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# How public and private properties can work together to optimize and improve stormwater management through communal design

*Presented by: Phil James Senior Manager, Integrated Water Management P.Eng*

*National Water and Wastewater Conference - November 14th, 2023*

*The water component of STEP is a collaborative of:*

Lake Simcoe Region conservation authority

Credit Valley Conservation inspired by nature

Toronto and Region Conservation Authority

# Agenda

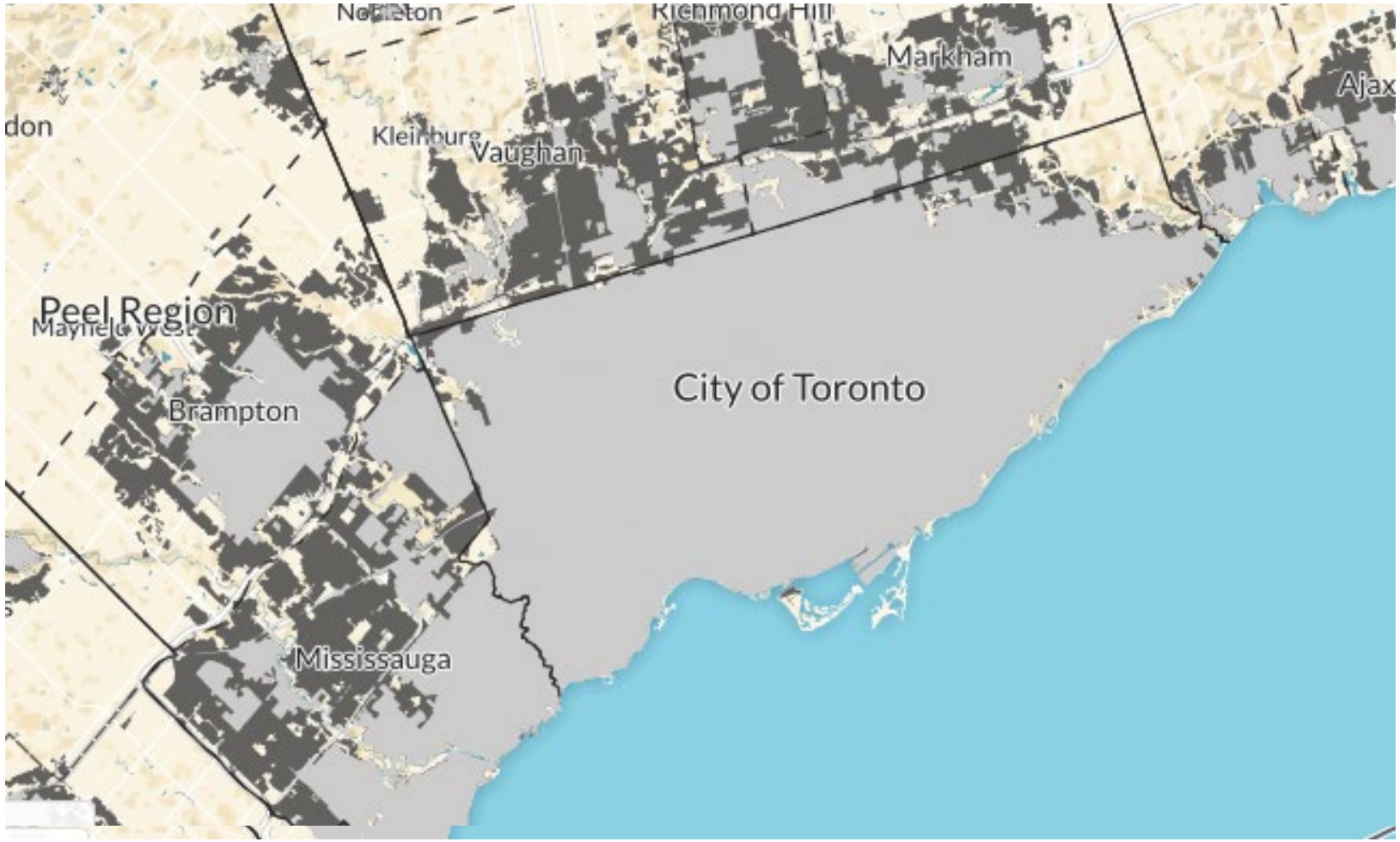
1. *Background*
   - *Current Challenges with Urban Stormwater Management*
2. *Communal Stormwater Retrofit Feasibility Study*
   - *A 'Made in Ontario' Innovative Solution to Stormwater Management*
3. *Application of the Drainage Act in Urban Areas*
4. *Next Steps*

# 1.0 Background

# The problem: legacy stormwater infrastructure

Development prior to 1981

Development between 1981 and 2011



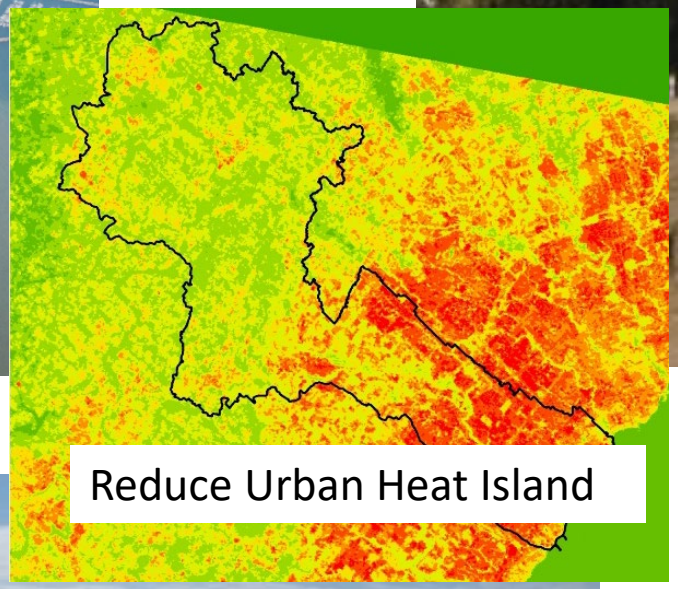

Source: Neptis Geoweb (2020)

# Urban Stormwater Challenges

