide SWM Optimization Study 1

2.1.1 Study Location 2
2.1.2 Lake Simcoe Protection Plan 3
2.2 System-wide SWM Principles and Findings 3
3 Implementation Blueprint 4
3.1 Project Management 4
3.2 Research Methodology 6
3.3 Secondary Research 6
3.4 Primary Research – Municipal Key Informant Interviews 8
3.5 Secondary Research Findings 9
3.5.1 Intermunicipal Collaboration 9
3.5.2 Watershed-scale SWM 10
3.5.3 Siting Stormwater Control Measures on Commercial Properties 11
3.6 Primary Research Findings 13
4 Financing Enhanced Stormwater Management 22
4.1 How SCM Costs Were Estimated 25
4.2 Cost Saving Opportunities 25
4.2.1 Optimization Generated Cost Savings 26
4.2.2 Mitigating Risks and Potential for Cost Savings 26
4.2.3 Cost Saving via Municipal Collaboration 26
4.3 Cost Sharing 27
4.4 Costs by municipality 29
Aurora 31
East Gwillimbury 32
Georgina 33
King 34
Newmarket 35
Whitchurch-Stouffville 36
5 Implementing System-wide SWM 37
5.1 Intermunicipal Collaboration: The N6 Municipal Partnership 37
5.1.1 Risks and Management Strategies 37
5.1.2 N6-System-wide SWM Management Framework 38
5.1.3 Potential Areas for N6 Collaboration on SWM 41
5.1.4 Incentivizing Stormwater Control Measures on Existing Commercial Properties 41
5.1.4.1 Current Limitations to Incentivizing SCMs on Existing ICI Properties 42
5.2 Pilot test: N6 Collaboration on System-wide SWM 42

Preparation 42
Planning 43
Deployment 43
Evaluation 43
5.3 Implementation Schedule 43
6 Summary 44

Appendices

Appendix 1 Research Compendium
Appendix 2 Research Guidance
Appendix 3 Financial Data
Appendix 4 Cost Savings: Phosphorus reduction scenario

List of Figures

Figure 1-1: Current municipal approach to planning and managing stormwater vs a watershed-wide, collaborative approach (Source: Freeman Associates, 2022) I

Figure 1-2: Location of study area in the East Holland River watershed, Ontario, CAN (Source: adapted from the East Holland Sub-watershed Plan, Lake Simcoe Region Conservation Authority 2010)..... III

Figure 1-3: Evaluating and distilling viable options (Source: Freeman Associates Ltd., 2022) V

Figure 1-4: Process for determining preferred options, cost considerations and pilot test design and scope VI

Figure 1-5: Comparing status quo to an optimal watershed-wide approach to SWM (Source: Adapted, based on modelling analysis for the 2021 report, Equitable Responsibility for Transformative Design: A systems-based approach to Stormwater Management)..... XI

Figure 1-6: Potential N6 municipal partnership collaboration framework for watershed-wide SWM XII

Figure 1-7: Possible implementation schedule XIV

Figure 2-1: Current municipal approach to SWM (A) compared with watershed-wide SWM (B). (Source: adapted from the East Holland Sub-watershed Plan, LSRCA, 2010) 1

Figure 2-2: Location of East Holland River watershed in the Lake Simcoe Basin, Ontario, CAN (Source: adapted from the East Holland Subwatershed Plan, Lake Simcoe Region Conservation Authority, 2010)..... 2

Figure 3-1: Project management framework 5

Figure 3-2: Research and analysis framework..... 6

Figure 3-3: Intermunicipal agreement in Canada by policy area (Source: Spicer, Z., Institute on municipal Finance & Governance) 9

Figure 4-1: Comparing status quo to an optimal watershed-wide approach to SWM (Adapted, based on modelling analysis for the 2021 report, Equitable Responsibility for Transformative Design: A systems-based approach to Stormwater Management)..... 22

Figure 4-2: Transition to full-cost stormwater management in Aurora..... 31

Figure 4-3: Transition to full-cost stormwater management in East Gwillimbury..... 32

Figure 4-4: Transition to full-cost stormwater management in Georgina 33

Figure 4-5: Transition to full-cost stormwater management in King 34

Figure 4-6: Transition to full-cost stormwater management in Newmarket 35

Figure 4-7: Transition to full-cost stormwater management in Whitchurch-Stouffville 36

Figure 5-1: Potential N6 municipal partners collaboration framework for watershed-wide stormwater management 39

Figure 5-2: Possible implementation schedule for a pilot test of an N6 municipal partnership delivery of watershed-wide SWM 44

List of Tables

Table 1-1: Summary of Pilot test Phases and Key Actions XIII
Table 3-1: Screening Criteria 7
Table 3-2: Interview List by Municipal Department and Role 8
Table 3-3: Municipal Interview Findings - Key Themes by Functional Area 16
Table 4-1: SCM Numbers and Costs by Municipality 23
Table 4-2: Summary of SCM Life Cycle Costs by Municipality [(a)] 24
Table 4-3: Cost Burden by Jurisdiction for Stormwater Control Measures 28
Table 4-4: Description of Indicators for the Budget Analysis 30
Table 4-5: Aurora Overview 31
Table 4-6: East Gwillimbury Overview 32
Table 4-7: Georgina Overview 33
Table 4-8: King Overview 34
Table 4-9: Newmarket Overview 35
Table 4-10: Whitchurch-Stouffville Overview 36
Table 5-1: Potential Risks of Intermunicipal Collaboration Arrangements and Associated Management Strategies 38
Table 5-2: Summary of Roles & Responsibilities for Proposed Implementation Groups 40
Table 5-3: Potential Shared SWM-related Activities and Services by Policy Area Category 41

ACROYNYMS & ABBREVIATIONS

BMP	Best Management Practice
Conservation Authority or LSRCA	Lake Simcoe Region Conservation Authority
CAO	Chief Administrative Officer
CBP3	Community-Based Public-Private Partnerships
D.O.	Dissolved Oxygen
ECA	Environmental Compliance Approval
ESG	Environmental, Social and Governance (rating system)
GI	Green Infrastructure
G.I.S.	Geographic Information Systems
ICI	Industrial, Commercial and Institutional
ISO	International Organization for Standardization
IWM	Integrated Watershed Management
LEED	Leadership in Energy and Environmental Design
LSPP	Lake Simcoe Protection Plan
L.I.D.	Low Impact Development
MECP	Ministry of Environment, Conservation and Parks (Ontario)
N6	Northern 6 (Municipal Partnership)
O&M	Operations and Maintenance
P.E.S.	Payment for Ecological Services
P3	Public-Private Partnerships
ROI	Return on Investment
SCM	Stormwater Control Measure
SWM	Stormwater Management
SWOT	Strengths, Weaknesses, Opportunities & Threats
P.A.C.	Project Advisory Committee
P	Phosphorus

2 Background & Context

In 2017 the Lake Simcoe Region Conservation Authority (herein "Conservation Authority") and partner municipalities undertook a thirty-month study entitled, "System-wide SWM" to determine if an alternative approach to planning and managing stormwater could provide cost savings and/or improved Stormwater Management (SWM).

2.1 System-wide SWM Optimization Study

The System-wide SWM study used optimization analysis to comparatively evaluate the current municipal-based approach to stormwater management with an alternative approach. Currently, municipalities site stormwater infrastructure on available public lands exclusively within their municipal borders as shown in Figure 2-1 (A). The alternative approach modelled what would happen if municipalities in a shared watershed collaborate across political boundaries for watershed-level SWM and consider both public and private lands to achieve 'optimal' siting of stormwater infrastructure as illustrated in Figure 2-1 (B). The watershed-wide, collaborative approach resulted in cost savings of about 30%, while providing better environmental outcomes – improved water quality and reduced runoff – than the current municipal-based approach to SWM.

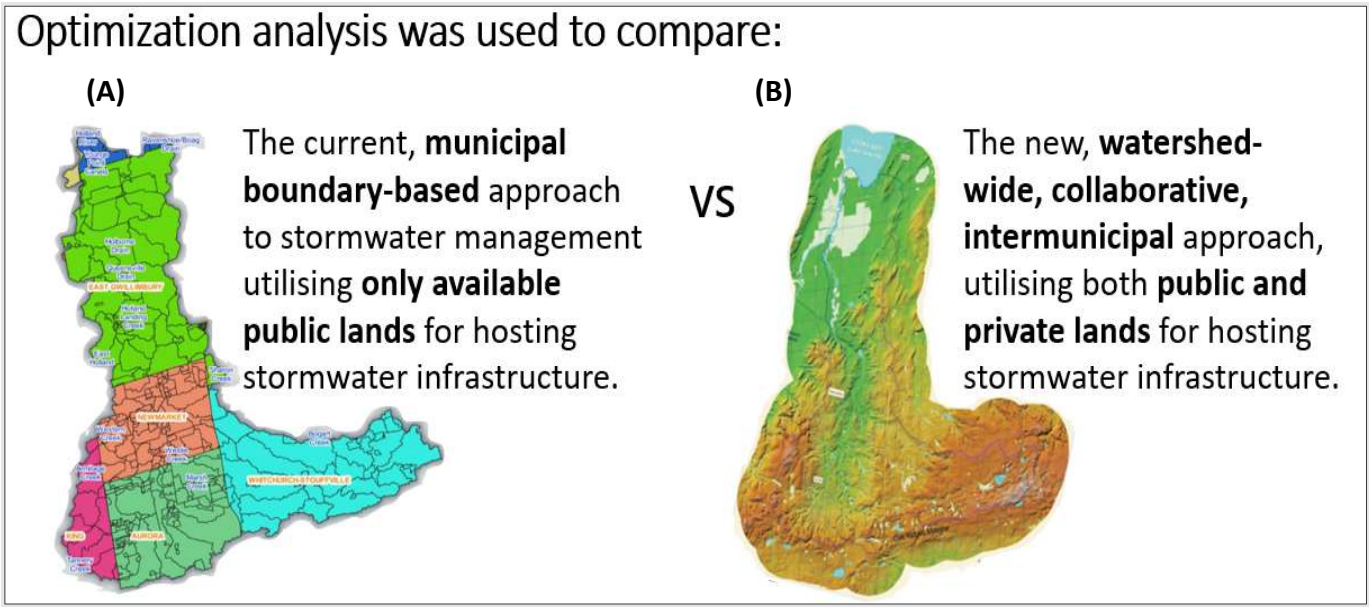


Figure 2-1: Current municipal approach to SWM (A) compared with watershed-wide SWM (B). (Source: a*dapted from the East Holland Sub-watershed Plan, LSRCA, 2010)*

Municipalities in Ontario and across Canada are struggling with limited resources and capacity to address stormwater infrastructure deficits and an historic legacy of insufficient investment in SWM, while at the same time dealing with the compounding challenges of urbanization, climate change and increasing liability risks. This situation informed the study goal to find a more cost-effective way for municipalities to manage stormwater under changing conditions. Recognizing that an integrated approach to water management considers SWM from a watershed perspective, where water quality impairment and flooding are related problems having potentially more effective and less costly shared solutions. Remedial measures are defined at a watershed-scale, crossing municipal boundaries where necessary. The measures are evaluated based on an accounting of all costs, public and private, and these costs are measured over the lifetime of each measure using a life cycle cost-efficiency analysis.

The system-wide approach also considered the entire water cycle across the watershed—seasonal patterns, upstream vs. downstream contributions, rural and urban catchments, connections between overland flows, stream flows and ground water, and so on. In addition, the study evaluated how longer-term changes in land use

and climate impact water quality and quantities (run off and flooding), and assessed potential management strategies to mitigate impacts.

2.1.1 Study Location

The study was undertaken in the East Holland River watershed, located in the Lake Simcoe Basin in south-central Ontario (Figure 2-2). East Holland is one of the fastest developing watersheds in the country and is experiencing declining water quality and impaired hydrology. Conditions in the East Holland reflect those typically found in urban and peri-urban watersheds. Watershed resident municipalities – the towns of Aurora, East Gwillimbury, Georgina, King, Newmarket, and Whitchurch-Stouffville – face the same challenges of constrained budgets, areas having insufficient SWM capacity, rapid urbanization, and increasing climate variability as other municipalities in developed and developing watersheds.

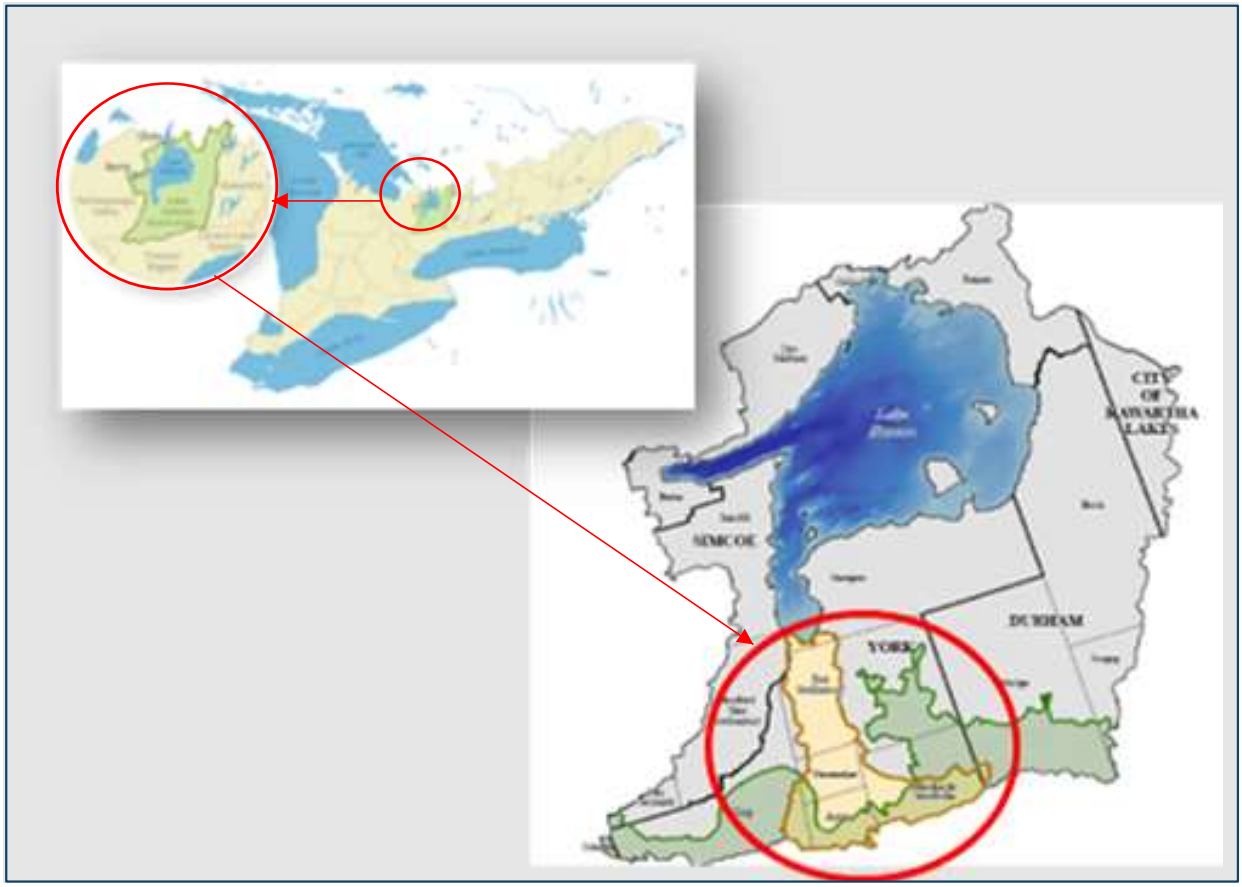


Figure 2-2: Location of East Holland River watershed in the Lake Simcoe Basin, Ontario, CAN (Source: a*dapted from the East Holland Subwatershed Plan, Lake Simcoe Region Conservation Authority, 2010)*

The watershed is about 238.7 km^2 in size and encompasses six local municipalities and resides within the Regional Municipality of York. The East Holland River watershed was selected for the study as it is reflective of the conditions found in urbanizing watersheds in Ontario and across Canada, specifically:

- rapid growth and development with increasing density of urban cores;
- a mix of urban, suburban, and rural agricultural lands;
- significant older urban areas built prior to SWM control that are subject to both riverine and sewer overflows during large precipitation events;
- impaired water quality in tributaries and Lake Simcoe due to non-point source pollution in runoff;

- significant portion of land throughout the watershed privately-owned and representing a mix of commercial, industrial, residential, and agricultural land use types; and,
- municipalities facing significant demand on resources for upgrading, repairing, and replacing aging SWM infrastructure and responding to increasing climate variability.

With six local and one regional municipality and a large portion of privately-held property of different land use types, the East Holland River watershed provides the necessary elements to assess municipal versus watershed-wide approaches to SWM and evaluate viable privately-owned parcels in combination with public lands to host SCMs versus siting SCMs exclusively on public property.

2.1.2 Lake Simcoe Protection Plan

Management of the Lake Simcoe basin is governed by the LSPP, established under the Province of Ontario's Lake Simcoe Protection Act (2008). The LSPP sets out policies and water quality targets for the lake and its tributaries. A key target in the LSPP is 7mg/L Dissolved Oxygen in Lake Simcoe. Dissolved Oxygen is the amount of oxygen dissolved in water that is available to aquatic organisms and is therefore a good indicator of water quality. The 7mg/L D.O. target equates to a reduction in phosphorus entering the lake from all sources of approximately 44 tonnes/year or 51%. Phosphorus is a prevalent fertilizer or nutrient that is carried by stormwater runoff into streams, rivers, and lakes. In larger quantities, phosphorus reduces the levels of Dissolved Oxygen in water and therefore is a contaminant of concern.

As discussed, the East Holland River watershed is one of the fastest urbanizing areas in Canada and as such, the focus of the System-wide SWM study is urban sources of phosphorus loadings to the Lake. Other significant sources of phosphorus, such as sewage treatment plants and agricultural lands were excluded from the study. To reflect the exclusion of other sources of phosphorus and the focus on urban-based sources only, a phosphorus reduction target of 40% was selected for the study. This 40% target was applied to scenarios that considered both future development and climate change.

It should be noted as well that the LSPP requires the evaluations of "priority" sub-watersheds, of which East Holland River is one. Section 8 of the LSPP describes a sub-watershed-based approach as "critical to prioritizing initial actions, developing focused action plans…"[4]

2.2 System-wide SWM Principles and Findings

The three main principles tested via the System-wide SWM study were as follows:

1. **Using an optimization methodology for stormwater planning will significantly expand the scope and depth of SCM evaluation, enabling the development more efficient SWM strategies.**

   The watershed-scale decision support framework based on cost optimization used for the study enabled targeting of watershed-scale investments to manage stormwater and achieve water quality goals at the lowest possible cost. The tiered optimization approach utilized for the study enabled the evaluation of the cost-effectiveness of Stormwater Control Measures in the East Holland watershed. The outputs from optimization modelling used in the study, provide the first detailed economic feasibility assessment of achieving phosphorus and peak flow reduction in the watershed.

2. **Siting SWM SCMs on private properties (vs municipal-owned properties only) will provide improved performance at greater cost-efficiency.**

[4] Lake Simcoe Protection Plan (2009); https://www.ontario.ca/document/lake-simcoe-protection-plan

The study findings show that if, in addition to evaluating municipal public parcels for siting SWM infrastructure, suitable privately-owned parcels are also considered, then SWM targets could be achieved at greater cost-efficiency than the current practice of considering only municipal public parcels. More importantly, reduction targets could not be achieved by using only publicly-held lands to site SCMs.

3. **Planning and managing stormwater using a watershed-wide framework will provide improved performance at greater cost-efficiency as compared with municipal-scale planning.**

   Municipal collaboration for watershed-wide implementation of a SWM strategy resulted in cost savings over the conventional, municipal-centric practice for SWM and improved outcomes for water quality and a reduction in flood damage for modelled 10-year and 100-year storm events. A total of six flood-prone areas were identified in the East Holland watershed with potential for flood damage to structures and infrastructure in the floodplain. As expected, substantial reductions in *peak flow*, the maximum volume of runoff during a storm event, were indicated. Peak flow reductions for the 10-year storm and 100-year storm events were 23.09% and 14.85%, respectively. A detailed discussion of the peak flow reductions is provided in the technical study report.[5]

The study clearly showed that by working collaboratively and sharing expertise and resources, municipalities can better plan and manage stormwater, lower costs, and build resilient, future-ready systems. Including private commercial properties as potential sites for SCMs enables optimal siting of measures for improved SWM and additional cost savings. The significant findings: improved environmental outcomes at markedly lower costs, of study provided the basis for the next phase, the development of a blueprint for the implementation of System-wide SWM in the East Holland River watershed.

3 Implementation Blueprint

The study findings provided the scientific and economic evidence to support implementation of System-wide SWM in the East Holland River watershed. How to implement watershed-scale SWM amongst six local and one regional municipality and considering commercial properties as potential sites for hosting SCMs is the question this Implementation Blueprint is intended to answer.

Through a research and analysis process, options and approaches for intermunicipal collaboration on stormwater planning and management at a watershed-scale, including the consideration of ICI properties for siting SCMs, were determined.

3.1 Project Management

A Project Management Framework (Figure 3-1) and Research and Analysis Framework guided the development of the Implementation Blueprint.

[5] Equitable Responsibility for Transformational Design: A Systems-based Approach to Stormwater Management; https://sustainabletechnologies.ca/app/uploads/2021/03/ERFTD_Final-Technical-Report.pdf

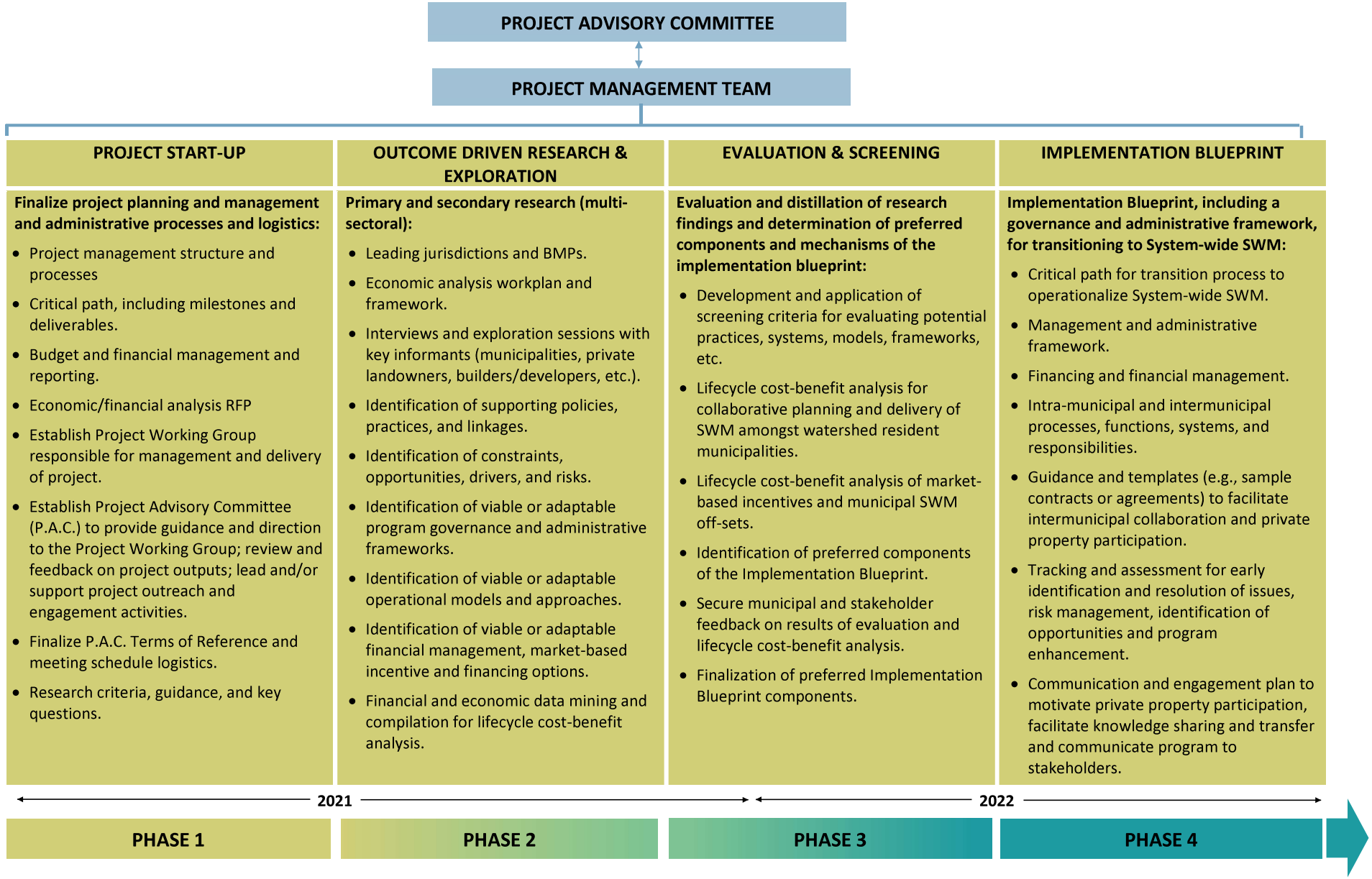


Figure 3-1: Project management framework

A multistakeholder Project Advisory Committee with membership representing the six local and one regional municipality, the Conservation Authority, and insurance (risk), building/development and landscaping industries provided project guidance and feedback. An interdisciplinary Project Team was led by the LSRCA supported by a project co-ordinator, economist, financial specialist and two local municipal representatives from the P.A.C.. The Project Team was responsible for the research, analysis and development of the Implementation Blueprint and the day-to-day management of the project. The development of the Implementation Blueprint was divided into four phases: project start-up, research, evaluation and screening and creation of the blueprint based on preferred practices and measures for implementation.

3.2 Research Methodology

The Research and Analysis Framework (Figure 3-2) informed the leading jurisdictions and best research and interview questions explored with key informants. The research was undertaken by the Project Team to identify potential measures and approaches for intermunicipal collaboration on planning and management of stormwater and incentivizing ICI property hosting of SCMs.

INTERMUNICIPAL COLLABORATION

Governance	Policy & Legal	Administration	Financial	Planning & Operations
• N6? • Municipal-Conservation Authority integrated delivery.	• Regulatory constraints, implication, and options & strategies to address? • Ownership of capital works. • Liability concerns associated with asset ownership/management, lease arrangements, shared financing, etc., and options & strategies to address.	• How is the shared-delivery model administered? • How are personnel & administrative resources shared? • Roles and responsibilities?	• Who pays for what? • How to determine benefits and allocate cost sharing accordingly? • Valuation of assets?	• How to integrate functions and associated resources (e.g., planning, modelling, detailed design, operations, maintenance, monitoring, etc.). • Roles and responsibilities?

PRIVATE LANDOWNER PARTICIPATION

Governance	Policy & Legal	Administration	Financial
• What is the administrative framework? • Roles & responsibilities for managing private property participation program. • How are personnel & administrative resources shared?	• Regulatory constraints, implications, and options and strategies to address? • Contracts and enforcement (e.g., requirements, approvals, monitoring, access, failure to comply, title transfer, etc.). • Liability concerns and options & strategies to address.	• Determining instruments/incentives? Structuring? By property type/sector? Targeted/priority areas? • How to calculate municipal offsets? Percent allocation to incentives? • Standardization of SWM fees? Other financing mechanisms (e.g., Conservation Authority offsets, ROW utility charge).	• Determining target areas and prioritizing potential SCM host properties and appropriate SCM by property/location. • Monitoring construction, O&M, performance, etc. • Monitoring and evaluating impact of distributed SCMs (individually & collectively).

Figure 3-2: Research and analysis framework

3.3 Secondary Research

The initial research involved a literature review of relevant peer-reviewed studies and recognized periodicals published up to September 2021. Based on the research framework, key words and phrases related to *intermunicipal collaboration*, *stormwater* and *integrated watershed management*, *SWM infrastructure*, *market-based instruments*, and *incentivizing private property uptake* in sustainable actions were used to search for potentially relevant publications. A scan review of the publications was completed to:

- screen for applicability to the implementation of System-wide SWM in the East Holland River watershed with consideration as to what would be viable in a Canadian and Ontario context, and for the local municipalities and the regional municipality;
- develop a list of leading jurisdictions and BMPs to explore and evaluate in the subsequent research phase; and,
- identify potential opportunities, constraints, and screening criteria to inform the subsequent research and assessment phases.

Information from the more detailed literature review and the leading jurisdictions and BMPs research was compiled and distilled based on its potential relevance and application to the implementation of System-wide SWM. A compendium of the applicable research is provided in Appendix 1. Screening criteria for the literature and leading jurisdictions and BMPs research is summarized in Table 3-1.

Table 3-1: Screening Criteria

EVALUATION COMPONENT	CRITERIA	DESCRIPTION
Governance, Policy & Administration	Within the purview of the local municipalities	• Practice or measure within the responsibility or purview of the local municipalities and aligns with their guiding policies, including but not limited to, the Official Plan, Master Plans, corporate strategies and provincial legislation and mandates.
	Viable with existing N6 governance & admin. framework	• Practice or measure must be implementable using the N6 governance and administration framework without significant and burdensome changes or requirements to be viable.
Finance / Economic	Financially viable	• Practice or measure is financially sustainable based on necessary capital and O&M investments to meet level of service, address SWM deficits, mitigate flooding and provide improved resiliency, and reduce water quality impairment. • Cost to implement practice or measure is less than the cost to provide the same level of service and meet water quantity and quality targets
	Prioritizes focus of resources	• Practice or measure improves the efficient use of resources. • Practice or measure prioritizes the use and allocation resources based on greatest need and ROI.
SWM Infrastructure	Enhanced SWM	• Practice or measure will provide improved water quantity and quality stormwater control.
	Climate change resilience	• Practice or measure will provide improved resiliency to the impacts of climate change and urbanization, specifically, provide improved flood mitigation.
Environmental	Source water protection	• Practice or measure provides equal or better protection of surface and ground water sources.
Operations	Level of Service	• Practice or measure will ensure an equal or better level of service for SWM.
	Effectively operated and maintained	• Practice or measure allows for the effective operation and maintenance of the stormwater system and individual SCMs.
Legal/Regulatory	Compliance	• Practice or measure complies with provincial and federal regulations and municipal by-laws.
	Viable within regulatory framework	• Practice or measure is viable based on existing municipal by-laws

Findings from the literature review, and leading jurisdictions and BMPs research, informed the development of interview questions for key informant interviews with staff from the six local watershed municipalities. Small group and individual interviews were conducted via video conferencing. Information from staff at York Region was obtained via questionnaires, which were completed and returned to the research team. Consistencies or themes in responses from key informants distilled from questionnaire responses were captured as a constraint or an opportunity by category (e.g., finance, O&M, capital works).

3.4 Primary Research – Municipal Key Informant Interviews

Individual and group session interviews were held with key informants from relevant N6 municipal departments, as listed in Table 3-2. York Region staff were provided their answers through completion of questionnaires specific to their departmental function. The purpose of these primary research was to understand the current context of municipal SWM amongst the N6 municipalities and the Region and to explore options for intermunicipal collaboration for watershed-wide SWM and the potential role of ICI properties as hosts of SCMs. To secure the necessary information and insights to develop an effective implementation plan, beginning with a pilot test, both individual and group interviews were used to:

- explore and discuss potential operational and functional considerations pertaining to governance, administration, financial management and financing, programming, economic development, policy and legislation, planning and development, and legal matters;
- identify potential constraints/barriers to effective implementation and determine strategies to address;
- secure input and perspectives on potential implementation options and approaches;
- identify potential opportunities or strategies that support effective implementation; and
- clarify areas of uncertainty or fill information gaps.

The selection of municipal representatives to be interviewed was based on the Research Framework (Figure 3-2) developed for the project. The roles and responsibilities of those listed for interviews (Table 3-2) are directly related or relevant to intermunicipal collaboration amongst the N6 and/or incentivized private commercial landowner uptake of lot-level or aggregated SCMs.

Table 3-2: Interview List by Municipal Department and Role

N6 PARTNER MUNICIPALITIES & YORK REGION

Department	Key Informant Role
Engineering/Environmental Services (SWM)	• Commissioner/Director • SWM Engineer • Operations Director/Manager and Operations field lead(s) • Climate change Manager/Co-ordinator (where applicable)
Financial Services	• Treasurer/Director • Budget/Financial manager
Office of the CAO	• Chief Administrative Officer
Planning & Development	• Commissioner/Director • Lead planner
Economic Development	• Director
Legal Services	• Senior Counsel

Guiding questions based on research objectives and the research framework were developed for each department or functional area (e.g., finance, planning, engineering, etc.). The questions served as guidance to enable wider exploration

and discussion which provides greater insight into the views and experiences of those being interviewed. The guiding questions by department are included in Appendix 2. As the interviews progressed, some of the questions were modified to focus on key constraints and opportunities specifically related to the pilot test and implementation of System-wide SWM in the East Holland River watershed.

3.5 Secondary Research Findings

Findings from the literature review and the subsequent leading jurisdictions and BMPs research were screened for applicability and collated based on municipal operations.

3.5.1 Intermunicipal Collaboration

As collaboration between municipalities is not an explicit part of their official mandates in Ontario, determining a solution to co-ordination between and amongst multiple municipalities for watershed-scale SWM was a primary research objective.

Growing recognition of the potential value of intermunicipal collaboration for improved levels of service and cost savings has led to formal and informal frameworks and agreements amongst municipalities across Ontario and nationally. These agreements cover a range of policy areas, with emergency services and transportation (roads) being the leading areas for intermunicipal collaboration (Figure 3-3). Only in recent years have jurisdictions in Canada and elsewhere looked to establish some form of agreement for intermunicipal or multi-stakeholder collaboration for watershed-scale SWM.

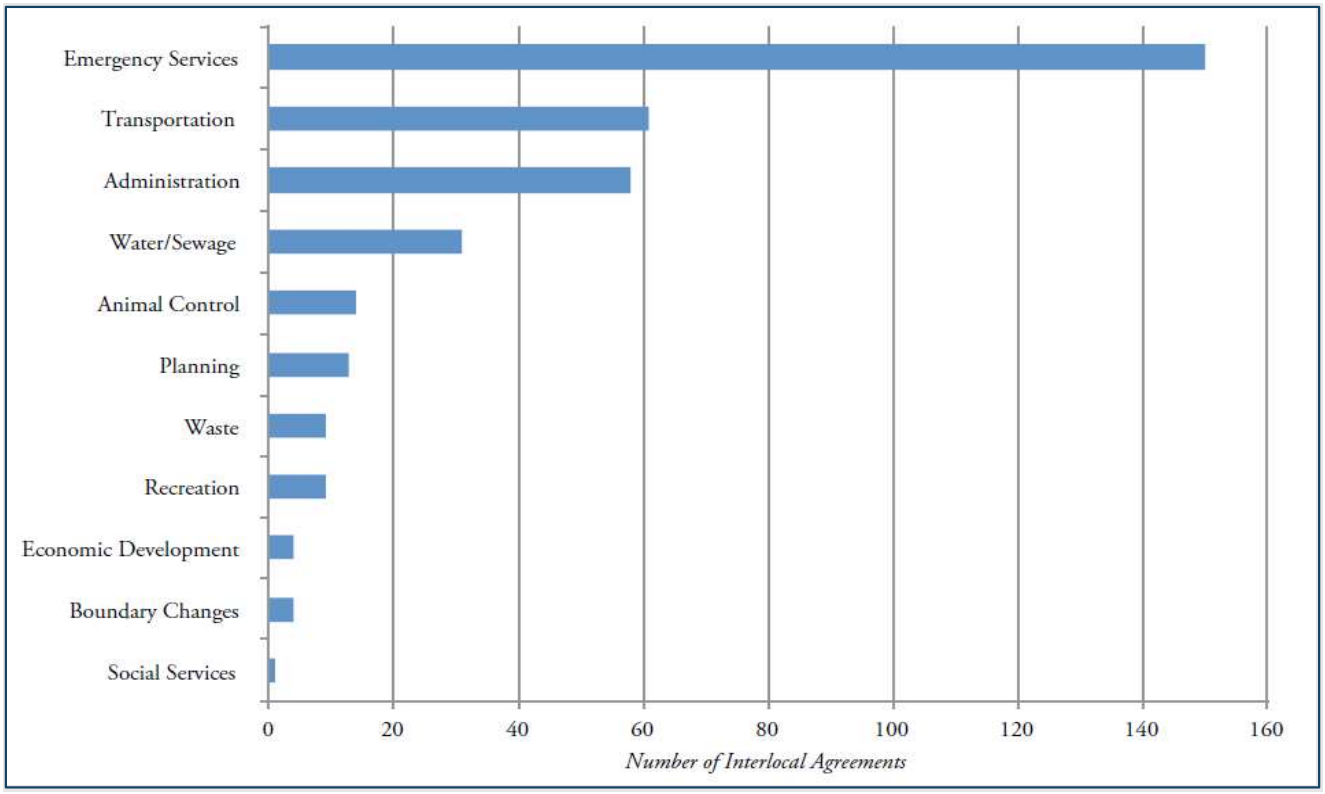


Figure 3-3: Intermunicipal agreement in Canada by policy area (Source: Spicer, Z., Institute on municipal Finance & Governance)

In Alberta, for example, an Intermunicipal Collaboration Framework Regulation came into effect in 2017, in addition to several amendments to the province's Municipal Government Act (MGA) "to address and promote a more integrated and strategic approach to intermunicipal land use planning and service delivery within the province"[6], which includes

[6] Stantec Consulting, Alberta Urban Municipalities Assoc., Rural Municipalities of Alberta; Intermunicipal Collaboration Framework Workbook (Version 3); Alberta; 2015. https://rmalberta.com/wp-content/uploads/2020/09/ICF-Workbook-Version-3-FINAL.pdf

SWM. With limited exceptions, the MGA requires all municipalities that share a common boundary to prepare and approve Intermunicipal Collaboration Frameworks. More open or adaptive agreements, such as memoranda of understanding, letters of agreement and other types of informal agreements are used by municipalities in Canada and many other countries. Recent research suggests that decentralized, voluntary means of inter-local co-operation may help ensure service and policy continuity.[7]

The Northern 6 (N6) Partnership, which includes the municipalities of Aurora, East Gwillimbury, Georgina, King, Newmarket, and Whitchurch-Stouffville, is an informal arrangement between and amongst the six local municipalities to collaborate on shared services and initiatives. The N6 Partnership formed in 2006 as a result of an assessment determining collaboration amongst the six, in whole or in part, could provide efficiencies and/or service improvements. The partnership is endorsed by all six municipal councils and is administered by the Chief Administration Officers.[8] The N6 Partnership is focused on areas of common interest where administrative and/or operational efficiencies may be realized through collaboration and functions in a way to ensure municipalities retain their individual roles and identities.[9] In 2019, an Ontario government third-party review to assess amalgamation of municipalities to improve efficiencies identified the N6 Partnership as a viable model for Ontario municipalities, indicating that the partnership exemplifies the benefits of a cohesive approach to shared service delivery.

The N6 Partnership has effectively collaborated on multiple service initiatives including, waste management, audit procurement and auditing services, fire services master planning, emergency services, insurance, economic development, employee training and development, and animal control and shelter services. Memoranda of understanding or letters of agreement are entered into by the participating municipalities with one municipality taking the lead for a given initiative. Although collaboration has focused on shared services not capital projects, two of the N6 municipalities entered into an agreement for a shared fire station. The fire station is housed in Newmarket but services Aurora as well. The asset is owned by Newmarket with a cost-sharing arrangement with Aurora based on population area served by the fire station.

3.5.2 Watershed-scale SWM

The research revealed a consistent trend amongst leading jurisdictions in water management toward integrated watershed-wide planning and programming. As understanding of the downstream impacts of upstream development and water management has evolved, so too has the shift to greater co-ordination amongst jurisdictions for planning and managing water on a sub-watershed-/watershed-scale.

IWM is a "continuous and adaptive process of managing human activities in an ecosystem, within a defined watershed".[10] Watersheds are natural hydrologic units with complex interrelationships between land, water, and ecosystems. IWM considers these interrelationships in the context of urbanization, providing an adaptive process for managing human activities, natural resources, and ecosystems within a specific watershed. In Ontario, IWM monitoring, assessments and planning is undertaken by the conservation authorities (CAs). Although IWM plans inform municipal master planning for SWM, to date there is no formal mandate for planning and managing stormwater on a watershed-basis in Ontario.

IWM planning in other jurisdictions is evolving to include objectives for basin-watershed-scale development and SWM planning. In New Zealand, the Auckland Council is implementing integrated management of freshwater and land development planning in whole catchments and in collaboration with local municipalities and indigenous communities.

---

[7] Spicer, Zachary; Cooperation and Capacity: Inter-Municipal Agreements in Canada; Institute on Municipal Finance and Government, University of Toronto; 2015. https://tspace.library.utoronto.ca/bitstream/1807/81247/1/imfg_paper_19_spicer_may_11_2015.pdf

[8] Doug Nadorozny, Town of Aurora Information Report: Northern Six Municipalities (N6) Collaborative Initiatives and Partnership Update; Aurora. May 19, 2020

[9] Cash, David; Finding Common Ground: Inter-Local Cooperation in Canada; presentation at the School of Global Affairs, University of Toronto; Toronto; 2017

[10] Canadian Council of Ministers of the Environment; Summary of Integrated Watershed Management Approaches Across Canada (2016). https://ccme.ca/en/res/summaryofintegratedwatershedmanagementapproachesacrosscanada.pdf

A basin-wide water management strategy and implementation plan, emphasizing water quality and quantity control, that encompasses 10 watersheds provides a framework for implementing a co-operative approach to managing water resources.[11] Water sensitive planning and design and integrated stormwater planning across multiple catchments (i.e., watershed and subwatershed) is a requirement for resident municipalities.

The Okanagan Basin in British Columbia has experienced significant drought and flooding events over the past several decades. In response to growth pressures and climate change impacts leading to significant water management challenges, an Okanagan Water Stewardship Council was formed to support collaboration amongst local municipalities, indigenous communities and other key stakeholders. In 2019, the Council published the *Okanagan Sustainable Water Strategy* which encompasses a series of actions and recommendations for a coordinated, basin-wide approach to water management.[12]

The research identified an evolving trend toward collaboration frameworks for IWM. Common elements of these frameworks are:

- A formalized structure.
- Active involvement of multiple municipalities, other levels of government and watershed stakeholders.
- A focus on source water protection, development planning, water allocation and infrastructure planning (flood mitigation, flow management, and water quality).
- Collaboration agreements that are more formal and prescriptive in nature and cover a longer term for implementation and management.
- Clearly defined roles and responsibilities for participating levels of government and stakeholders.

Chesapeake Bay is perhaps the most advanced model of multistakeholder collaboration for IWM. The Chesapeake Bay estuary is the largest in the USA and is spread across three states (Maryland, Pennsylvania, and Virginia) and the District of Columbia. A *Chesapeake Bay Watershed Agreement*, created in 2014 and amended in October 2022, includes signatories for the entire basin area. The agreement set outs goals and outcomes for the restoration and protection of the Bay, its tributaries and the surrounding lands via shared and measurable commitments and an implementation plan for basin-wide actions for water quality and quantity management, land conservation, stewardship and climate change adaptation.[13] Watershed Implementation Plans are developed by the watershed jurisdictions and provide a roadmap for required actions to meet federal pollution reduction requirements, referred to as Chesapeake Bay Total Maximum Daily Load, by 2025.

3.5.3 Siting Stormwater Control Measures on Commercial Properties

With limited public land available for stormwater management and the high and growing cost of land in urban and peri-urban watershed, leading jurisdictions are incentivizing uptake of SCMs by commercial property owners/managers on a lot-level basis and via aggregation of multiple neighbouring properties.

With much of the land in urban and urbanizing watersheds privately-owned there is limited municipal lands on which to site SCMs. Available municipal land is typically restricted to municipal parks, community centres and other facilities, and road Right-of-Ways. Siting GI/L.I.D. in the municipal Right-of-Way is often more costly than the adjacent, privately-owed,

[11] https://www.aucklandcouncil.govt.nz/environment/looking-after-aucklands-water/Documents/auckland-water-strategy-implementation-plan.pdf
[12] Okanagan Water Stewardship Council; Okanagan Sustainable Water Strategy: Action Plan 2.0; Vernon BC. October 2019. https://www.obwb.ca/library/okanagan-sustainable-water-strategy/#:~:text=The%20Strategy%20builds%20on%20Action,changes%20that%20impact%20water%20today
[13] Chesapeake Bay Executive Council; Chesapeake Watershed Agreement (2014), Amended October 2022 https://d18lev1ok5leia.cloudfront.net/chesapeakebay/Chesapeake-Bay-Watershed-Agreement-Amended.pdf

setback land due to the confined space and the need to accommodate electric, gas and tele-communications infrastructure within the Right-of-Way.

With limited available public land available to site SWM infrastructure, leading jurisdictions have established incentive programs to support private property uptake of SCMs. Many of these programs focus on securing SCMs on commercial properties versus residential because they tend to have larger impervious areas generating runoff; more resources to contribute toward lot-level controls; offer a larger footprint for locating SCMs; and there are external drivers in place, such as environmental investment or performance standards [e.g., Environmental-Social-Governance (ESG) ratings, LEED and other green building standards, and ISO 14001 standard to motivate their investment in lot-level SCMS. Because the majority of land within a municipality is privately-owned, developing a network of distributed lot-level SCMs, in particular GI/L.I.D. is a cost-effective way to reduce stormwater runoff and erosion and prevent contaminants from entering waterways.

The main drivers for municipalities offering incentives to encourage implementation of SCMs on commercial properties, with a particular focus on GI/L.I.D.-based measures, are as follows:

- The majority of land in urban and peri-urban watersheds, typically 70 percent or more, is privately-held.
- Indications from existing programs are that SCMs on private property have lower capital costs.[14] In addition, the potential to aggregate neighbouring private properties to enable installation of shared infrastructure provides additional economies of scale[15] often not possible on public land due to space limitations (See section 4.0 and Appendix 4 for a more detailed discussion of cost savings).
- Optimal locations – providing the greatest level stormwater management at the lowest cost – for siting SCMs are often privately-owned lands.
- Restricting SCMs exclusively to public land limits the ability to address underserviced or problem areas (older, existing areas with predominantly privately-owned properties and little or no SWM infrastructure).

The research found jurisdictions offering incentives to secure private property uptake of SCMs had typically, 1) undertaken cost-benefit comparisons between a public land-based solution vs a combined solution using both public and private property for managing stormwater and, 2) SWM plans that emphasize the development of a network of centralized-type (e.g., engineered wetlands) and decentralized-type (e.g., bioretention) SCMs and conveyance measures on both public and private property for managing stormwater. Centralized-type SCMs can be installed on larger private commercial properties or, via aggregation, across multiple neighbouring properties. Regulations combined with the type, structure and value of incentives determine what type and size (centralized vs decentralized) of SCMs may be sited on private properties. Some leading jurisdictions have established long-term leasing arrangements, tied to the title of the property, to host centralized SCMs, while others have utilized financial incentives, individually or collectively, such as grants, property tax discounts, stormwater credit trading, and stormwater fee rebates to secure uptake of centralized- or decentralized-types of SCMs.

Although some Canadian municipalities with stormwater utility fees offer partial rebates as an incentive for property owners to implement lot-level controls, the percentage uptake is typically in the low single digits. The main reason for the low uptake is that the fee rebates provide an insufficient return on investment for the property owner. Although incentive programs in Canada for landowners to install SCMs on their properties are limited, their numbers are growing.

[14] For example, in 2015 the Philadelphia Water Department estimated the average capital costs for SCMs on public property were between $200K and $300K per acre managed vs a cost of $100K to 200K per acre managed on private property

[15] Philadelphia found a 67% reduction in cost per greened acre by allowing private firms to 'bundle' green infrastructure across multiple private properties

Currently, the City of Ottawa incentivises, beyond partial fee rebates, private property hosting of lot-level SCMs. The Ottawa program is a pilot test and targets residential properties in priority sub-watersheds by providing a scale of rebates up to a maximum of $5,000 to homeowners for rain gardens, soak-away pits, porous paving, downspout redirection. The City of Toronto offers an Eco-roof grant program for commercial and residential properties. The Fraser Basin Council in British Columbia provides water quality grants to farms and other large land holdings to improve nutrient management and reduce loadings to surface waters. ALUS (Alternative Land Use Services) works with farming communities, providing grants and support to build nature-based solutions and green infrastructure on farmland. They also use ecological fee-for-service arrangements with farm owners to secure marginal farmlands to receive flood waters to prevent downstream flooding and nutrient loadings to surface waters.

Market-based incentives or by-laws/ordinances are more commonly used to drive uptake SCMs by private property owners in jurisdictions in the United States and Europe. As mentioned, the types of incentives include grants, low or 'zero' interest loans, stormwater fee rebates, fee-for-service payments, credit trading, property tax rebates, expedited review and approval on development projects, and bonusing, such as increased floor area or increased units to builders/developers. These incentive programs are targeted to both existing property owners and new development/re-development. Local by-laws/ordinances requiring SCMs typically apply to new development or re-development projects.

The City of Philadelphia offers substantial stormwater fee rebates – up to 90% of the fee – and a program of layered grants. Incentive programs are structured differently for commercial, residential, and institutional properties. Seattle, Washington has an L.I.D. ordinance with multiple objectives and standards for new development and redevelopment projects. Washington, DC has established a credit trading market, essentially enabling trading in stormwater offsets amongst property owners and developers.[16] New York City offers grants aimed specifically at securing GI/L.I.D. retrofits for existing commercial properties, as well as property tax rebates and grants for redevelopment projects. Prince George County, Maryland implemented the first Community-based Public-Private Partnership (CBP3) for GI wherein, the is responsible for delivering an incentive program directed toward institutional and commercial properties. The CBP3 model accelerates implementation of SCMs by moving past the conventional, successive design-bid-build process. Instead, the private partner can integrate planning, design, and construction into a single free-flowing program that the public sector then monitors.[17] Risks and costs are shared between the County and the private sector partner reducing the cost and resourcing burden to the jurisdiction.

3.6 Primary Research Findings

Key informant interviews with municipal staff provided valuable insight into the current state of stormwater planning and management in the N6 municipalities and an understanding of the different department perspectives on SWM. Themes emerged from the interviews with municipal staff indicating areas of shared experience and issues amongst the N6 municipalities and are provided in detail in Table 3-3. The responses provided by York Region staff aligned with those of the N6 municipalities in some common areas of activities, such as planning for SWM, siting and implementing GI/L.I.D. in the Right-of-Way.

Generally speaking, the interviews found respondents had a good level of understanding and insight into SWM challenges and opportunities, and a commitment to getting work done with limited resources. There was a widely expressed concern about delivering effective SWM over the longer-term without a significant increase in capital and O&M investment. Most respondents support the principle of intermunicipal collaboration on stormwater planning and management. Staff were well acquainted with the N6 collaboration and saw it as a vehicle for co-operating on SWM and a potentially effective means of addressing resourcing limitations. Sharing of equipment, expertise and know-how,

[16] https://www.epa.gov/sites/default/files/2020-10/documents/10-15_1140_session-_2nd_speaker_cholland.pdf
[17] https://www.epa.gov/G3/prince-georges-county-maryland-clean-water-partnership

collective tendering and funding submissions were several of the collaborative opportunities identified by municipal staff. Many respondents identified the Conservation Authority as a potential partner for various aspects of SWM, in particular, monitoring, implementing L.I.D. and support for integrated watershed-wide planning.

The primary constraints/opportunities identified or confirmed through the staff interviews are summarized below.

Primary Constraints

- Limited stormwater budgets for capital and O&M with longer-term implications for budgeting and increasing stormwater revenues.
- Most of the municipalities have identified substantial stormwater deficits, but not comparable as SWM asset assessment methodologies vary amongst the municipalities.
- Prioritizing of capital projects and O&M based on available dollars and areas of greatest need.
- Majority of stormwater budgets directed toward maintenance and upgrades of existing SWM infrastructure, particularly stormwater management ponds.
- SWM a lower priority compared to other areas (e.g., roads, community facilities, water supply & wastewater)
- No dedicated full-time operations staff for SWM.
- Varying degree of expertise in areas of stormwater planning, GI/L.I.D., and O&M of stormwater control measures, specifically GI/L.I.D.
- Limited knowledge and understanding of natural assets and their potential role in SWM.
- Challenge siting GI/L.I.D. in municipal Right-of-Way due to presence of utilities and more difficult where there is intensified development.
- Varying degree of support for investments in GI/L.I.D./natural assets, climate change mitigation and adaptation.
- Concerns over liability, financing, performance and upkeep of SWM infrastructure, and need for an ECA for siting/incentivising SCMs on commercial and institutional properties.
- Uncertain how Councils would respond to investing stormwater funds in infrastructure located outside of the municipality, several indicating the need for a strong business case and/or pilot test.
- Liability exposure and need to assess and mitigate risks (due diligence) a recognized concern.

Primary Opportunities

- Highly knowledgeable staff having significant insights into the challenges and potential solutions to SWM constraints and managing with limited resources.
- Universal recognition of need to address stormwater deficits and consider alternative financing and increased SWM revenue for long term sustainability.
- Universal recognition of the need to increase SWM revenues and consider alternative fee structures to secure need revenues and build reserves.

- Recognition of the need to act and plan ahead for the combined impacts of urbanization and more severe storms associated with climate change.
- Good support for building resiliency and reduce risk/liability through strategic SWM infrastructure investment.
- See value of the N6 Partnership for over more than a decade and see it as a proven effective mechanism for municipal collaboration with potential application for watershed-wide SWM.
- Support working collaboratively amongst the N6 partnership for watershed-level SWM while maintaining local-directed stormwater planning and management, noting many SWM issues are of a localized nature.
- Support for joint tendering, sharing resources, equipment, and training, collaborative SWM planning, and shared capital investment (with business case).
- Support for collaborating and leveraging municipal SWM budgets to access funding.
- Some municipalities have comprehensive SWM planning with strong emphasis on GI/L.I.D. and natural asset investment and growing support for same within other municipalities.
- Almost universal support and recognition of the potential benefits of working collaboratively with LSRCA for improved SWM.
- Many respondents identified the Region as potential collaborator for stormwater planning and management, particularly given the Region's role in source water protection and managing wastewater and their work on L.I.D./GI and Inflow and Infiltration (I&I)
- Growing recognition of a greater role for distributed stormwater control measures, including lot-level controls on private property, to better manage stormwater going forward.

Taken collectively, the primary and secondary research showed a strong argument in favour of intermunicipal collaboration for watershed-wide SWM and the use of optimization analysis to support stormwater infrastructure investment decision-making. The N6 Partnership provides a sound framework for intermunicipal cooperation on stormwater planning and management, including SWM infrastructure investment. The potential for reduced costs, improved SWM and access to higher thresholds of funding are compelling reasons to undertake a pilot test of N6 collaboration for stormwater planning and management.

In terms of siting of SCMs on commercial and institutional properties, the literature review and leading jurisdictions & BMPs research clearly indicated that it offers significant advantages, including cost-savings, improved environmental outcomes both in terms of water quality and reduced runoff and erosion, as well as multiple co-benefits such community enhancement, increased property values, reduced heat island effect, increased carbon sequestration, and improved air quality. However, current provincial requirements for an ECAs for SCMs on private property and the lack of substantial drivers of uptake found in other jurisdictions, specifically federal and/or state regulations and/or local by-laws/ordinances, and substantial state-level financial support are significant impediments to incentivizing use of SCMs on commercial and institutional properties.

Table 3-3: Municipal Interview Findings - Key Themes by Functional Area

Finance	
THEMES	• Most municipalities' asset management plans have identified stormwater infrastructure deficits. • Current stormwater revenue levels are not sufficient to address stormwater deficits, build reserves or meet anticipated increase demand – in terms of new infrastructure, upgrades, and replacements – due to climate change and continued urbanization of the watershed. • Need to substantially increase stormwater revenues over time in order to address future needs and stormwater deficits – considering or applying a dedicated 'reserve' charge and or higher rates. • "Resourcing for capital SWM investments is a longer-term challenge." • Method and scope of asset management assessments vary amongst municipalities, therefore estimates of deficits are not comparable (i.e., a more thorough assessment of asset condition will identify a higher deficit than a generic or assumptive assessment of asset condition). • Transportation and community infrastructure often take precedent in terms of budget allocation and spending approval. • How stormwater fees are calculated and charged vary from municipality to municipality. • Universal recognition of need to transition to and maintain full cost recovery for stormwater, but significant challenge given deficits, limits to rate and amount can increase revenues, competing priorities and varying levels of Council support amongst municipalities. • Recognize potential of N6 collaboration on SWM for cost savings (via optimization of system, sharing of resources, collective tendering, etc.) and the ability to meet higher funding threshold requirements for infrastructure by pooling SWM budgets providing additional funding to address deficits, build new SCMs and enhance O&M capacity and capability.
OTHER	• One municipality has adopted a utility fee based on the category of property (i.e., imperviousness as factor of type and size of property), two have a dedicated SWM charge and for the remainder the stormwater is included in the wastewater charge (i.e., on the water/wastewater bill).

Table 3-3 (cont'd): Municipal Interview Findings – Key Themes by Functional Area

Engineering/Capital Works	
THEMES	• Limited dollars available for new SWM infrastructure (green or grey). • SWM-MPs primary guidance for prioritizing investments, but also must respond to changing circumstances. • SWM budgets and approved spending dictate focus, i.e., what new SWM infrastructure or retrofits may be undertaken. • Significant portion of SWM budgets allocated to O&M-related improvements/retrofits, in particular pond clean outs and refurbishment. • Some SWM infrastructure requires upgrades/refurbishment (e.g., ponds) and depending on the scope and cost of these undertakings, may come from capital budget/reserves or O&M. • Support concept of investing in SCMs outside of their municipalities provided clear business case (improved SWM and cost savings). • Recognise need for greater investment in SWM and need to address deficits and develop greater resiliency in light of the combined impacts of urbanization and climate change. • For SCMs on private property would need to have mandatory and enforceable requirements around construction and O&M for SCMs on private property – see benefit in principle but concerned over logistics and viability given limited SWM resources. • Varying levels of knowledge and expertise around GI/L.I.D. types and applications, integration with grey technology and SWM system, and design and construction. • Varying levels of council support for GI/L.I.D. and actions related to climate change mitigation: some councils good level of understanding and highly supportive while not a priority for others. • The Conservation Authority identified as a significant source of expertise and support on L.I.D. for municipalities. • Consideration of potential for flooding with larger storm events is a growing concern and considering ways of adapting to climate change and increasing development.

OTHER	• Shared capital projects for SWM could be challenging – "who is the proper steward?" • "See two parts: 1) macro-scale (watershed) plan with agreement/MOU with hosts municipalities providing stewardship of the infrastructure, and 2) municipality-focused plan for local SWM." • Effort to reduce larger pipes & ponds, trying to be "more strategic" in siting and SCM selection/design. • Planning for L.I.D. as part of the larger SWM system (ensuring synergies) can be challenging. • Investment in GI/L.I.D. varies amongst municipalities - some place significant emphasis and SWM dollars on GI/L.I.D.; others indicated limited consideration of GI/L.I.D. currently, but indicated potential for more emphasis in future. • Intensification presents challenges in planning for SWM, particularly considering building in capacity for larger storm events with more intensified impervious development. • For design standards for L.I.D. use the Conservation Authority's Technical Guidelines for SWM submissions. • See role for the Region in supporting watershed-level SWM system, like the trunk system for water/wastewater. Region has more resources and could support and collaborate with municipalities and the Conservation Authority to develop watershed-wide system. • Would require an ECA for SCMs on ICI properties (likely make it too costly and involved). • Recognise potential value of SCMs on ICI properties but concerned about ensuring proper construction, O&M and management of the asset, as well as recourse if something goes wrong or property owner doesn't maintain. • Using private property for smaller SCMs (L.I.D./OGS) measures could be advantageous – "think there is a good rationale for easements for larger SCMs. • "Maybe opportunity for joint agreement with property owner – use property for SCM but municipality maintains".

Table 3-3 (cont'd): Municipal Interview Findings – Key Themes by Functional Area

Asset Management	
THEMES	• All municipalities have completed or are completing asset management plans. • Assessment of SWM asset conditions and estimates of deficits vary amongst municipalities. • Most municipalities have or will be turning the results of asset mgmt. planning into capital plans. • Asset management planning has focused greater attention on SWM infrastructure and need to maintain and upgrade infrastructure and address gaps. • Dollars and staffing resources needed for asset renew is another challenge.
OTHER	• Via the planning process, some municipalities have found SWM assets (e.g., ponds) that were not known and, therefore, not managed so implications for resourcing to renew or decommission. • Developers want and are encouraged to use reduce land use so more focus on underground SWM is a challenge – need to understand the life-cycle costs for O&M over the life of the asset but these systems are going in without this information.

Table 3-3 (cont'd): Municipal Interview Findings – Key Themes by Functional Area

Operations & Maintenance	
THEMES	• Limited O&M staffing and dollars available for SWM. • Given limited resources, mix of reactive and proactive O&M for stormwater (i.e., responding when problems/issues arise, such as calls about flooding vs. checking and upkeep of linear and surface SWM infrastructure). • Balancing act to provide sufficient O&M to SWM with near- and longer-term but challenges – need more dollars to fully cover O&M needs for stormwater infrastructure. • Maintenance and refurbishment to ensure level of function of stormwater ponds consume significant resources for most municipalities. • Due to limited O&M staff & competing priorities for operations and maintenance across asset classes, no FTE dedicated to O&M for SWM – most municipalities assign portion of FTE(s). • O&M training for SWM infrastructure, in particular, ponds and GI/L.I.D. is needed, but challenge is freeing up limited O&M staff. • Don't have in-house expertise to assess SWM infrastructure (e.g., ponds, pipes, L.I.D.) • Maintenance of surface SCMs typically shared between Transportation and Parks departments. • Universal concern for O&M is the use of backyard swales in new residential development as homeowners make changes (e.g., landscaping, pools, regrading, etc.) that impair function and result in flooding of neighbours creating challenge for municipal staff to access and to rectify. • See potential benefit of sharing of resources – equipment and staff time for some O&M for SWM infrastructure – with other N6 municipalities. • See collaborating on O&M an opportunity to prioritise projects across the watershed – all participating municipalities would need to agree on priorities/schedule – and improve efficiencies. • Support collective training of O&M staff for SCMs, in particular GI/L.I.D. and ponds. • N6 have good experience with shared delivery, O&M for SWM could be a "good fit…certainly, a good test case." • Collaboration – opportunity to share "approaches, expertise, what works, what doesn't" – "would be advantageous to share information and discuss issues and strategies". • Joint tendering for some O&M, assessments (e.g., ponds, pipes), or improvements could be cost-effective and reduce some of the contracting logistics. • Limited input on O&M at planning phase so issues show up after development – would be beneficial to get input from O&M at planning stage. • Currently there are SCMs, primarily oil-grit separators (OGS) but also some ponds, located on private property but there is no compelling requirement to maintain nor report on their maintenance and operation and the municipalities do not any authority to require the property owner to maintain and/or report. • See value of SCMs on private property to improve SWM, but concerned with ensuring proper O&M and if issues arise, problem will fall to the municipality to address/fix.
OTHER	• Varying knowledge of state and functionality of ponds amongst municipalities – indications are that many ponds are not functioning at required level. • Collaboration could work for some level of rotation for equipment and possibly specialized O&M (team pulled from municipalities) on a scheduled-basis for a given period (e.g., one month, twice per year) – challenge with sharing is that often the same equipment is needed by the municipalities at the same time of the year. • Some municipalities twin GI/L.I.D. installation in the Right-of-Way with road reconstruction. • Some lack of clarity about assigning O&M for underground pipes and getting a good understanding/assessment of condition.

Table 3-3 (cont'd): Municipal Interview Findings – Key Themes by Functional Area

Planning	
THEMES	• For SWM, input from the engineering side is always provided to planning. • Overall, developers are receptive to GI/L.I.D.; "…if no large pond, frees up land, possibly for more units and may lower cost". • Emphasis for greener development, including green development standards, has been focused more on the energy side. • Green development standards (code and above code) are in progress or under consideration • Green development standards would include GI/L.I.D.. • Sustainability assessment is part or will be part of OP reviews. • Site plan agreements for SCMs like OGS, but no requirement for maintenance and reporting. • Looking for shared purpose for green space in development – recreation, park area, SWM. • No requirement in plan approval for maintenance of lot-level SCMs (e.g., rain gardens)
OTHER	• Shared capital projects could be a planning challenge initially; "…might be a headache but only until it's been done a few times". • Watershed-wide planning for SWM "could be a game changer…requires a lot of work but shouldn't shy away from it". • Most respondents incorporate drainage considerations into their designs but that does not mean their designs include Green Stormwater Infrastructure (GSI) measures per se. • GSI measures are not typically requested or installed unless there is a specific drainage issue.

Table 3-3 (cont'd): Municipal Interview Findings – Key Themes by Functional Area

Economic Development	
THEMES	• Collaboration on economic development between N6 and the Region has been beneficial. • Areas of focus for economic development vary amongst municipalities. • Technology (including green tech) is one area where business growth is targeted for most N6 municipalities. • As municipalities move to adopt green development standards, incorporating sustainability in official plans, may be an opportunity for green sector growth. • Economic development potential of GI/L.I.D. is an unknown – would require detailed assessment.
OTHER	• Philadelphia, Seattle and other examples are "…certainly noteworthy but all have policies and substantial budgets to facilitate investment in GI". • "Having a basin-wide policy and commitment to GI could be impactful in terms of attracting associated businesses."

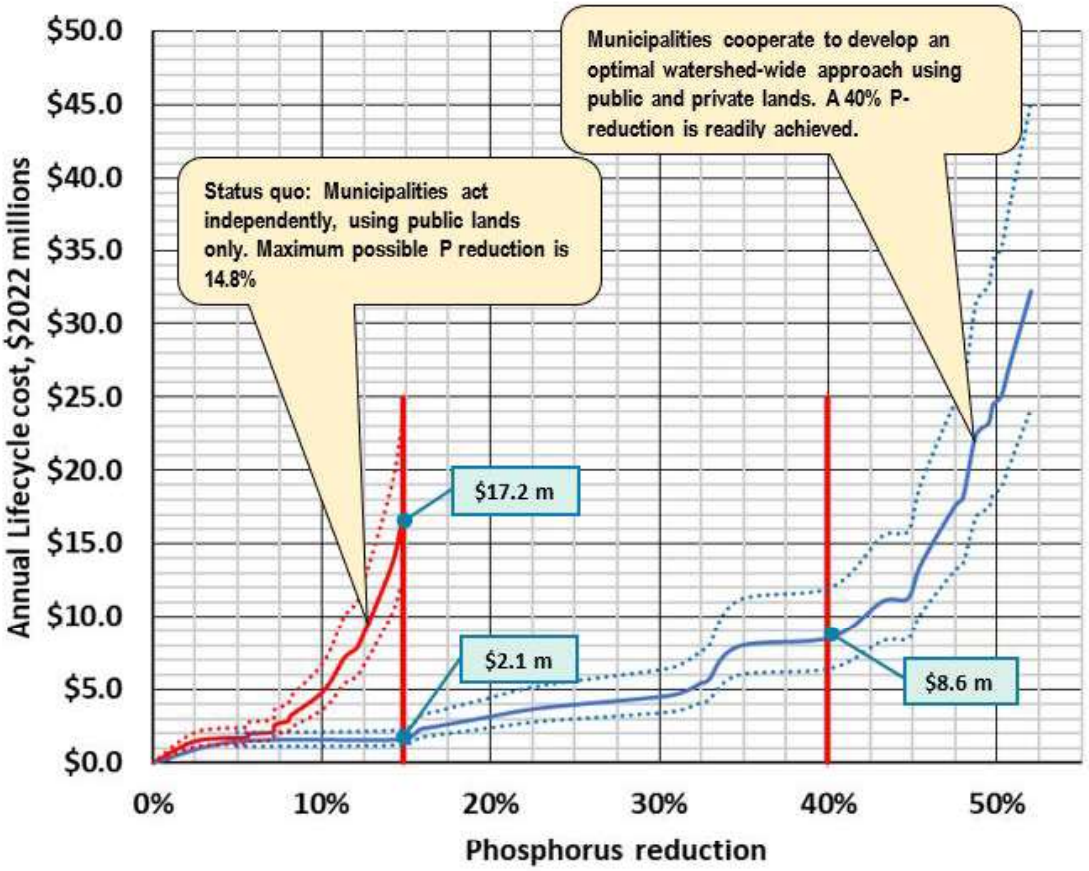
Table 3-3(cont'd): Municipal Interview Findings – Key Themes by Functional Area

Legal	
THEMES	• Agreements, insurance, and indemnification requirements allow municipalities to share liability for joint capital projects. • Cost-benefit and risk analysis is done and requirements, etc., are set out in agreements for shared services and projects – "split of liability would be a negotiation". • Shared infrastructure can be done via legislation (e.g., water/wastewater) or by agreement (e.g., fire station). • Regional insurance is being considered. • Risk management and liability are a concern in general – certainly starting to consider impacts of development and climate change in terms of risk, demonstration of due diligence. • Any defence of liability is that we follow the Planning Act and approve in accordance with the Act.
OTHER	• Watershed-wide planning may not shield from liability, but it does, in theory provide protection. • Small SCMs can be deeded on property; for larger ones, may want an easement. • Unclear if water/wastewater infrastructure in setback lands on private property provide a precedent for SWM infrastructure in setback lands.

4 Financing Enhanced Stormwater Management

This report promotes an optimized approach to stormwater planning and management in the East Holland River Watershed. In this section we present the costs of enhanced SWM, discuss options for cost savings, presents how costs are distributed across municipalities and discuss options for cost sharing.

The focus is on measures that improve SWM, namely a combination of centralized infrastructure, such as hybrid stormwater ponds/constructed wetlands (see Terms and Definitions for an explanation), and distributed infrastructure, such as, GI/L.I.D. measures and hybrid storm water ponds. The analysis focusses on developed lands in towns, villages, and rural subdivisions where new SWM costs are most likely to be incurred in whole or in part by municipalities. Growth-related costs for stormwater drainage and SCMs in new developments are not included because we assume these to be incurred by developers. SCMs and associated costs proposed for each municipality in the System-wide SWM study are summarized in Figure 4-1 and Table 4-1 and Table 4-2.



Dotted lines indicated upper and lower bounds for cost estimates

*Figure 4-1: Comparing status quo to an optimal watershed-wide approach to SWM (*Adapted, based on modelling analysis for the 2021 report, *Equitable Responsibility for Transformative Design: A systems-based approach to Stormwater Management).*

Table 4-1: SCM Numbers and Costs by Municipality

Municipality	# of facilities (avg size)	Total Cost (2022 $1000s)			Avg Cost/Facility (2022$s)	
		Capital, $	OM, $/YR	Life Cycle Costs, $/yr [a]	CAPITAL, $	OM, $/YR
OPTIMAL WATERSHED-WIDE STRATEGY, 40.5% P REDUCTION						
L.I.D.						
Aurora	170 (230 m^2)	25,192.6	243.4	1,352.8	92,300	900
East Gwillimbury	34 (300 m^2)	5,871.9	56.6	315.1	110,800	1,100
Georgina[b]	excluded	excluded	excluded	excluded	excluded	excluded
King	25 (260 m^2)	5,273.4	42.7	274.9	210,900	1,700
Newmarket	192 (190 m^2)	20,852.8	211.1	1,129.4	71,200	700
Whitchurch-Stouffville	72 (450 m^2)	23,773.6	218.8	1,265.7	308,700	2,800
Totals	493 (250 m^2)	80,964.3	772.5	4,338.0	112,300	1,100
HYBRID PONDS						
Aurora	11 (3,560 m^3)	24,682.4	899.5	1,986.5	2,243,900	81,800
East Gwillimbury	2 (2,000 m^3)	2,385.8	86.9	192.0	1,192,900	43,500
Georgina	excluded	excluded	excluded	excluded	excluded	excluded
King	None	0.0	0.0	0.0	0	0
Newmarket	12 (2,670 m^3)	19,049.0	694.2	1,533.1	1,587,400	57,900
Whitchurch-Stouffville	3 (3,810 m^3)	6,804.0	248.0	547.6	2,268,000	82,700
Totals	28 (3,090 m^3)	52,921.2	1,928.6	4,259.2	1,890,000	68,900
STATUS QUO USING ONLY PUBLIC LANDS, 14.8% P REDUCTION						
L.I.D.						
Aurora	118 (620 m^2)	66,619.7	541.6	3,475.4	395,300	3,200
East Gwillimbury	20 (1,580 m^2)	31,674.4	232.3	1,627.2	1,065,100	7,800
Georgina [b]	excluded	excluded	excluded	excluded	excluded	excluded
King	15 (1,150 m^2)	17,382.7	126.7	892.2	1,519,800	11,100
Newmarket	147 (630 m^2)	76,908.8	623.8	4,010.8	406,700	3,300
Whitchurch-Stouffville	31 (1,570 m^2)	47,909.4	356.7	2,466.6	1,745,300	13,000
Totals	331 (800 m^2)	240,495.1	1,881.2	12,472.2	564,200	4,400
HYBRID PONDS						
Aurora	21 (2,550 m^3)	31,868.9	1,161.4	2,564.9	1,990,200	72,500
East Gwillimbury	1 (110 m^3)	67.7	2.5	5.5	88,800	3,200
Georgina	excluded	excluded	excluded	excluded	excluded	excluded
King	None	919.8	33.5	74.0	0	0
Newmarket	18 (2,210 m^3)	23,716.1	864.3	1,908.7	1,727,900	63,000
Whitchurch-Stouffville	5 (810 m^3)	2,398.0	87.4	193.0	629,000	22,900
Totals	49 (2,020 m^3)	58,970.4	2,149.1	4,746.0	1,578,300	57,500

Source: SUSTAIN model output from the 2021 Equitable Responsibility for Sustainable Design study.

(a) Annual life cycle costs estimated as the amortized value of capital costs (1.9%, 30 years) plus O&M costs.

(b) The analysis focussed on SCMs on developed land that achieve a 40% P-loading reduction in the East Holland River watershed upstream of Holland Landing in East Gwillimbury. Georgina was therefore not included in the model study area.

Table 4-2: Summary of SCM Life Cycle Costs by Municipality [(a)]

Jurisdiction	Optimal watershed-wide strategy, 40.5% p reduction (2022 $1000s)			Status quo using only public lands, 14.8% p reduction (2022 $1000s)		
	L.I.D.	HYBRID PONDS	TOTAL	L.I.D.	HYBRID PONDS	TOTAL
Aurora	1,352.8	1,986.5	3,339.3	3,475.4	2,564.9	6,040.3
East Gwillimbury	315.1	192.0	507.1	1,627.2	5.5	1,632.6
Georgina [(b)]	Excluded	excluded	excluded	excluded	excluded	Excluded
King	274.9	0.0	274.9	892.2	74.0	966.3
Newmarket	1,129.4	1,533.1	2,662.5	4,010.8	1,908.7	5,919.5
Whitchurch-Stouffville	1,265.7	547.6	1,813.3	2,466.6	193.0	2,659.6
Totals	4,338.0	4,259.2	8,597.2	12,472.2	4,746.0	17,218.2

Source: SUSTAIN model output from the 2021 *Equitable Responsibility for Sustainable Design* study.

(a) Annual life cycle costs estimated as the amortized value of capital costs (1.9%, 30 years) plus O&M costs.

(b) The analysis focussed urbanized areas that achieve a 40% P-loading reduction in the East Holland River watershed upstream of Holland Landing in East Gwillimbury. Georgina was therefore excluded from the model study area.

Costs for the optimal watershed-wide strategy are much lower than the status quo strategy while P-removal performance is much better. Capital costs for the optimal strategy are 45 percent of those for the status quo strategy and life cycle costs, are just 50 percent. The type, number and location of SCMs underlies this cost disparity. Adopting a watershed-wide approach to SWM management achieves a remarkable 82% reduction in required storage capacity for the 15% P-reduction scenario, and even the 40% P reduction scenario requires 30% less storage capacity than the optimized status quo approach while achieving a much greater level of P-control. This demonstrates the significant advantage afforded by the opportunity to locate SWM measures optimally, i.e., where they are most effective, whether on public or private land and the benefits of the N6 collaborating to plan and manage stormwater watershed-wide. Refer to Appendix 4 for background on the comparison of cost savings for the 15% P-reduction scenario.

The life cycle cost per cubic meter of SW storage capacity varies from a low of $465 for an infiltration chamber to $1,965 for the "Green Street" measure or siting SCMs in the municipal Right-of-Way. The mix of measures in the Status Quo scenario largely reflects the availability of sites for each type of measure since it is essentially a do-everything option that still fails to achieve the 40% P reduction target using only public lands. When private lands are made available in the watershed-wide strategies, there is a shift away from the costly Green Street measure towards the less costly measures like the infiltration chamber. Consequently, average life cycle costs per cubic meter of SW storage capacity fall by about 30% with adoption of the watershed wide approach with access to both public and private lands.

The flood control performance of the optimal watershed-wide strategy was evaluated for five flood-prone built-up areas in the East Holland watershed. Flooding strategies were integrated with water quality strategies by emphasizing SCMs that provide both flood reduction and water quality benefits. A range of storms from a 10-year storm to the 100-year storm were evaluated. The maximum peak flow reduction achieved was 23.09% for the 10-year storm and 14.85% for the 100-year storm. Flood water levels, which are the main determinant of flood damage, were reduced an averaged 6.3% across all flood return periods and 4.5% for the 100-year flood. With these reductions, average annual flood damages for the five flood prone areas fell 13% from $399,100 to $348,500. These flood control benefits relate to riverine flooding. There may be additional flood control benefits associated with sewer backups but these were not evaluated.

4.1 How SCM Costs Were Estimated

Costs reported in the preceding paragraphs were prepared using the STEP Low Impact Development Life Cycle Costing Tool.[18] Costs considered in this tool include preconstruction costs (e.g., equipment mobilisation, soil test pits, erosion controls), excavation, materials and installation, inspections, a 10% allowance for overheads and a 16% allowance for retrofitting existing infrastructure. While this costing model accounts for economies of scale in the construction of SCMs, cost estimates from the model were converted into simple constant unit costs to facilitate the optimization modelling.[19] As a result, economies of scale were no longer accounted for so that costs for larger SCM installations were probably overestimated while for small installations, underestimated. Moreover, costing did not account for any local design factors apart from the size and soil type of the area available for an SCM installation. Reported costs are best characterized as pre-feasibility costs with an error range of -25% to +40%, as shown by the upper and lower cost limits in Figure 4-1.[20]

The analysis here considers SCMs on developed land that achieve a 40% P-loading reduction in the East Holland River watershed above Holland Landing in East Gwillimbury. The exclusion of large area of agricultural land and smaller developed lands in the north end of East Gwillimbury and in Georgina makes the analysis of costs more conservative as agricultural lands have significant potential to provide lower costs solutions for phosphorus mitigation and SWM. Moreover, all SCM costs are assumed to be borne by local governments, including costs for measures on private lands, an assumption that is also very conservative since mandated SCMs are financed by builders and developers for new development or redevelopment projects. SCM costs do not account for municipal promotional and incentive program costs which may be required to inform and incentivise property owners who are not mandated to implement SCMs.

4.2 Cost Saving Opportunities

The most significant opportunity for cost savings, namely the opportunity to adopt an optimal, watershed-wide approach to the design and placement of SCMs, is captured in the costs reported above. The status quo approach to SWM can achieve, at most, a 14.8% reduction in phosphorus loading (P-loading) from the East Holland River at an annual lifecycle cost of $17.2 million. The same reduction can be had for approximately $2.1 million if municipalities cooperate to implement an optimal plan using public and private lands. The 40% phosphorus reduction (P-reduction) target can be achieved with this approach for only $8.6 million, and as previously discussed, at this level flood control benefits are realized.

Additional opportunities exist for cost savings during implementation. Perhaps the most significant of these will be realised when the watershed's rural areas are included in the analysis of optimal phosphorus control (P-control) and SWM strategies, since this will provide access to lower cost agricultural-based measures.

The municipal costs for SCMs that are presented above are conservative since they assume that each municipality assumes full responsibility for the finance of SCMs including those on private property, which accounts for approximately 80% of the impervious lands that are available for treatment by implementation of L.I.D. measures. This assumption is unrealistic for L.I.D. measures on commercial land since we can expect much of this land to be redeveloped over the assumed 20-year implementation period. With redevelopment, the private sector must comply with SWM control standards which address quality and quantity of stormwater runoff, including financing the measures

[18] Developed under the Sustainable Technologies Evaluation Program (STEP) and available at https://sustainabletechnologies.ca/lid-lcct/

[19] These unit costs were costs per square meter for the L.I.D.s and per cubic meter for the hybrid ponds.

[20] Error range based on AACE International Recommended Practice No. 56R-08, August 7, 2020. Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Building and General Construction Industries TCM Framework: 7.3 – Cost Estimating and Budgeting. In addition to the AACE International Recommended Practice No. 56R-08 Error range, further support for this assumption is found in (1) T. K. Geberemariam, 12 November 2018. Deterministic and Probabilistic Engineering Cost Estimating Approaches for Complex Urban Drainage Infrastructure Capital Improvement (CIP) Programs. Preprints (https://www.preprints.org/manuscript/201811.0259/v1), doi:10.20944/preprints201811.0259.vi, and (2) Joint Federal Government / Industry Cost Predictability Taskforce, November 2012. Guide to Cost Predictability, in Construction: An analysis of issues affecting the accuracy of construction cost estimates. Canadian Construction Association.

that are needed to comply with these standards. On redeveloped lands, municipal costs are therefore limited to the costs for approval and inspection of SCMs.

Some existing commercial lands may be strategically located to help with SWM by implementing SCMs. If existing commercial properties are not likely to be redeveloped in the near- to medium-term, incentives sufficient to motivate uptake of lot-level SCMs by the owners of these properties would be required (see Section 5.1.2 for a discussion of the use of incentives for commercial property investment in SCMs).

Providing incentives to private sector landowners for SCM implementation creates an opportunity for significant savings if those incentives encourage aggregated projects that serve multiple contiguous properties thereby providing economies of scale. For example, Philadelphia found a 67% reduction in cost per greened acre by allowing private firms to 'bundle' green infrastructure across multiple private properties.[21]

4.2.1 Optimization Generated Cost Savings

Bundling of proximate SCMs to achieve economies of scale was not evaluated in the optimization analysis, but an analogous aggregation of hybrid pond facilities was evident in the optimal watershed-wide strategy. While the status quo approach using public lands involved 49 hybrid ponds with an average capacity of 2,000 m^3, the optimal strategy used just 28 more strategically placed ponds with an average capacity of 3,000 m^3. In both scenarios, a suite of smaller L.I.D. measures was used along with the hybrid ponds; in the public lands only scenario, 560 installations with an average size of 510 m^2, and for the watershed-wide strategy, 710 measures with an average size of 200 m^2. It is these 710 L.I.D. measures that may provide the opportunity for cost savings by bundling into aggregated installations.

4.2.2 Mitigating Risks and Potential for Cost Savings

SWM investments that reduce the risk of flooding directly benefit property owners exposed to overland flooding and sewer surcharging and backup. Recent cases of such flooding have led to class action lawsuits against municipalities, including a successful suit against the City of Stratford in 2010, and ongoing suits against the cities of Thunder Bay and Mississauga[22] and more recently, Oakville. Particularly note worthy in the latter case, the class action names upstream municipalities citing disregard for downstream impacts in their planning and development. Effective flood control therefore benefits the municipality responsible for SWM infrastructure to the extent that their liability exposure and related insurance premiums may decrease in response to implementation of flood control measures. Property owners may also be able to avoid the insurance premium and deductible increases associated with high-risk properties.[23]

4.2.3 Cost Saving via Municipal Collaboration

Cost savings can also be expected from inter-municipal collaboration on the delivery of integrated SWM. These savings arise from procurement of goods and services, resource sharing, sharing of administration and overhead costs and access to technical services made possible by the larger scale of a watershed-wide program. Watershed municipalities already have extensive experience with inter-municipal collaboration through N6. To date, collaboration has focused on operations, for example garbage collection, audit and HR services and animal control. In these instances, collaboration is undertaken via contractual agreements based on agreed standards and levels of service, cost sharing and implementation arrangements. Cost savings from past collaborative efforts include $11 million for a joint 10-year waste

[21] O'Neill, S.J., S. Cairns (2016). New Solutions for Sustainable Stormwater Management in Canada. Sustainable Prosperity

[22] Laura L. Zizzo, Travis Allan, Alexandra Kocherga, April, 2014. Stormwater Management in Ontario: Legal Issues in a Changing Climate. A Report for the Credit Valley Conservation Authority

[23] Sandink, D., P. Kovacs, G. Oulahen, G. McGillivray (2010). Making Flood Insurable for Canadian Homeowners: A Discussion Paper. Toronto: Institute for Catastrophic Loss Reduction & Swiss Reinsurance Company Ltd.

collection contract, a 10 percent discount on a five-year contract for external audit services, and an overall cost savings of 40 percent on a joint procurement contract to prepare four individual Fire Master Plans.[24]

Municipal staff interviewed for this project held a favourable view of N6 collaboration, citing avoided costs, improved efficiency and knowledge sharing as some of the benefits. The also cautioned that any proposal for collaboration must clearly show benefits to participating municipalities in terms of efficiencies, cost savings, or service improvements to win support of CAOs and the approval of Councils.

Collaborative delivery of infrastructure projects has not yet been tried by N6 although there is some experience with the shared management of existing SWM ponds that service both East Gwillimbury and Newmarket. Going forward, collaboration in the delivery of SWM infrastructure projects and initiatives between and amongst the N6 municipalities or, at the program level, to facilitate the delivery of services such as watershed-level planning, facility design, inspection and monitoring, training, O&M, etc.

4.3 Cost Sharing

This discussion of cost sharing applies only to the costs for optimized SCMs and not asset management costs, including O&M, for other SWM assets such as storm sewers and catch basins, which make up the larger portion of annual costs in each municipality. Cost sharing is an issue because optimized location of SCMs may require placement of facilities to control runoff upstream in the watershed benefiting downstream municipalities. In this case, the facility size and cost are determined by cost drivers in those upstream municipalities. SWM infrastructure located outside of a municipality but benefiting that same municipality by mitigating stormwater flows that it would otherwise have to manage is a major element of the business case for cost sharing as all beneficiaries contribute to the cost of the SCMs. As previously discussed, emerging liability concerns for municipalities and minimizing risk exposure associated with upstream development having downstream consequences are another significant and pointed reason for municipalities to collaborate to plan and manage stormwater on a watershed-wide basis.

The approach to cost sharing will vary depending on the context of the intermunicipal agreement. Municipalities may negotiate ad hoc agreements for specific SCMs, establish an agreement for watershed-wide SWM based on optimization of infrastructure, or a hybrid version such as an agreement for collaborative, watershed-wide SWM planning with separate agreements for specific SCMs.

N6 municipalities already have experience with cost sharing for specific facilities, an important example being the Newmarket-Aurora fire station for which cost shares are based on calls received, population served, and current value assessment. For a facility such as a hybrid SWM pond serving a drainage area straddling two or more municipalities, cost sharing might be based on the size of respective jurisdictional drainage areas adjusted for impervious area.

For a watershed-wide program, cost sharing is a more complex issue that will have to be negotiated by participating municipalities. The approach to cost sharing could be based on metrics such as current value assessment, population, urban population, watershed urban area or impervious area. To illustrate how some of these metrics would affect the cost shares across municipalities, a desktop exercise was completed using the costs reported in Table 4-1. Results are shown in Table 4-3.

[24] Nadorozny, D., Northern Six Municipalities (N6) Collaborative Initiatives and Partnership Update, Town of Aurora Information Report No. CAO20-001 (May 19, 2020)

Table 4-3: Cost Burden by Jurisdiction for Stormwater Control Measures

Basis for cost sharing [a]	Optimal Watershed-wide Strategy (40.5% P-removal)					Status quo public lands only strategy (14.8% P-removal)
	1. No cost sharing [b]	2. Urban area	3. Total population	4. Impervious Area	5. Impervious area + Total Population	
TOTAL ANNUAL COSTS, $1000/year [c]						
Aurora	3,636.6	3,327.8	3,324.6	3,868.5	3,596.6	6,627.4
East Gwillimbury	556.3	860.9	361.4	349.8	355.6	1,821.8
Georgina [d]	n/a	197.9	168.2	30.1	99.1	n/a
King	306.4	10.5	11.0	9.7	10.4	1,075.4
Newmarket	2,900.4	3,917.7	5,049.7	4,745.6	4,897.7	6,519.3
Whitchurch-Stouffville	1,995.6	1,080.4	480.5	391.7	436.1	2,959.5
Totals	9,395.4	9,395.4	9,395.4	9,395.4	9,395.4	19,003.5
PER CAPITA COSTS, $/Person/Year						
Aurora	66	60	60	70	65	109
East Gwillimbury	92	143	60	58	59	271
Georgina [d]	n/a	71	60	11	35	n/a
King	1,669	57	60	53	52	5,263
Newmarket	32	43	55	52	53	70
Whitchurch-Stouffville	226	123	55	45	50	332

(a) See Appendix 3 for a discussion of the cost allocation metrics in this table.

(b) Each jurisdiction pays for all measures within its own boundaries.

(c) Costs comprise capital costs spread over 20 years plus annual O&M costs. Capital and O&M costs are reported in Table 4-1.

(d) The study analysis focused on SCMs on developed land that achieve a 40% P-load reduction in the watershed upstream of Holland Landing in East Gwillimbury. Georgina was therefore excluded from the model study area so no costs are available for Case 1 and the Status Quo scenarios. Georgina is assumed to participate in the cost allocation process.

The cost allocation analysis for the optimal strategy, shown in the first 5 columns of the table, are labelled cases 1 to 5. To illustrate cost savings at a municipal level from adopting the optimal watershed-wide strategy, the unallocated costs for the status quo strategy involving only public lands are also shown in the last column. The cost reallocation appears to disadvantage some municipalities, especially Newmarket, while King and Whitchurch-Stouffville, which experience very high per capita costs under both the Status Quo option and Case 1, benefit from the reallocation of costs. But, with or without cost reallocation, all municipalities pay less under the optimal strategy than they would under a status Quo strategy.

Without cost sharing (Case 1), the per capita cost burden is very uneven and places municipalities with smaller watershed populations at a disadvantage. Approaches that account for urban area or impervious area (Cases 2, 4 and 5) greatly reduce the large per capita cost disparities evident without cost sharing. These factors focus on the source of SW runoff but fail to account for situations where a facility located in one municipality is meant to service a drainage area in an upstream municipality. When costs are shared based on watershed populations (Case 3), the per capita cost disparities are eliminated. Cost sharing based on population will reflect SW runoff generation if population is closely correlated with urban area and impervious area. It can also be justified based on the beneficiary pay principle since population should also be correlated with numbers of beneficiaries.

This discussion of cost allocation issues only scratches the surface. It does however reveal how complex these issues can be and suggests the need for careful deliberation to develop an agreed approach to cost allocation that can help assure the sustainability of a collaborative N6 SWM program.

4.4 Costs by municipality

To this point in the report, the focus has been on measures that improve SWM, namely a combination of centralized infrastructure, such as hybrid stormwater ponds and distributed measures, such as bioretention. But these investments cover only a portion of the full cost of SWM, which also includes assets such as sewers, catch basins, and overland channels to convey stormwater. In this analysis of costs by municipality, all SWM costs are included: O&M and asset management costs for existing SWM infrastructure and the capital and O&M costs of SCMs for improving stormwater quality and flood control.

For each municipality, estimated full-cost budgets comprise current O&M and the SWM asset management costs identified by each municipality for existing SWM infrastructure, plus the cost of SCMs identified in the System-wide SWM study and their related O&M.

Optimization analysis described in the System-wide SWM study report was a static analysis evaluating watershed conditions with all recommended SCMs in place. In order to compare total costs, the time period over which measures would be implemented was not a factor and therefore not considered. For this financial analysis, the assumed time period is 20-years for implementation of the SCMs, including a 3-year phase-in period to scale-up 2022 SWM costs to full-cost levels.

The estimated full cost SWM budgets are compared to each municipality's 2022 SWM budget to determine how funding will have to increase to achieve financial targets for asset management and stormwater control to mitigate flooding and contaminant loadings to Lake Simcoe. The use of reported numbers for municipal 2022 budgets and for their asset management plan costs takes those numbers at face value. Not considered is whether existing budgets account for the cost of O&M at an appropriate scale for clean-outs and repairs required to maintain performance levels of existing infrastructure. The budget analysis also does not address SWM issues such as urban and localized flooding or streambank erosion control, nor does it consider whether estimated asset management costs might be over or underestimated due, for instance, to the scope of, or costing methodology used in each municipality's asset management study.

It is important to appreciate that the financial analysis presented here indicates an approximate funding gap between current N6 municipal SWM budgets and full-cost budgets. The presence of significant funding gaps in some cases highlights the need for a phased in budget adjustment period to eliminate these gaps. It is also the motivation behind the System-wide SWM study and this implementation plan to ensure that going forward, stormwater planning and management is optimized. Taking full advantage of opportunities to improve efficiencies, will ensure that SWM programming and projects are cost effective and cost savings can be realized and shared by all municipalities.

The following sections present the budget analysis for each of the six municipalities in the East Holland watershed. Data presented for each municipality is described in Table 4-4.

Table 4-4: Description of Indicators for the Budget Analysis

Descriptors [(a)]	Description
Total area	Area of municipality in km^2
Area in watershed, km^2	Area of municipality found within the watershed in km^2. Percentage figure measures the proportion of the watershed occupied by the municipality
Developed area in watershed, km^2	Area, in km^2, of municipality within the watershed comprising developed urban and suburban areas, villages, and residential enclaves in rural areas. Percentage figure measures the proportion of the total developed watershed area occupied by this developed area
Total Population (2021)	Total municipal population in 2021
Population in watershed	Municipal population found within the watershed. Percentage figure measures the proportion of the total watershed population.
Watershed population in developed areas	Population of municipality within the watershed. Percentage figure measures the proportion of the total watershed population in developed areas.

Annual SWM Costs, $1000/year	Description
Operating costs including SCM costs [(b)]	2022 – SWM operating costs from 2022 budget documents 20-year forecast – 2022 O&M budget plus incremental O&M costs for SCMs[(b)]
Capital expenditures	2022 – SWM capital project costs from 2022 budget documents.
Reserve Contribution	2022 – SWM capital reserve contributions from 2022 budget documents.
Asset management costs	SWM costs reported in asset management plans (AMP)
SCM capital costs – L.I.D. [(b)]	SCM capital costs for L.I.D.
SCM capital costs – hybrid ponds [(b)]	SCM capital costs for hybrid ponds

(a) Methodology for area and population estimates are described in Appendix 3
(b) Source: *Equitable Responsibility for Sustainable Design* study

A summary of the budget analysis for each of the N6 municipalities is provided on pages 30 through 36, inclusively.

Aurora

The Aurora 2022 budget for SWM was essentially a full cost budget based on available cost estimates for asset management and SCMs for phosphorus (P) control (Table 4-5, Figure 4-2). Just over half of the forecast budget is required for asset management. For the full cost stormwater budget, the annual per capita cost for SWM is $104, of which $39 finances SCMs for P-control.

Table 4-5: Aurora Overview

Descriptors	Indicator	Percent of total watershed
Total area, km^2	50	not app.
Area in watershed, km^2	48.1	19.8%
Developed area in watershed, km^2	28.4	35.4%
Total Population (2021)	62,057	not app.
Population in watershed	62,044	37.1%
Watershed population in developed areas	61,833	37.1%

Annual SWM Costs, $1000s at 2022 prices	2022 budget	20-year forecast
Operating costs (forecast includes SCM costs)	$1,411	$1,466
Capital expenditures	$4,487	not app.
Reserve Contribution	$2,000	not app.
Asset management costs (a)	not app.	$2,618
SCM capital costs – L.I.D.	not app.	$1,206
SCM capital costs – hybrid ponds	not app.	$1,182
TOTALS	$5,899	$6,473

(a) The annual average expenditure for SWM from the 2018-28 AMP forecast in Appendix 3 - Detailed 10-Year Financial Forecast for Infrastructure of the report "Assets Asset Management & Investment Plan, Securing Sustainability of our Infrastructure." (Adjusted to $2022, approved by Aurora council on March 26, 2019)

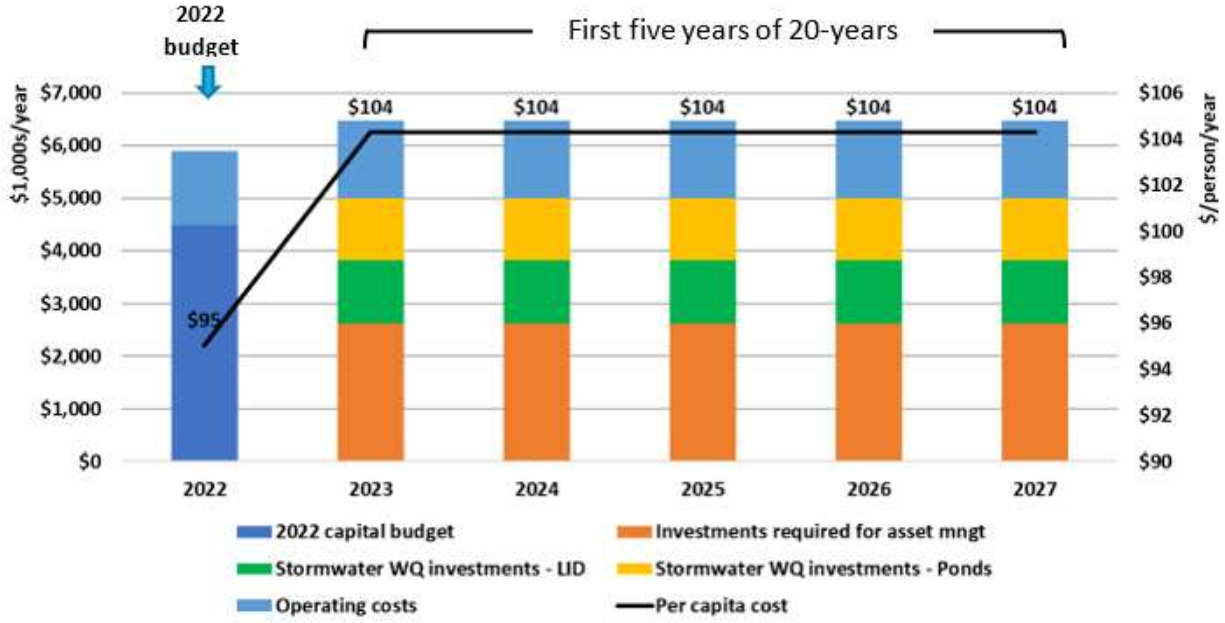


Figure 4-2: Transition to full-cost stormwater management in Aurora

East Gwillimbury

The East Gwillimbury 2022 budget for SWM falls well short of a full cost budget primarily because no stormwater capital investments were planned (Table 4-66, Figure 4-33).[25] An increase of more than 200 percent is required to fully fund asset management requirements and SCM investments for P-control. For the full cost stormwater budget, the annual per capita cost for SWM is $65, of which $12 finances SCMs for P-control.

Table 4-6: East Gwillimbury Overview

Descriptors	Indicator	Percent of total watershed
Total area, km^2	245	not app.
Area in watershed, km^2	72.9	30.0%
Developed area in watershed, km^2	7.4	9.2%
Total Population (2021)	34,637	not app.
Population in watershed	6,065	3.6%
Watershed population in developed areas	5,934	3.6%

Annual SWM Costs, $1000s at 2022 prices [(a)]	2022 budget	20-year forecast
Operating costs (forecast includes SCM costs)	$690	$697
Capital expenditures	$0	not app.
Reserve Contribution	not avail.	not app.
Asset management costs [(b)]	not app.	$390
SCM capital costs – L.I.D.	not app.	$96
SCM capital costs – hybrid ponds	not app.	$39
TOTALS	$690	$1,221

(a) Storm water was not identified separately in the 2022 budget. The stormwater budget was assumed to be 10 percent of the Community Infrastructure & Environmental Services 2022 Tax Supported Budget.

(b) Based on the annual repair and maintenance cost requirement for stormwater assets of $0.786 million ($2014) identified in Town of East Gwillimbury Asset Management Planning presentation by Public Sector Digest, 2014.

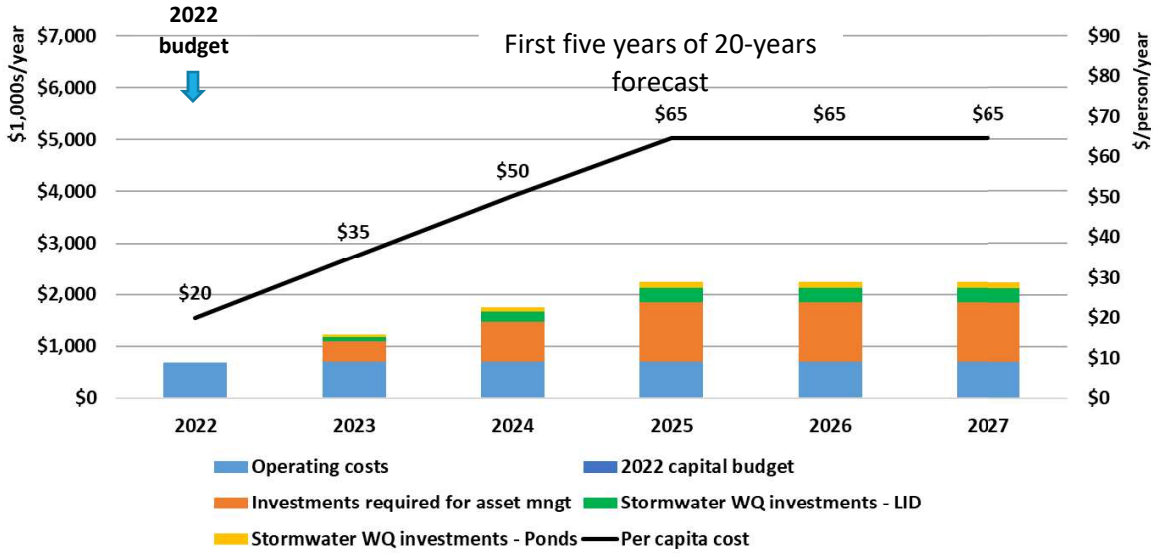


Figure 4-3: Transition to full-cost stormwater management in East Gwillimbury

[25] This does not account for 2022 reserve contributions of $0.716 million for Community Infrastructure & Environmental Services. It is not clear how much of this amount are earmarked for SW.

Georgina

Georgina's 2022 budget for SWM falls well short of a full cost budget (Table 4-7, Figure 4-4). An increase of 160 percent is required to fully fund asset management requirements. The annual per capita cost for a fully funded SWM program is $51. None of this finances SCMs for P-control because the System-wide SWM study extended only as far as the Holland Landing.[26]

Table 4-7: Georgina Overview

Descriptors	Indicator	Percent of total watershed
Total area, km^2	288	not app.
Area in watershed, km^2	8.0	3.3%
Developed area in watershed, km^2	1.7	2.1%
Total Population (2021)	47,642	not app.
Population in watershed	2,805	1.7%
Watershed population in developed areas	2,783	1.7%

Annual SWM Costs, $1000s at 2022 prices	2022 budget	20-year forecast
Operating costs	$541	$550
Capital expenditures	$400	not app.
Reserve Contribution	not avail.	not app.
Asset management costs (a)	not app.	$1,897
SCM capital costs – L.I.D. (b)	not app.	not app.
SCM capital costs – hybrid ponds (b)	not app.	not app.
TOTALS	$941	$2,447

(a) An annual capital expenditure requirement of $1.897 million for repair and maintenance of stormwater assets was reported in the Town of Georgina Council Agenda for Wednesday, June 22, 2022, 9:00 AM (Page 249).

(b) The analysis considered SCMs on developed land that achieve a 40% P-loading reduction in the East Holland River watershed upstream of Holland Landing in East Gwillimbury. Georgina was therefore not included in the model study area, but it is included in the cost allocation analysis.

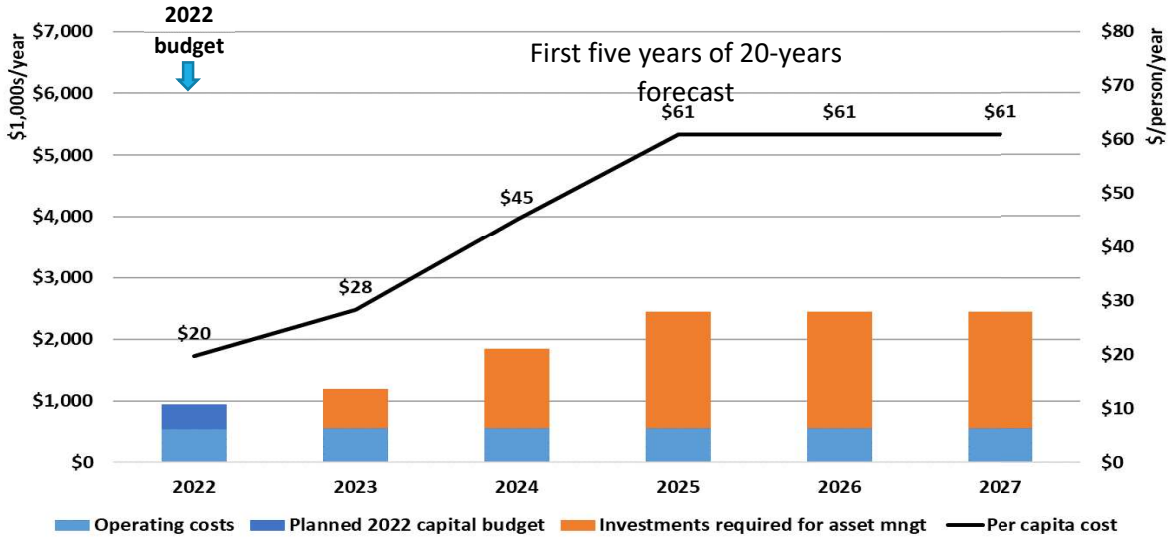


Figure 4-4: Transition to full-cost stormwater management in Georgina

[26] Costs for SCMs of $6.8 million ($9.2 million $2022) are reported in "Georgina Comprehensive Stormwater Management Master Plan" (Aquafor Beech Ltd, July 2017). These costs cover the entire township, not just the East Holland watershed.

King

To reach full cost expenditure levels, King township's 2022 budget for SWM will have to increase by 450% (Table 4-8, Figure 4-5). The main driver for this increase is the requirement for asset management identified in the 2021 asset management plan.[27] For the full cost stormwater budget, the annual per capita cost for SWM is $149, of which $9 finances SCMs for P-control. It is important to note that these SCMs are located in an area of the Township, representing only 6% of the total Township, that is found in the East Holland watershed.

Table 4-8: King Overview

Descriptors	Indicator	Percent of total watershed
Total area, km^2	333	not app.
Area in watershed, km^2	14.7	6.0%
Developed area in watershed, km^2	0.1	0.2%
Total Population (2021)	27,333	not app.
Population in watershed	298	0.2%
Watershed population in developed areas	266	0.2%

Annual SWM Costs, $1000s at 2022 prices	2022 budget	20-year forecast
Operating costs (forecast includes SCM costs)	$186	$188
Capital expenditures	$550	not app.
Reserve Contribution	not avail.	not app.
Asset management costs [(a)]	not app.	$3,635
SCM capital costs – L.I.D.	not app.	$253
SCM capital costs – hybrid ponds	not app.	$0
TOTALS	$736	$4,075

(a) Based on the annual cost of $3.1 million ($2021) for storm sewers, SWM pond cleanouts, and OGS replacements reported in Table 2-18 of "Asset Management Plan – Core Assets, Township of King" (Watson Associates, 2021).

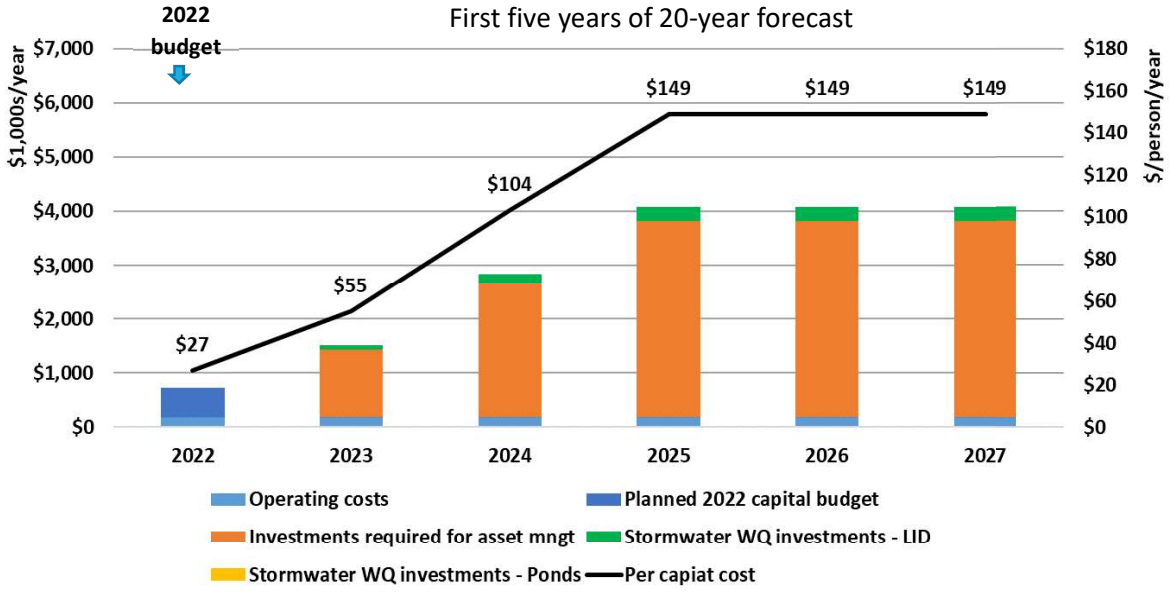


Figure 4-5: Transition to full-cost stormwater management in King

[27] Watson Associates, 2021. Asset Management Plan – Core Assets, Township of King, Table 2-18.

Newmarket

The Newmarket 2022 budget for SWM is 40% of a full cost budget (Table 4-9, Figure 4-6). An increase of 140% is required to fully fund asset management requirements and SCM investments for P-control. If reserve contributions for stormwater capital are accounted for, this percentage falls to 40%. For the full-cost stormwater budget, the annual per capita cost for SWM is $63, of which $22 finances SCMs for P-control.

Table 4-9: Newmarket Overview

Descriptors	Indicator	Percent of total watershed
Total area, km^2	38	not app.
Area in watershed, km^2	35.9	14.8%
Developed area in watershed, km^2	33.5	41.7%
Total Population (2021)	87,942	not app.
Population in watershed	87,913	52.5%
Watershed population in developed areas	87,622	52.6%

Annual SWM Costs, $1000s at 2022 prices	2022 budget	20-year forecast
Operating costs (forecast includes SCM costs)	$1,530	$1,574
Capital expenditures	$780	not app.
Reserve Contribution	not avail.	not app.
Asset management costs [(a)]	not app.	$2,070
SCM capital costs – L.I.D.	not app.	$999
SCM capital costs – hybrid ponds	not app.	$912
TOTALS	$2,310	$5,554

(a) An annual average cost for SWM asset repair and maintenance of $1.77 million ($2021) was estimated based on the total cost for stormwater for the period 2021-30 of $14.122 million reported in "Corporate Asset Management Plan, Core Assets".

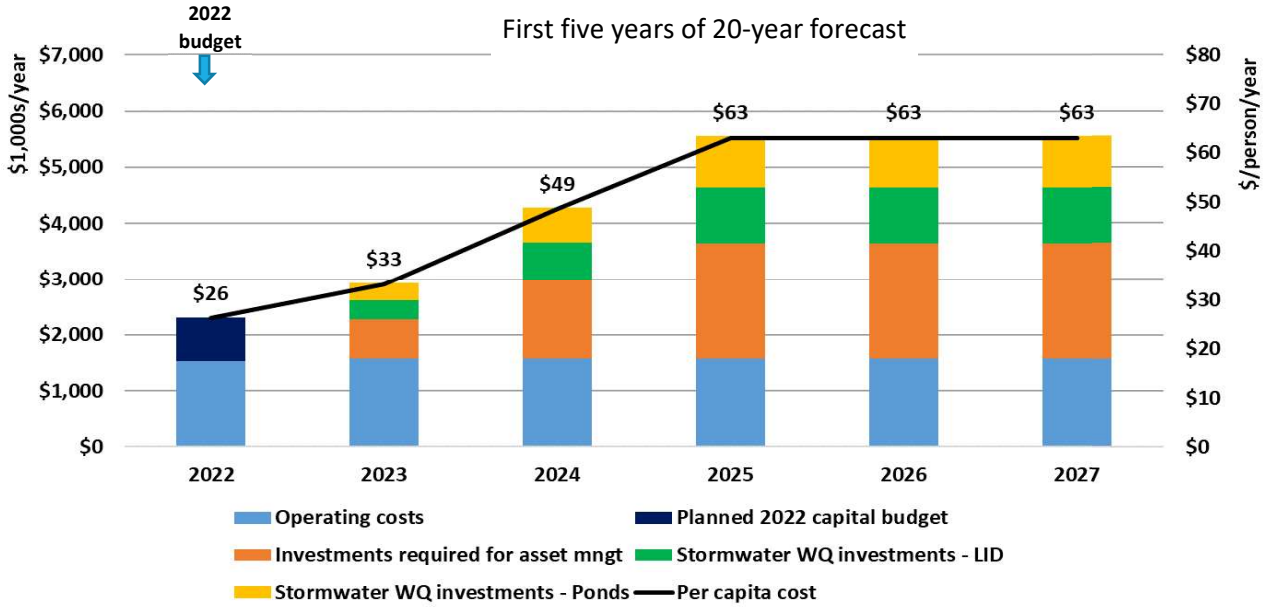


Figure 4-6: Transition to full-cost stormwater management in Newmarket

Whitchurch-Stouffville

The 2022 stormwater budget for Whitchurch-Stouffville is 23% of a full cost budget (Table 4-10, Figure 4-7). When planned annual stormwater reserve contributions $130 million are accounted for, this increases to 26%. A budget increase of 320% is required to fully fund asset management requirements and SCM investments for P-control. For the full cost stormwater budget, the annual per capita cost for SWM is $107, of which $30 finances SCMs for P-control on the East Holland, an area representing just 26% of the total Town area.

Table 4-10: Whitchurch-Stouffville Overview

Descriptors	Indicator	Percent of total watershed
Total area, km^2	206	not app.
Area in watershed, km^2	63.5	26.1%
Developed area in watershed, km^2	9.2	11.5%
Total Population (2021)	49,864	not app.
Population in watershed	8,213	4.9%
Watershed population in developed areas	8,064	4.8%

Annual SWM Costs, $1000s at 2022 prices	2022 budget	20-year forecast
Operating costs (forecast includes SCM costs)	$959	$981
Capital expenditures	$318	not app.
Reserve Contribution	not avail.	not app.
Asset management costs [(a)]	not app.	$2,900
SCM capital costs – L.I.D.	not app.	$1,138
SCM capital costs – hybrid ponds	not app.	$326
TOTALS	$1,277	$5,346

(a) An annual cost for SWM asset repair and maintenance of $2.9 million ($2022) was reported in Table 6-2 of "Town of Stouffville 2022 Asset Management Transportation, Stormwater, Water and Wastewater Services" (SLBC Inc., June 20, 2022).

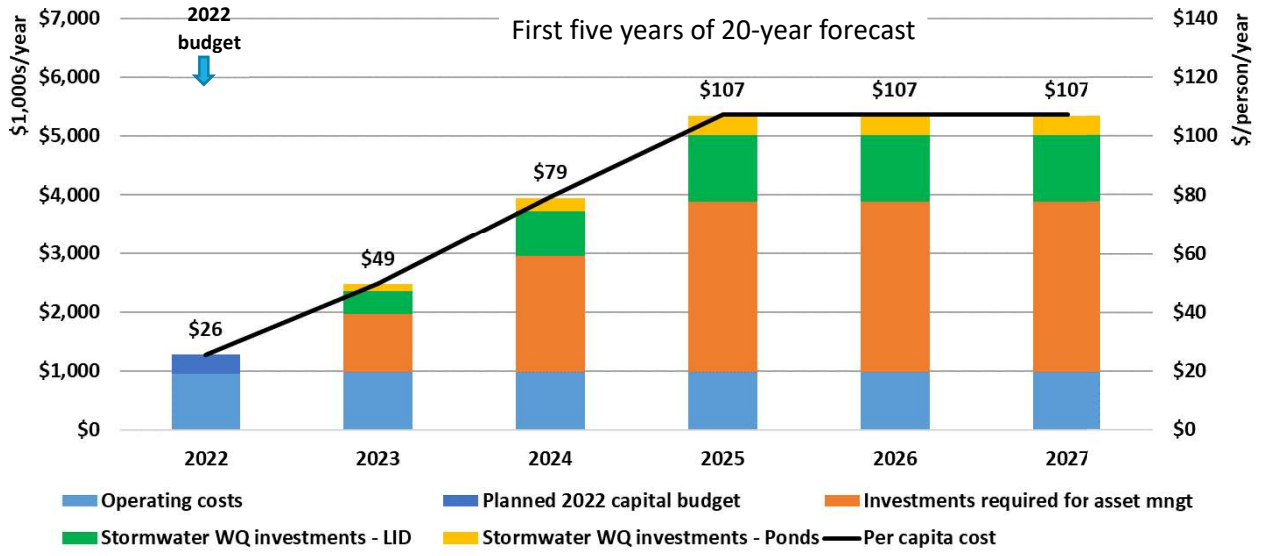


Figure 4-7: Transition to full-cost stormwater management in Whitchurch-Stouffville

5 Implementing System-wide SWM

Distilling the results from the secondary research, key informant interviews with municipal staff and questionnaire responses from York Region staff, highlighted the merits of intermunicipal collaboration including; cost-savings, improved levels of service, shared staff expertise, know-how and strategizing, and better access to funding and financing (public and private). In addition, the research produced numerous options for intermunicipal collaboration for watershed-wide stormwater planning and management in the East Holland River watershed. Applying the screening criteria narrowed potential measures and approaches for consideration and, in particular, emphasize the value of the N6 Municipal Partnership and its suitability for implementation of System-wide SWM.

5.1 Intermunicipal Collaboration: The N6 Municipal Partnership

A review of existing N6 collaboration agreements and the outcomes from those arrangements, specifically costs savings and improved levels of service, further reinforced using the N6 partnership framework for collaboration on watershed-wide SWM. In addition to its suitability as a governance and administration, it is important to note some of the less tangible benefits of the N6 partnership, specifically the maintenance of autonomy of the participating municipalities, collaborative and collegial nature of the relationship, option for opting in or out of an undertaking, Council-granted authority of the Chief Administration Officers (CAOs) in co-ordination with their staff to identify and explore opportunities for collaboration before presentation to Council. The N6 partnership also provides the necessary framework to address existing and emerging challenges, such as evolving pressures for improved SWM due to rapid urbanization, an historic legacy of limited stormwater infrastructure in older, established areas of the municipalities, increasing frequency and severity of storm events due to climate variability, implications of intensified development for SWM and ensuring livable communities, and increasing liability risks associated with downstream impacts from upstream development and previous planning decisions.

5.1.1 Risks and Management Strategies

The benefits of N6 municipalities collaborating on SWM are numerous and certainly worth exploring via a pilot test, but collaboration arrangements are not without potential risks. The effectiveness of the N6 Partnership agreements is the result of the following:

- All participating municipal senior management and Councils are supportive of the Partnership
- Research and pre-planning amongst participating municipalities.
- Establishment of a clear business case for every collaborative venture with each participating municipality's priorities being met by the joint undertaking.
- Determination of shared objectives and outcomes and clearly defined roles and responsibilities for participating municipalities.
- Establishment of a municipal lead with accountability to participating municipalities and on-going assessment and evaluation of shared delivery of undertakings.
- Informal negotiations with option for municipalities to opt-in or opt-out of a given undertaking.

A summary of potential risks and the corresponding management or mitigation strategies to address them is provided in Table 5-1. Ensuring good communications between and amongst partner municipalities, pre-agreement of key aspects of shared undertakings including sound budgeting, contingency planning and funds, on-going monitoring, evaluation and reporting are common elements of successful intermunicipal collaboration arrangements.

Table 5-1: Potential Risks of Intermunicipal Collaboration Arrangements and Associated Management Strategies

POTENTIAL RISK	MANAGEMENT/MITIGATION STRATEGY
Uncertainty of behaviour or decisions within a given partner municipality having adverse impacts.	• Contractual agreements wherein participating municipalities commit and bind themselves to mutual actions.[28] • Clearly defined roles and responsibilities with on-going monitoring, reporting and evaluation to enable early identification of potential issues for targeted resolution. • Established dispute resolution mechanism imbedded in agreements.
Co-ordination problems between one or more municipal partners failing to deliver on their contractual responsibilities	• Pre-agreement capacity and capability assessments with shared planning and scoping of undertakings, deliverables and responsibilities. • Clearly established communications protocol, defined roles and responsibilities, and monitoring, reporting and evaluation requirements defined in collaboration agreements. • Established dispute resolution mechanism imbedded in agreements.
Defection problems with one or more municipalities reneging on a collaboration agreement.[29]	• Pre-agreement planning wherein individual objectives and requirements are explored to determine viability and ensure all participating municipalities are fully supportive prior to development of contractual agreements. • Clearly defined roles and responsibilities with on-going monitoring, reporting and evaluation to enable early identification of potential issues for targeted resolution. • Established dispute resolution mechanism imbedded in agreements.
Issues pertaining to division or sharing of costs amongst one or more partner municipalities.	• Pre-agreement financial analysis and budgeting • Setting of upset limit budgets with clearly defined and agreed to metrics (e.g., area served) for assigning and sharing in costs and benefits. • Provisions for contingency funds established prior to initiation of undertakings and prescribed in contractual agreements • Budgets and assigned division of costs incorporated in contractual agreements. • On-going tracking and reporting of expenditures with clearly defined accountability for budget overruns. • Established dispute resolution mechanism imbedded in agreements.

5.1.2 N6-System-wide SWM Management Framework

The N6 partnership has not yet undertaken collaborative planning and management of infrastructure, although the jointly-shared fire station between the towns of Newmarket and Aurora does provide some insight into how infrastructure can be shared between municipalities. Given the layered complexity of SWM, putting in place a more prescribed management structure would provide the necessary oversight and coordination for N6 delivery of System-wide SWM.

A suggested 'hybrid' model for collaborative, watershed-scale SWM would to retain the beneficial and essential elements of the N6 partnership while overlaying a more defined framework typical of intermunicipal collaboration arrangements for infrastructure such as roads and water/wastewater. Like the N6 partnership, the hybrid model would facilitate investigation of collaboration opportunities, enable municipalities to opt-in/op-out, designate a lead

[28] Spicer, Z., Cooperation and Capacity: Inter-Municipal Agreements in Canada; Institute on Municipal Finance and Government, University of Toronto. 2015. https://policycommons.net/artifacts/1222398/cooperation-and-capacity/1775476/

[29] *Travares, A., Feiock, R.; Applying an Institutional Collective Action Framework to Investigate Intermunicipal Cooperation in Europe* (Nov 2017). https://www.researchgate.net/publication/321013730_Applying_an_Institutional_Collective_Action_Framework_to_Investigate_Intermunicipal_Cooperation_in_Europe

municipality per undertaking, maintain an open and collegial communications and support CAO-led initiatives but with a more prescribed management and administrative structure (Figure 5-1)

The proposed management framework retains the current N6 partnership structure, with the municipal CAOs leading the collaboration. Budgetary and financing support would be collectively provided by the N6 treasurers/directors of finance. The N6 CAOs would have oversight and decision-making authority for undertakings approved by their respective Councils. A Stormwater Infrastructure Management Group reporting to the N6 CAOs would direct the implementation of approved undertakings. Consistent with the current N6 partnership arrangements, individual municipal leads would have responsibility for implementation and day-to-day management of specific undertakings but would be supported by interdisciplinary tactical teams. Depending on the size and scope of a given undertaking, a tactical team could be responsible for implementing one or more undertaking. Tactical teams would be made up of municipal staff from relevant areas of responsibility (e.g., operations, engineering, finance, planning etc.) at applicable municipalities (i.e., participating in the undertaking). Table 5.2 provides a summary of the roles and responsibilities for the two proposed management and implementation group; Infrastructure Management Group and the Interdisciplinary Tactical Teams headed by the Individual Project Lead.

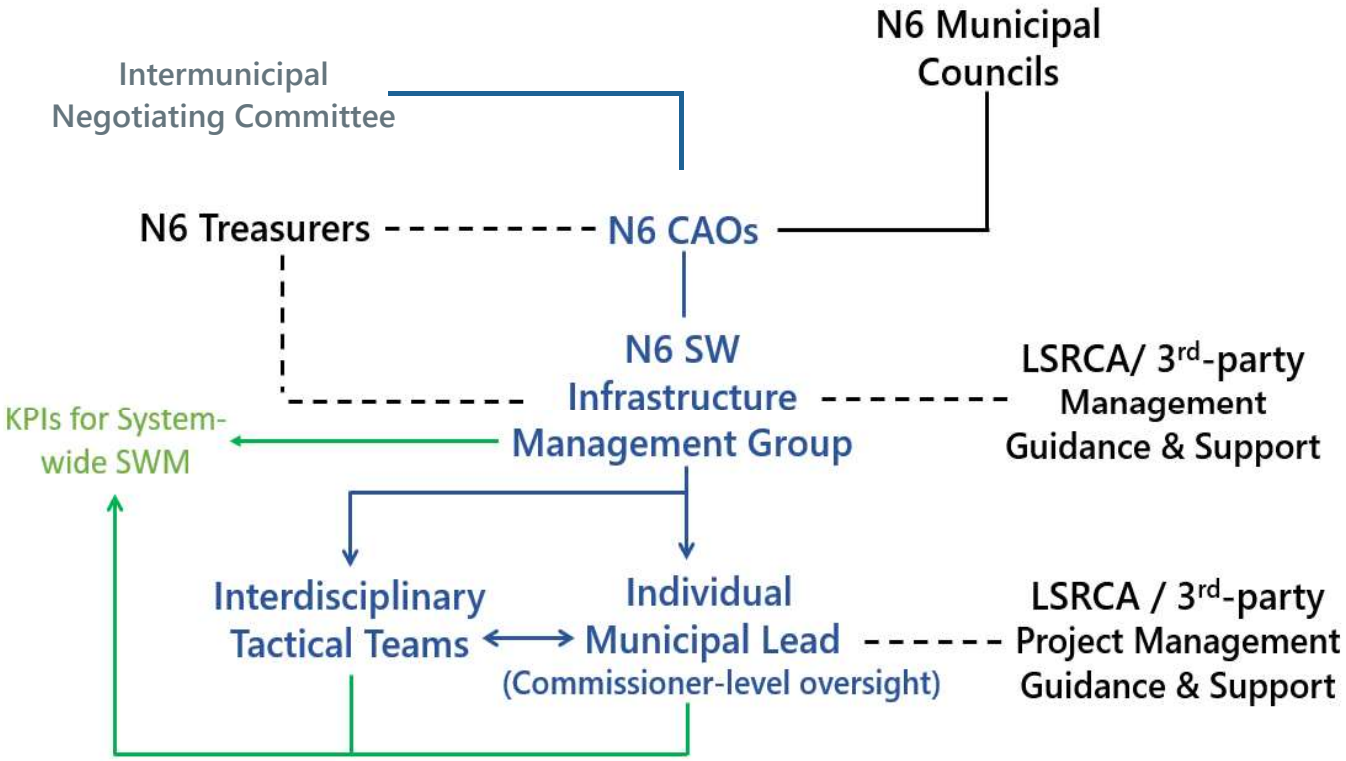


Figure 5-1: Potential N6 municipal partners collaboration framework for watershed-wide stormwater management

Table 5-2: Summary of Roles & Responsibilities for Proposed Implementation Groups

Infrastructure Management Group
• Finalize Terms of Reference • Research and analysis to confirm priority projects/programs, evaluate capacity and resources • Determine scope, generate *scalable transition plan* for joint project(s)/program(s) – determine budgeting and finance, roles & responsibilities, monitoring & reporting, assignment of municipal staff and deliverables, third-party services (research, analysis, planning, management support, etc.). • Assess level of service – life-cycle costing (growth and land use plans and servicing plans), evaluate land use planning impacts on servicing and amongst partner municipalities to ensure equitable sharing of costs and risks over time. • Determine lead municipality for each shared program/project • Establish program- / project-specific KPIs for municipal staff • Risk mitigation strategy • Communications and engagement plan • Dispute resolution process
Municipal Leads – Interdisciplinary Tactical Teams
• Reports to the N6 Stormwater Infrastructure Group • Select municipal department lead with Commissioner-level oversight and reporting • Project/program planning, scheduling, specific roles and responsibilities and design. • Costing and budgeting, budget management and reporting • Detailed project/program deliverables, milestones, monitoring and reporting • Implementation and management of intermunicipal SWM project(s)/program(s)

In addition to the proposed management team and tactical teams that would collectively manage implementation of undertakings within the existing N6 framework, the formation of an Intermunicipal Negotiating Committee, which would function on an as-needed basis, is also recommended. The initial role of the committee would be negotiating the scope, mandate, vision and priorities for N6 collaboration on stormwater planning and management. Representation would include N6 municipal CAOs; select senior management representatives from finance, planning, engineering & capital works, O&M, policy/legal, planning and economic development; select members of councils, and critical front-line staff. The Intermunicipal Negotiating Committee would have responsibility for the following:

- Developing the collective vision, goals and guiding principles.
- Securing N6 Council, CAO and senior management agreement on the alignment of overarching municipal priorities.
- Determining potential shared projects and services, capacity, resources, budgets and financing, and agreement terms and conditions.
- Performance measurement criteria and review process (e.g., KPIs, monitoring and reporting).
- Framework and Terms of Reference for the Intermunicipal Management Team (i.e., roles and responsibilities, term, reporting, measurable objectives, etc.).
- Dispute resolution process.

5.1.3 Potential Areas for N6 Collaboration on SWM

Multiple opportunities for N6 collaboration for SWM exist across a range of departmental function and areas of priority. The research identified policy & legal services, planning, engineering & capital works, O&M, asset management, and finance as areas for potential collaboration summarizes the potential shared activities and services by area category.

Table 5-3: Potential Shared SWM-related Activities and Services by Policy Area Category

CATEGORY	SERVICE/ACTIVITY DESCRIPTION
Policy and Legal	• Policy research and guidance • Legal analysis and agreements
Planning	• SWM master planning • Scope and priority setting • Asset management planning • Watershed planning • Natural asset planning • Modelling • Data compilation and analysis

Capital Projects (green & grey infrastructure)	• Project management of 3rd-party contractors:
	  ○ Blueprints and detailed design
	  ○ Construction guidance and inspections
	  ○ Monitoring and compliance inspections
	  ○ Performance monitoring
	• Identification of project twinning opportunities and works planning and scheduling
	• Tendering
	• BMP/new technology research to support capital project decision-making

Operations & Maintenance	• Inspection and assessment of surface and sub-surface infrastructure. • Maintenance and minor retrofits/improvements. • Infrastructure data management and O&M prioritization. • O&M planning, prioritization and scheduling. • BMP/new technology research to support O&M decision-making. • SWM issue logging and priority response. • Tendering. • Project management of 3rd-party contractors.
Asset Management	• Asset condition assessment and prioritization for maintenance, upgrades, decommissioning. • O&M guidance manual – priorities and timelines for repair as required by MECP. • BMP/new technology research to support asset management decision-making.
Finance	• Financial and budgetary guidance and support to address SWM priorities. • Review, support, and evaluation of cost and cash flow estimates and projections, tenders, funding submissions, etc.

5.1.4 Incentivizing Stormwater Control Measures on Existing Commercial Properties

As the research into leading jurisdictions and BMPs found, supported by both peer-reviewed studies and third-party program evaluations, private property hosting of SCMs can reduce SWM costs and provide improved environmental outcomes, specifically reduced runoff and erosion and enhanced water quality. Incentivizing SCMs on private property is a growing trend as much of the land in urban and urbanizing watersheds is privately-held and managing stormwater at its source is often most cost effective. In addition, securing SCMs on private property is consistent with the widely accepted practice of employing a treatment train approach, wherein the focus is first on lot-level control of stormwater, followed by conveyance control and lastly, end-of-pipe management (e.g., SWM ponds).

In the absence of regulations for enhanced SWM on existing commercial properties, incentives are the only means to drive uptake of SCMs by owners/managers of commercial properties. Business and homeowners are not compelled by law to implement energy conservation measures. Rather, incentives combined with cost savings on energy bills results in a sufficient ROI to warrant the investment. For small to mid-sized businesses, typically a payback period or ROI under five years is considered acceptable. For larger size companies, longer payback periods are more acceptable, but seven years is a common ROI threshold. Securing investment in enhanced, lot-level SWM by existing commercial property owners in Ontario is low due to the excessively long payback periods; usually well beyond 10 years and readily as long as 20 plus years. Reducing the payback period for commercial property investment in enhanced SWM will require a combination of, 1) a substantial increase in stormwater fees and associated rebates and, 2) additional financial incentives to provide a reasonable ROI to justify the investment.

5.1.4.1 Current Limitations to Incentivizing SCMs on Existing ICI Properties

Four prominent constraints to incentivizing and securing uptake of SCMs on institutional and commercial properties exist is Ontario, they are:

1) No federal or provincial legislation compelling subordinate jurisdictions to meeting specified water quality targets for receiving source waters.
2) No significant federal or provincial funding directed to municipalities to specifically for meeting water quality or stormwater management objectives.
3) Limited municipal stormwater reserves and revenue combined with high percentage of municipalities have substantial stormwater deficits, therefore there is insufficient funds for incentivizing existing private property uptake of SCMs.
4) Private stormwater infrastructure, including those on commercial property, is not authorized for future alterations under MECP's consolidated linear ECA. Under the OWRA, an ECA may be required for any private stormwater works or exempt under O. Reg 525/98, creating a logistical and cost barrier to incentivizing uptake of SCMs by property owners.

In light of these constraints, it would be necessary to determine if other sources of funding could be secured to support incentives, such as available federal and private sector adaptation funding, or if other arrangements, such as lease or fee-for-service agreements, would be more cost-favourable. In addition, it would be important to understand if specific exemptions for an ECA could be secured from the MECP provided certain criteria are met pertaining to the site (e.g., land use, soil, topography, well head protection areas, etc.) and business operations (type of business, presence of hazardous materials, property management practices, etc.). Such research and analysis are beyond the scope of this project, but given the benefits, in terms of lower costs; improved water quality, reduced runoff and erosion; greener, more livable communities; and other co-benefits that can be realized via a network of SCMs on private property they merit further investigation.

5.2 Pilot test: N6 Collaboration on System-wide SWM

Given the scope and complexity of stormwater planning and management, implementing a new, watershed-wide approach that is integrated and complementary to local municipal SWM should begin with a pilot test. The pilot test would be divided into 4 phases: Preparation, Planning, Deployment and Evaluation.

Preparation

- In preparing for the pilot test, it is recommended that a working group be established with members representing the N6 municipalities, York Region and LSRCA. The purpose of the working group is to lay the initial foundation for pilot test, specifically, identify shared priorities for the pilot, the general scope and timeframe, ballpark budget estimate, feasibility assessment, funding and financing options and pilot test

framework, including the study lead municipality(ies). A staff report to the N6 CAOs seeking approval for a detailed pilot test plan and supporting budget for plan development would be completed by the working group.

Planning

- Formation of the Pilot Test Project Team (PSPT) would be the first step in developing a detailed plan for the pilot test. The PSPT may have the same members as the initial working group or the membership may be modified as needed based on priorities, required roles and responsibilities, availability and budgets. The key planning steps for the pilot test are as follows:
  - Refine and finalize project priorities, goals and measurable objectives.
  - Identify potential risks and develop strategies and contingencies.
  - Refine scope and priorities and identify key activities and associated costs.
  - Complete detailed feasibility analysis.
  - Develop study plan, including tasks by key activities, logistics, scheduling, milestones, line budgeting by tasks, and roles and responsibilities of PSPT members.
  - Prepare and submit funding proposals.
  - Secure funding and finalize budget and cash flow.
  - Establish reporting and monitoring and evaluation process.
  - Present plan to relevant senior municipal managers, N6 treasurers and CAOs for their review, feedback and approval.
  - Prepare Council Report and present to all N6 councils (and Regional Council and/or LSRCA Board, if appropriate) to secure required approvals.
  - Review and refine pilot test plan as needed based on feedback of CAOs and councils.

Deployment

- Implement pilot test plan.
- Monitor progress against deliverables and ensure continuous feedback and evaluation.
- If required, modify and adjust plan as required.

Evaluation

- Complete an efficiency and effectiveness evaluation of System-wide SWM, including a cost-benefit analysis and comparison with existing municipal SWM.
- Complete a SWOT analysis and determine gaps and issues and strategies to address and need for modification.
- Present results of pilot test and recommendations to N6 municipalities' senior management and CAOs.
- If successful and recommendation for scaled implementation is supported by N6 CAOs, prepare report to be presented to N6 councils (and Regional Council and/or LSRCA Board, if appropriate).

5.3 Implementation Schedule

Should the N6 CAOs decide to explore the feasibility of implementing a pilot test to test N6 collaboration for SWM, preliminary planning and budget forecasting and identification of potential funding for the study would need to be completed. A possible implementation schedule is outlined in Figure 5-2.

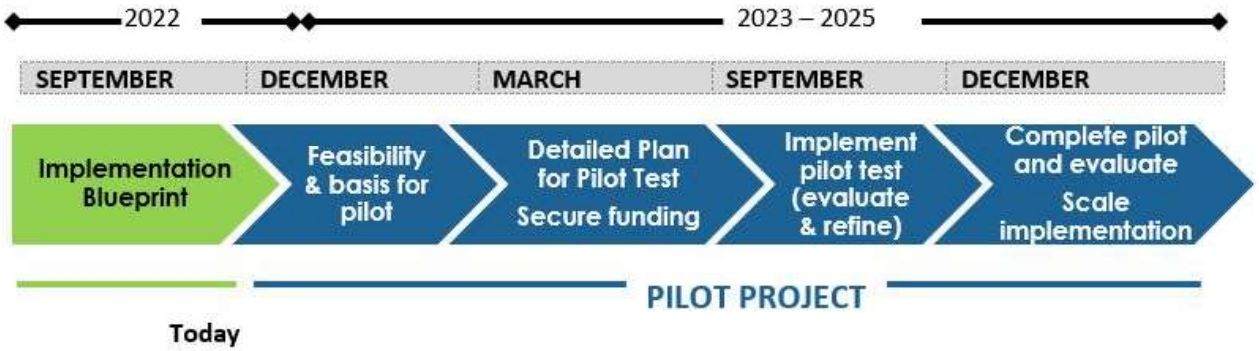


Figure 5-2: Possible implementation schedule for a pilot test of an N6 municipal partnership delivery of watershed-wide SWM

6 Summary

Intermunicipal collaboration for watershed-wide stormwater planning and management can provide substantial cost-savings and improved SWM level of service. As well, the N6 Municipal Partnership has a proven track record for shared service delivery amongst member municipalities and provides a sound basis for testing N6 collaboration for SWM planning, capital investment and O&M. For these reasons and others detailed in this implementation plan it is recommended that a pilot test to determine if scaling to full roll-out of an N6 collaboration on key facets of stormwater planning and management is merited.

In order to understand the potential value and means for incentivizing uptake of lot-level SCMs on commercial and institutional properties, a detailed evaluation of viable drivers, both market-based incentives (e.g., grants, property tax rebates, fee-for-service arrangements, etc.) and/or regulations or by-laws would be needed. As previously discussed, the current MECP requirement for ECAs for stormwater works on ICI properties would likely make it logistically challenging and likely not feasible to secure the necessary approvals to attempt to incentivize SCMs on existing properties. Determining if certain site-specific criteria were met an exemption for an ECA could be obtained, similar to what was done for residential developments, would require an evaluation of a range of ICI properties and site conditions to identify and validate potential exemption criteria.

For the optimization study that led to the development of this Implementation Blueprint, optimal commercial sites for locating SCMs were identified through the process-based decision modelling. This information could be used to evaluate the suitability of the sites for a range of SCMs. Detailed profiles of sample ICI sites, including size and type, impervious area, soil, hydrology, outdoor storage, potential sources of contamination, topography, ground cover, parking and loading areas, proximity to wellhead protection zones, etc. could be developed and assessed against 'must-have' and 'knock-out' criteria for suitability for SCMs. Validation of exemption criteria via modelling current and future scenarios using conceptual SCM designs for the sample commercial properties, and undertaking an efficacy and risk analysis would be required.

APPENDIX 1

RESEARCH COMPENDIUM

System-wide SWM Implementation Blueprint

Stormwater Optimization – Intermunicipal Collaboration

Collaboration, at its essence, is people who are participating in a group, working toward a shared goal with mutual understanding, curiosity in divergent views, open communication, and shared responsibility for outcomes. A collaboration can consist of just two individuals, small groups, and even entire communities. It has some defining characteristics: it involves a shared goal, all people participate equally, and the effort to implement is also shared. Collaboration tends to assume there is a common good that may require compromise to reach, marked by a willingness to let go of privilege, power and control in the interest of more inclusive and sustainable solutions. Cooperation and partnerships are other ways in which people work together, but they are different from collaboration. People can cooperate without a shared goal; it is a helping and supportive dynamic, but does not require the same mutual effort as collaboration. Partnerships tend to be contractual, with rights and responsibilities between organizations, as well as transactional in nature, with predetermined, equal gains for each party. Collaboration can be a part of partnerships, but not necessarily. In building capacity for collaboration it is essential to lift the hood on the inner dynamics of how people work together. To begin, this includes:

- interpersonal patterns and habits
- how trust is built
- how information is shared
- how decision-making progresses, especially when there are divergent views
- the physical spaces where people gather to work together
- the tools and methods for organizing

Page 19:
https://static1.squarespace.com/static/5c6db2e17a1fbd028b68396f/t/5e28836059973a01ace1e5e9/1579713378261/Governance+and+Collaboration+Discussion+Paper.pdf

Question #1 - Viable Models and Frameworks

What are potentially viable governance models and frameworks for intermunicipal collaboration currently in use in Ontario, other Canadian provinces and external jurisdictions (most likely Commonwealth countries as they have similar government structure but the US and Europe have used intermunicipal collaboration agreements for infrastructure projects)?

Munk School of Global Affairs

Cooperation and Capacity: Inter-Municipal Agreements in Canada: 2015

The challenge of governing regions that fall within the jurisdiction of more than one municipality is a long-standing policy problem for local governments. While institutional changes are often suggested as a solution to coordination and servicing difficulties in metropolitan areas, recent research suggests that decentralized, voluntary means of inter-local cooperation may help ensure service and policy continuity.

https://munkschool.utoronto.ca/imfg/uploads/318/1623_imfg_no.19_spicer_online.pdf

Institute on Municipal Finance and Governance

Linking Regions, Linking Functions: Inter-Municipal Agreements in Ontario: 2014

This paper describes the reasons for forming inter-municipal agreements, discusses the different forms these agreements take, and presents the findings of a 2012 survey of Ontario municipalities that examined the nature of shared services arrangements.

https://www.researchgate.net/publication/270162576_Linking_Regions_Linking_Functions_Inter-Municipal_Agreements_in_Ontario_Acknowledgements

Journal of Economic Policy Reform

Factors explaining inter-municipal cooperation in service delivery: a meta-regression analysis: 2015

Inter-municipal cooperation is an important public service delivery reform, whose drivers move beyond simple concerns with costs and economic efficiency, to policy issues related to governance structure and spatial context. We conduct a meta-regression analysis based on the existing multivariate empirical literature to explore what factors explain divergence in results in the existing empirical studies. We find strong evidence that fiscal constraints, spatial, and organizational factors are significant drivers of cooperation. Our meta-regressions do not yield results to explain divergence in results on community wealth, economies of scale, or racial homogeneity. More studies on these factors are needed to understand how these factors might affect cooperation. Future theoretical and empirical research should give more attention to spatial and organizational factors to develop a better understanding of factors driving cooperation, and how they differ across local government structures and regions.

https://www.tandfonline.com/doi/abs/10.1080/17487870.2015.1100084

Institute on Municipal Finance and Governance

Finding Common Ground: Interlocal Cooperation in Canada: 2018

This paper examines interlocal cooperation in practice, by considering examples of partnerships between municipalities and between Indigenous governments and local governments. It then addresses some of the challenges posed by interlocal cooperation.

https://tspace.library.utoronto.ca/bitstream/1807/81208/1/imfg_forum_7_daley_spicer_Jan_17_2018.pdf

Alberta

Intermunicipal Collaboration Framework (ICF) Workbook: 2018

As part of the Province of Alberta's Modernized Municipal Government Act, Alberta municipalities that share a common boundary must create an Intermunicipal Collaboration Framework (ICF). The purpose of the ICF is to: provide for integrated and strategic planning, delivery and funding of intermunicipal services; to steward scarce resources efficiently in providing local services; and to ensure municipalities contribute funding to services that benefit their residents. Each framework must be accompanied by a bylaw that stipulates how services are currently provided, identifies how services would be best delivered, and outlines how intermunicipal services will be delivered and funded. The framework must address services including transportation, water and wastewater, solid waste, emergency services, recreation, among others. Municipalities are able to establish bilateral and multilateral frameworks to best suit their needs. Municipalities are also required to develop an Intermunicipal Development Plan, which is a statutory land use plan typically prepared at the interface of neighbouring municipalities.

https://auma.ca/sites/default/files/Advocacy/Programs_Initiatives/MGA_Change_Mgt_Resources/icf_workbook_final_lower_resolution.pdf

Saskatchewan

A Guide to Municipal Cooperation: Succeeding in Regional Partnerships: 2010

The purpose of the guide is to provide municipalities with the information, resources and tools that they will need to begin or continue effective working relationships with other municipalities. The full-length guide provides a wealth of information on: beginning a collaborative process; structuring an intermunicipal working group; and, maintaining a cooperative relationship. The document also contains templates to guide municipalities when writing agreements, memorandums of understanding, and questions to consider when beginning the process.

https://sarm.ca/wp-content/uploads/2022/03/a-guide-to-municipal-cooperation-succeeding-in-regional-partnerships.pdf

Asset Management Cohort Program, Atlantic Canada

Atlantic Infrastructure Management Network (AIM): 2018

Municipalities participating in this program will be among the first in Atlantic Canada to take a comprehensive approach to integrating management practices across their municipalities including capacity building, infrastructure planning and community engagement. (New Brunswick, Nova Scotia, PEI, NL).

Expect this program is a precursor to Intermunicipal Collaboration. Consistent methodology of valuation of assets across Atlantic provinces may help to pave the way for a smooth transition.

https://www.aimnetwork.ca/cohort-program

Federation of Canadian Municipalities

First Nations – Municipal Community Infrastructure Partnership Program: Service Agreement Toolkit: 2011

In the event that there will be a requirement within the project to satisfy First Nations Service Agreement requirements.

See page 7 for **Trends in service agreements across Canada for First Nations.**

See page 57 for: Principles for establishing cost sharing and pricing / Pricing considerations / Sample Pricing models / Regulatory Challenges /Service Agreement Case Studies.

https://fcm.ca/sites/default/files/documents/resources/tool/service-agreement-toolkit-cipp.pdf

Cities, The International Journal of Urban Policy and Planning

Infrastructure & institutions: Stakeholder perspectives of SW governance in Chicago (2017)

This 2020 paper examines the disparate understandings of how to best manage stormwater in the city. The results reveal that departmental silos may not adequately explain variation in stakeholder perspectives. Instead, two dominant perspectives towards stormwater management connect diverse stakeholder groups in Chicago: the Infrastructural Interventionist and the Institutional Interventionist. The first strongly views stricter laws and regulations, developed in tandem with science and data-driven approaches, as the best way to improve stormwater management. The second desires new rules and institutions to foster integrated management approaches, as well as more robust economic instruments capable of assigning a monetary value to stormwater, as critical to resolving stormwater problems. Conflicting points of perspective arise around the preferred type of infrastructure to be implemented to deal with stormwater and how it is to be developed. Understanding how these two social perspectives interact and conflict is important in considering the actions that will ultimately be undertaken to direct landscape changes capable of resolving the multiple challenges Chicago faces in managing stormwater.

https://www.sciencedirect.com/science/article/abs/pii/S026427511630573X - Click on PDF link

Sweden: Department of Thematic Studies—Environmental Change, Centre for Climate Science and Policy Research, Linköping University

Integrating Sustainable Stormwater Management in Urban Planning: Ways Forward towards Institutional Change and Collaborative Action: 2020

A lack of a collaborative culture is considered a major bottleneck to the implementation of sustainable stormwater management in Sweden. It has long been argued that the greatest challenge to transform the stormwater management sector, beyond solutions based upon piped networks, is not about advancing technology, but about developing new working procedure and planning routines that involve wider actor

collaborations, in order to make stormwater a concern for a much more diverse and inclusive urban planning community.

Overview of perceived challenges for and needs to improve sustainable stormwater planning and management in Sweden, and proposed ways forward through institutional developments.

https://www.researchgate.net/publication/338548921_Integrating_Sustainable_Stormwater_Management_in_Urban_Planning_Ways_Forward_Towards_Institutional_Change_and_Collaborative_Action

Journal of Global Environment Change

Actors working the institutions in sustainability transitions: The case of Melbourne's stormwater management: 2013

The results revealed the importance of a small group of loosely connected frontrunners from across government, private, community and scientific sectors who, through a mix of creating and disrupting institutional strategies, managed to facilitate a growing and diverse actor-network that steered this transition over decades. The establishment of networked bridging organisations was also instrumental because they formed different types of networks and alliances over time for protecting and deepening the reach of the transition dynamics across the city. The findings suggest there is no single cause–effect relationship nor one dominant intervention or action that shifted the urban stormwater management regime. Rather, it showed that the co-evolutionary processes between the broader transitional dynamics were played into by frontrunners and their actor-networks in such a way that emerging new narratives diffused, giving meaning to the evolving scientific agendas and on-the-ground experiments, which led to new institutional structures and enabling administrative tools. It seems as though each one of these dimensions is as crucial as the other in explaining the outcomes of this successful sustainability transition.

https://www.sciencedirect.com/science/article/abs/pii/S0959378013000435 - Cost is $39.95 USD

KPMG

Central Temiskaming MMP Project: 2020

The intention of the review was to provide the Municipality of Charlton and Dack, the Township of Chamberlain, the Township of Evanturel, and the Town of Englehart (the 'Group') with an objective evaluation of the its operations, resources and service offerings currently provided by each municipality, with the view of identifying potential opportunities to share services intended to maximize value-for-money, minimize pressure on taxes and contribute towards the long-term sustainability of the member municipalities of the Group.

https://www.evanturel.com/PDFS/2021/Central-Temiskaming-MMP-SharedServices-FinalReport-2020.pdf

Somerset County, New Jersey

Somerset County Launches Shared Services Marketplace For Towns: 2021

Somerset County launched a county-wide on-line marketplace where towns can save money by sharing services and equipment. One of the obstacles faced by municipalities is the lack of a localized database of

what services are available. The county's online marketplace removes that obstacle. Somerset County will act primarily as a facilitator, the county commissioner said, with the municipalities drafting their own agreements.

https://patch.com/new-jersey/bridgewater/somerset-county-launches-shared-services-marketplace-towns

Question #2 - Administrative Considerations and Strategies

What are the administrative considerations for intermunicipal collaboration & what strategies/approaches are potentially viable for use in Ontario?

Journal of Public Procurement

Managing for performance: Measurement and monitoring of contracts in the transit industry: 2016

This study examines the state of performance measurement and contract monitoring in the U.S. transit agencies. We focus on three research questions: (1) What monitoring capacity exists within transit agencies? (2) What monitoring methods are used by transit agencies? (3) What performance measures are tracked by transit agencies? We find monitoring units are common in a third of agencies in the study. Service and customer complaints are the most common performance measures, while penalties and liquidated damages are the most frequent form of penalties.

https://www.semanticscholar.org/paper/Managing-for-performance%3A-Measurement-and-of-in-the-Smirnova-Yusuf/1064f7a8fedf3e7190cc826289dc174659c58d97

Journal of International Review of Administrative Sciences

Intermunicipal cooperation: The quest for governance capacity (2018}?

Intermunicipal cooperation is being increasingly adopted in various countries to cope with the dilemmas of territorial scale and resource rationing. Despite the pressures towards the reshaping of administrative boundaries, little is known about the capacity of intermunicipal associations to function as effective, legitimate and resilient policy actors. This article aims to contribute to this debate by addressing two interrelated dimensions. First, it seeks to present a conceptual definition of governance capacity, unpacking the conceptual framework into dimensions that can be measured systematically. Second, it aims to empirically assess the governance capacity of Portuguese intermunicipal associations, drawing on a unique survey of intermunicipal associations. Overall, results suggest that despite being instrumentally driven, intermunicipal associations have proven to be efficient, with members recognizing the benefits and the spillover effects of trustworthy arrangements.

https://journals.sagepub.com/doi/abs/10.1177/0020852317740411 - Cost is $37.50 USD

Local Government Studies

Bridging the accountability and transparency gap in inter-municipal collaboration (2017)

Municipal governments are increasingly showing interest in inter-municipal cooperation. Often overlooked in the discussion of such collaborative relationships are concerns related to accountability and transparency. In this article, we introduce a framework to measure accountability and transparency in inter-local relationships and test it with a brief case study of inter-municipal cooperative agreements collected from the Greater Toronto Area. Overall, the agreements collected score very low on our accountability scale, mainly because of low levels of public access and poor internal accountability. We conclude the study by examining the challenges of having multiple lines of accountability in local service collaboration.

https://www.tandfonline.com/doi/abs/10.1080/03003930.2017.1288617

Central European Journal of Public Policy

The perception of inter-municipal cooperation by local officials and managers (2021)

Our survey results show that agreement with the statement that inter-municipal cooperation (IMC) helps solve administrative capacity problems tends to vary with the size of the municipality. This study detected considerable obstacles to IMC use, with one set of respondents indicating that they had tried cooperation and found that it did not yield significant, positive financial or non-financial benefits for them. Our in-depth interviews revealed that strong political leadership and experienced managerial staff can contribute to the development of municipal cooperation. In summary, our research provides evidence supporting the notion that the perception of IMC by municipal officials could be an important precursor to actual IMC use and future development.

https://www.researchgate.net/publication/349711881_The_perception_of_inter-municipal_cooperation_by_local_officials_and_managers

Journal of Management and Governance

Incentivising inter-municipal collaboration: the Lombard experience (2011)

The purpose of this exploratory research is to show how incentive policies have helped to shape the scenario of inter-municipal partnerships in the Italian region of Lombardy. Do these policies really work? Have they been the driver of greater collaboration among municipalities? Overall, the impact of the financial subsidies can be seen mainly when the intended beneficiaries are involved in the stages of negotiation and commitment that precede the setting-up of the collaborative arrangements. However, the capacity of the incentives to ensure that collaborative efforts are effectively maintained and developed over time is questionable. Importantly, the incentives do not seem to make a real difference in the collaborative choices aimed at joint policy-making and regulation. This qualitative study extends the evaluation research on implementation and contributes to the partnership management debate.

https://link.springer.com/article/10.1007/s10997-011-9204-3

Journal of Environment and Planning C: Politics and Space

Assessing socio-technical resistance to public policy instruments: Insights from water performance indicators in the Grenoble area (France, 2021)

We observe the misuse of performance indicators by local actors in urban water systems in Europe to highlight the empirical significance of socio-technical resistance. Results support that socio-technical resistance is frequent and reduces significantly the reliability of the information gathered through performance indicators. These results and the proposed notion underline a crucial limitation of public policies and regulation in the process of policy-instruments implementation and compliance. Empirically, it particularly relevant to provide new insights on New public management and performance-based regulation, where measurements are crucial.

https://journals.sagepub.com/doi/abs/10.1177/2399654420986561 - Article Cost = $37.50

Public Management Review

The blind spots of collaborative innovation (2018)

In discussing some of the core claims of collaborative innovation, this article uses the notion of 'blind spots' in a double meaning. On the one hand, it points at some blind spots in the debate on collaborative innovation, i.e., potential weaknesses, risks, and unintended effects of public sector innovation strategies resting on principles of collaborative innovation. Second, the paper considers collaborative innovation as a counter-strategy against blind spots and attention biases of public organizations. Drawing on this perspective helps to critically discuss some of the key assumptions supporting the promise of collaborative innovation to deliver benefits critical for public governance.

https://www.tandfonline.com/doi/full/10.1080/14719037.2018.1433311?src=recsys

Municipal World

Creating a pathway to strong intermunicipal collaboration

https://www.municipalworld.com/articles/creating-a-pathway-to-strong-inermunicipal-collaboration/

Question #3 - Barriers, Challenges and Impediments

What are the potential impediments to intermunicipal collaboration – Problems that have arisen? The solutions to those problems? What has been put in place (i.e., in agreements, or the functional structure, etc.) to help ensure the collaborative mechanism and process works equitably?

Public Organization Review

The Opportunities and Constraints to Collaboration in Public Sector Management (2019)

This article synthesizes current insights about the opportunities and constraints to collaborative public management. Despite the swath of research on collaboration there has been little attempt to present the opportunities and constraints in a single article that articulates both perspectives coherently. Drawing on an extensive literature review, the main arguments are that collaboration presents opportunities to maximize scarce resources and improve public services delivery. Yet, the difficulty in evaluating the outcomes of collaboration as well as accountability and power-sharing issues remain key constraints.

https://link.springer.com/article/10.1007%2Fs11115-019-00452-6

International Journal of Public Administration

Interlocal Agreements and Multilateral Institutions: Mitigating Coordination Problems of Self-Organized Collective Action (2019)

In the United States, competition among cities for economic development tends to be the norm. Cities are also collaborating more to improve their economic advantage. However, transaction costs inhibit various of interlocal agreements from being formed. This study examines the role of multilateral institutions in facilitating interlocal agreements for economic development. An analysis of survey data collected from city governments in eleven US metropolitan areas highlights the importance of regional institutions in moderating the effect of coordination problems on the formation of developmental joint venture agreements. The findings complement extant research on the governance mechanisms that mitigate transaction costs of collective action.

https://www.tandfonline.com/doi/full/10.1080/01900692.2019.1643879?src=recsys

Perspectives on Public Management & Governance

Collaboration Risk and the Choice to Consolidate Local Government Services (2019)

Collaboration among local governments occurs through a range of mechanisms, which vary in degree of formality from contracts and ad hoc agreements to full consolidation. Prior work indicates that local decision makers favor formal mechanisms when expected gains from less formal collaboration may not be realized. This article explicates the concept of collaboration risk, treating it as a product of the likelihood that collaboration fails and the severity of consequences should failure occur. We examine how characteristics of a local service contribute to collaboration risk and thereby influence the choice to consolidate service delivery. Focusing on the case of drinking water provision, we identify physical and financial features of service delivery that contribute to the likelihood and severity of collaboration failure.

https://academic.oup.com/ppmg/article-abstract/3/3/223/5628216?redirectedFrom=fulltext

Journal of Urban Affairs

The Transitional Impacts of Municipal Consolidations (2016)

This article examines the transition and short-term effects of municipal consolidation on five recently amalgamated municipalities in Canada. The data for this study were collected from provincial and municipal legislations, tax-rate by-laws and finance reports, as well as surveys and interviews with a variety of municipal officials and mayors. The analysis shows that municipal consolidation involves a complex reorganization of intricate administrative and political structures. Many of the problems encountered, and successes achieved, were particular to the circumstances of the municipalities that amalgamated. Ultimately, the success of consolidation in achieving greater efficiency and effectiveness in governance and service delivery will depend on the distinct history, as well as the spatial and economic circumstances, of the region considering reform. The five case studies, however, provide some useful lessons on how to improve the success of consolidations.

https://www.tandfonline.com/doi/abs/10.1111/0735-2166.00063

Central European Journal of Public Policy

The perception of Inter-Municipal Cooperation by local officials and managers (2020)

This paper is focused on revealing the relationship between the perceptions of municipal public officials and the realized benefits of municipal cooperation. Our survey results show that agreement with the statement that IMC helps solve administrative capacity problems tends to vary with the size of the municipality. This study detected considerable obstacles to IMC use, with one set of respondents indicating that they had tried cooperation and found that it did not yield significant, positive financial or non-financial benefits for them. In summary, our research provides evidence supporting the notion that the perception of IMC by municipal officials could be an important precursor to actual IMC use and future development.

https://www.sciendo.com/article/10.2478/cejpp-2021-0002 - Select, “Article”

Public Management Review

Qualitative comparative analysis of collaborative governance structures as applied in urban gardens: 2021

Many public issues require collaboration between governments, private actors, NGOs, civic organizations, and individual organizations. Initiating such a collaboration is challenging, but sustaining such a partnership can be even more difficult. This paper aims to explore what types of collaborative governance structures (CGSs) are found in urban gardens that have continued to exist over the years and that have been discontinued. In order to do this, we analysed 14 urban gardens in the Netherlands as striking examples of CGSs. By applying Fuzzy-set Qualitative Comparative Analysis (FsQCA), we were able to unravel plausible explanations for gardens that (did not) stand the test of time. The analysis shows that financial independence, strong institutionalization, and having a small core group of volunteers is the most important configuration for the durability of an urban garden. Even though some gardens were meant to be temporary, this structure made them durable.

https://www.tandfonline.com/doi/full/10.1080/14719037.2021.1879912?src=recsys

Journal of Public Money and Management

Sharing services, saving money? Five risks to cost-saving when organizations share services (2016)

Shared services are a popular reform for governments under financial pressure. The hope is to reduce overheads and increase efficiency by providing support services like HR, finance and procurement once to multiple agencies. The authors identify five risks that shared services won't live up to expectations. Each is illustrated with international evidence, before the conclusion discusses ways to manage these risks.

https://www.tandfonline.com/doi/full/10.1080/09540962.2016.1194081?scroll=top&needAccess=true

Journal of the American Water Resources Association

Stakeholder Analysis - Collaborative Watershed Management Process: A Florida Case Study (2011)

This study focuses on a Florida watershed where development of a total maximum daily load (TMDL) and its implementation plan resulted in conflicts among stakeholders. The overall goal is to build a better understanding of stakeholder perceptions of water quality problems, water policy processes and decisions, and water management plan development in a region where these issues have become contentious. Findings are based on a stakeholder analysis using qualitative data collected through focus groups with agricultural producers, local governments, and environmental groups, and supplemented with additional qualitative data on the watershed management process. Stakeholder conflicts in this case study are associated with perceived flaws in the structural and procedural characteristics of the stakeholder involvement process: (1) suboptimal watershed stakeholder representation on the TMDL executive committee, (2) an inappropriate voting procedure for making TMDL decisions, (3) limitations in information sharing between regulatory agencies and watershed stakeholders, and (4) stakeholders' doubts about whether tradeoffs associated with achieving the water quality targets were assessed adequately throughout the TMDL planning and implementation process. This study contributes to the literature on collaborative watershed management by analyzing stakeholder involvement given Florida's unique institutional settings, where implementation of TMDL pollution abatement is mandatory.

https://onlinelibrary.wiley.com/doi/full/10.1111/j.1752-1688.2011.00615.x

The Municipal Natural Assets Initiative

Identifying Barriers & Opportunities Within Professional Planning Practice in Ontario (2018)

Planners were identified as having a potentially important role within MNAM due to their diverse and interdisciplinary field, as well as their key involvement with land use decision-making. Accordingly, the primary objective of this study was to identify the top five barriers and opportunities in professional planning norms and standards that stand to affect the refinement, replication, and scaling up of MNAM projects in an Ontario context.

https://institute.smartprosperity.ca/sites/default/files/spmnaijune18-low-res.pdf

Huron County, Ontario

Morris-Turnberry to end shared building department agreement with North Huron (2021)

The cost-sharing agreement of the current agreement is a 60/40 split, with Morris-Turnberry picking up the larger portion of the tab. Earlier this year, Morris-Turnberry staff conducted a review of the department's data and claim that the amount of work being done by the department in each municipality does not match the cost-sharing split.

"In two and a half years we haven't been able to make a deal with cross border water and sewer. In two and a half years they have taken away funding for soft services. This year, they're not even showing up to help with the COVID-19 clinic that will help save our communities," said Bailey."

https://www.thestar.com/news/canada/2021/05/29/morris-turnberry-to-end-shared-building-department-agreement-with-north-huron.html

Nova Scotia

West Hants votes to replace Windsor fire service with new provider (2015)

An agreement between West Hants and the Windsor Fire Department for joint fire services went up in smoke after West Hants municipal council voted this week to find its own fire service provider. The municipality and the fire department have been embroiled in a dispute for some time over payment for the service. The department said the Municipality of West Hants was behind in its payments, while West Hants said the costs were excessive.

Windsor and West Hants amalgamation being forced by citizens group: https://www.cbc.ca/news/canada/nova-scotia/amalgamation-uarb-windsor-west-hants-citizens-1.3465829

Windsor-West Hants merger pegged a success, one year in: https://www.cbc.ca/news/canada/nova-scotia/windsor-west-hants-merger-pegged-a-success-one-year-in-1.5972448

Dispute Backgrounder: https://www.westhants.ca/fire-services/1038-cao-cathie-osborne-formal-remarks-to-council-regarding-fire-services/file.html

https://www.cbc.ca/news/canada/nova-scotia/west-hants-votes-to-replace-windsor-fire-service-with-new-provider-1.3188946

Somerset County, New Jersey

Removing the Barriers to Shared Services: A Prescription for Creating Efficiency and Taxpayer Savings Through Local Government Shared Services

This article is beneficial to provide further information on some of the barriers that municipalities face (e.g., lack of support for employees), with additional recommendations on how to resolve them.

Also in Somerset County:

Bridgewater Council Questions Need for Increased County Recycling Fees: Council members don't think Bridgewater is getting its fair share from Somerset County when it comes to recycling.

https://www.tapinto.net/towns/bridgewater-slash-raritan/sections/government/articles/bridgewater-council-questions-need-for-increased-county-recycling-fees

https://www.tapinto.net/towns/bridgewater-slash-raritan/sections/government/articles/bridgewater-council-questions-need-for-increased-county-recycling-fees

LIT REVIEW

Collaborative environmental governance: Are watershed partnerships swimming or are they sinking?

https://www.sciencedirect.com/science/article/abs/pii/S0264837712001020

Question #4 - Legal Considerations

What are the legal considerations for intermunicipal collaboration and what strategies and approaches are potentially viable for use in Ontario and how have they been addressed in other jurisdictions?

Green Infrastructure, Ontario Coalition

Changes to Municipal Legislation support Green Infrastructure (Bill 68 enacted in 2017)

Among many changes introduced in the legislation, three in particular are beneficial for green infrastructure:

1) Municipalities will be required to have a policy pertaining to protection and enhancement of their tree canopy and natural vegetation.
2) Municipalities across Ontario will be able to pass green roof by-laws.
3) Municipalities will have clearer jurisdiction to regulate with respect to climate change and energy conservation.

Bill 68, Modernizing Ontario's Municipal Legislation Act (2017)

https://www.ola.org/en/legislative-business/bills/parliament-41/session-2/bill-68

https://greeninfrastructureontario.org/changes-to-municipal-legislation-support-green-infrastructure/

Alberta

Intermunicipal Collaboration Framework Regulation: 2018

The Municipal Government Act (MG) gives municipalities the option to engage in cooperative initiatives with neighbouring municipalities through mechanisms such as intermunicipal agreements, mutual aid agreements, and regional services commissions. Additionally, the MGA allows two or more municipalities to voluntarily collaboratively plan for future growth & development through intermunicipal plans which are passed by bylaws by each participating municipal council.

Intermunicipal Collaboration Frameworks Regulation

https://open.alberta.ca/dataset/ab5db63d-302c-4c1b-b777-1eeb0fe23090/resource/cf2c5e46-220f-401c-ace4-708c68824691/download/intermunicipal-collaboration-frameworks-arbitration.pdf

https://open.alberta.ca/dataset/ab5db63d-302c-4c1b-b777-1eeb0fe23090/resource/9fedc3c0-d036-44bc-9f72-4b5d07f47110/download/intermunicipal-collaboration-frameworks-.pdf

Alberta, 2020

What's Yours is Actually Mine? Recent Case Law Clarifies the Line Between Municipal and Private Utility Responsibility, and Best Practices.

Quote: "caution and legal review are recommended in any scenario proposing private servicing arrangements involving multiple parcels. Municipalities should plan to take ownership of all water, storm, and sanitary utility infrastructure that serves multiple parcels, or plan to have a proper and fully approved franchise agreement under MGA, s. 45 in place. In either event, municipalities should require all utility facilities servicing more than one parcel to be constructed to municipal standards (or standards that the municipality is comfortable taking-

over). This may well result in additional costs to, or complexities for, developers. However, Medicine Hat shows that this is due to Alberta law, not merely municipal preference."

http://news.brownleelaw.com/post/102gfbd/whats-yours-is-actually-mine-recent-case-law-clarifies-the-line-between-municip

Journal of Financial Accountability & Management

Pricing joint use of municipal services: Theoretical perspectives and regulatory issues (2018)

This paper analyses price regulation of inter-municipal contracts in Finland to demonstrate interpretative problems of regulatory rules specifying full-cost or market prices and, by so doing, deepen understanding of the theoretical underpinnings for pricing collaborative municipal services. A study of Finnish case demonstrates how the loose legal statutes of intermunicipal cooperation leave unresolved the demarcation between joint use-of-services as part of municipal public administration based on democratic self-government and public procurements as part of the ESM. It also demonstrates how this lack of resolution creates governance problems in municipal financial management and so contributes to the tightening of state regulation of the pricing decisions of local governments. Furthermore, the conceptual analysis reveals the weaknesses of the key cost and price terms used by courts and lawmakers in their efforts to regulate pricing of inter-municipal services. This analysis is relevant not only for Finland but also for the rest of the EU and elsewhere.

https://onlinelibrary.wiley.com/doi/full/10.1111/faam.12180

Question #5 - Policy

Are there municipal or provincial policies that support/deter intermunicipal collaboration, and if yes what are they and how could they be addressed to enable collaboration for SWM planning and management?

Association of Municipalities Ontario

Come Hell or High Water: Flooding, Climate Change and Municipal Responses

This paper explores what options exist for municipalities to address flooding.

https://www.amo.on.ca/sites/default/files/assets/DOCUMENTS/Reports/2020/ComeHellorHighWaterFloodingClimateChangeandMunicipalResponses20201019.pdf

Local Government Studies

Interlocal collaboration and local climate protection: 2019

The influences of state government have been curiously absent from most studies of collaboration among cities. Extant research on city collaboration which promotes on climate and environmental sustainability issues focuses primarily on local-level institutions, politics, and processes. Thus, the role of states to constrain or facilitate collaboration among local governments needs to be more fully accounted for. Building on transaction cost and institutional collective action theory and drawing on data from a national survey of US cities, we investigate the influences of city-level factors together with the hierarchical effects of state rules and policies on the extent to which mechanisms for interlocal collaboration are employed in pursuing climate protection and renewable energy development goals. The results confirm predictions that multilevel intergovernmental forces influence the extent to which cities collaborate. These results have both theoretical and practical implications for understanding interlocal collaborations.

https://www.tandfonline.com/doi/full/10.1080/03003930.2019.1615464?scroll=top&needAccess=true

Journal of Environmental Planning & Management

The governance of climate change adaptation: stormwater management policy and practice (2018)

This article focuses on SWM policy in the Province of Ontario, Canada, with the broader objective of assessing the nature and dynamics of adaptation governance arrangements.

https://www.tandfonline.com/doi/abs/10.1080/09640568.2019.1634015

Water Resources Research (Article)

A game theory analysis of green infrastructure stormwater management policies (2017)

Game theory, an analysis framework that has historically been under-utilized within the context of stormwater management, is uniquely suited to address this policy question. The results indicate that municipal regulation leads to the greatest reduction in pollutant loading. However, the choice of the "best" regulatory approach will depend on a variety of different factors including politics and financial considerations. Large, downstream agents have a disproportionate share of bargaining power.

https://agupubs.onlinelibrary.wiley.com/doi/10.1002/2017WR021024

Article

Green Infrastructure through Citizen Stormwater Management: Policy Instruments, Participation and Engagement

As a decentralized approach, green infrastructure requires implementation on, as well as access to, property throughout a watershed, which poses particular governance challenges for watersheds where most land is held privately. We argue that green infrastructure on private property has a strong potential for creating a more sustainable regime through Citizen Stormwater Management, a participatory form of governance with strong citizen influence and engagement. We develop a classification scheme to assess policy instruments' degree of government intervention, citizen participation, and engagement. The paper explores how various policy instruments encourage Citizen Stormwater Management across the United States on both public and private property.

https://pdfs.semanticscholar.org/221a/32cf428ed273da0e5d0c604dff0011d7e310.pdf?_ga=2.200329390.1865260036.1622829576-1596911875.1622829576

Ontario Ministry of Natural Resources and Forestry

Ontario's Flooding Strategy Released (2020)

Overall, this report will require municipal governments:

- to alter practices for where or under what circumstances development is allowed, including avoiding hazard lands and an emphasis on low impact development.
- to alter expectations of developers to better manage stormwater, maintain wetlands, increase permeable surfaces and require low impact development.
- to be more stringent with development. There will be some developments that may not be able to proceed which may result in some landowners being frustrated.
- to evaluate storm and wastewater management. There may be some costs (depending on how infrastructure funding is provided) to upgrading existing and up sizing future infrastructure designed to manage waste and storm water. Sewer overflow reporting will also require municipal attention.

Read the full Report: https://www.ontario.ca/page/protecting-people-property-ontarios-flooding-strategy

https://www.amo.on.ca/advocacy/environment/ontarios-flooding-strategy-released

Ontario 360

In It Together: Clarifying Provincial-Municipal Responsibilities in Ontario (2020)

The Province of Ontario and its municipalities should review the current division of responsibilities for planning, regulating, funding, and delivering key services to Ontarians. Such a review should focus on safeguarding accountability, sharing costs fairly, enhancing quality of service, and ensuring effective and efficient service delivery. The following six recommendations should guide the review:

- Take a collaborative approach
- Follow the pay-for-say principle and avoid unfunded mandates
- Consider local revenue capacity

- Respect local and regional differences
- Look forward, not backward

Start with health and social services.

https://on360.ca/policy-papers/in-it-together-clarifying-provincial-municipal-responsibilities-in-ontario/

Question #6 - Examples of Collaboration Agreements

What are current examples of intermunicipal collaboration agreements in use in the East Holland, Lake Simcoe Basin and York Region? How are they structured? What works, what doesn't?

Northern 6 Collaborative Partnership

Multiple collaboration agreements between and amongst N6 municipalities since 2002:

- Creation of the Central York Fire Services resulting from a merger of Newmarket and Aurora fire services (2002) was the start of exploring potential municipal partnerships or collaborative agreements to improve efficiencies and led to further exploration of shared servicing opportunities amongst the northern six municipalities
- The "N6 Partnership" was formalized in 2005, and includes agreements for shared services amongst some or all of the N6 municipalities.
- Out of a meeting of N6 Mayors in 2005 a mandate was given to the CAOs of the member municipalities to explore initiatives of mutual interest and to opportunities for collaboration and shared services to reduce costs and the administrative burden for individual municipalities.
- Shared service agreements/initiatives leading to the development of the N6 Partnership or established under the N6 Partnership include waste collection, accessibility standards for customer services, employee benefit reviews, fire and emergency services co-ordination, animal control services, insurance, etc.

The Ontario government undertook a "Regional Governance Review" in 2019 to investigate the merits of amalgamating the northern six municipalities under one regional government. The findings of the review were that amalgamation would not be advantageous as "…by working together the N6 Partnership exemplifies the benefits that a cohesive approach to shared service delivery can create for residents. It is these cross-municipal initiatives that make amalgamation unwarranted."

https://www.aurora.ca/en/your-government/resources/Legislative-Services/Information-Reports/2020-Information-Reports/CAO20-001-N6-Collaborative-Initiatives-Partnership-Update.pdf

https://munkschool.utoronto.ca/imfg/uploads/425/imfg_presentation_dave_cash_20170529.pdf

Aurora, Ontario

Town of Aurora Information Report (2020)

This report provides a high-level overview of past Northern Six ("N6") partnerships, current collaborative initiatives, and potential future considerations.

Potential future partnership/collaboration projects: risk management / asset management / external legal services / IT / fleet procurement and maintenance

- A joint service delivery review is recommended to be undertaking for Emergency Services

See page 2 for wastewater budget information.

https://www.aurora.ca/en/your-government/resources/Legislative-Services/Information-Reports/2020-Information-Reports/CAO20-001-N6-Collaborative-Initiatives-Partnership-Update.pdf

Edmonton

Corporate Costs Allocation Methodology - EPCOR Water Services Inc (2021)

Appendix N-02 describes the services and associated costs related to shared services that are provided from EWSI to the City of Edmonton water and wastewater treatment operations.

https://www.edmonton.ca/city_government/documents/PDF/AppendixL-Inter-Corporate-Service-Charges-Allocation-Methodology.pdf

Brandon University

Regionalization of water infrastructure in Canada: a comparative study of conflict resolution approaches

The study, employing a case study (Greater Vancouver, York Region and Halifax) approach, is of value to analysts and policy makers seeking guidelines for negotiating water and wastewater agreements. The case studies would serve as examples for guiding future inter-community projects.

https://pcag.uwinnipeg.ca/Prairie-Perspectives/PP-Vol02/haque-csapo-rounds.pdf

Cornell University

Shared Services in New York State: A Reform That Works

This issue brief reports on a statewide survey, conducted in Winter 2013, of New York towns, counties, villages and cities to assess their level of collaboration in the delivery of public services, as well as the motivators and barriers to such service sharing. Across the responding municipalities, service sharing accounts for 27 percent of the 29 services measured on the survey. On average, inter-municipal sharing agreements have been in place about 18 years. More than one-fifth of sharing arrangements are informal understandings between local officials. Almost 40 percent use a somewhat more formal memorandum of understanding (MOU). Contracting with another government is used by one-quarter of local governments, while joint ownership/joint production/joint purchase and the creation of a special district are less frequent sharing strategies.

http://nycom.org/images/pdfs/Shared_Services_Survey_Results_from_Cornell.pdf

Alberta

Vulcan County and the Village of Carmangay INTERMUNICIPAL COLLABORATION FRAMEWORK AGREEMENT (2021)

Also included is Framework Protocols (pg. 6) and an Inventory of Shared Municipal Services (pg. 8)

See page 13 for shared water provisions.

http://villageofcarmangay.ca/wp-content/uploads/2021/04/2021-03-23-Vulcan-County-Village-of-Carmangay-ICF-Agreement.pdf

District Municipality of Muskoka

Inventory of Shared Service Agreements: 2017

https://muskoka.civicweb.net/document/29383

York Region

1 York info Partnership

"The partnership's success has led to increasing buy-in and support among the partnership senior management and a renewed realization of its impact"

The partnership is:

- Accountable to the local CAO's.
- The Executive Board meets annually and is made up of Directors and CIOs from all partner organizations. The Executive Board confirms needs, sets priorities, commits resources and reviews the overall program and progress.
- The Executive Board meets annually and is made up of Directors and CIOs from all partner organizations. The Executive Board confirms needs, sets priorities, commits resources and reviews the overall program and progress.
- The Coordinating Committee is comprised of G.I.S. Coordinators, Managers and Analysts. They meet five times a year to review the status of the projects, discuss joint data and/or technology purchases and share knowledge to aid in partner program building.
- Task forces are created for all major projects and purchases
- Measured through a multi – year work plan that includes a tracking scorecard to assess satisfaction across three dimensions – Readiness, Implementation & Impact
- Co-ordinated by a dedicated Partnership Manager

Supported by 25 regional staff.

https://www.esri.com/about/newsroom/blog/york-region-pioneers-next-level-local-government-collaboration/

https://yorkinfopartnership.com/about-us/#our-achievements

2 Shared Service Amendment for York-Peel Water & Wastewater Partnership Agreement (2017)

Peel provides water to York, and the two municipalities share infrastructure and plant operating costs.

https://www.york.ca/environment/water-and-wastewater/water-and-wastewater-master-plan

3 Shared Services Agreement for Water and Wastewater Services from City of Toronto to Developments in City of Vaughan (2017)

This report seeks Council approval for the provision of water and wastewater services from the City of Toronto to the three proposed developments in City of Vaughan owned by Woodbridge Park Limited, Smith Farm Property Holdings Inc. and 407 ETR Concession Company Limited and to authorize Commissioner of Environmental Services to enter into necessary servicing agreements with the City of Toronto, City of Vaughan and the Owner of each development.

https://www.york.ca/environment/water-and-wastewater/water-and-wastewater-master-plan

4 York Region recognized with Excellence in Municipal System (2020)

York Trax is a centralized, browser-based solution that was developed in-house and is now used across multiple departments enabling the Region to forecast and manage growth, prioritize infrastructure delivery

and enhance customer service. It streamlines the development application review and commenting process by incorporating automated workflows and integrated mapping capabilities.

YorkTrax Development Application Management System.

https://cdn.ymaws.com/www.misa-asim.ca/resource/collection/2516D4CA-7038-4180-B303-DD3F1D930B60/York_MISA_Award_Presentation_-_June_25_2020.pdf

UK – Health care

Example of a Shared Service Agreement for Health care in the UK.

All encompassing!

https://www.sec.gov/Archives/edgar/data/1124804/000119312509046202/dex101.htm

Vaughan

Integrated Urban Water Plan (2020)

The Integrated Urban Water Plan study will evaluate servicing plans for current and future developments, such as the Vaughan Metropolitan Centre, and will identify alternative solutions and sustainability initiatives. The study will also integrate current sustainability, resiliency and climate change adaptation/mitigation initiatives identified in Green Directions Vaughan and the Official Plan Review. The Plan will also take into consideration Major Transit Station Areas (MTSAs), as per York Region's Municipal Comprehensive Review, to create new tools based on best practices.

https://www.vaughan.ca/about-city-vaughan/projects-and-initiatives/infrastructure-engineering-and-construction-projects/integrated-urban-water-plan/about-integrated-urban-water-plan

Payment for Ecological Services/Eco Offsetting

The Municipal Natural Assets Initiative

Towards a Collaborative Strategy for Municipal Natural Asset Management: Private Lands (2018)

This report highlights how local governments can include private land and private landowners in a comprehensive municipal natural asset management framework.

https://institute.smartprosperity.ca/sites/default/files/reportmnaifeb7.pdf

Sustainable Prosperity

Advancing the Economics of Ecosystems and Biodiversity in Canada: A Survey of Economic Instruments for the Conservation & Protection of Biodiversity (2011)

This study provides an overview of the state of knowledge and experience with the use of Economic Instruments to conserve biological diversity and provide essential ecosystem services in Canada.

https://institute.smartprosperity.ca/sites/default/files/publications/files/Advancing%20the%20Economics%20of%20Ecosystems%20and%20Biodiversity%20in%20Canada.pdf

Vermont, USA

A mixed-methods analysis for improving farmer participation in agri-environmental payments for ecosystem services (2021)

We examine whether using a payment for ecosystem services (P.E.S.) framework for agri-environmental programs could increase farmer participation through a mixed methods approach. Transaction costs present a barrier towards participation with both programs. We suggest these costs can be lowered by greater technical assistance.

https://www.sciencedirect.com/science/article/pii/S2212041620301650

Science of the Total Environment

Agricultural eco-compensation may not necessarily reduce chemical inputs (2020)

The eco-compensation targeting agricultural non-point source pollution is considered to have a positive role in the farmland environment. However, the effect depends on how the farmers respond and implement the policies. This paper aimed to understand whether the agricultural eco-compensation changes the farmers' planting decision and to what extent it affects the input of chemicals. Taking World Heritage, Hani Terraces in southwest China as an example, this paper established a multi-objective production decision model for farmers to analyze the impact of different compensation standards on farmers' planting decisions and welfare. The results showed that, when the eco-compensation standard is relatively low, farmers tend to adopt the planting structure with higher income to make up for the loss caused by reducing chemicals input. With the increase of eco-compensation standard, the input intensity of chemicals (per unit area) continues to decrease.

However, the total amount of chemical inputs increases first and then decreases as the planting structure changes. That means, agricultural eco-compensation may not necessarily reduce chemical input.

https://www.sciencedirect.com/science/article/abs/pii/S0048969720333672 - Click on "view pdf" – top left corner of the site.

Water Economics & Policy

Evaluating Payments for Watershed Services Programs in the United States: Water Economics and Policy (2019)

We review 15 forest watershed protection programs in the United States in which a local government agency or water provider collects payments from downstream service beneficiaries, such as water consumers, and pays upstream forest landowners for provision of watershed services. We describe the features of these Payments for Watershed Services (PWS) programs, focusing on funding sources, how the payment mechanisms work, and outcomes achieved. We also assess the extent to which the programs adhere to the economic principles that are associated with efficient or cost effective PWS schemes. In general, we find that payments in the programs do not closely reflect the marginal value of the service provided. Payments received by landowners mainly reflect the landowners' opportunity costs. Fees paid by water consumers are set to yield revenue targets and/or reflect the avoided cost of additional water filtration and treatment. The programs appear to yield societal benefits, primarily through cost savings, but data from program outcomes is limited and more rigorous analysis of both the benefits and costs would be worthwhile.

https://www.worldscientific.com/doi/abs/10.1142/S2382624X19500036

International Institute for Sustainable Development

Leveraging Payments for Ecosystem Services: Poplar River First Nation leads the way with innovative conservation (2020)

See page 13 for Draft Agreement.

https://www.iisd.org/system/files/publications/payments-ecosystem-services-prfn.pdf

Department for Environment Food & Rural Affairs, UK

Payments for Ecosystem Services: A Best Practice Guide (2013)

This paper looks at Opportunities & Risks associated with P.E.S. and provides step by step advice on designing and implementing P.E.S. schemes.

https://www.cbd.int/financial/pes/unitedkingdom-bestpractice.pdf

Journal of Bio Science

Assessing Impacts of Payments for Watershed Services on Sustainability in Coupled Human and Natural Systems (2015)

Despite the laudable goals and growing popularity of PWS worldwide, they have received considerable criticism in recent years related to their failure to adequately document progress toward achieving the targeted hydrologic outcomes as well as for indirect effects that have led to undesirable social, economic, and environmental consequences. Unless effective accounting for these complexities is incorporated into PWS design and evaluation, such water markets will likely fail in achieving desired long-term impacts on watershed sustainability.

https://academic.oup.com/bioscience/article/65/6/579/304583 - Click on PDF

Lake Simcoe Region Conservation Authority

Ecological Offsetting: 2017

Our Ecological Offsetting Policy is one of the ways we're trying to improve our watershed's health. We launched the Policy in 2017 in order to respond to the impacts on the landscape as a result of development. Our Policy requires property developers to compensate for the negative environmental consequences of their activities on the land.

https://www.lsrca.on.ca/offsetting

Kitchener, Canada

1 Market Incentive Program (Stormwater)

The City of Kitchener is developing a Market Incentive Program to support private property owners in incorporating low-impact development stormwater features onto their property to improve resiliency to flooding. The key features of the proposed Market Incentive Program are:

- Targeted support for flood-prone areas: Using a purposeful, data-driven approach, the MIP will identify and focus support on local areas with the highest flood risk.
- Leverages existing local talent and expertise: From landscape designers and contractors to gardening centres, the MIP will leverage local expertise to deliver high-quality results to property owners while also supporting our local service and product provider industry.

Provides financial, social, and environmental benefits: Through the strategic use of incentives, the MIP will reduce cost barriers to installing low impact development features. Once installed, eligible property owners can apply for stormwater credits to reduce up to 45 per cent of the stormwater portion of their monthly utility bills.

2 Assessing the Social and Economic Barriers to Permeable Surface Utilization for Residential Driveways in Kitchener, Canada

This article reports on the multiple barriers associated with the installation of a permeable surface in single-family residences, along with the characteristics and incentives associated with early adopters. Results from standardized, self-administered mail-back questionnaires distributed within a Kitchener, Canada, community identified awareness, cost, and technological acceptance as permeable surface adoption barriers. Other results indicate that Kitchener residents possess the necessary characteristics to support permeable surface adoption once technical and economic barriers are resolved.

https://www.cambridge.org/core/journals/environmental-practice/article/abs/research-article-assessing-the-social-and-economic-barriers-to-permeable-surface-utilization-for-residential-driveways-in-kitchener-canada/E444F949958FE39837413D23BDEC25AD

YouTube

Payments for Ecosystem Services - Part One (2020)

This webinar is part one, of a three-part series focused on payments for ecosystem services and will guide you through the history of payments for ecosystem service programs and different types of payments farmers and ranchers can receive for improving or maintaining ecosystem services including: Direct Payments / Certification Programs / Tax Incentives / Ecosystem Service Markets.

https://www.youtube.com/watch?v=K8v7H43R4IE

Journal of Sustainable Water in the Built Environment

Fee Credits as an Economic Incentive for Green Infrastructure Retrofits in Stormwater-Impaired Urban Watersheds (2020)

Low participation rates in existing US stormwater utility fee credit programs indicate that the benefits attributed to credits are not being realized, most notably, the financial incentive for private property owners to control stormwater on their sites. This is problematic if credits are to be used to achieve the level of private property participation in green infrastructure (GI) retrofits necessary to effect stream quality improvements in stormwater-impaired urban watersheds. This paper examines economic and policy issues related to the use of stormwater fee credits as a market-based incentive strategy for private commercial property owners to invest in GI retrofits.

The results indicate that a stormwater fee and credit combination for a stormwater utility based on the cost of capital and credits for GI retrofits, and credits to property owners equal to the cost of annual maintenance for GI retrofits, can provide adequate incentive for investment by both groups.

https://ascelibrary.org/doi/pdf/10.1061/JSWBAY.0000923 - Cost is $35 USD

Review – Economic Instruments for Environmental Protection

The Canadian Cattle Association

The Canadian Cattlemen's Association is currently working with other Canadian agriculture organizations to establish their policies and principles on ecosystem services. A meeting was held in Ottawa in mid-2013 to present the findings of the Association's taskforce to organizations such as Dairy Farmers of Canada, Canadian Forage and Grasslands Association, Canola Growers, Grain Growers and Egg Farmers of Canada.

Program principles have been created in the following seven (7) categories: 1. Producer Rights / 2. Land Use / 3. Participation / 4. Measurement / 5. Compensation / 6. Valuing and Payment of ES / 7. Trade Implications

https://www.cattle.ca/advocacy/environment-and-climate-change

Water Economic and Policy

Evaluating Payments for Watershed Services Programs in the United States (2019)

Reviewed 15 forest watershed protection programs in the United States in which a local government agency or water provider collects payments from downstream service beneficiaries, such as water consumers, and pays upstream forest landowners for provision of watershed services. We describe the features of these Payments for Watershed Services (PWS) programs, focusing on funding sources, how the payment mechanisms work, and outcomes achieved. Also assess the extent to which the programs adhere to the economic principles that are associated with efficient or cost effective PWS schemes. In general, find that payments in the programs do not closely reflect the marginal value of the service provided. Payments received by landowners mainly reflect the landowners' opportunity costs. Fees paid by water consumers are set to yield revenue targets and/or reflect the avoided cost of additional water filtration and treatment. The programs appear to yield societal benefits, primarily through cost savings, but data from program outcomes is limited and more rigorous analysis of both the benefits and costs would be worthwhile.

https://www.worldscientific.com/doi/abs/10.1142/S2382624X19500036

North Carolina

Scaling Up Payment for Watershed Services Programs in the Upper Neuse River Basin (2012)

A payment for watershed services (PWS) approach to addressing the Upper Neuse River Basin's water quality issues would allow payment to private landowners and farmers to improve the water filtering functions of their lands. No known study to date has taken a place-based approach to this methodology using case study examples to assess the feasibility and guide the design of a PWS program for a specific watershed. (Full program assessment - 235 pages).

https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/5347/MP_Final.pdf?sequence=1

Sustainable Prosperity

A Study of Canadian Conservation Offset Programs (2014)

Lessons Learned from a Review of Programs, Analysis of Stakeholder Perceptions, and Investigation of Transactions Costs

https://institute.smartprosperity.ca/sites/default/files/publications/files/Noga%20Adamowicz%20Conservaton%20Offsets%20Oct%202014.pdf

EPA

Types of Economic Incentives for Stormwater Management (2021)

Article examines market-based, hybrid and voluntary initiatives to regulate pollution.

https://www.epa.gov/environmental-economics/economic-incentives

Conservation Finance Network

New Horizons for Market-Based Stormwater Management (2018)

The report focuses on two major types of economic tools, incentives and mitigation/credits.

https://www.conservationfinancenetwork.org/2018/04/24/new-horizons-for-market-based-stormwater-management

South Carolina – Sustainable Cities and Society

Understanding the public's behavior in adopting green stormwater infrastructure (2021)

Because of the importance of community participation in the success of GSI, we investigated the factors affecting the household's intention to adopt GSI practices on their properties. Household characteristics such as age, house ownership, property flooding history, and perception of flooding impacts and stormwater management were found to be significant in most of the models. (A questionnaire in the report that could be useful - see page 10).

https://files.nc.gov/ncdeq/Energy%20Mineral%20and%20Land%20Resources/Stormwater/Internal%20-%20Stormwater%20Guidance%20Documents/Ureta-et-al.---2021---Understanding-the-public-s-behavior-in-adopting-green-stormwater-infrastructure.pdf

Environmental Management

Social-psychological Determinants of the Implementation of Green Infrastructure for Residential Stormwater Management (2020)

Green stormwater infrastructure (GSI) can complement grey infrastructure, but public land for its installation is limited. Private lands provide an opportunity for lot-level GSI. While many studies have been conducted in the engineering aspects of GSI, less is known about what determines residents' decisions to install GSI on their properties. A survey of social-psychological determinants of residential GSI implementation using the Theory of Planned Behavior as theoretical framework was conducted. Results from three neighborhoods suggest that residents' decisions to install GSI largely are determined by social norms and perceived control factors such as available finances and time. However, residents' beliefs and attitudes toward the effectiveness and attractiveness of GSI did not seem to play a significant role. Neighborhood characteristics including local flooding history did not seem to affect residents' decisions about GSI installation either.

https://link.springer.com/article/10.1007/s00267-020-01393-3

Finance/Economics

Calgary

1 Cost of Service Study for Water, Wastewater and Drainage Services (2018)

https://pub-calgary.escribemeetings.com/filestream.ashx?DocumentId=62639

2 Co-operative Stormwater Management Initiative – Project Overview (2019)

Cooperative Stormwater Management Initiative to reduce localized flooding (2021)

Newspaper Article: https://www.theanchor.ca/2021/cooperative-stormwater-management-initiative-to-reduce-localized-flooding/

https://ecoimpact.ca/wp-content/uploads/2020/01/Laure-Corbeil-CSMI-generic-overview-public-comms.pdf

3 Entering into the Cooperative Stormwater Management Initiative (CSMI) Cooperative (2020)

The CSMI Cooperative is expected to include The City of Calgary, Rocky View County (RVC), Town of Strathmore, Wheatland County and the WID. The City of Chestermere withdrew from the initiative in 2019 December. CSMI is unique in that it will be owned and operated by an external party, on lands outside the city boundary, and governed by a Board on which The City would hold one of five equal votes.

The Summary of Legal Agreements & Risk Management are confidential documents.

https://pub-calgary.escribemeetings.com/filestream.ashx?DocumentId=144245

4 Cooperative Stormwater Management Initiative (CSMI): Master Stormwater Agreement (2018)

See page 4 for Financial Capacity, Operating and Capital Budget information.

https://pub-calgary.escribemeetings.com/filestream.ashx?DocumentId=47779

ASCE Library

A Proposed Framework for the Integrated Management of Municipal Infrastructure (2020)

This paper presents a framework for the integrated management of municipal infrastructure. The proposed framework accounts for the savings derived from the integration of maintenance activities in co-located infrastructure. It comprises three modules:

(1) an input module containing inventory data of the infrastructure systems;
(2) a data processing module that analyzes infrastructure condition, maintenance needs, and costs, and identifies potential areas for integration; and
(3) an evolutionary solving module that optimizes the maintenance program by accounting for the savings derived from integrated interventions.

An urban network including pavement and sewer systems is analyzed as a proof of concept to estimate the order of magnitude of the savings that could be derived from an integrated management.

https://ascelibrary.org/doi/10.1061/9780784482858.091

Credit Valley Conservation

Developing an Integrated Risk Management Framework to support "One Water" in Municipalities (2016)

This document examines a proposed integrated framework through the lens of three main drivers of risk: aging infrastructure, climate change, and a growing population. The project team found that municipalities are beginning to understand and respond to these drivers and that integrated approaches, while slow to be adopted in Canada, are on the rise.

https://cvc.ca/wp-content/uploads/2016/09/DEVELOPING-AN-INTEGRATED-RISK-MANAGEMENT-FRAMEWORK-TO-SUPPORT-%E2%80%9CONE-WATER%E2%80%9D-IN-MUNICIPALITIES.pdf

Simon Fraser University

Paying for Urban Infrastructure Adaptation in Canada: An Analysis of Existing and Potential Economic Instruments for Local Governments (2015)

This report examines a number of instruments that local governments in Canada may use to generate revenues in support of adaptation in general, and in support of the development of climate resilient infrastructure in particular. The report also examines instruments aimed at incentivizing behavioural changes at local levels that may reduce the need for public investments in adaptation, and could thereby reduce the need to generate revenues in support of such investments.

http://act-adapt.org/wp-content/uploads/2015/09/Urban-Infrastructure-08Sept.pdf

Insurance Bureau of Canada

Combatting Canada's Rising Flood Costs: Natural infrastructure is an underutilized option: 2018

This report demonstrates how to quantify the benefits and costs of these natural features as a strong complement or a viable alternative to grey infrastructure option for flood mitigation.

It's definitely worth a read.

See page 33 for: Measurement of costs – Considerations for natural infrastructure projects.

http://assets.ibc.ca/Documents/Resources/IBC-Natural-Infrastructure-Report-2018.pdf

Article

Financing of Municipal Infrastructure to Support Development: An Historical Perspective

Beyond boring, but may be useful.

https://www.woodbull.ca/docs/default-source/publications/financing-municipal-infrastructure-to-support-development-an-historical-perspective

Draft Discussion Paper

Equitable Economics: Inter-Municipal Financial Partnerships (Draft Paper - 2007)

This paper examines two different approaches to inter-municipal agreements: cost sharing and revenue sharing. Cost sharing, in turn, can be further defined into models that use a shared service basis and ones that rely on the concept of economic rent. An overview of cost and revenue sharing agreements is discussed and a high-level framework for constructing such agreements is provided.

https://vermilionriver.civicweb.net/content/pdfstorage/EC16B4831C5946FC9BF8FEB1AEC33F62-CnclAct-%20AAMDC-Draft%20-%20Equitable%20Economi.pdf

Green infrastructure, stormwater & financialization of municipal environmental governance

This paper examines how municipalities are adopting different fee structures and financial tools to pay for stormwater abatement through green and gray infrastructure and improve their capacity to deal with the impacts of climate change. Drawing on a survey of 233 municipalities and interviews with municipal leaders, we show that transitioning towards green infrastructure in municipal stormwater and climate change planning is a broad goal among most respondents, but stormwater fee systems are typically not sufficient for meeting regulatory mandates as well as the operation and maintenance costs needed to replace or repair urban water infrastructure. This shortfall has led many municipalities to use a host of other financial tools, such as credit and mitigation banking and social impact and green bonds. We suggest this shift has important implications for achieving sustainability and ensuring just transitions.

https://www.tandfonline.com/doi/abs/10.1080/1523908X.2021.1893164

An Economic Analysis of Green vs Grey Infrastructure (2019)

This paper examines the benefits derived from both green and grey infrastructure relative to their associated costs to identify the economic return on investment as measured by benefit-cost ratios. The analysis uses actual cost information (including capital as well as ongoing maintenance costs) derived from projects in both Canada and the US. Benefits considered include avoided damages (both insured losses and total losses) and, particularly for the case of green infrastructure, the additional benefits of reduced erosion mitigation and estimates of willingness to pay for water quality improvements. Further, the analysis considers a relatively large (City-level) scale, using the City of Markham as a case study and, as such, provides an example of the information that can be useful for establishing infrastructure strategies at that level.

https://drive.google.com/file/d/1-DjFrp4KRfdjMAqGL091Bpb4oE0RbSVV/view

Cost Allocation Review Ontario Power Generation: 2021 (See page 7 for the report)

Allocations are used when more than one business unit uses a resource but the portions of the resource of each use cannot be directly established. In these cases, a cost driver is used to allocate the costs of the resource. A cost driver is a formula for sharing the cost of a resource among those who caused the cost to be incurred.

https://files.opg.com/wp-content/uploads/2021/05/F3-01-04-Cost-Allocation-Methodology_Updated_20210429_210501_183611.pdf

Corvinus University of Budapest

Pricing at Shared Service Organizations: 2012

This paper focuses on the pricing systems in shared service organizations. Each organization needs a good pricing system but in a shared service organization it is a vital issue. Shared service organization has to fulfill the demand of internal customers and sometimes external customers and create a rightful and fair pricing. If the pricing system is not successful the customer will look for an outsourcing provider that makes delivering cheaper.

https://www.researchgate.net/publication/236270779_The_Hungarian_Shared_Service_Market_or_What_Are_the_Drivers_and_the_Obstacles_of_Progress

University of New Brunswick

Review of shared services cost allocation methodology: 2013

While this review provides costing details for shared services between universities (largely administrative), it may not be transferable for our purpose.

https://www.unb.ca/vpfinance/_resources/pdf/reports-presentations/shardserv.pdf

Alberta

Natural Asset Inventory & Ecosystem Service Assessment for the Town of Okotoks: 2020

This provided a baseline inventory and valuation of the ecosystem services provided by natural assets in the community, which will be incorporated into planning and future development. Incorporating natural assets into its asset inventory will enable the Town to determine the true value of undeveloped land, which includes the natural services it provides prior to development. This ground-breaking data will be used to develop a strategy for natural resource management that will help reduce Okotoks' ecological footprint, enhance environmental protection, support public health and safety, and improve operating costs and efficiencies that align with Okotoks' community values.

https://www.okotoks.ca/sites/default/files/2020-12/Okotoks%20Natural%20Asset%20Inventory%20Report.pdf

Urban Affairs Review

Does Inter-Municipal Cooperation Really Reduce Delivery Costs? An Empirical Evaluation of the Role of Scale Economies, Transaction Costs, and Governance Arrangements: 2019

Abstract: Inter-municipal cooperation in public service delivery has attracted the interest of local authorities seeking to reform public service provision. Cost saving, together with better quality and coordination, has been among the most important drivers of such cooperation. However, the empirical results on inter-municipal cooperation and its associated costs offer divergent outcomes. By conducting a meta-regression analysis, we seek to explain this discrepancy. We formulate several hypotheses regarding scale economies, transaction costs, and governance of cooperation. While we find no clear indications of the role played by transaction costs in the relationship between cooperation and service delivery costs, we find strong evidence that population size and governance are significant in explaining the relationship. Specifically, small populations and delegation to a higher tier of government seem to offer cost advantages to cooperating municipalities. As an extension of our model, we seek to disentangle service-related transaction costs based on asset specificity and ease of measurability of the service.

https://journals.sagepub.com/doi/abs/10.1177/1078087419839492

Journal of Public Administration Research and Theory

It Depends on What You Share: The Elusive Cost Savings from Service Sharing (2020)

Inter-municipal cooperation is the most prevalent alternative service delivery method for US local governments. While aspirations for budgetary savings are one motivating factor, increased service quality and regional coordination are also important goals. We use an original 2013 survey of local governments in New York State to assess the level of service sharing and outcomes. We match our survey with twenty years (1996-2016) of service-level costs data to explore the relationships between sharing and costs across twelve common local government services. Our multivariate time series regressions find that service sharing leads to cost reductions in solid waste management, roads & highways, police, library, and sewer services; no difference in costs for economic development, ambulance/EMS, fire, water, and youth recreation; and higher costs in elder services and planning & zoning. These differences are explained by whether services have characteristics such as asset specificity and the ability to achieve economies of scale on the one hand, or if sharing leads to greater administrative intensity or quality and regional coordination outcomes on the other hand. We also analyze the effect of sharing on service costs over time, and find solid waste management, roads & highways, police, and library are the only services where costs show a continued downward trend. Because cost savings are elusive, public-sector reformers should be careful not to assume cost savings from sharing.

https://www.semanticscholar.org/paper/It-Depends-on-What-You-Share%3A-The-Elusive-Cost-from-Aldag-Warner/d1ad1b6f667bd611e7eb10ad1c83abb28efe18b4 - Need to create free account to access

Article

Does cooperation affect service delivery costs? Evidence from fire services in Norway: 2017

The objective of this study is to develop our understanding of how cooperation between local governments affects service delivery costs. The current study provides three contributions to the existing literature: (1) we assess the relation between inter-municipal cooperation and service delivery costs for fire services; (2) we evaluate whether different forms of cooperation affect costs differently; and (3) we analysed how the number of cooperation partners affects the cooperation–cost relation. Theoretically, it is argued that cooperation promotes scale economies, but that increasing transaction costs from additional cooperation partners may outweigh these potential benefits. The data show that there are significant economies of scale linked to cooperation, but that this depends on the organizational form of the cooperation as costs are lower for contractual agreements than for joint organizations. Furthermore, cost benefits decrease significantly as the number of cooperation partners increases, and more so for contractual agreements than for joint organizations.

https://www.researchgate.net/publication/319496217_Does_cooperation_affect_service_delivery_costs_Evidence_from_fire_services_in_Norway - To read the full-text of this research, you can request a copy directly from the author.

Water Economics and Policy

Evaluating Payments for Watershed Services Programs in the United States: 2019

We review 15 forest watershed protection programs in the United States in which a local government agency or water provider collects payments from downstream service beneficiaries, such as water consumers, and pays upstream forest landowners for provision of watershed services. We describe the features of these Payments for Watershed Services (PWS) programs, focusing on funding sources, how the payment mechanisms work, and outcomes achieved. We also assess the extent to which the programs adhere to the economic principles that are associated with efficient or cost effective PWS schemes. In general, we find that payments in the programs do not closely reflect the marginal value of the service provided. Payments received by landowners mainly reflect the landowners' opportunity costs. Fees paid by water consumers are set to yield revenue targets and/or reflect the avoided cost of additional water filtration and treatment. The programs appear to yield societal benefits, primarily through cost savings, but data from program outcomes is limited and more rigorous analysis of both the benefits and costs would be worthwhile.

https://www.worldscientific.com/doi/abs/10.1142/S2382624X19500036

Pricing joint use of municipal services: Theoretical perspectives and regulatory issues

Abstract: This paper analyses price regulation of inter-municipal contracts in Finland to demonstrate interpretative problems of regulatory rules specifying full-cost or market prices and, by so doing, deepen understanding of the theoretical underpinnings for pricing collaborative municipal services. It considers how to price inter-municipal services taking into account the specific socio-economic nature of inter-municipal cooperation, including both financial and non-financial objectives, through a new joint-use pricing model of

municipal services that challenges the supremacy of full-cost pricing requirements in cases of inter-municipal collaborative contracting.

https://onlinelibrary.wiley.com/doi/full/10.1111/faam.12180

Public Sector Digest

The Infrastructure Database of Canada

The Infrastructure Database of Canada (IDC) contains detailed information about the state of tangible capital assets across Canada's municipalities and the average cost of infrastructure. Member communities are able to compare costs for specific infrastructure asset categories and sub-categories, asset life cycles, and funding requirements. Through the use of the IDC, senior management is able to conduct a comparative analysis to rank their community's performance among their peers, discover best practices and efficiencies achieved by leading communities, and network directly with those municipalities that are demonstrating the best results.

https://publicsectordigest.com/infrastructure-database-canada-idc

Economic Impact Assessment of the GI Sector in Ontario

This 2020 report was prepared by The Delphi Group, on behalf of the Green Infrastructure Ontario Coalition (GIO) with funding from the Greenbelt Foundation and additional financial support from Landscape Ontario. (See page 28 for key Economic indicators for Stormwater.)

https://greeninfrastructureontario.org/app/uploads/2020/07/Economic-Impact-Assessment-of-GI-Sector-in-Ontario_UPDATED_july20-20.pdf

Local Government Studies

Privatization, contracting-out and inter-municipal cooperation: new developments in local public service delivery: 2017

In theory, IMC should improve efficiency if the production of public services is characterised by scale economies. In larger organisations, fixed costs can be spread out over higher production volumes. Yet, corporate governance theory predicts that IMC increases agency costs and reduces the degree of monitoring to which public servants are exposed. Based on the three multivariate empirical studies examining costs in this special issue, the cost advantages of IMC remain unclear.

https://www.tandfonline.com/doi/full/10.1080/03003930.2017.1403904?src=recsys

Public Money & Management

Sharing services, saving money? Five risks to cost-saving when organizations share services: 2016

Shared services are a popular reform for governments under financial pressure. The hope is to reduce overheads and increase efficiency by providing support services like HR, finance and procurement once to multiple agencies. Drawing on insights from organization theory and political science, we identify five risks

that shared services won't live up to current expectations. We illustrate each with empirical evidence from the UK, Ireland and further afield, and conclude with suggestions on how to manage these risks.

https://www.researchgate.net/publication/301297243_Sharing_services_saving_money_Five_risks_to_cost_saving_when_organizations_share_services

Public Management Review

A contingency approach to managing outsourcing risk in municipalities: 2008

We discuss outsourcing risk in relation to different governance models, and provide a framework for classifying the risk related to an outsourcing choice. We argue that different kinds of outsourcing have different degrees of risk, and that the governance model needed for successful outsourcing is contingent on the nature and amount of that risk. As a result, municipalities need to use several different governance models, each attuned to the degree of risk of the service being outsourced. Moreover, a municipality's managers must be especially careful not to outsource a service unless they have the capability to manage the requisite governance model.

https://www.tandfonline.com/doi/full/10.1080/14719030701763211

Journal of Policy Analysis and Management

Managing contract performance: A transaction costs approach: 2003

Managing contracts is a complex process, often exacerbated by high transaction costs inherent in negotiating, implementing, and monitoring contract relationships with vendors. Through analyses of data from a 1997 International City|County Management Association survey of municipal and county governments, the way in which municipal and county governments respond to transaction cost factors inherent in contract service delivery is examined. The results of the analyses demonstrate that when governments contract for services in contexts that risk contract failure, they engage in a variety of monitoring techniques to improve their ability to monitor and correct vendor performance.

https://www.semanticscholar.org/paper/Managing-contract-performance%3A-A-transaction-costs-Brown-Potoski/7df9f23313f23fed57cb18912ed930847ab6086f

Local Government Studies

Political incentives and transaction costs of collaboration among US cities for economic development: 2017

This study extends research on Institutional Collective Action by testing a transaction cost explanation for self-organising economic development agreements between US cities. We offer a unique contribution to this literature by identifying how these agreements between cities with similar political institutions mitigate the transaction costs of collaboration, and how characteristics of these agreements combine with political institutions to shape collective action. The results of an empirical analysis of data collected through a survey of local officials suggest the alignment of high-powered political incentives between cities mitigates the coordination and division problems of forming a joint venture. Agreements that enable elected officials to distribute the benefits of an agreement are also found to moderate this effect.

https://www.tandfonline.com/doi/full/10.1080/03003930.2017.1337568?src=recsys

Journal of Ecological Economics

Do Stormwater Basins Generate Co-benefits? Evidence from Baltimore County, Maryland: 2017

An often-cited advantage of green infrastructure projects is the potential for "co-benefits" generated from its natural features, which depend on the generation of positive house price capitalization. Using housing transactions data and exploiting variation in placement and design, we examine the capitalization of stormwater retention basins, a common green infrastructure project in suburban housing developments. Results show adjacency causes decreases in housing prices between 13 and 14% for the average home.

https://www.sciencedirect.com/science/article/abs/pii/S0921800916314938 - Click on PDF

Journal of Urban Forestry & Urban Greening

The capitalized amenity of green infrastructure in single-family housing values: An application of the spatial hedonic pricing method: 2020

The environmental benefits of having retention/detention ponds as major stormwater management facilities in a neighborhood have been well documented since the adoption of green infrastructure strategies in early 1990s. However, the capitalization effect of stormwater treatment ponds in real estate values still remains unclear. This study developed classic hedonic pricing and spatial econometric models to examine the capitalization effects of neighborhood-level detention and retention ponds using both cross-sectional and longitudinal housing prices. The housing market value from 2007 to 2016 was assessed in four subdivisions in Houston, Texas. A subdivision, located in the upper neighborhood, had retention ponds which were converted from detention ponds in 2011, while three subdivisions in the lower neighborhood had detention ponds over the same study period. The study results show that living near retention ponds has positive capitalization impacts on single-family housing prices, not only cross-sectionally but also longitudinally. In contrast, maintaining detention ponds depreciates housing values, and living nearby lowers the price increase over a decade.

https://www.sciencedirect.com/science/article/abs/pii/S1618866719306934 - Cost is 39.95 USD

Journal of Science of The Total Environment

A spatial life cycle cost assessment of stormwater management systems: 2020

- Equivalent annual costs were assessed for seven GI systems across five cities.
- Cost effectiveness was estimated based on stormwater reduction and nutrient removal.
- Land and tax costs account for up to 78% of a GI system's equivalent annual cost.
- Ranking of GI cost effectiveness varies significantly across performance variables.

https://www.sciencedirect.com/science/article/abs/pii/S0048969720323044

Modernizing Federal Freshwater Leadership

Draft White Paper, May 2020:

Relevant points

- Purpose a two-pronged approach to modernize federal freshwater leadership: institutional and legislative reform.
- Include provisions in the renewed Act to enhance transboundary watershed planning by bolstering opportunities for partnership and collaborative agreements between the federal government and provincial, territorial, and Indigenous governments. Pg3
- Improve collaborative river basin planning by building durable partnerships for water management and decision making with provinces, territories, and Indigenous governments, with clear outcomes that include building resilience to extreme events, identifying priority areas for watershed restoration, and ensuring effective environmental flow regimes are in place across all levels of jurisdiction and authority. Pg 3 https://www.canada.ca/en/environment-climate-change/news/2020/12/government-of-canada-launches-consultations-on-new-canada-water-agency.html

https://gwf.usask.ca/documents/ffl_white-paper_may2020.pdf

Toward the Creation of a Canada Water Agency

May 2020: Discussion Paper

The Discussion Paper presents key issues for consideration in the Government of Canada's approach to creating a Canada Water Agency.

https://www.placespeak.com/uploads/6321/Canada_Water_Agency_Discussion_Paper.pdf

Shared service Agreements

Cooperation, not cost savings: explaining duration of shared service agreements December, 2014:

Among local governments, inter-municipal cooperation is the growing reform; but the literature is silent regarding the determinants of longer-term shared service agreements. We conducted a survey of all local governments in New York State in 2013 to assess the level of sharing across 29 public services. The duration of shared service agreements varies from 1 to 80 years. Our hierarchical linear model shows that service sharing agreements fall along a cooperation continuum, where cost savings are a determinant of shorter agreements, while the public values of service quality and cross-jurisdictional coordination explain longer-term agreements. We also find that positive past experience with sharing partners increases the duration of sharing agreements.

https://www.tandfonline.com/doi/full/10.1080/03003930.2017.1411810

Journal of Sustainable Cities and Society (Private Property)

Understanding the public's behavior in adopting green stormwater infrastructure in South Carolina: 2021

This paper investigated the factors affecting the household's intention to adopt GSI practices on their properties. We found that respondents' characteristics such as age, income, property ownership, as well as their perception and experiences of local flooding and GSI, are influencing the households' intention to adopt stormwater management practices. Although the respondents cited various adoption barriers, their perception that GSI practices are ineffective was the only statistically significant barrier in the models. Providing the household with enough information on these practices' effectiveness will likely increase their interest in adopting GSI on their properties. Meanwhile, water quality improvement is the only statistically significant ES in the analysis. This shows that residents value water quality and would likely adopt GSI that could significantly improve this benefit.

https://reader.elsevier.com/reader/sd/pii/S2210670721001062?token=FBB5D7E17A194C1DDF294CFAB807F563353761B83585667C59C1DF858317425FF2C392F226A28AEA5E4F3A986D74204A&originRegion=us-east-1&originCreation=20210525180600

Journal of Energy Research & Social Science

Tweets and transitions: Exploring Twitter-based political discourse regarding energy and electricity in Ontario, Canada: 2020

The article explores how Twitter data can inform the study of the socio-political dimensions of sustainability transitions. Additionally, the analysis suggests that users lacking traditional political empowerment can influence the political discourse on Twitter through high levels of retweets; however, savvy and strategic use of Twitter communication, rather than simply engagement with an issue, is important in generating consistent amplification from other users.

https://www.sciencedirect.com/science/article/abs/pii/S221462962030445X?dgcid=rss_sd_all - Cost applies

Cold Regions Science and Technology

Spatial variability of ice thickness on stormwater retention ponds: 2018

Research conducted by the University of Alberta shows how hazardous stormwater facilities are. With more facilities being built and warmer winter temperatures caused by climate change, there is a higher need for safety precautions.

- The ice surface varies in depth across the whole surface. While it may appear thick in some areas, other areas may have little to no ice.
- There are generally no visible surface indications of unsafe conditions.
- Snow often obscures holes in the inconsistent ice.
- Water is continuously flowing beneath the surface.

https://www.epcor.com/outages-safety/safety/neighbourhood/stormwater/Documents/UA-ResearchPaper-IceThickness.pdf

Urban Land Institute

Job Description for Senior Advisor to work in the realm of 'Shared Services'. May 2021

Although the infrastructure is Transit in Toronto, I would imagine that the skill sets is transferable to stormwater. Pay Range: 83,638.00 – 114,790.00.

Intermunicipal Collaboration

https://tspace.library.utoronto.ca/bitstream/1807/81208/1/imfg_forum_7_daley_spicer_Jan_17_2018.pdf
Approximately 650 agreements from 12 Census Metropolitan Areas across Canada. ***

Enhancing Ontario's Rural Infrastructure Preparedness: Inter-Community Service Sharing in a Changing Climate — Community Service Sharing in a Changing Climate — Environmental Scan Environmental Scan: https://scholars.wlu.ca/cgi/viewcontent.cgi?article=1037&context=geog_faculty

Halton Hills ECA: https://pub-haltonhills.escribemeetings.com/filestream.ashx?DocumentId=4020

Municipality of Niagara ECA: https://www.accessenvironment.ene.gov.on.ca/instruments/5960-BA6NNN-14.pdf

Purpose:
Understanding the constraints and opportunities and strategies for overcoming any issues pertaining to intermunicipal collaboration models/frameworks such that we can develop criteria to evaluate and screen options (governance, administrative, and legal) and understand the structural and functional elements and set up that would work for SWM planning and management in the East Holland, Lake Simcoe Basin, Ontario-wide and Canada-wide.

Research questions:

1. What are potentially viable governance models and frameworks for intermunicipal collaboration currently in use in Ontario, other Canadian provinces and external jurisdictions (most likely Commonwealth countries as they have similar government structure but the US and Europe have used intermunicipal collaboration agreements for infrastructure projects)?
2. What are the administrative considerations for intermunicipal collaboration and what strategies and approaches are potentially viable for use in Ontario?
3. What are the potential impediments to intermunicipal collaboration – what problems have arisen, what have been the solutions to those problems, what can be put in place (i.e., in agreements, or the functional structure, etc.) to help ensure the collaborative mechanism and process works equitably.
4. What are the legal considerations for intermunicipal collaboration and what strategies and approaches are potentially viable for use in Ontario and how have they been addressed in other jurisdictions?
5. Are there municipal or provincial policies that support/deter intermunicipal collaboration, and if yes what are they and how could they be addressed to enable collaboration for SWM planning and management?
6. What are current examples of intermunicipal collaboration agreements in use in the East Holland, Lake Simcoe Basin and York Region? How are they structured? What works, what doesn't?

Secondary Research – Literature Review

Intermunicipal collaboration

Constraints

- The municipal governance model and associated municipal culture is based on delivery of services within the municipal boundary, therefore, cooperation between municipalities and other local entities, specifically watershed authorities and Indigenous communities, is not an explicit part of their official functions.
- Perceived loss of municipal autonomy and authority.
- Concerns about potential legal, financial and administration complications.
- Numerous provincial ministries and agencies have some level of oversight for municipal SWM – adding intermunicipal collaboration will create another level of complexity.
- Policies to encourage watershed scale planning (BC) and collaboration (AB – although not specific to SWM but rather to planning and infrastructure) and ON already in place therefore, watershed issues already considered by municipalities in the context of SWM planning.
- No provincial level legislative requirement for municipalities to cooperate (with possible exception of Alberta).

Opportunities

- Numerous mechanisms (e.g., Intermunicipal Service Agreements, Intermunicipal Partnership Agreements or Third-party Delivery Agreements with intermunicipal oversight) provide an informal means for cooperation for shared delivery/management of specific municipal functions such as SWM, but provides the necessary rules and parameters to ensure autonomy, fiscal management and effective administration.
- Temporary and long-term intermunicipal collaboration agreements and management frameworks are used successfully by many municipalities in Canada (e.g., transit, water & wastewater services, emergency services, etc.) and could be adapted for cooperative, watershed-wide stormwater planning and management.
- There is no legislation restricting or preventing intermunicipal collaboration on stormwater planning and management.
- Merging watershed planning, source water protection guidance, and SWM planning functions could reduce provincial programming and administrative costs while significantly enhancing opportunities to harmonize policies to meet multiple goals and for greater impact and improved efficiency.
- Opportunities to integrate policy and oversight functions are significant – in most Canadian provinces the ministries having oversight of watershed planning are the same ministries with oversight for municipal SWM.
- Opportunity for harmonization of environmental policies in related areas providing for improved co-ordination and management and greater cost-efficiency.
- Guidance supporting intermunicipal collaboration for planning and managing stormwater on a sub-watershed-, watershed- or nested watershed-scale.

Leading Jurisdictions Research:
GOVERNANCE

Auckland, NZ

- Auckland Council is implementing integrated management of freshwater and land development planning in whole catchments.

https://www.aucklandcouncil.govt.nz/environment/looking-after-our-waterways/Pages/wai-ora-healthy-waterways.aspx

Alberta, CA

- The Alberta Municipal Act provides for the development of an Inter-municipal Collaboration Framework (ICF) between municipalities sharing a common border. An ICF is intended to:
    - provide for integrated and strategic planning, delivery and funding of intermunicipal services.
    - allocate scarce resources efficiently in the providing local services.
    - ensure municipalities contribute funding to services that benefit their residents.

Greater Vancouver Regional District, BC

- GVRD led a process to establish integrated watershed planning amongst municipalities (Cities of Vancouver, Burnaby, Coquitlam and Port Moody) in the Brunette River watershed.
- Focus on integration of SWM and land use planning to protect the Brunette River, an inter-municipal watershed.
- All five municipalities committed to a vision, goals and objectives for catchments within the Brunette River basin.

Capital Regional District, BC

- The CRD established an Integrated Watershed Management Program (IWMP) works with municipalities, First Nations and watershed communities to monitor quality and stormwater, develop regulatory tools and codes of practice, restore key areas within harbours and watersheds and promote BMPs.

Prince George's County, Maryland

- Implemented a public-private partnership model referred to as a Community-Based Public-Private Partnership (CBP3), for the management of stormwater county-wide.
- CBP3 is a pay-for-performance service delivery model that delegates project selection, design, construction and Operations and Maintenance (O&M) responsibility to the private partner.

https://www.epa.gov/G3/prince-georges-county-maryland-clean-water-partnership

https://www.corvias.com/projects/clean-water-partnership

Okanagan Regional Districts, BC

- Establishment of the Okanagan Basin Water Board (OBWB), including a legislative framework setting out the authority, objectives, purpose, membership and representation and cost sharing measures between regional districts for watershed planning and management.

New York City, New York

- The Department of Environmental Protection (DEP) established an Office of Green Infrastructure to facilitate and oversee implementation of GI on public and private property throughout the City.

POLICIES, PLANS & REGULATIONS

New York City, New York

- The NYC Department of Environmental Protection (DEP) developed "hybrid plan" for combined sewer overflows using grey infrastructure (where cost effective) in combination with GI.
- DEP committed to spend $1.5 billion on green infrastructure and stimulate another $900 million in private green infrastructure investment by 2030.

The DEP's Office of Green Infrastructure developed design standards for various types of green infrastructure. These design standards and procedures apply to City properties and are intended to streamline the development of contract plans and drawings, and reduce the timeline and costs associated with design and approval processes.

Seattle, Washington

- The City set up "Open Space Seattle 2100" Guidance Committee to develop guiding principles for open space planning and to establish Green Infrastructure Plans for 2025 and 2100.
- Process led to the development of a Green Stormwater Infrastructure (GSI) Strategy

In 2013, a City Council Resolution established GSI as a critical aspect of a sustainable drainage system and challenged Seattle to rely on GSI to manage stormwater runoff whenever possible. The Resolution and associated Exec Order also set a community-wide implementation reduction target for runoff and a 2020 goal of managing 400M gallons of stormwater annually with GSI.

Washington, Connecticut

- Established maximum lot coverage requirements within its zoning regulations to limit impervious cover.
- The ordinance states: "In residential districts, the maximum land coverage for all buildings and structures (principal and accessory uses) including paved, impervious, or traveled surfaces shall not exceed: a. 15% of the total land area for lots less than two acres, b. 0.3 acres for lots between two and three acres (about 12%), and c. 10% for lots three acres and larger."
- The ordinance limits imperviousness in business districts to a maximum of 25%.

In all cases, lot coverage is defined as: "the percentage of the lot, which is covered by structures.

Towns of Exeter, Stratham & Newfields, New Hampshire

- Developed a framework for integrated water management to facilitate a watershed-based approach to managing water quality issues.

Toronto, Ontario

- **Green Streets Technical Guidelines**: Provides direction for the planning, design, integration and maintenance of a range of green infrastructure

- The guidelines provide direction for the planning, design, integration and maintenance of a range of green infrastructure options appropriate for Toronto street types and conditions

GI and Vegetation Selection Tools to identify "site specific GI options that are viable for implementation as part of a street retrofit or reconstruction project and then determine plant species that would be context appropriate (where applicable)".

Portland, Oregon

- **Green Streets Policy**: a citywide Green Streets Policy and Resolution was developed and approved by City Council, processes were formalized for permitting and integration of Green Streets into city plans, and a fund was established to support construction of green street facilities.
- The goal is to promote and incorporate the use of green street facilities in public and private development.

PROGRAMMES & PRACTICES

Onondaga County, New York

- **Green Projects & Streets:** A new G.I.S. map tool to familiarize the community with GI projects that have been constructed.

  https://socpa.maps.arcgis.com/apps/Shortlist/index.html?appid=a797dbe56ce745c2920e3c9e7d827d2b

Philadelphia, Pennsylvania

- **Expedited Reviews** for obtaining stormwater approvals. Two types of reviews are available:
  1. **Disconnection Green Review:** Redevelopment projects must disconnect 95% or more of the post-construction impervious area within the project's Limits of Disturbance (LOD) using DIC to comply with PCSM Requirements.
  2. **Surface Green Review:** New Development & Redevelopment projects that can demonstrate that 100% of post-construction impervious area within the project's LOD is managed by Disconnected Impervious Cover (DIC) and/or bio infiltration/bioretention SMPs to comply with PCSM Requirements are eligible.

http://www.phillywatersheds.org/doc/Expedited%20Review%20Handout_20150706.pdf

- **The Green Infrastructure Living Laboratory** project collects data from green infrastructure that has been constructed on private property. Via the partnership with the Living Laboratory, the City can weigh in on experimental designs and offer perspective about key needs. The outcomes of experiments and monitoring are used to inform design guidance and policy: "…monitoring data collected by the GILL team from a water reuse cistern at Drexel is a great example. We will use that case study as guidance for designers at PWD Philadelphia Water Dept)."
- Data collected by GILL serves as a feedback loop to the Water Department's green stormwater infrastructure Design Team.

http://www.govtech.com/fs/infrastructure/Real-Time-Data-Helps-Philadelphia-Improve-Green-Design.html

Franklin, Massachusetts

- Best Practices guidebook for green infrastructure to expedite permitting requirements for developers.

Established a four-step process for site plan and subdivision applications that begins with an existing site conditions map and an initial pre-development meeting, where developers are offered guidance on how to meet multiple permit requirements and community planning objectives. Through this process, L.I.D. and green infrastructure strategies are coordinated with other project requirements early in the planning process.

Pima County, Arizona

- Provide green infrastructure guidance, which includes standard engineering drawings, vegetation list, and BMP sizing guidance.

Plan submittal checklists for GI and water balance are provided to ensure that all details are provided in submittals to speed up plan reviews. Inspection checklists help ensure that long-term maintenance of GI facilities is completed as needed.

Canada: Alternative Land Use Services (ALUS)

- ALUS works with farmers to establish and maintain GI projects that produce ecosystem services for Canadian communities
- Assist farmers to restore wetlands, reforest, install riparian buffer, manage sustainable drainage systems, create pollinator habitat and establish other ecologically beneficial project on their properties.

Provides Payment for Ecological Services (P.E.S.) annually to ensure the ongoing stewardship of each ALUS project.

Philadelphia, Pennsylvania

- **Stormwater Credits Explorer Map:** For non-residential properties, this tool allows the user to sketch out ideas of up to 5 different types of "stormwater tools", including green roofs, rain gardens and permeable pavers, to determine effectiveness and feasibility of different approaches.
- As Stormwater Tools are added or removed, the application updates the monthly stormwater charge for that property. Users can rapidly get a sense of the feasibility and effectiveness of adding stormwater infrastructure systems.

https://stormwater.phila.gov/explore/

Leading Jurisdictions Research – Part 2

Portland, Oregon

SWM Utility:

Portland finances stormwater management services by collecting public utility fees on developed property, and system development charges (SDCs) on new development.

1 Residential Users – Fees are applied using the following categories:
   a. Single Family and Duplexes
   b. 3-Plex and 4-Plex Residences
2 Developments of 5 or More Units Non-Residential Users
3 Discounts
   - Clean River Rewards: User fee discounts of as much as 100% of the monthly stormwater management charge for private on-site facilities that manage stormwater runoff, and 100% of the monthly on-site stormwater management charge for Drainage District residents and businesses. At the end of April 2014, a total of 35,813 utility ratepayers with active accounts have registered for stormwater discounts: 34,480 single family residential ratepayers (accounting for a total of 76,511,888 square feet of impervious area managed for stormwater) and 1,333 multifamily, commercial, and industrial ratepayers (accounting for a total of 69,393,012 square feet of impervious area managed for stormwater).

http://www.portlandoregon.gov/bes/article/390568 - Summary of the program

http://www.portlandoregon.gov/bes/article/402804 - Detailed program document

Marketing:

Green Streets Program: a citywide Green Streets Policy and Resolution was developed and approved by City Council, processes were formalized for permitting and integration of Green Streets into city plans, and a fund was established to support construction of green street facilities.

Green Streets Policy: The goal is to promote and incorporate the use of green street facilities in public and private development. Key Program Elements:

- Infrastructure Projects in the Right of Way will incorporate green street facilities into all City of Portland funded development, redevelopment or enhancement projects as required by the City's Stormwater Management Manual. If a green street facility is not incorporated into the Infrastructure Project, or only partial management is achieved, then an off-site project or off-site management fee will be required.
- Any City of Portland funded development, redevelopment or enhancement project, that does not trigger the Stormwater Manual but requires a street opening permit or occurs in the right of way, shall pay into a "% for Green" Street fund. The amount shall be 1% of the construction costs for the project.

Green Streets Policy: https://www.portland.gov/sites/default/files/2020-06/36500-green-streets-policy-report-exhibit-a-155896.pdf

Green Streets Resolution: https://www.portland.gov/policies/environment-built/sewer-stormwater-erosion-control/enb-419-green-streets-policy-and-green

% For Green Program: The City of Portland requires all public and private development projects to manage stormwater on-site to the extent possible. Some right-of-way projects do not trigger application of this requirement. A percentage of the budget of these projects goes to the % for Green Program to help fund green infrastructure projects throughout the city. Two funding sources are combined to fund % for Green projects:

- City right-of-way projects not required to meet the Stormwater Management Manual (SWMM) requirements.
- Off-site management fees collected when a private development cannot meet the SWMM requirements due to site conditions.
- Funds may not be used on a project to meet SWMM requirements, but may be used for projects that go above & beyond the requirements.

https://www.portland.gov/bes/grants-incentives/percent-green

ECO Roof Floor Area Ratio Bonus Option: The amount of FAR bonus allowed to a developer depends on the percentage of eco roof coverage in relation to the building footprint.

- 10% – 30% coverage earns 1 sq ft of additional floor area per square foot of eco roof / 30% - 60% coverage earns 2 sq ft / 60% or greater earns 3 sq ft.

Wet Weather Program: Consists of numerous individual projects and activities at locations throughout the City. The goal is to reduce the peak volume of stormwater entering the combined system and manage SW to reduce pollutant concentrations. Funding for projects is in whole or in part by EPA grants. Proposed projects are in five main categories: *Water quality-friendly streets and parking lots*, *Downspout disconnections*, *Eco-roofs*, *Monitoring and feasibility studies*, and *Educational efforts.*

http://www.portlandoregon.gov/bes/article/62175

Treebate Program: Treebate is an incentive to plant yard trees at Portland residences. Homeowners can receive a credit to water/sewer utility bill for half the purchase price per tree up to $15 (small), $25 (medium) or $50 (large) depending on mature tree size and stormwater management potential.

http://www.portlandoregon.gov/bes/article/314187?#eligible

Downspout Disconnection: In targeted neighborhoods, the City pays homeowners $53 for each downspout they disconnect themselves, or will do the work for free.

http://www.portlandoregon.gov/bes/article/127466

Stormwater Management Plan (Jan 2011): The plan identifies Best Management Practices (BMP's) to be implemented to meet the requirements of Portland's Municipal Stormwater Permit.
http://www.portlandoregon.gov/bes/article/126117

Community Stewardship Grants Program: in place since 1995, provides up to $10,000 per project to citizens and organizations to encourage watershed protection. Projects must be within the City of Portland, promote citizen involvement in watershed stewardship, and benefit the public. From 1995 through June 2011, the program allocated over $948,000 to 198 projects.

Clean Rivers Education Programs: free water quality classroom and field science education programs for grades K through 12 within the City of Portland. The Goal is to provide outreach to approximately 15,500 K-12students annually.

Regional Coalition for Clean Rivers & Streams: a group of agencies & municipalities in the Portland/Vancouver metro area dedicated to educating the public about the impacts of SW runoff. The coalition develops an annual region wide public awareness campaign that reaches more than 1.4 million people in the 4-county areas.

Watershed Education and Stewardship: The watershed-based approach stresses comprehensive, multi-objective watershed management through inter-jurisdictional coordination within each watershed. Each program includes public education and stewardship.

Publication & Signage: Examples include water bill inserts, plant posters with stormwater pollution prevention messages, eco roof question and answer fact sheets, landscape swale posters, a "Stormwater Cycling" brochure and map for a self-guided tour of demonstration projects, erosion control information for street tree plantings, and educational materials for community meetings and events.

Stormwater Management Facilities – Operation & Maintenance Guide for Private Property Owners: Property owners are legally responsible for inspecting and maintaining the stormwater management facilities on their sites. Required maintenance is outlined in the operations and maintenance (O&M) plan for the facility. This handbook supplements the O&M Plan.

Policy:

- Ordinance to establish rates for stormwater management services, September, 2012: http://www.portlandoregon.gov/bes/article/413237
- Portland Stormwater Management Manual, January 2014: This document outlines stormwater management requirements and the related regulations and policies.

Stormwater Management Program for the period 2011-2016: This document outlines the goals and mandates of the program. http://www.portlandoregon.gov/bes/article/126117

Minneapolis, Minnesota

Fee Structure: The Stormwater Utility Fee was established in 2005. The stormwater utility fee is based on impervious area and is charged on a per unit basis. Each ESU (Equivalent Stormwater Unit) is 1,530 square feet of impervious area on a property. The impervious area was calculated based on the size of the property, as well as the current use. Single family properties are billed based on: High – 1.25 ESU / Medium – 1.00 ESU / Low – 0.75 ESU

Additional details of the fee structure: https://lims.minneapolismn.gov/v2/archive/legislation/294414

Storm Water Fund 2014 Budget Financial Plan: The Storm Water Fund is comprised of the Storm Water Collection and Street Cleaning programs. The Fund accounts for street cleaning and the design, construction, and maintenance of the City's storm drain system. A portion of the Storm Water Fund is used for sanitary water interceptor and treatment services. The Fund also accounts for the Combined Sewer Overflow program. 2014 budget information:

The Stormwater Credit system: provides up to 50% credit (reduction) in your stormwater utility fee for management tools/practices that address stormwater quality, and 50% or 100% credit (reduction) in your stormwater utility fee for management tools/practices that address stormwater quantity. Maximum credits are cumulative and cannot exceed 100% credit.

Stormwater Quantity Credit Program: only those properties that can demonstrate the capacity to handle a 10-year or 100-year rain event can receive a stormwater quantity credit. Property owners must have their applications certified by a state licensed engineer or landscape architect. Property owners can apply for either the "Standard Quantity Reduction Credit" or the "Additional Quantity Reduction Credit."

Public Education and Outreach: Water quality education programs are required as part of the National Pollution Discharge Elimination System (NPDES) permit. These programs are funded through the MPRB and the City of Minneapolis.

Policy:

Stormwater Management for Development and Re-development Ordinance: The ordinance establishes requirements for projects with land disturbing activities on sites greater than one (1) acre, including phased or connected actions, and for existing stormwater devices.

- An option is reserved for only those sites that demonstrate that performance of on-site stormwater management is not feasible. With approval of the City Engineer, the Ordinance allows developers to contribute to the construction of a regional stormwater facility in lieu of on-site treatment/management.

Comparison of SWMP and LSWMP: The Storm Water Management Program (SWMP) document is a federal requirement. There are many similarities between these two documents. The SWMP specifically focuses on stormwater runoff. The LSWMP has a broader view of surface water management in the City and includes water resource management activities, including management of the sanitary sewer collection system and other surface water management activities. The LSWMP was adopted in 2006 and ultimately was incorporated into the City's comprehensive plan.

Philadelphia, Pennsylvania

Fee Structure:

Residential Stormwater Charge: Residential customers pay a standard amount based on the average surface area of impervious cover on residential properties throughout the city. Stormwater Management Service Charge is NOT based on monthly water consumption. The Service Charge is based on two parameters: the average Gross Area square footage and the average Impervious Area square footage for all residential properties. The average Gross Area for a residential property is 2,110 square feet. The average Impervious Area for a residential property is 1,050 square feet. Based on this average Gross Area and Impervious Area values, a uniform monthly charge has been defined for all residential properties. All Residential Properties are charged a monthly Service Charge and a monthly Billing and Collection charge.
http://www.phila.gov/water/wu/stormwater/Pages/ResidentialSWBilling.aspx

Non-Residential Stormwater Charge: the cost to manage stormwater is based on the specific square footage of impervious area covering the property and the total square footage of the property.
http://www.phila.gov/water/wu/Stormwater%20Resources/scaa_manual.pdf - page 34 of the document

http://www.phila.gov/water/wu/stormwater/Pages/NonResidentialStormwaterBilling.aspx

Stormwater Management Service Charges Transition: effective July 1, 2010, Philadelphia's Water Department is transitioning from an equivalent meter-based Service Charge to a parcel area-based Service Charge. See page 58 of the report:

Stormwater Management Service Charge CAP: The objective of the Service Charge CAP is to enable stormwater customers to mitigate the annual fiscal year increase on their monthly Service Charge due to the transition from a meter based to a parcel area-based charge.

http://www.phila.gov/water/wu/Stormwater%20Resources/scaa_manual.pdf - See page 13 of the document.

Stormwater Billing Map Viewer: This web application lets users explore parcels on an interactive map, including high resolution ortho-photography, transparent overlays of impervious surfaces, and tools to make approximate measurements of length and area.

http://www.phila.gov/water/swmap/#eyJhZ3NNYXAiOsSAem9vbcSIMCwieMSIMjcwNTI2Ny4yOTA4ODE1xJF5xJQ1MzY2MS4wMDc4NjQxMn3EkW1lYXN1cmXEiMSAY29udHJvbEFjdGl2xL06bnVsbMS1ImxlZ2VuZMS%2BIkFlcmlhbDIwMTDEiGbFoHNlxJFwdl9kYXRhLTHEiMWDdWV9fQ%3D%3D

Stormwater Credits Program: offers Non-residential and Condominium customers (with at least 500 square feet of gross area) the opportunity to reduce their total SWMS Charge. Three classes of credits are available and depending on the types of SMPs present on the property and whether the customer holds a valid industrial NPDES permit for the site, a parcel may be eligible for all three classes of credits:

1 Impervious Area Stormwater Credit (IA Credit):
2 Tree canopy cover
3 Roof leader/downspout disconnections
4 Pavement disconnections
5 Green Roofs
6 Porous Pavement

Gross Area Stormwater Credit (GA Credit) – Two options available: 1) Management of the First Inch of Runoff (Impervious Area Only) and 2) Credit Based on NRCS-CN (Open Space Only).

National Pollutant Discharge Elimination System (NPDES) Credit for industrial stormwater discharge activities - customer must demonstrate that the parcel is subject to an active NPDES Permit for industrial stormwater discharge activities.

http://www.phila.gov/water/wu/Stormwater%20Resources/scaa_manual.pdf - See page 16 of the document

Marketing:

Stormwater Management Incentives Program: offers non-residential property owners low-interest financing to stimulate investment in and utilization of stormwater best management practices which reduce a parcel's contribution of stormwater to the City's system.

http://www.phila.gov/water/wu/Stormwater%20Grant%20Resources/SMIPFactSheet.pdf

Greened Acre Retrofit Program: provides stormwater grants to contractors, companies or project aggregators who can build large-scale stormwater retrofit projects across multiple properties. Additionally, upon completion of the project, participating property owners (or customers) will be eligible for credits against their stormwater charges.

http://www.phila.gov/water/wu/Stormwater%20Grant%20Resources/GARPFactSheet.pdf

http://www.phila.gov/water/wu/Stormwater%20Grant%20Resources/GARPSeminar1.pdf

Green Roof Tax Credits: The credit is for 25% of the cost of installing the green roof, up to $100,000.

Basement Protection Program: This Program provides eligible residents with free installation of backwater valves and modifications to downspouts that help prevent sewage back up in their basements.
http://www.phillywatersheds.org/watershed_issues/flooding/basement_backup_protection

http://www.phillywatersheds.org/doc/BPP_Summary_Application_2.pdf

Stormwater Management Guidance Manual: created to assist developers in meeting the requirements of the Philadelphia Stormwater Regulations.

https://www.pwdplanreview.org/manual-info/guidance-manual

Green Guide for Property Management: A guide to help commercial property owners reduce stormwater fees through innovative green projects on their properties.

http://archive.phillywatersheds.org/doc/Green_Guide_For_Property_Management.pdf

Homeowner's Guide to Stormwater Management: guide provides actions homeowners can take to improve stormwater management on their property or in the community.
http://www.phila.gov/water/wu/Stormwater%20Resources/Homeowners_Guide_Stormwater_Management.pdf

Green Streets Design Manual: http://www.phillywatersheds.org/what_were_doing/gsdm

Free Assistance Program: The Philadelphia Water Department provides free assistance through site inspections and design recommendations for green retrofits that allow customers to obtain stormwater credits. This program minimizes the up-front costs to customers for preliminary evaluation and concept design, including evaluation of available credits.

Downers, Illinois

Fee Structure:

Residential: The stormwater fee is based on the total amount (in square footage) of impervious area on each parcel. Fees are expressed in Equivalent Runoff Units (ERU). One ERU is equal to 3,300 square feet of impervious area, which is the average for a single-family residential property in the Village. Property owners and tenants are jointly responsible for paying the bills. Utility bill payments will be applied toward the stormwater utility fee first, then to any water charges. Outstanding utility bill balances that remain unpaid for 45 days may result in the shut-off of water service. The Village may also place a lien against the property.

Stormwater Permit Fees & Securities Single-Family, Single-Lot Residential:
http://www.downers.us/public/docs/permits/SWM_Fees_Scheduling_Single_Family.pdf

Stormwater and Flood Plain Fees: http://www.downers.us/public/docs/code/UserFee.pdf - see page 13 of the document.

Marketing:

Incentive Program: a one-time reduction in the stormwater utility fee, applied to a customer's account balance. It is offered to assist property owners with the cost of materials, construction and installation of qualifying stormwater facilities.
http://www.downers.us/res/stormwater-management/stormwater-utility

Credit Program: A credit is an ongoing reduction in the amount of stormwater fees assessed to a parcel in recognition of on-site systems, facilities, or other actions taken to reduce the impact of stormwater runoff, in compliance with the Stormwater Credit and Incentive Manual.

Control Activity	Stormwater Credit
Site Run-off Rate Reduction (detention basin)	Up to 20%
Volume Reduction (retention basin, permeable pavement, cisterns, etc.)	Up to 20%
Water Quality (BMPs)	Up to 10%
Direct Discharge (outside and downstream of the Village's stormwater system)	Up to 50%
Education (the allowable education credit will be $3.00 per student taught per year)	Up to 100%
Partnership (provide land/facilities to Village to manage stormwater)	Up to 100%

http://www.downers.us/res/stormwater-management/stormwater-utility

Stormwater Improvement Cost-Share Program: offers financial assistance to residents seeking to make stormwater improvements on their private property. To qualify, the proposed improvement must mitigate existing flooding conditions such as structural flooding of a house/garage or non-structural flooding over multiple properties. Flooding conditions must be present on more than one property to receive reimbursement. Once the qualifying criteria are met, reimbursement of up to $1,500 is available for each participating property. The maximum reimbursement per project is $10,000.
http://www.downers.us/top-stories/2010/10/14/stormwater-improvement-cost-share-program

Stormwater Improvement Fund: created in 2008 to pay for projects in the *Watershed Infrastructure Improvement Plan*. The revenue sources for this Fund include *Issuance of General Obligation* (GO) bonds, a 1 /4 cent of the *Home Rule Sales Tax*, property taxes and *Detention Variance* fees collected on certain building permits.

In 2008, the first round of GO Bonds was issued in the amount of $25 million. Depending on the status of future budgets and market conditions, the Village hopes to issue additional GO Bonds in 2011 and 2014, each in the amount of $25 million, to complete all High Priority projects in the WIIP.
http://www.downers.us/govt/village-budget/watershed-infrastructure-improvement-plan-wiip

Policy:

Stormwater & Flood Plain Ordinance Update (Dec 2014): The purpose of this item is to introduce changes to the Municipal Code that would lower the threshold for providing on-site stormwater storage for new development. The substantive changes to the Ordinance include Section 26.1001, the reduction of the threshold by which new development would be required to provide on-site stormwater storage from 2,500 square feet of new impervious surface to 500 square feet of new impervious surface.
http://www.downers.us/public/docs/agendas/2014/12-02-14/ORD00-05763-SWREGS.pdf

2014 Stormwater Project Analysis: includes a new approach for prioritizing stormwater capital improvement projects that is consistent with the Village's fee-based stormwater utility. The goal of this new approach is to establish a minimum service level standard for stormwater management such that the stormwater system will safely convey and store 95% of all rainfall events.

http://www.downers.us/govt/village-budget/stormwater-project-analysis-report-2014

http://www.downers.us/public/docs/Stormwater_%20Management/Final%20Report%20only%20%286-19-2014%29.pdf

Halifax, Nova Scotia

Fee Structure: Charges are separated into two segments:

Site Related Flow Charge: Effective July 1, 2017 residential properties are billed based on the actual amount of impervious area, with properties placed in tiers.

Stormwater Right-of-Way Charge: On September 5, 2017, Regional Council approved a new billing approach for the municipality's Right of Way (ROW) Stormwater charge and set a flat annual rate for all properties receiving stormwater service from Halifax Water (both residential and commercial inside the Halifax Water stormwater boundary). Effective July 1, 2018 the annual charge is $40.

https://www.halifax.ca/home-property/halifax-water/stormwater-services

Stormwater Credit Program:

In order to qualify for the credit program, the private stormwater management system for the property must match the post-development peak flow rate with the pre-development peak flow rate for, at minimum, the 1:5-year storm event. Non-Residential Customers that demonstrate their Site Related Flows are detained on their property or an adjacent property, as part of an overall stormwater management plan, are eligible to receive a credit. Stormwater credits are renewed annually and are contingent upon maintenance of the site. Eligible credits (30-50%) are applied against stormwater bills.

https://www.halifax.ca/sites/default/files/documents/home-property/water/Non_Residential_Customer_Stormwater_Credit_Manual_%20July_1_2017.pdf

Seattle, Washington

Fee Structure:

Seattle charges a drainage fee on all properties in the City, with the exception of certain exempt properties. Drainage fees do not appear on utility bills. Seattle uses King County as its billing agent for the drainage fee.

The drainage fee is shown on King County property tax statements as *Surface Water Management* (SWM) or Drainage. The method for calculating the drainage fee depends on the size and type of property owned. Single family and duplex properties smaller than 10,000 square feet are assigned to drainage rate categories based on the size of the parcel. All properties in a given rate category pay the same flat rate. This rate is also equal to the total bill, or charge. For example, parcels between 3,000 and 4,999 square feet will be subject to an annual drainage charge of $234.87 in 2014 while parcels between 5,000 and 6,999 square feet will all be subject to an annual drainage charge of $318.92 in the same year.

All other properties, including single family/duplex properties 10,000 square feet and larger, are assigned to rate categories based on how much impervious surface is contained on the parcel. Each rate category is assigned a rate which is multiplied by the parcel area (in 1,000s of square feet) to calculate the total charge, or bill.

Low Impact Rates: apply to large residential and commercial parcels with significant amounts of highly pervious surface, such as forested land, unmanaged vegetated areas such as pasturelands and meadows and athletic fields designed with specific drainage characteristics. This highly pervious surface must cover a continuous area of at least one-half an acre, although this coverage may span more than one parcel. Low impact rates are available for the Undeveloped (0-15 percent impervious), Light (16-35 percent impervious) and Medium (36-65 percent impervious) rate categories.

https://www.seattle.gov/utilities/your-services/accounts-and-payments/rates/drainage/understanding-your-drainage-bill

Credits and Discounts:

Low Impact Rates: Discounts of 20 to 41 percent are applied to the rate for undeveloped natural areas of 0.5 acres or greater containing sufficient amounts qualifying “highly infiltrative” surface (i.e. forested areas, unmanaged grasslands, etc.). Certain athletic facilities with engineered designs that mimic the stormwater retention benefits of these large natural areas are also eligible for low impact rates.

Stormwater Facility Credit Program: program offers credits of up to 50 percent for privately-owned systems that slow down stormwater flow and/or provide water quality treatment for run-off from impervious areas, thus lessening the impact to the City’s stormwater system, creeks, lakes or Puget Sound. Stormwater systems are structures such as vaults, rain gardens, permeable pavements and filtration systems.

https://www.seattle.gov/util/cs/groups/public/@spu/@ssw/documents/webcontent/spu01_006501.pdf

Marketing:

Residential Rain Wise Program: Provides technical support, education/outreach to assist homeowners, landscapers and property managers in understanding low impact development techniques such as site design, pervious paving, vegetation retention, sustainable landscape practices, and other natural drainage solutions.

https://www.seattle.gov/util/cs/groups/public/@spu/@drainsew/documents/webcontent/01_025302.pdf

Rain Wise Rebate Program: provides rebates to private landowners (at their request and if eligible) for the installation of rain gardens and cisterns to reduce stormwater runoff from their private properties. In

target areas, qualifying properties may be eligible to receive a rebate of up to $3.50 for each square foot of runoff controlled using a rain garden and/or cistern, both forms of green infrastructure.
https://www.seattle.gov/util/cs/groups/public/@spu/@usm/documents/webcontent/02_008093.pdf

The King County 2012 Surface Water Management Rate Study: assesses changes to program requirements and funding availability under the County's surface water management fee. In particular, the study focuses on revising the existing rate adjustment ("discount") program for non-residential parcels. The intent is to offer direct incentives to landowners to encourage them to better control stormwater runoff and improve water quality on private property.
https://your.kingcounty.gov/dnrp/library/water-and-land/rate-study/swm-rate-study-9-11-12.pdf

Policy:

Green Stormwater Infrastructure Program: In July 2013, City Council unanimously passed Resolution 31549, with key components:

- Green Stormwater Infrastructure (GSI) should be relied upon to manage stormwater wherever possible.
- Target to manage 700MG annually with GSI by 2025.
- City Departments shall collaborate with Office of Sustainability & Environment (OSE) to produce Implementation Strategy for meeting new target.

Executive Order: 2013-01 Citywide Green Stormwater Infrastructure Goal & Implementation Strategy: An Executive Order directing City departments to coordinate to develop an implementation strategy for managing 700 million gallons of stormwater annually with green stormwater infrastructure approaches by 2025. To be considered Green Stormwater Infrastructure, it must provide a function in addition to stormwater management such as water reuse, providing greenspace and/or habitat in the City.
http://clerk.seattle.gov/~scripts/nph-brs.exe?s1=green+stormwater+infrastructure&s3=&s2=&s4=&Sect4=AND&l=20&Sect2=THESON&Sect3=PLURON&Sect5=CFCF1&Sect6=HITOFF&d=CFCF&p=1&u=%2F~public%2Fcfcf1.htm&r=1&f=G

Seattle Stormwater Code Ordinance: http://clerk.ci.seattle.wa.us/~scripts/nph-brs.exe?s1=&s3=&s4=123105&s2=&s5=&Sect4=AND&l=20&Sect2=THESON&Sect3=PLURON&Sect5=CBORY&Sect6=HITOFF&d=ORDF&p=1&u=%2F~public%2Fcbor1.htm&r=1&f=G

Seattle Stormwater Code: http://www.seattle.gov/dpd/codesrules/codes/stormwater/default.htm

https://www.municode.com/library/wa/seattle/codes/municipal_code?searchRequest={%22searchText%22:%22SMC%2023.66%22,%22pageNum%22:1,%22resultsPerPage%22:25,%22booleanSearch%22:false,%22stemming%22:true,%22fuzzy%22:false,%22synonym%22:false,%22contentTypes%22:%5B%22CODES%22%5D,%22productIds%22:%5B%5D}&nodeId=TIT22BUCOCO_SUBTITLE_VIIISTCO

Requirements for Green Stormwater Infrastructure to the Maximum Extent Feasible for Single-Family Residential and Parcel Based Projects: http://www.seattle.gov/dpd/codes/dr/DR2012-15.pdf

Requirements for Green Stormwater Infrastructure to the Maximum Extent Feasible for Roadway, Trail, and Sidewalk Projects: http://www.seattle.gov/dpd/codes/dr/DR2012-16.pdf

The Right-of-Way Improvement Manual: Chapter 6.4, provides information on rules specific to the use of GSI Facilities within the Right-of-way (ROW).

Other:

City of Seattle - Stormwater Low Impact Development Practices: A 10- page paper that examines Seattle's success with GSI.

https://www.seattle.gov/util/cs/groups/public/@spu/@usm/documents/webcontent/spu02_020004.pdf

Washington, DC

Fee Structure:

There are two utility charges that apply: The Impervious Surface Area Charge (IAC) and the Stormwater Fee. Both fees relate to improving the District's water quality. However, the Stormwater Fee and the DC Impervious Surface Area Water Charge address separate pollution control requirements.

IAC Charge: DC Water implemented the IAC charge in 2009 to recover the cost of the $2.6 billion federally mandated Combined Sewer Overflow Long Term Control Plan to control overflow into the waterways. This includes building large metro sized tunnels to store overflow until it can be treated at the wastewater treatment plant. The charge is based on a property's contribution of rainwater to the District's sewer system. Because charges are based on the amount of impervious area on a property, owners of large office buildings, shopping centers and parking lots will be charged more than owners of modest residential dwellings. All residential and non-residential customers are billed for CRIAC.

Residential: Includes condominium or apartment units where each unit is served by a separate line and is individually metered; multi-family structures of less than 4 units where all are served by a single service line that is master metered; and single-family dwellings. There is a six-tiered rate for residential customers. The tiers were developed in order to bill residential customers more equitably, based on the size of their properties.

Non- Residential: The fee is based on the total amount of impervious service area at a property. The total amount of impervious area is converted to ERU's and reduced to the nearest 100 sq feet.

Stormwater Fee: The federal government requires that the District controls pollution from stormwater runoff. The stormwater fee provides a dedicated funding source to pay for these pollution control efforts. This fee helps to pay for green roofs, rain gardens, tree planting, street sweeping, and other activities that help keep waterways clean. Effective May 1, 2009, the stormwater fee collected from each District of Columbia retail water and sewer customer shall be based upon the Equivalent Residential Unit (ERU). An ERU is defined as 1,000 sq ft of impervious area of real property. A program to assist Low income residents with water bills is under development. The Department of the Environment (DDOE) manages the fee program.

http://www.dcregs.dc.gov/Gateway/RuleHome.aspx?RuleID=474056

Residential: A residential customer means a single-family dwelling used for domestic purposes, a condominium or apartment unit where each unit is served by a separate service line and is individually metered and the unit is used for domestic purposes, or a multifamily structure of less than four apartment

units where all the units are served by a single service line that is master metered. Residential customers shall be assessed ERUs for the square feet of impervious surface on the property, as follows:

a) 0.6 ERUs for 100 to 600 square feet of impervious surface
b) ERU for 700 to 2,000 square feet of impervious surface
c) 2.4 ERUs for 2,100 to 3,000 square feet of impervious surface
d) ERUs for 3,100 to 7,000 square feet of impervious surface
e) 8.6 ERUs for 7,100 to 11,000 square feet of impervious surface
f) 13.5 ERUs for 11,100 square feet or more of impervious surface.

Non-Residential: All non-residential customers shall be assessed ERU(s) based upon the total amount of impervious area on each lot. This total amount of impervious area shall be converted into ERU(s), reduced to the nearest 100 square feet. Non-residential customers shall include all customers not within the residential class.

Impervious-only properties: Are properties that have not, prior to May 1, 2009, had metered water/sewer service and require the creation of new customer accounts for billing of stormwater fees. (i.e., parking lots). The DC Water and Sewer Authority, pursuant to the Water and Sewer Authority Establishment and Department of Public Works Reorganization Act of 1996, effective April 18, 1996 (D.C. Law 11-111, §§ 203(3), (11) and 216; D.C. Code §§ 34-2202.03(3), (11)), shall establish accounts for and bill these impervious-only properties for stormwater fees pursuant to its regulations in 21 DCMR Chapter 41.
http://www.dcregs.dc.gov/Gateway/RuleHome.aspx?RuleID=474056

Stormwater Fee Discount Program, 2013: The RiverSmart Rewards program provides District property owners and tenants who install systems that retain stormwater runoff, with discounts of up to 55% on its stormwater fee. Customers who are awarded RiverSmart Rewards will automatically be enrolled in the Clean Rivers Impervious Area Charge (IAC) Incentive Program, which offers a discount of up to 4% on the IAC.
http://ddoe.dc.gov/release/district-establishes-new-stormwater-fee-discount-program

RiverSmart Homes Program: Targets single family homes. Offers incentives to District of Columbia homeowners interested in reducing stormwater pollution from their properties. Homeowners receive up to $1,200 to adopt one or more of the following landscape enhancements: Shade tree planting, rain barrels, rain gardens, pervious pavers, bay scaping.
https://doee.dc.gov//service/riversmart-homes#Overview and https://doee.dc.gov/service/riversmart-homes#Rebates

RiverSmart Communities Program: Targets larger Properties (ie apartments, condominiums and businesses). There are two options available to participate in the Communities Program:

- Option 1: Rebate (open city-wide): offers rebates of up to 60% of the project cost of specific L.I.D. practices to multi-family residences such as condominiums, co-ops, apartments, small locally-owned businesses and houses of worship. This program is open city-wide.
- Option 2: Design/Build (restricted to priority watersheds). Properties in designated high-priority watersheds will be considered for fully funded L.I.D. projects.

http://ddoe.dc.gov/service/riversmart-communities

RiverSmart Rewards: property owners can earn a discount of up to 55% off the Stormwater Fee when they reduce stormwater runoff by installing green infrastructure (GI) such as green roofs, bioretention, permeable pavement, and rainwater harvesting systems. DC Water also offers a similar incentive program for its customers to earn a discount of up to 4% off the Clean Rivers Impervious Area Charge (IAC). Using one application, District residents, businesses, and property owners can apply for discounts through RiverSmart Rewards and the Clean Rivers IAC Incentive Program. Discounts are based on the stormwater retention volume achieved and are posted to DC Water bills. http://ddoe.dc.gov/riversmartrewards

RiverSmart Roof Tops Rebate: The 2014-2015 green roof rebate program will provide base funding of $10 per square foot, and up to $15 per square foot in targeted sub-watersheds. There is no cap on the size of projects eligible for the rebate. Properties of all sizes including residential, commercial and institutional are encouraged to apply. For buildings with a footprint of 2,500 square feet or less, funds are available to defray the cost of a structural assessment. Additional funding may be available for features that further advance environmental goals. http://ddoe.dc.gov/greenroofs

RiverSmart Schools Program: In addition to installing new schoolyard greenspace, the RiverSmart Schools program provides teachers with the training they need to use their conservation site with confidence to teach lessons based on the DCPS Standards. The gardens serve as a permanent outdoor learning tool that can enhance many areas of study. This year, funding is available for five schools with a minimum of $3,500 and up to $70,000 in gardening and classroom resources, plus additional technical assistance and in-kind support. http://ddoe.dc.gov/page/riversmart-schools-application

Stormwater Retention Credit Trading (SRC): The program allows land-constrained developers to meet part of their mandated stormwater retention requirements by purchasing credits from offsite projects that reduce stormwater runoff, like rain gardens, green roofs, permeable pavement and other green infrastructure practices. Credits can be sold on the open market to those who need them to meet regulatory requirements.

http://encouragecapital.com/wp-content/uploads/2016/03/DC-Stormwater-Press-Release.pdf

Large development projects must install runoff-reducing green infrastructure (GI) if they trigger the District of Columbia's stormwater management regulations. This requirement, called the Stormwater Retention Volume (SWRv), is calculated by determining the volume of stormwater runoff from the regulated site. Projects with high compliance costs may be able to reduce costs by using Stormwater Retention Credits (SRCs). Each project must meet 50% of the required SWRv on-site, but DOEE offers the flexibility to meet the remaining 50% off-site through the use SRCs.

DC's Stormwater Retention Credit Trading Program: https://doee.dc.gov/src

The Washington Retention Credit Program is also discussed in this report:
https://www.iisd.org/system/files/publications/stormwater-markets-concepts-applications.pdf - see page 21

DOEE rolled out two new elements of its SRC program (2017):

1 **Price Lock Program:** Eligible SRC generators have the option to sell SRCs to DOEE at fixed prices. SRC generators can participate without losing the option to sell to another buyer. The option to sell to

DOEE effectively constitutes a price floor in the SRC market and offers certainty about the revenue from an SRC-generating project. "We generally hear that investors want predictable investments that aren't tied to market swings," (Matthew Espie, Stormwater Program Manager at DOEE. "The main way we're providing confidence to investors is through the reserved money in the Price Lock program". https://doee.dc.gov/service/faq-src-price-lock-program

2 **Aggregator Startup Grants:** The Grant provides funds (up to $75,000) to support SRC-generating businesses as they evaluate sites for the feasibility of GI retrofits. https://doee.dc.gov/node/1283461

Environmental Impact Bond: In September 2016, DC Water issued a $25 million Environmental Impact Bond (EIB) to finance the construction of green infrastructure to manage stormwater runoff.

http://www.quantifiedventures.com/dc-water/

Marketing:

Grants for L.I.D. Rebates & Environmental Education: program of incentivizing low impact development (L.I.D.) implementation on private property in the District and to assist DDOE in providing a meaningful watershed education experiences for every student enrolled in District public schools. The total amount available for this initiative is approximately $1,310,000.00.

http://ddoe.dc.gov/release/grants-lid-rebates-environmental-education

Rain Barrel and Cistern Rebate: Homeowners can purchase and install up to two rain barrels or cisterns and receive $50 to $500 back by submitting an application, receipt, and pictures of the installed barrel. The rebate amount is dependent on volume: $1 per gallon stored.

http://ddoe.dc.gov/service/riversmart-rebates

Tree Rebate: Provides rebates to individuals who purchase and plant a tree on private property, residential or commercial. There is no maximum number of rebates per property. 40 species noted for their large canopy and environmental benefits qualify for rebates up to $100 per tree. Small and medium canopy trees are eligible for rebates up to $50 per tree, as long as the tree reaches 15' tall and wide at maturity.

http://caseytrees.org/programs/planting/rebate/

Rain Garden, Pervious Paver, and Impervious Surface Removal Rebate: The rebate is based on how many square feet of impervious area is treated with rain garden or pervious pavers/impervious surface removal. The rebate will reimburse homeowners $1.25 per impervious square foot treated. The minimum square footage that must be treated is 400 square feet (a $500 rebate). The maximum rebate is $1,000 or treating 800 square feet or more of impervious surface.

http://ddoe.dc.gov/service/riversmart-rebates

The Clean Marinas Program: is a partnership among the District Department of the Environment/Watershed Protection Division, the National Park Service/National Capital Region, and marinas in the district. It is a voluntary program through which marina operations become more environmentally responsible and marina managers educate the boating public on environmentally responsible boating practices.

Green Jobs Grant: Stormwater Retention Best Management Practice Maintenance Training Course: Funds are available for non-profit organizations or educational institutions to develop a training course for

District residents to learn the specific skills required for maintenance of stormwater retention Best Management Practices (BMPs). The amount available for the project in this RFA is approximately $150,000.
http://ddoe.dc.gov/node/831062

Grants for Demonstration of Innovative Green Practices: On-going program of incentivizing L.I.D./GI implementation District on properties and to participate, in whole or in part, in demonstrations of innovative L.I.D.-GI practices on private and public spaces. The amount available for the projects in this RFA is approximately $2,110,000.
http://ddoe.dc.gov/node/468782

Policy:

Stormwater Management Laws and Regulations: A comprehensive listing and associated links for all regulations pertaining to stormwater management.
http://dcregs.dc.gov/Gateway/ChapterHome.aspx?ChapterNumber=21-5

2013 Stormwater Management Rule and Guidebook: http://ddoe.dc.gov/swregs. The purpose is to enhance transparency and effectiveness of the stormwater plan review process for regulated and voluntary projects. The new database will also streamline participation in the Stormwater Retention Credit and RiverSmart Rewards programs, which incentivize installation of runoff-reducing Green Infrastructure.
http://ddoe.dc.gov/node/951112

Other:

Sustainable DC Omnibus Amendment Act of 2014: The components of this legislation address the challenges as prioritized in the Sustainable DC Plan including: growing jobs and the economy, improving health and wellness, ensuring equity and diversity, and **protecting the District's climate and the environment**.
https://www.adaptationclearinghouse.org/resources/sustainable-dc-omnibus-amendment-act-of-2014-washington-d-c.html

Onondaga County, Syracuse, New York

Non-Residential Stormwater Incentives – Grant Programs:

Save The Rain Green Improvement Fund (GIF): GIF grant funding offers assistance to applicants installing GI technologies as an aspect of the development, redevelopment, and/or retrofitting of certain classes of privately-owned properties (commercial, business, and not-for-profit owned properties) in specific geographical locations. Since its inception (2010), GIF has provided over $11.2 million in funding to local green infrastructure projects on private property.

2018 Program Details: http://savetherain.us/wp-content/uploads/2018/06/2018_GIFApplication_051618.pdf

Suburban Green Infrastructure Program: The purpose of the program to support the development of green infrastructure and stormwater mitigation techniques on public property within the Onondaga County sanitary sewer district but outside of the City of Syracuse. Funding is aimed at municipal entities within Onondaga County that are planning projects to reduce inflow and infiltration to the sanitary sewer

system. All eligible projects must be on municipally-owned property within the Onondaga County sewer system.

Burlington, Vermont

Fee Structure:

The stormwater fee is based on impervious area and is charged on a per unit basis. Each ISU (Impervious surface unit) is 1,000 square feet of impervious area on a property. Single family, duplex, triplex homes, as well as seasonal and mobile homes pay a flat fee based on the average amount of impervious associated with these parcel types. Other types of properties (commercial parcels and vacant lots) are assessed a fee based on the amount of impervious surface on the parcel. Non-residential properties are eligible to apply for up to 50% credit on their stormwater bill if they can document that they have implemented stormwater management practices on their property.

Stormwater Credit Manual: Fee credit program for directly assessed properties. The credit program is not yet available for those properties with a flat fee.
Multiple credits can be given to eligible properties. The total credit given to any property shall not exceed 50% of the stormwater user fee for that property, and in no event shall a property pay a stormwater user fee less than the flat fee for a detached single-family home.

Water Quantity Reduction Credits: Available to properties whose peak stormwater runoff rate is restricted and/or controlled through onsite structural control facilities such as detention and retention ponds or chambers. If a higher level of detention is provided than required by the Vermont Stormwater Manual, then additional credits may be granted. The credit will be granted for the portion of impervious area that drains to the BMP. The maximum water quantity credit is 50%. Approved water quantity reduction credits can be applied in addition to any other approved credits.

Water Quality Treatment Credits: Offered to properties that discharge a portion of the runoff to approved structural BMPs which significantly reduce pollutants in stormwater runoff. The goal for water quality practices is for the removal of 80% total suspended solids (TSS) for 90% of all Vermont storms, estimated as a 0.9 inch/24-hour event. Approved water quality credits can be applied in addition to any other approved credits. The maximum water quality credit for a property is 25% reduction in stormwater user fees for BMPs with 80% TSS removal. Credit for BMPs with lower TSS removals shall be prorated using the following formula: % Credit = 0.31 x (Estimated % TSS Removal). The credit will be granted for the portion of impervious area that drains to the BMP.

Non-Structural Practices: In some instances, the ability to strictly meet the requirements may not be possible, feasible or desired in an urban landscape. As such, the city encourages the use of alternative management practices and technologies as a way to both satisfy the requirements of this Division, to give flexibility to design and to encourage Green Infrastructure (green), Best Management Practices (BMP), Low Impact Design (L.I.D.) or other innovative practices that satisfy the requirements. Such practices include but are not limited to, green roofs, alternative detention practices, water reuse, including stormwater use, infiltration practices, including pervious and porous pavements and pavers. Application of Non-Structural Practice Credits are identical to those offered under Water Quantity Credits and Water Quality Credits.

Water Education Credit: Approval of the credit application will result in a 10% credit to the assessed stormwater fee.

http://www.burlingtonvt.gov/sites/default/files/DPW/Stormwater/Stormwater%20Credit%20Manual.pdf

Marketing:

Stormwater Friendly Driveways: A stormwater friendly driveway can reduce the amount of coverage calculated for zoning permit purposes and may allow property owners to construct additional building space elsewhere on their lot. Currently "strip driveways" provide this benefit, but soon other stormwater drive types may provide up to 50% coverage credit if proposed amendments to zoning regulations are approved in early 2014.

http://www.burlingtonvt.gov/DPW/Stormwater-Friendly-Driveways

Let it Rain: Stormwater Best Management Practice Grants: Private and public property owners are eligible for funds through this program. This includes all residents, non-profits, businesses, corporations, churches, private schools, homeowner associations, lake associations and municipal entities located within the Vermont portion of the Lake Champlain Basin. Available funds for initiatives: Downspout Disconnection - up to $20 / Rain Barrel - up to $25 / Rain Garden - up to $250 / Cistern - up to $500 / Permeable Pavers - up to $1 per sq ft / Other - dependent on practice.

http://www.burlingtonvt.gov/DPW/Get-Involved

Adopt-a-Drain Program: Encourages community awareness of stormwater management.

http://www.burlingtonvt.gov/DPW/ADOPT-A-DRAIN

Policy:

Wastewater, Stormwater and Pollution Control Ordinance – Chapter 26

The Burlington City Council adopted a revised Chapter 26, December 15, 2008. The effective date is April 1, 2009.

http://www.codepublishing.com/vt/burlington/?Burlington26/Burlington26.html

The wastewater sections of Chapter 26 will be revised to reflect the decision to pursue municipal delegation of wastewater permitting. Wastewater permits are presently administered by the state. Beginning July 1, 2007, every parcel of land came under the authority of the state's on-site wastewater & potable water supply system program. As a result, a state permit is needed for most repairs, upgrades, and new construction of on-site wastewater treatment and disposal facilities, and connections to municipal water distribution and wastewater collection systems. Delegation of the state's regulatory program means that the state would transfer administration of its wastewater systems permit program to the city if the city makes a request in writing and meets specific criteria.

http://www.burlingtonvt.gov/sites/default/files/DPW/Stormwater/Stormwater%20Taskforce%20Report.pdf –page 2.

Chapter 26 contains standards for construction site erosion control. The standards are basically split between large and small projects. Large projects include all "major impact," "subdivision," and "planned unit developments" as defined in the City's Comprehensive Development Ordinance. Small projects are all others with at least 400 square feet area of disturbed earth involved in the construction process.

Chapter 26 also contains standards for post-construction stormwater management plans. All projects that result in greater than or equal to ½ acre of clearing, grading, construction or land disturbance activity, and create greater than or equal to ½ acre of impervious surface are required to have a post-construction stormwater management plan.

Chapter 26 includes provision for City administration of wastewater permits upon delegation by the State of Vermont. Previously, all wastewater permits were issued by the State of Vermont DEC Wastewater Division. City administration of wastewater permits will allow one stop shopping for applicants upon implementation.

http://www.burlingtonvt.gov/sites/default/files/DPW/Stormwater/Stormwater%20FAQs.pdf

Burlington Comprehensive Development Ordinance: http://www.burlingtonvt.gov/PZ/CDO

Other:

Stormwater Infrastructure Mapping Update Project: Locations of all known manholes, catch basins, water valves and hydrants have been collected. A database associated with G.I.S. mapped features allows better prioritization of maintenance activities.

http://www.burlingtonvt.gov/DPW/Stormwater-Infrastructure-Mapping-Update-Project

St Paul, Minnesota

In-lieu Fee Program (2018):

The primary objective of Minnesota's In-Lieu Fee Program is to provide high quality and sustainable mitigation (replacement) to offset the loss of aquatic resource functions resulting from authorized impacts. The Program will provide high quality mitigation credit through strategic site selection based on a watershed approach that incorporates stakeholder input.

https://bwsr.state.mn.us/sites/default/files/2018-12/Wetland_Banking_In-Lieu_Fee_Program_Prospectus.pdf

The fee-in-lieu project is a research investigation that will inform the design of a shared green infrastructure district. It plans for a model in which, rather than building individual stormwater facilities onsite, property developers would pay a certain fee that would be pooled together by the city to develop district-based green infrastructure.

See Minneapolis – St Paul below for a district-level approach to SWM

http://www.govtech.com/fs/news/St-Paul-Minn-Modernizes-Stormwater-Infrastructure.html

New York City, New York

Green Infrastructure Grant Program: Applicable for private property owners in combined sewer areas of New York City. The program provides funding for green infrastructure projects that manage the first inch of rainfall, including blue roofs, rain gardens, green roofs, porous pavement and rainwater harvesting. Private property owners in combined sewer areas are eligible for the grants of up to $5 million. In order to ensure that the green infrastructure is well-maintained, grantees must sign a covenant that requires twenty years of maintenance.

Since its introduction in 2011, the Grant Program has sought to strengthen public-private partnerships and public engagement in regards to the design, construction and maintenance of green infrastructure on private property. As of 2016, the Grant Program has committed more than $13 million to 33 private property owners to build green infrastructure projects in combined sewer areas.

Green Roof Policy Bill Proposed for NYC: On January 28th, 2019 City Council held a hearing to decide on two pieces of proposed green roof legislation: whether green roofs and solar panels should be mandatory on certain New York City roofs, and, if the green roof tax abatement should be increased from $5.23 per square foot to $15 per square foot (60% of most med-large NYC green roof installations).
https://www.urbanstrong.com/nyc-green-roof-policy-bill-proposed/

Prior to March 2018: NYC offered a property tax abatement to building owners to install green roofs. The one-time abatement is based on dollar amount per sq ft and is limited to the lesser of $200,000 or the building's annual tax. The program was suspended in 2018.
https://www.urbanstrong.com/financial-incentives-solar-green-roofs-nyc/

The original **Green Roof Program**:
https://www1.nyc.gov/assets/buildings/pdf/green_roof_tax_abatement_info.pdf

Article: ***Expanding Green Roofs in New York City: Towards a Location-Specific Tax Incentive*** (a 2018 paper that examines the failure of New York's Tax abatement program and suggests a different strategy)
"In this Article, we suggest a strategy to help get around the budgetary dispute. Specifically, we propose that New York City increase the size of the tax abatement offered to property owners in targeted areas where green roofs are deemed most advantageous- perhaps those neighborhoods that are most vulnerable to the effects of stormwater runoff – while decreasing, or even eliminating, the abatement offered to properties located elsewhere. Moving towards a location-specific subsidy of this sort would allow the City to increase the impact of the tax incentive without increasing the total funding allocated to the program. Not only would the higher rate likely encourage increased utilization of the funding that has already been allocated to the program, but the roofs that are subsidized would be located in areas where they confer greater societal value."
https://www.nyuelj.org/wp-content/uploads/2018/06/Spiegel-Feld-Sherman-Green-Roofs-Draft-Final.pdf

Baltimore, Maryland

Environmental Impact Bond (EIB):

A new EIB project (2018) totaling $10 million in green infrastructure is coming to the port city of Baltimore, the Chesapeake Bay Foundation (CBF) announced in a press release. Four million dollars in funding will come from state funds and the collection of city stormwater fees. The introduction of EIBs will allow Baltimore's Department of Public Works to take a bigger bite into green infrastructure. A further six million dollars' worth of infrastructure projects will be funded through EIBs, with Kresge Foundation and other funders yet to be named acting as the private investors. CBF and its partner, impact investment advisor Quantified Ventures (QV), are helping the city to design the plan.
https://www.baltimoresun.com/maryland/baltimore-city/bs-md-bay-city-green-20180325-story.html

The Green Infrastructure Environmental Impact Bond project being conducted by CBF, with our contractor Quantified Ventures, is funded by a generous one-to-one grant from an anonymous donor that is being matched in part by The Kresge Foundation and The Abell Foundation.

http://www.cbf.org/how-we-save-the-bay/programs-initiatives/environmental-impact-bonds.html

Atlanta, Georgia

Environmental Impact Bond:

Through a creative financing opportunity won by the Department of Watershed Management (DWM), funding will support the improvement of resilience projects in Westside neighborhoods prone to flooding. Eight green infrastructure projects were proposed for funding at an estimated cost of $12.9 million.

https://www.prnewswire.com/news-releases/atlantas-department-of-watershed-management-wins-environmental-impact-bond-challenge-for-green-infrastructure-and-resilience-projects-on-the-citys-westside-300619657.html

Philadelphia, Pennsylvania

Non-residential Stormwater Regulation (Philadelphia began following updated stormwater regulations July 1, 2015):

New developments are now required to handle more water, slow stormwater more effectively, and improve pollutant reduction. New, specific requirements for water quality and water quantity are identified in a chart on the following link:

http://www.phillywatersheds.org/stormwaterregulations

Non-residential Stormwater Incentives – Expedited Review:

Two types of reviews are available:

1. **Disconnection Green Review:** (Formerly named Green Project Review) Redevelopment projects exempt from the Channel Protection and Flood Control requirements are eligible for Disconnection Green Review. Projects must disconnect 95% or more of the post-construction impervious area within the project's limits of disturbance (LOD)using DIC to comply with PCSM Requirements.
2. **Surface Green Review:** New Development and Redevelopment projects that can demonstrate that 100% of post-construction impervious area within the project's LOD is managed by DIC and/or bio infiltration/bioretention SMPs to comply with PCSM Requirements are eligible.

http://www.phillywatersheds.org/doc/Expedited%20Review%20Handout_20150706.pdf

Non-residential Impervious Area (IA) Reductions Credit: Customers on a *Non-residential* or *Condominium* parcel with at least 500 square feet of gross area are eligible to apply for credits in the following five categories: Tree Canopy Cover, Roof Leader/Downspout Disconnections, Pavement Disconnections, Green Roofs, and Porous Pavement.

- To be eligible for IA Credit, the customer must demonstrate applicable management of the first inch of runoff from impervious areas on a property via infiltration and/or detention & slow release and/or volume reduction and filtration. https://rrstormwater.com/city-philadelphia

Impervious Area Reduction Exemption: Applicants having difficulty meeting the Channel Protection and/or Flood Control requirements using only DIC and bio-infiltration/bio-retention SMPs should investigate options to achieve a 20% reduction in impervious area from predevelopment to post development conditions, which exempts projects from both requirements.

http://www.phillywatersheds.org/doc/Expedited%20Review%20Handout_20150706.pdf

Non-Residential Stormwater Incentives – Grant Programs:

Stormwater Management Incentives Program (SMIP) and the **Greened Acre Retrofit Program** (GARP) to reduce the price for qualified non-residential Philadelphia Water Customers and contractors to design and install stormwater best management practices. Competitive applications limit the request to no more than $100,000 per impervious acre managed.

The SWM Incentives Program (SMIP) - grant program providing direct financial assistance to property owners for design and construction of SMPs.

The Greened Acre Retrofit Program (GARP) provides funding to project aggregators or companies to construct stormwater retrofit projects on private property in the combined sewer area.
https://www.pidcphila.com/images/uploads/product/Stormwater_Grants_Manual.9.14.15.pdf

The Greened Acre Retrofit Program (GARP), encourages contractors or design / construction firms to compete for limited public grant funding by aggregating the lowest-cost retrofit opportunities available on private land. The availability of public dollars through GARP is intended to create a competitive green infrastructure market that can help source low-cost stormwater management, while also generating a potentially new line of business for engineering/design/construction firms. Private property owners in Philadelphia also benefit from GARP, as its funding provides a means for private property owners to reduce the impervious area on their parcels and thereby reduce their monthly stormwater management fees.

Note: the above paragraph is an excerpt from a 15-page report that examines some of the challenges with adoption of the GARP program, 2016:
https://www.nrdc.org/sites/default/files/spurring_entrepreneurship_and_innovation_in_stormwater_markets.pdf

Any property is eligible to pursue and install retrofits; however, only non-residential, condominium, and multi-family properties with more than 4 units are eligible to receive stormwater credits.
https://www.phila.gov/water/PDF/SWRetroManual.pdf

Green Roof Business Tax Credits: provides businesses a rebate for 50% of green roof costs up to $100,000.
https://www.phila.gov/services/payments-assistance-taxes/tax-credits/green-roof-tax-credit/

Green Roof Density Bonus Ordinance: This ordinance allows for increased density in properties zoned for a low-density multi-family residential and neighborhood commercial corridors if a qualifying green roof covers at least 60% of the building's roof area.
https://www.pwdplanreview.org/upload/pdf/Green_Roof_Density_Bonus_Factsheet_20160624.pdf

Stormwater Credits Explorer Map:

This tool appears easy to use & provides a generic cost estimate to install GI & the resultant decrease in stormwater charge. The drawing function is a little sticky, but the concept is excellent and provide property owners with a quick estimate of ROI for GI.

The application turns any non-residential property into a canvas where a user can sketch out ideas of up to 5 different types of "Stormwater Tools", including Green Roofs and Rain Gardens, Permeable Pavers and different types of storage basins. The tools enable users to lay out potential changes while keeping

realistic limits for that given property. As Stormwater Tools are added or removed, the application updates the monthly stormwater charge for that property. Users can rapidly get a sense of the feasibility and effectiveness of adding stormwater infrastructure systems.

https://stormwater.phila.gov/explore/

Big Green Map Captures Scale of Philly's Growing Green Infrastructure Network:

http://phl-water.maps.arcgis.com/apps/webappviewer/index.html?id=c5d43ba5291441dabbee5573a3f981d2

Community Engagement:

Soak it up Adoption Program: A community-level grant program.

Grants are available on an annual basis up to $5,000. The amount awarded is contingent on the number of sites adopted as well as the level of public engagement proposed. Program is open to Philadelphia based non-profit organizations representing a specific community. Essentially this program is about engaging citizen participation in the management of GI. Private property is ineligible.

https://www.pidcphila.com/product/soak-it-up-adoption-program

http://www.phillywatersheds.org/sites/default/files2/SIU%20Adoption_FAQ.pdf

Residential Homeowners Incentive Program: Residential property owners currently pay a flat stormwater charge and are not eligible for credits.

A **Rain Check Program** is available for residential customers. Rain Check includes a free rain barrel giveaway and installation, or a small-scale stormwater intervention for a reduced cost. A downspout planter which usually costs $800 will be installed by the Water Department for $100, or for a rain garden or permeable pavers, the Water Department will pay up to $2,000.

https://www.pwdraincheck.org/en/stormwater-tools-home

Green Infrastructure Living Laboratory (GILL): A Partnership between the Philadelphia Water Department and Drexel University's Sustainable Water Resource Engineering Lab to regularly monitor (use sensors) green infrastructure in order to utilize city storm water more efficiently.

The GILL project collects data from green infrastructure that has been constructed on private property. Philadelphia's Green City, Clean Waters program can only be successful if investments are made in both public and private property. The more information gathered about private systems — in particular, green roofs and cisterns — the better the evaluation of which projects are working and are most effective in capturing stormwater.

Through the partnership, the city can weigh in on experimental designs and offer perspective about key needs. The outcomes of experiments and monitoring are used to inform design guidance and policy… "…monitoring data collected by the GILL team from a water reuse cistern at Drexel is a great example. We will use that case study as guidance for designers at the Water Department. It also demonstrates that there is a capacity for water reuse that can meet our design requirements for stormwater management."

The data collected by GILL can serve as a constant feedback loop to the Water Department's green stormwater infrastructure design team.

http://www.govtech.com/fs/infrastructure/Real-Time-Data-Helps-Philadelphia-Improve-Green-Design.html

Prince George County, Maryland

Community-Based Public-Private Partnership (CBP3):

In 2015, PG County entered into the 30-year "Clean Water Partnership" with Corvias, which is a pay-for-performance service delivery model that delegates project selection, design, construction and O&M responsibility to the private partner. Under the agreement, the county provides Corvias with funds to retrofit 2,000 acres over a three-year project period, in which the county provides oversight, and Corvias serves as the program manager, handling procurement of subcontractors to ensure projects are executed in line with the scope, schedule and costs. After each project is completed, the Maryland Environmental Service, an independent state agency, inspects and certifies work as completed, and then monitors subsequent O&M work. In this particular case, private sector financing was not the primary driver of the partnership. Following the EPA's Community-Based PPP (CBP3) model, the private sector was engaged to meet regulatory requirements in an economically efficient manner, to bring in expertise in GI design, to transfer knowledge to public sector employees, and to provide additional local economic and community benefits. The overall effort is expected to install 46,000 GI elements – including rain gardens, permeable pavement and green roofs – by 2025. The agreement requires that Corvias meet socioeconomic targets as well, with goals for participation of country residents, and goals of 30–40 percent for subcontracting to local small, minority, veteran, disabled and women-owned businesses.

See pg. 32: https://www.preventionweb.net/files/61829_181107engagingtheprivatesectoringi.pdf

The Clean Water Partnership: The first-ever CBP3 model to address stormwater management at such a large scale. Under the terms of the 30-year agreement, the county has committed to invest $100 million during the initial three years of the partnership. The funding covers the planning, design and construction of green infrastructure to retrofit 2,000 acres of impervious surfaces. Additionally, there is an option in the partnership to retrofit an additional 2,000 acres after the initial 3-year term if the county is satisfied with the progress of private entity.

https://www.epa.gov/G3/prince-georges-county-maryland-clean-water-partnership

https://www.corvias.com/sites/default/files/Insights/Prince_Georges_County_CWP_05-2017.pdf

Prince George's County Clean Water Partnership: https://thecleanwaterpartnership.com/wp-content/uploads/2016/06/PGC-CBP3-Clean-Water-Partnership.pdf

Master Program Agreement for the Urban Stormwater Retrofit Program Public-Private Partnership between Prince George's County and Corvias:

https://thecleanwaterpartnership.com/wp-content/uploads/2017/10/CR-099-2014-Corvias-MPA-MMA-Legislative-Approval.pdf

Counter opinion on the merits of public-private partnerships for SWM:

Public-Private Partnerships for Stormwater: Are We Sacrificing Innovation and Quality for Lower Costs? (pertinent to Prince George County, Maryland)

https://www.cwp.org/public-private-partnerships-stormwater-sacrificing-innovation-quality-lower-costs

Chester, Pennsylvania

Community-based Public-Private Partnership:

In 2017, generated a **Vision** is to plan, implement and manage a 350-acre integrated Green Stormwater Infrastructure urban retrofit program with $50 million investment, including a long-term (20-30 year) operation and maintenance program. The effort will support greater greening efforts in the region, generating hundreds of jobs and significant small business growth for this historically impoverished, overly burdened, urbanized community.

https://www.corvias.com/news/new-and-exciting-community-based-public-private-partnership-cbp3-drive-economic-growth-and

http://www.chestercity.com/wp-content/uploads/2017/05/Chester_CCBP3_Announce_FactSheet_v5.pdf

Challenges and Issues with the Community-based Public-Private Partnerships System: *This system will destroy the city of Chester*

https://www.delcotimes.com/news/this-system-will-destroy-the-city-of-chester/article_cb9769b4-4f03-5da7-90a8-f0e7c7307cd8.html

The Ramsey-Washington Metro Watershed District, Minnesota

Property Tax Levy to Fund Green Infrastructure:

The Ramsey-Washington Metro Watershed District is located in the Eastern Twin Cities metropolitan area. The watershed encompasses approximately 41,600 acres and includes 18 lakes, 5 streams, and hundreds of wetlands. Land use in the watershed is generally developed, and includes industrial, commercial, and residential land.

Green Infrastructure funding has come from a special property tax on all properties within the watershed. The EFC has worked with the District to share their approach and successes with state water bankers from across the country interested in lending funds for these types of programs. Not surprisingly, the bankers were interested in how they will be paid back and were impressed with the stability and capacity of the watershed improvement tax.

http://efc.web.unc.edu/2014/10/08/bottom-financing-options-green-infrastructure-will-approach/

Approximately 95 percent of the District's funds for implementing capital projects, programs, and other operations are raised through a property tax levy. This tax is an ad valorem tax (a tax on all taxable parcels in the District, based on property value). As a guiding principle, the District intends to restrict its annual levy to a property tax rate of approximately 0.025 percent, or about $25 per $100,000 of property value. From 2006 through 2015, the District's annual levy ranged from approximately $3M to $6M. This tax rate will allow the District's levy to grow at approximately the same rate as the increase in property values.

https://www.rwmwd.org/wp-content/uploads/RWMWD-Strategic-Overview.pdf - see tab, page 26.

The District is currently focusing much of its efforts on reducing dissolved Phosphorus as well as chlorides from road salt. Reduction in imperviousness is essential in achieving these goals. Green infrastructure is being used to retrofits streets, parking lots and site drainage. The District is working on pooling funds in order to take advantage of financing opportunities. Options being investigated include an "Impervious Surface Reduction Opportunities Fund" or a "Distributed Green Infrastructure Fund." State Revolving Fund money has successfully been used for partial funding of previous District projects. Opportunities to expand this role of the Fund are being explored.

Stewardship Grants (Residential & Commercial): available to install and maintain a variety of BMP's designed to filter and reduce runoff, protect groundwater, restore native ecosystems, prevent flooding and lessen the effects of drought.

- **Installation Grants** of up to $15,000 for homeowners or $100,000 for ICI. Funding covers 50-100 percent of the project, depending on type and location.
- **Maintenance:** For new projects, they will reimburse up to 50 percent of annual maintenance costs with a maximum of $5,000 over five years.

https://www.rwmwd.org/get-involved/stewardship-grants/

St Paul, Minneapolis

Towerside District Stormwater: A New Model of Green Infrastructure

Towerside is the region's first designated innovation district. This 370-acre area is envisioned as a high-intensity, high density mixes of places and spaces where working, living and innovation come together. A coalition of public, private and non-profit partners is working to establish Towerside as a replicable model for sustainable urban redevelopment. Key to this model is the use of district-wide systems for stormwater management, energy, parking, parks and other amenities.

This "first-of-its-kind district stormwater system" is the result of a voluntary agreement between four private developers (owning adjacent properties) to manage stormwater runoff jointly rather than separately. This shared "district" approach to stormwater management will save the property owners money while creating more effective, cost-efficient and eco-friendly stormwater treatments. The MWMO facilitated the agreement between the landowners and is providing $1.3 million to supplement the owners' investment in stormwater infrastructure. The district system design integrates infrastructure to facilitate sustainability and resilience for the community while adding new public amenities like green space. The stormwater system is also a component of the larger redevelopment of Fourth Street, which is known as "Green Fourth."

The result of this effort is the Towerside District Stormwater System, which comprises a pair of biofiltration basins connected to a 206,575-gallon underground storage tank. Together, these features capture, treat and hold stormwater runoff from an approximately 8-acre area so that the water can be reused.

https://www.mwmo.org/management/planning/towerside-district-stormwater-management/

https://www.mwmo.org/projects/towerside-district-stormwater-system/

Montgomery County, Maryland

Residential/Commercial Rebate Program for Stormwater Control:

RainScapes Program for residential, commercial and institutional property owners who implement efforts to help control stormwater runoff. The maximum per property rebate has been increased to $7,500 per residential property, and $20,000 for properties owned by commercial entities, institutions, homeowner associations or non-profit organizations. Once a RainScapes project is installed, residents can apply for a reduction to their property tax bill in the form of a credit for maintaining their project.

Since the launch of the RainScapes Rewards Rebate Program 11 years ago, 987 rebates have been distributed totaling $511,481.63.

Types of projects (i.e., green roof, permeable pavers etc.) can be found here along with rebate amounts for each project type.

https://www.montgomerycountymd.gov/water/Resources/Files/rainscapes/Rebate-Table.pdf

The program: https://www.montgomerycountymd.gov/water/rainscapes/rebates.html

Shepherd Creek Watershed, Cincinnati, Ohio

Using Economic Incentives to Manage Stormwater Runoff in the Shepherd Creek Watershed: A study of reverse auctions by the US EPA

https://nepis.epa.gov/Exe/ZyNET.exe/P1002Q4G.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C06thru10%5CTxt%5C00000006%5CP1002Q4G.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

Reverse Auction: A reverse auction modifies the application and approval process by soliciting offers from proponents. The latter enters a bid that describes the L.I.D. technology that they wish to implement as well as the amount of financial compensation required. The administering agency selects approved projects based on both the efficacy of measures proposed and the extent of financial assistance requested. This system could achieve greater SW control for the same budget if requests come in below what would be administered under prescribed compensation programs.

APPENDIX 2
PRIMARY RESEARCH GUIDANCE
System-wide SWM Implementation Blueprint

Purpose

Primary research via key informant interviews with relevant staff in the N6 Partnership municipalities and York Region to explore the opportunities and constraints to the implementation of System-wide SWM in the East Holland sub-watershed.

Context – Potential options and approaches

Extensive secondary research into intermunicipal collaboration for system-based stormwater planning and management and the use of incentives (monetary and non-monetary) by municipalities to drive uptake of Stormwater Control Measures (SCMs), by commercial property owners was recently completed. A detailed literature review and on-line research was undertaken to identify best practices for both intermunicipal collaboration and private property uptake of sustainable practices (e.g., green infrastructure, alternative energy, biodiversity, carbon neutrality, etc.). Options and approaches covering governance and administration; operations; planning; finance and economics; and policy and legal considerations were identified via secondary research. A preliminary screening of the options and approaches based on applicability and viability for System-wide SWM in the East Holland was completed. From the research and preliminary screening, information gaps and/or critical questions vis-?-vis intermunicipal collaboration for stormwater planning, financing and management and incentivizing commercial landowner hosting of SCMs were identified. Municipal staff interview will provide the necessary municipal perspective and context, identify constraints and opportunities and potential management strategies, and screen for viable options for implementation of System-wide SWM.

Guiding Questions

Guiding questions specific to municipal staff roles and responsibilities have been developed and are provided in this appendix.

Interview Guidance

Interview times: 30 to 40 minutes – CAOs, Planning, Legal, Policy, Economic Development

60 to 90 minutes – Environmental Services/Works, Operations, and Finance

The following information will be communicated to all key informants before the start of the interviews: *All responses will be kept completely confidential and no quotes or information will be credited unless otherwise requested by the interviewee. Only publicly available information will be directly cited/credited to the municipality.*

Guiding Questions – Environmental / Engineering Services

Department or Area: Environmental / Engineering Services (SWM)

1) How are the following functions for SWM broken out by departments or divisions?
   a) Operations (maintaining, cleaning, monitoring, etc.).
   b) Capital works (new, and major repairs or replacements).

2) What is the approximate percentage of your primary SW system comprising, by length? (Do you have available information your SWM assets?)
   a) Separated sewers.
   b) Open channels/ditches (not stream channels).

3) What design standards do you use for SW investments (new, repairs, replacements)?

4) Have Conservation Authority standards been incorporated into your municipalities SWM standards?

5) Are you considering your SWM standards in response to climate change?

6) In your opinion, what are the most significant stormwater challenges/issues for your municipality?

7) How are SWM infrastructure projects identified or prioritized?

8) Are there any current/planned SWM projects being undertaken jointly with neighbour municipalities?

9) Do you twin capital/O&M projects?

10) Does your municipality have any stormwater related data sharing/monitoring arrangements with area municipalities or the Conservation Authority? Please describe.

PRIVATE PROPERTY

11) Does the municipality have any stormwater control measures on private property or support any measures on private property? If yes, what arrangement is in place to for their management.

Our study found that some private commercial properties and institutional properties (e.g., schools) in the East Holland River watershed were optimal locations for stormwater control measures (versus municipal land locations). Other jurisdictions have determined the same and as a result, some leading jurisdictions utilize municipal offsets and other sources of funding or financing to provide monetary incentives (e.g., grant, fee-for-service, etc.) to private landowners to implement SCMs on their property. Requirements for the construction, O&M and asset management of these measures are put in place and the SCMs are deeded on property.

12) What is your view of incentivizing private landowners to install green infrastructure and other stormwater control measures on their properties?

13) Is Green Infrastructure/Low Impact Development part of your municipality's SWM plan/program (current/planned)?

Our study showed cost savings of about 30% by moving to a watershed-wide approach to planning and siting new SCMS at optimal locations in the watershed as opposed to the current practice of individual municipalities siting infrastructure exclusively within their boundaries. We are examining the potential of

the N6 to collaborate on planning and management of SW which would include the siting new SCMs in other municipalities.

14) What is your view on the concept of intermunicipal collaboration amongst the N6 for stormwater planning and management and what do you think are the implications (positive & negative) of a collaborative municipal approach to SWM?

15) What do you think about investing a portion of your municipal SWM dollars in infrastructure located in another municipality in the watershed?

SW ASSET MANAGEMENT PLAN

16) What are the implications of the findings from the SW asset management planning work?

17) What, if any, is the planned action or response to the findings from the SW asset management planning work?

REPORT

18) Anything you want to see in the report?

19) Do you have any other comments or ideas you would like to add?

Guiding Questions – Financial Services

Department or Area: Finance / Financial Services

1) We understand that the Municipalities Strategic Plan informs the budgeting and financing priorities, but in your view, where do stormwater infrastructure and addressing the stormwater deficit fit in terms of priorities?

2) Are Climate Change adaptation and resiliency influencing budgeting or investment decisions? If yes, please briefly explain how?

3) How are the following SW expenses financed?
   a) SWM operating costs (e.g., general levy, SW fees, water and wastewater fee revenues, grants, etc.)
   b) Capital – new or expansions (development charges reserve funds, other reserves/reserve funds, new debt, grants, etc.)
   c) Capital – repairs and replacements (current revenues (fee rev, general levy, debt, reserves/reserve funds, grants, etc.)

4) Is Green Infrastructure or Low Impact Development treated as a capital project or an operational expense? (What is the threshold over which a project is capitalized?)

5) Are Green Infrastructure/Low Impact Development investments readily identified and summarized in accounting records so they can be analysed separately?

6) Are costs associated with stormwater surcharging (basement flooding) and preventative measures assigned to the stormwater budget? Capital or Operating?

7) How significant have federal or provincial grants been for SWM capital / O&M financing; e.g. Canada Community-Building Fund (gas tax fund), Ontario Community Infrastructure Fund, Canada Strategic Infrastructure Fund, or others?

8) Are senior government grants considered in setting SWM budgets?

9) Who is responsible for preparation of grant funding applications? Admin issues?

CAPITAL PLANNING, FISCAL STRATEGY AND ASSET MANAGEMENT PLANNING

10) Are there any changes or updates to:
   - The 2021 Fiscal Strategy?
   - The Asset Management Plan

11) What is the progress and how long will it take to implement this new fiscal strategy policy for capital planning?

DEBT MANAGEMENT

12) Given the debt management strategic objectives, would debt financing be used for stormwater infrastructure or other stormwater management initiatives?

13) Is there a debt ceiling other than that imposed by the Annual Repayment Limit?

14) When do you use reserves versus debt for capital projects?

GUIDING QUESTIONS

15) Is capital planning keeping up with expected growth? Examples from York Region on-line community profiles in 2021:

- East Gwillimbury

  Sharon's population is approximately 3,000 residents, but expected to reach 10,000;

  i. Holland Landing – River Drive Park Community is currently home to roughly 9,000 residents, but its population is expected to more than double in the coming years;
  ii. Mount Albert is home to about 4,200 residents – a number that is expected to grow to approximately 6,000;
  iii. Queensville is still relatively small, but will see massive expansion, eventually reaching 30,000 people;
  iv. In Green Lane Corridor New, new neighbourhoods will be added, pushing the corridor's population to at least 24,000.

- King is still sparsely populated, with only 24,000 residents and projected growth to 34,900 by 2031.

- Approximately 33% of all of Whitchurch-Stouffville's businesses and employment reside in "The Corridors" area of Stouffville includes Highway 404, Woodbine Avenue and Stouffville Road. Employment and business growth is consistently 3-5% a year.

N6 / SHARED CAPITAL PROJECTS

16) What is your perspective on shared capital works or infrastructure between the N6 municipalities?

17) How are shared capital expenditures allocated between the municipalities?

18) How are shared operational expenditures allocated across the municipalities?

19) For shared projects, how is planning and budgeting managed?

20) Our study showed cost savings of about 30% by siting new SCMs at optimal locations in the watershed versus on an individual municipality basis– What do you think about investing a portion of your municipal SWM dollars in infrastructure located in another municipality in the watershed?

SWM CHARGE/FEE STRUCTURE

21) Full-cost recovery is used to set fee, but does the current SW fee pay for new infrastructure, repairs, replacement, etc.?

22) Is there any consideration of a stormwater fee based on the impervious area, in other words, the amount of stormwater a given property generates?

23) What is your opinion about a P3 arrangement for SWM?

PRIVATE PROPERTY

Our study found that some private commercial properties in the East Holland River watershed were optimal (best performance at lowest cost) sites for stormwater control measures (vs., municipal land locations). Other jurisdictions have determined the same and as a result, some leading jurisdictions provide monetary incentives (e.g., grant, fee-for-service, etc.) to private landowners to implement SCMs on their property.

GUIDING QUESTIONS

24) What do you think about this practice?

ECONOMIC DEVELOPMENT

25) What is normally considered in the business case for municipal investments? (Is local economic stimulus or development considered in your investment decisions?)

ASSET MANAGEMENT

26) What are the implications of the findings from the SW asset management planning work?

27) What, if any, is the planned action/response to the findings from the SW asset management planning work?

OTHER

28) Some jurisdictions use a third-party administrator (community-based P3) to deliver elements (e.g., private property incentive) of their SW program; what do you think about this approach?

29) Do you have any other comments or ideas?

Guiding Questions – Management (Office of the CAO)

Department or Area: Office of the CAO

1) In your opinion, what are the most pressing issues facing your municipality?

2) On a scale of 1 to 10, where 1 is low and 10 is high, how important is SWM relative to other municipal responsibilities for you or your municipality (where 1 is low importance and 10 is very high importance)?

   a) Please briefly explain why you gave this rating?

We reviewed the (insert applicable strategic and business plans and current budget) and identified four areas of focus that we would like to discuss:

- economic growth (in terms of attracting business development)
- key financial strategies and financial planning
- sustainability and asset management planning
- direct connection with Lake Simcoe (and the waterfront strategy)

3) How, if at all, does planning stormwater management and green infrastructure in particular, fit into the overall strategy?

4) How significant is building community resiliency to the impacts of more frequent and severe weather due to climate change on the radar for strategic planning going forward? Why or why not?

SW ASSET MANAGEMENT PLAN

5) What is your perspective on the state of SWM assets and the implications for management of those assets going forward?

6) What is the collective view – senior management and Council – of the future direction for planning and managing stormwater given potential resourcing constraints?

CLIMATE CHANGE & RISK MANAGEMENT

7) Are the potential risks and liabilities associated with potential future flooding and/or the need to plan and build for resiliency strategic considerations for your municipality and if yes, how?

   a) For your Council

INTERMUNICIPAL COLLABORATION & THE N6 PARTNERSHIP

The study determined that by taking a watershed-wide approach, unencumbered by political boundaries, to siting stormwater infrastructure provided optimal performance at the greatest level of cost efficiency. This may include siting SW infrastructure that would benefit your municipality in a neighbouring or upstream municipality.

8) How significant is the N6 partnership to the longer-term financial sustainability of municipal services?

9) What is your perspective on intermunicipal collaboration for planning, building and managing SW infrastructure, in whole or in part, in the East Holland River watershed?

GUIDING QUESTIONS

10) What is your perspective on financially supporting SW infrastructure located in another municipality?

11) If the N6 were to jointly delivery on some aspects of SWM, what type of agreement between the municipalities would be required?

PRIVATE PROPERTY

Our study found that some private commercial properties and institutional properties in the East Holland River watershed were optimal (best performance at lowest cost) sites for locating Stormwater Control Measures. Other jurisdictions have determined the same and as a result, some leading jurisdictions and using infrastructure offsets (savings) and other sources of funding/finance to provide monetary incentives (e.g., grant, fee-for-service, etc.) to private landowners to implement SCMs on their property. These measures are placed on title on the commercial & institutional properties, there are contractual agreements requiring the owner maintain the facility and submit annal 3rd party reports on the maintenance and function of the facility.

12) What do you think about incentivising commercial property owners and institutions to implement green infrastructure or other SWM practices on their property as part of an overall stormwater management plan?

13) What do you think would be the primary barriers to your municipality supporting SCMs on private property?

FINANCING AND FUNDING

14) What is your perspective on the N6 municipalities, in whole or in part, pooling a portion of their capital budget for SW to leverage federal and provincial funding for watershed-scale SWM?

OTHER

15) We will be putting together an implementation plan over the coming months, is the anything you would like to see in the report or that you think we should address?

16) Any other comments or questions?

Guiding Questions – Operations

Department or Area: Operations

1) In your opinion, what, if any, are the most significant stormwater challenges/issues in your municipality?

OPERATIONS & MAINTENANCE

2) To help us understand the operations side, please take us through the plan of approach for maintaining municipal SW infrastructure.

3) Is there an inspection or monitoring procedure/process for SWM infrastructure and if yes, what is the approach? What are the maintenance triggers?

4) How are SWM maintenance/up-keep activities prioritized?

5) What are the major maintenance/up-keep challenges for stormwater infrastructure including GI?

6) What aspects of maintaining stormwater infrastructure place the greatest demand on resources (dollars/personnel) and why?

7) We understand there has been some limited Green Infrastructure installed on some town right-of-ways as well as some developers put in GI, has it been necessary to update the standard operating procedures to address maintenance specific to GI? If yes, how?

8) Have you needed to modify your operations and maintenance practices to deal with GI/L.I.D.? If yes, how?

9) Is there sufficient budget and human resources to deliver on the maintenance and upkeep of the SWM system over the longer-term (10-years+)?

INTERMUNICIPAL COLLABORATON

10) What do you think about collaborating/sharing in the operations and maintenance of stormwater infrastructure with neighbouring municipalities (e.g., N6)?

11) What do you think about collaborating/sharing in the operations and maintenance of stormwater infrastructure with the Conservation Authority?

TWINNING

12) Considering longer-term capital planning, do you see a role for GI/L.I.D.? If yes, why and how will it be included in longer term planning for SWM?

PRIVATE PROPERTY

13) Does your municipality have or support any stormwater control measures on private property? If yes, what arrangement is in place for their on-going maintenance/management?

GUIDING QUESTIONS

Our study found that some private commercial properties and institutional properties (e.g., schools) in the East Holland River watershed were optimal locations for stormwater control measures (versus municipal land locations). Other jurisdictions have determined the same and as a result, some leading jurisdictions utilize municipal offsets and other sources of funding/financing to provide monetary incentives (e.g., grant, fee-for-service, etc.) to private landowners to implement SCMs on their property. Requirements for the construction, O&M and asset management of these measures are put in place and the SCMs are deeded on property.

14) From both an O&M perspective, what is your opinion about incentivizing private commercial landowners to implement stormwater control measures including GI on their property?

15) Our study showed cost savings of about 30% by moving to a watershed-wide approach to planning and siting new SCMS at optimal locations in the watershed, including private commercial properties, as opposed to the current practice of individual municipalities siting infrastructure exclusively within their boundaries. These savings do not include potential savings through sharing of resources between the N6 municipalities. We are examining the potential of the N6 to collaborate on planning and management of stormwater which would include the siting new SCMs in other municipalities.

16) What do you think about the N6 collaborating on stormwater operations and maintenance across the watershed?

17) What do you think about investing a portion of your municipality's SW dollars in infrastructure located in another municipality in the watershed?

DEVELOPMENT & CLIMATE CHANGE

18) Has there been any impact on maintenance and repair of SWM infrastructure due to development and/or changes in weather (i.e., larger rainfall events) due to climate change?

19) Are or will potential future impacts of climate change be considered in planning for O&M and if yes, how?

OTHER

20) Anything that you would like included or addressed in the report?

21) Anything else to add?

Guiding Questions – Planning and Development

Department or Area: Planning and Development Services

1) How does your department address or incorporate stormwater infrastructure planning in larger growth and development planning?

2) How have the Conservation Authority's model by-law and stormwater management guideline changed the municipalities approach to planning and approvals?

3) Is climate change and/or green infrastructure a consideration in development planning and if yes, how?

4) In your opinion, what are the barriers or impediments to the municipality implementing green infrastructure/Low Impact Development?

5) Some municipalities in York Region have green building standards (e.g., Vaughan) or are considering them, what is your view of incorporating such standards in your municipality?

6) Do you see a value or benefit in having a universal green building standard across York Region or amongst neighbouring municipalities? Why/why not?

PRIVATE PROPERTY

7) For stormwater control measures (e.g., oil-grit separator, infiltration trench, etc.), are there requirements for maintenance/monitoring?

Our study found that some private commercial properties and institutional properties (e.g., schools) in the East Holland River watershed were optimal locations for stormwater control measures (versus municipal land locations). Other jurisdictions have determined the same and as a result, some leading jurisdictions utilize municipal offsets and other sources of funding/financing to provide monetary incentives (e.g., grant, fee-for-service, etc.) to private landowners to implement SCMs on their property. Requirements for the construction, O&M and asset management of these measures are put in place and the SCMs are deeded on property.

8) What is your view of the private commercial and institutional property hosting of stormwater control measures?

Our study showed cost savings of about 30% by moving to a watershed-wide approach to planning and siting new SCMs at optimal locations in the watershed as opposed to the current practice of individual municipalities siting infrastructure exclusively within their boundaries. We are examining the potential of the N6 to collaborate on planning and management of stormwater which would include the siting new SCMs in other municipalities.

9) What is your view on the concept of intermunicipal collaboration amongst the N6 for stormwater planning and management?

10) What do you think would be implications (negative and/or positive) of intermunicipal collaboration to plan stormwater infrastructure watershed-wide amongst some or all of the N6 municipalities?

GUIDING QUESTIONS

11) What do you think about investing a portion of your municipal SWM dollars in infrastructure located in another municipality in the watershed?

REPORT

12) We will be putting together an implementation plan over the coming months, is the anything you would like to see in the report or that you think we should address?

13) Any other comments or questions?

Guiding Questions – N6 Municipalities & York Region

Department or Area: Economic Development

1) What are the top or priority economic development objectives for your municipality?

2) What are the key value propositions your municipality is promoting? (Rationale, sectors of focus)

3) Do you have economic development or growth targets and if so, can you share them?

4) What do you think are the primary obstacles or challenges to meeting your economic development objectives/targets?

5) Are their any economic development initiatives or programmes that your municipality undertakes in partnership with other municipalities? If yes, please describe how the arrangement works. If no, any particular reason(s)?

Our study found that some private commercial properties in the East Holland River watershed were optimal (best performance at lowest cost) sites for Green Infrastructure and other stormwater control measures. Other leading jurisdictions, such as Philadelphia, Seattle and municipalities in Chesapeake Bay have determined the same and provide monetary incentives (e.g., grant, fee-for-service, etc.) to commercial landowners to implement GI on their property. The most recent (2021) economic analysis of Philadelphia's green infrastructure incentive program determined it had a 1.5 times ROI, growth in GI-related industries was 9.2% from 2011 to 2019 as compared with 6.3% statewide during the same period as well, the increase in GI related jobs over the that time was 13.3%.

6) What is your view of incentivizing green infrastructure on private commercial property as a value proposition?

7) If incentivizing of GI on private commercial property was to implemented, what do you think could be the economic development advantages and how could the municipality capitalize on them?

8) Potential downsides or disadvantages?

The next steps are to complete an implementation plan and undertake a pilot study with the goal of scaling up to full implementation. A key element of this approach to stormwater management is it moves from an individual municipal-basis to watershed-wide with the northern six municipalities and Conservation Authority collaborating on the planning and management of stormwater.

9) What is your opinion on a collaborative or shared approach amongst the N6 municipalities to deliver an economic development strategy for the relevant sectors (e.g., engineering, GI-related industries, hydrology, G.I.S., construction, landscape architecture, landscaping, etc.)

10) What do you think are the advantages and disadvantages of a collaborative approach to by the N6 municipalities?

11) We will be putting together an implementation plan over the coming months, is the anything you would like to see in the report or that you think we should address?

12) Any other comments or questions?

Guiding Questions – N6 Municipalities & York Region

Department or Area: Environmental Services / Climate Change

1) If a Consolidated Linear ECA is being considered or has been undertaken by the municipality, what was the rationale for completing a system-wide ECA at this time?

2) With the work completed on your municipality's Asset Management Plan, what in your opinion were the most important findings or issues identified?

3) From any ECA-related work that has been undertaken, could you provide an approximate percentage breakdown of your primary SW system comprising, by length?
   a) separated sewers.
   b) open channels/ditches (not stream channels).

4) With respect to design standards for green and grey SWM infrastructure, what criteria are considered when evaluating designs/incorporating design standards?

5) Are you adjusting these standards in response to climate change? If yes, how? If no, why not?

6) In your opinion, what are the most significant stormwater challenges/issues for your municipality?

7) Does your municipality have a service agreement with the Conservation Authority for any aspect of your SWM program/infrastructure? If yes:
   a) What was the rationale or motivation for securing the agreement with the Conservation Authority?
   b) What is the basic framework/structure of the agreement and timeframe?
   c) What works well with the agreement?
   d) What does not work as well or could be improved upon?

JOINT INTIATIVES

8) In your opinion, what are the benefits or constraints to undertaking joint initiatives with the N6 municipalities and/or the Region?

9) Does your municipality twin SWM projects with other capital or O&M undertakings? If yes, please briefly describe the process followed to identify and twin capital/O&M projects?

10) Currently there are no SWM-related data sharing agreements with the N6 municipalities or the Region and data sharing with the Conservation Authority is on an ad hoc-basis.
   a) Do you think there would be any advantage to the municipalities or the Conservation Authority sharing data and if yes, what would be the advantages or benefits?
   b) What do you think are potential challenges or barriers?
   c) Do you think establishing standardized data collection and formatting for common use amongst municipalities would be of value? If yes, why, if no, why not?

11) In developing the 10-year capital plan to present to the new Council, in your opinion, what do you think are the key areas or issues to be addressed by the capital plan?

GUIDING QUESTIONS

12) What is your opinion with regard to the SW credit as a motivator for private property investment in on-site L.I.D. or other SCMs?

13) In your opinion, how important is private property uptake of L.I.D. or other SCMs in managing stormwater and the longer-term impacts of climate change? Why?

14) What do you think might be the best approach to strategy to secure private property uptake of L.I.D. or other SCMs?

15) What do you think are the most significant barriers or challenges associated with L.I.D.s or other SCMs on private property?

REPORT

16) Anything you want to see in the report?

17) Do you have any other comments or ideas you would like to add?

Guiding Questions – N6 Municipalities & York Region

Department or Area: Legal Services

N6 PARTNERSHIP

1) What, if any, are the legal considerations or implications of the N6 municipalities undertaking shared or joint capital projects such as the fire station?

Our study found that cost savings of about 30% could be realized if the N6 municipalities collaborated on SWM at a watershed scale (East Holland River) versus the current practice of managing stormwater on an individual municipal-basis.

2) What, if any, are the legal consideration or implications of the N6 sharing in the planning, design, construction, operation and asset management of stormwater infrastructure?

PRIVATE PROPERTY

Our study found that some private commercial properties in the East Holland River watershed were optimal (best performance at lowest cost) sites SCMs. Other jurisdictions have determined the same and as a result, some leading jurisdictions provide monetary incentives (e.g., grant, fee-for-service, etc.) to private landowners to implement SCMs on their property. Reductions in the stormwater fees are also provided to cover the costs of maintenance and upkeep of SCMs. These projects are on placed on title, have strict requirements for maintenance, monitoring and reporting, the municipality has the right to inspect at anytime and there are financial penalties for failure to comply.

3) What, if any, are the legal considerations or implications of incentivizing SCMs on private commercial property?
   - Placing SCM on title?
   - Requirements for maintenance, monitoring and 3rd-party reporting of such?
   - Applying financial penalties for non-compliance?

A growing trend amongst the leading jurisdictions is twinning public GI/L.I.D. projects in the municipal right-of-way with incentives to adjacent private property owners (typically commercial properties) to implement GI/L.I.D. on the privately held setback (first few metres) of the property. These jurisdictions are covering the capital costs and often designing and constructing (usually contracted) both the GI/L.I.D. on the right-of-way and the private property setback to increase the effectiveness of the installation. Again, a reduction in annual stormwater fees is provided to the property owner and arrangements are made for either the property owner or the municipality to maintain the setback portion of the GI/L.I.D. installation.

4) What if any would be the legal considerations:
   - The municipality undertaking/contracting to undertake works on private property?
   - Marrying the public right-of-way infrastructure with the private property infrastructure? (Similar to water/wastewater?)
   - The municipality taking on the maintenance portion of the setback area versus the property owner having the responsibility?

GUIDING QUESTIONS

RISK MITIGATION AND LIABILITY

5) In older areas of the municipality where there is insufficient stormwater infrastructure as it was not a consideration at the time of development. In addition, some older developed areas may be located in flood plains. In both cases, the properties located in these areas are susceptible/prone to flooding. Given the increasing frequency and severity of precipitation events due to climate change and the increasing development upstream (expanding the impervious surfaces and thereby increasing run-off and downstream flooding), on a scale of 1 to 10, with 1 being low and 10 being high, how significant a concern or issue is the potential liability to the Town?

6) Please explain why you gave this rating.

Currently, there is a $1 billion class action suit brought by residents of Oakville against the municipality, as well as the Region of Peel and the local municipalities upstream of Oakville for the expansion of the floodplain over a large area of single-family residences. As a result, their home values have gone down, they are restricted in making changes to their properties (e.g., cannot add a pool), and face increased likelihood of flooding. The lawsuit identifies development in upstream municipalities as a major contributor to the expansion of the floodplain downstream in Oakville.

7) Is downstream risk mitigation a consideration in development planning (i.e., is the potential downstream impact of development in your municipality and the associated liability a consideration in development or infrastructure planning)? Why/why not? Implications?

8) Is mitigation of risks associated with increased extreme weather due to climate change a consideration for your municipality? If 'yes', how. If 'no', why not?

9) We will be putting together an implementation plan over the coming months, is the anything you would like to see in the report or that you think we should address?

10) Any other comments or questions?

Guiding Questions – Climate Change (Engineering and Capital Delivery)

Department or Area: Engineering and Capital Delivery (Climate Change)

1) A system-wide ECA was recently completed. What was the rationale for completing a system-wide ECA at this time?

2) With the completion of the ECA and the Asset Management Plan, what in your opinion were the most important findings or issues identified?

3) From the ECA work that was undertaken, could you provide an approximate percentage breakdown of your primary SW system comprising, by length?
   a) separated sewers.
   b) open channels/ditches (not stream channels).

4) Does Newmarket planned and developed a secondary SW system to manage flows that exceed the capacity of the primary system?

5) We understand that a mix of design standards are used by your dept for SW infrastructure/L.I.D. (e.g., I&I from York Region, L.I.D. design standards from the Conservation Authority and City of Toronto), what criteria or issues are considered in when evaluating/incorporating design standards?

6) How are you adjusting these standards in response to climate change?

7) In your opinion, what are the most significant stormwater challenges/issues for your municipality?

8) With regard to the service agreement Newmarket has with the Conservation Authority to help with SW ponds:
   a) What was the rationale or motivation for Newmarket securing the agreement with the Conservation Authority?
   b) What is the basic framework/structure of the agreement and timeframe?
   c) What works well with the agreement?
   d) What does not work as well or could be improved upon?

9) With regard to the service agreement Newmarket has with the Conservation Authority for performance monitoring and assessment for Ray Twinney and Forest Glen:
   a) What was the rationale or motivation for the agreement with the Conservation Authority?
   b) What is the basic framework/structure of the agreement and timeframe?
   c) What works well with the agreement?
   d) What does not work well or could be improved upon?

10) With the SWM pond that is located in East Gwillimbury but receives storm flows from Newmarket, it's understood that there is an interest in working together with EG to change the pond over to a wetland and to jointly maintain it.
   a) In your opinion, what are the benefits of jointly undertaking this initiative?
   b) In your opinion, what are the potential constraints or challenges?

11) Please briefly describe the process followed to identify and twin capital/O&M projects?

12) We understand there are no SWM-related data sharing agreements with the N6 municipalities.

a) Do you think there would be any advantage to the municipalities sharing data and if yes, what would be the advantages or benefits?
b) What do you think are potential challenges or barriers?

13) In developing the 10-year capital plan to present to the new Council, in your opinion, what do you think are the key areas or issues to be addressed by the capital plan?

14) What is your opinion with regard to the SW credit as a motivator for private property investment in on-site L.I.D. or other SCMs?

15) In your opinion, how important is private property uptake of L.I.D. or other SCMs in managing stormwater and the longer-term impacts of climate change? Why?

16) What do you think might be the best approach to strategy to secure private property uptake of L.I.D. or other SCMs?

17) What do you think are the most significant barriers or challenges associated with L.I.D.s or other SCMs on private property?

18) Anything you want to see in the report?

19) Do you have any other comments or ideas you would like to add?

APPENDIX 3
DATA AND CALCULATIONS
System-wide SWM Implementation Blueprint

Cost Allocation Metric

Metric	Rationale	Source/Method
Total watershed area & Urban area	Area is assumed to correlate with causation since storm water runoff processes are land based. The urban area is likely to be more closely correlated with storm water runoff processes considered in this study which are primarily urban in nature.	1. Manual measurement by grid method (5 mm grid at a scale of approximately 1:150,000) 2. Measurement using *SketchAndCalc* software, which uses Gauss's area formula for the calculation (also called surveyor's formula).
Developed area	All areas developed for human use other than agricultural and natural areas. Estimated as total watershed area minus areas of intensive and non-intensive agriculture and natural heritage features.	Areas determined by summation of area estimates by type of land use provided by Conservation Authority staff.[1] The estimate for King Township only considered the impervious area of rural estate-residential and subdivision developments since the East Holland portion of King Twp is quite small and does not exhibit other uses such as industrial or commercial.
Impervious area	The total impervious area within developed areas, estimated as the area of buildings and pavement.	
Total population[2]	Urban and rural population within watershed boundaries	Most population estimates were based on reported populations (2021 census) apportioned to watershed areas by area pro-rating. Rural and urban populations were analyzed separately in the apportionment. In cases where an urban area was completely outside of a watershed area, for example, Stouffville or King City, their populations were excluded from the analysis. Populations of rural estate-residential and subdivision developments were estimated by counting houses in each development and multiplying by average persons per household for the jurisdiction.
Urban population[2]	Urban population within watershed boundaries including residents of estate-residential and subdivision developments in rural areas	

Notes:

1. Data provided in file: Landuse2013StatsByMunicipality.xlsx. Land use categories in this file are active aggregate, commercial, estate residential, industrial, institutional, intensive agriculture, manicured open space, natural heritage feature, non-intensive agriculture, rail, road, rural development, and urban. Areas are further subdivided into areas for buildings, pavement, storm pond, and unpaved areas.
2. Total and urban population data sources: Statistics Canada – all Towns and townships (census sub-divisions) from 2021-Census-YR-Population-Dwelling.pdf (https://www.york.ca/census-and-demographic-item/2021-census-population). Certain villages (population centers) from (https://www12.statcan.gc.ca/census-recensement/2016/ref/98-501/98-501-x2016007-eng.cfm); AreaVibes website for Sharon (https://www.areavibes.com/east+gwillimbury-on/sharon/demographics); City-Facts website for Holland landing (https://www.city-facts.com/holland-landing-east-gwillimbury).

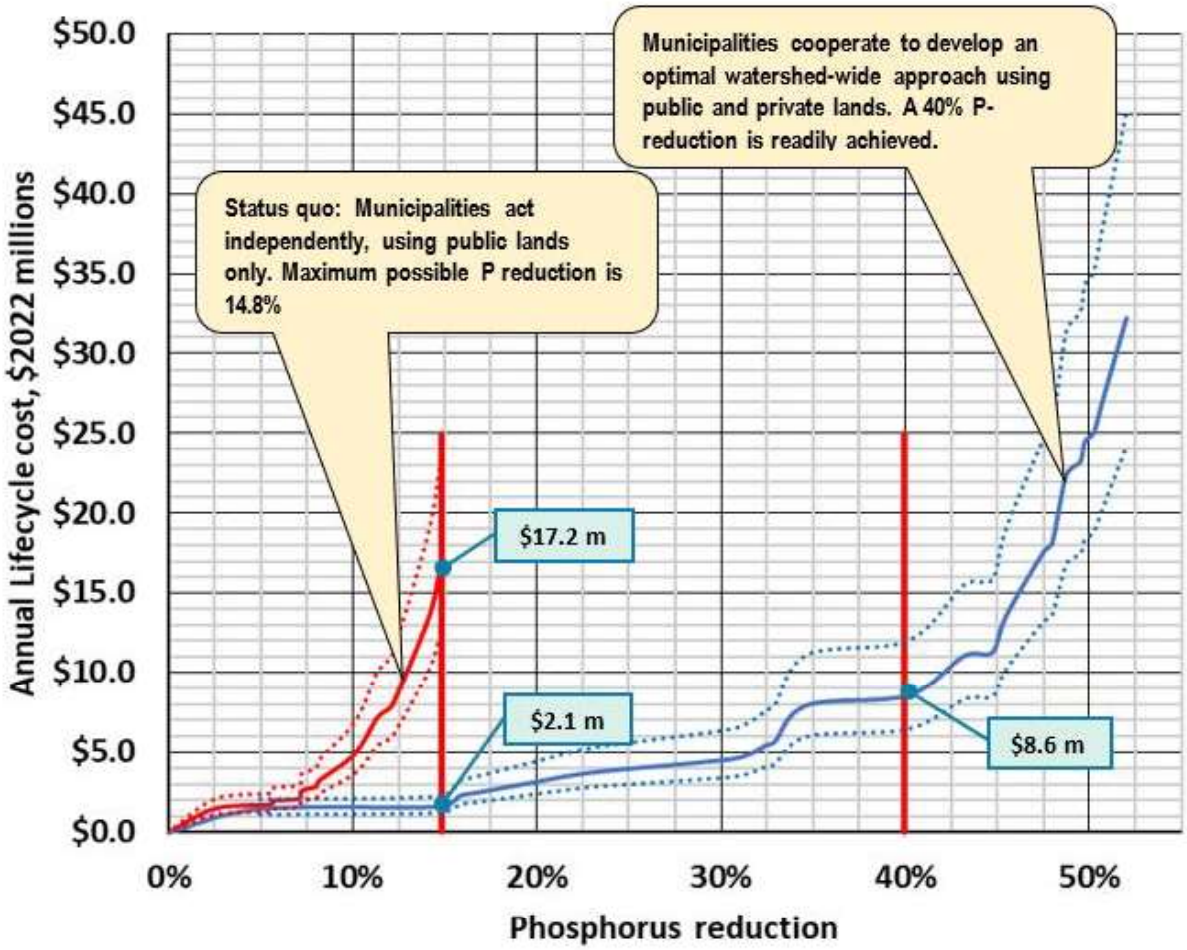
APPENDIX 4

Cost Savings: Phosphorus reduction scenario

System-wide SWM Implementation Blueprint

Background: Cost Savings for the 15% P Reduction Scenario

This appendix presents detailed information on two P-control scenarios to explain the cost difference between them. The scenarios are the Status quo using only public lands that achieves a 14.8% P reduction and the comparable 15% P reduction strategy located on the Optimal watershed-wide strategy curve shown in Figure 4-1 in the main report and reproduced below showing the two 15% scenarios.



Dotted lines indicate upper and lower bounds for estimated costs.

Figure A-1: Comparing status quo to an optimal watershed-wide approach to SWM *(Source: Based on modelling analysis for the 2021 report, Equitable Responsibility for Transformative Design: A systems-based approach to Stormwater Management)*

The unit costs of SWM measures that are used in these two scenarios are described in Table A-1. The green streets are the most expensive low impact development (L.I.D.) options per unit of stormwater (SW) storage capacity.

Table A-1: SWM Measures in the SUSTAIN Scenarios

SWM Measure	Description	Unit Costs[1] (2022$s per m^3)		
		Capital	Annual	Life Cycle Cost[2]
Infiltration Trench with underdrain	Manages rooftop runoff	746.4	17.8	1,149.6
Infiltration Chamber no underdrain	Manages parking lot runoff	356.0	4.8	464.7
Infiltration Chamber with underdrain		469.3	3.9	558.4
Green streets (Silva Tree Pit + Infiltration Trench with underdrain)	Manages runoff from Regional roads	1,685.5	12.3	1,964.6
Hybrid stormwater pond	Intercepts creeks (inline ponds) and storm drains (offline ponds)	454.0	16.5	830.1

Notes:

1. Unit Costs: per m^3 for these measures are based on their SW storage capacity.
2. Life Cycle Costs: Estimated over a 30-year period assuming 5% inflation and a 3% discount rate.

Table A-2 below reports the installed SW storage capacity for each of the scenarios identified in Figure A-1. Adopting a watershed-wide approach to SWM management achieves a remarkable 82% reduction in required storage capacity for the 15% P-reduction scenario, and even the 40% P reduction scenario requires 30% less storage capacity than the Status Quo approach despite achieving a much greater level of P control. These results demonstrate the significant advantage afforded by the opportunity to locate SWM measures optimally, i.e. where they are most effective, whether on public or private land.

Table A-2: Installed SW Storage Capacity by Municipality[1], m^3

MUNICIPALITY	STATUS QUO, Public lands only	WATERSHED-WIDE, Public and Private	
		15% P reduction	40% P reduction
Aurora	89,647	11,338	63,602
East Gwillimbury	14,775	3,110	10,487
Georgina	not app.	not app.	not app.
King	9,447	224	3,515
Newmarket	89,708	22,681	55,416
Whitchurch-Stouffville	26,959	4,581	29,308
Totals	230,535	41,934	162,329

Note:

1. Storage capacity (in m^3) represents the stormwater runoff storage volume provided by SCMs that is required to achieve both stormwater quantity and quality control standards in each jurisdiction.

Table A-3 shows how relative costs influence the choice of SWM measure. The mix of measures in the Status Quo scenario largely reflects the availability of sites for each type of measure since it is essentially a do-everything option that fails to achieve the 40% P reduction target using only public lands. When private lands are made available in the watershed-wide strategies, there is a shift away from the costly Silva Tree Pit plus Infiltration Trench measure towards the less costly infiltration chamber and hybrid pond measures. Initially, for a 15% reduction, there is also a shift away from the infiltration trench, but this measure must be relied on more heavily to achieve the 40% reduction.[1]

Table A-3: Installed SW Storage Capacity by Type of SWM Measure, m^3

SWM Measure	STATUS QUO, Public lands only	WATERSHED-WIDE, Public and Private	
		15% P reduction	40% P reduction
Infiltration Trench with underdrain	6,163 (2.7%)	569 (1.4%)	6,023 (3.7%)
Infiltration Chamber, no underdrain	5,077 (2.2%)	1,584 (3.8%)	24,294 (15.0%)
Infiltration Chamber with underdrain	20,455 (8.9%)	2,022 (4.8%)	22,789 (14.0%)
Silva Tree Pit + Infiltration Trench	99,786 (43.3%)	2,298 (5.5%)	22,595 (13.9%)
Hybrid Pond, Private	00 (0.0%)	17,092 (40.8%)	57,798 (35.6%)
Hybrid Pond, Public	99,054 (43.0%)	18,367 (43.8%)	28,831 (17.8%)
Totals	**230,535 (100.0%)**	**41,934 (100.0%)**	**162,329 (100.0%)**

The outcome of a watershed wide approach, in terms of costs per cubic meter of installed SW storage capacity is shown in Table A-4. Average life cycle costs per cubic meter of SW storage capacity fall by about 30% with adoption of the watershed wide approach using public and private lands.

[1] This probably happens because the SUSTAIN modelling analysis limits implementation of any measure to 20% of available sites for that measure to reflect the fact that uptake of these measures on private land will be limited.

Table A-4: Average Costs of SWM Measures in 3 Scenarios, 2022 $ per m^3

Average costs are estimated with a weighted average calculation using SW storage volumes for each measure as weights. Measures are those shown in Table A-1.

Capital Costs

MUNICIPALITY	STATUS QUO, Public lands only	WATERSHED-WIDE, Public and Private	
		15% P reduction	40% P reduction
Aurora	837.7	547.0	597.9
East Gwillimbury	1,638.2	626.4	600.4
Georgina	not app.	not app.	not app.
King	1,477.3	1,272.9	1,144.0
Newmarket	855.3	481.2	549.0
Whitchurch-Stouffville	1,422.9	556.1	795.5
Totals	**990.5**	**522.2**	**628.9**

Operations and Maintenance Costs

MUNICIPALITY	STATUS QUO, Public lands only	WATERSHED-WIDE, Public and Private	
		15% P reduction	40% P reduction
Aurora	14.5	14.8	13.7
East Gwillimbury	12.1	13.9	10.4
Georgina	not app.	not app.	not app.
King	12.9	10.1	9.3
Newmarket	12.6	15.7	12.5
Whitchurch-Stouffville	12.6	15.5	12.1
Totals	**13.3**	**15.3**	**12.7**

Life Cycle Costs - Estimated over a 30-year period assuming 5% inflation and a 3% discount rate.

MUNICIPALITY	STATUS QUO, Public lands only	WATERSHED-WIDE, Public and Private	
		15% P reduction	40% P reduction
Aurora	1,166.9	883.2	909.4
East Gwillimbury	1,913.3	941.5	837.5
Georgina	not app.	not app.	not app.
King	1,771.1	1,501.4	1,354.2
Newmarket	1,142.8	838.6	832.2
Whitchurch-Stouffville	1,708.2	907.7	1,071.5
Totals	**1,293.4**	**869.4**	**917.3**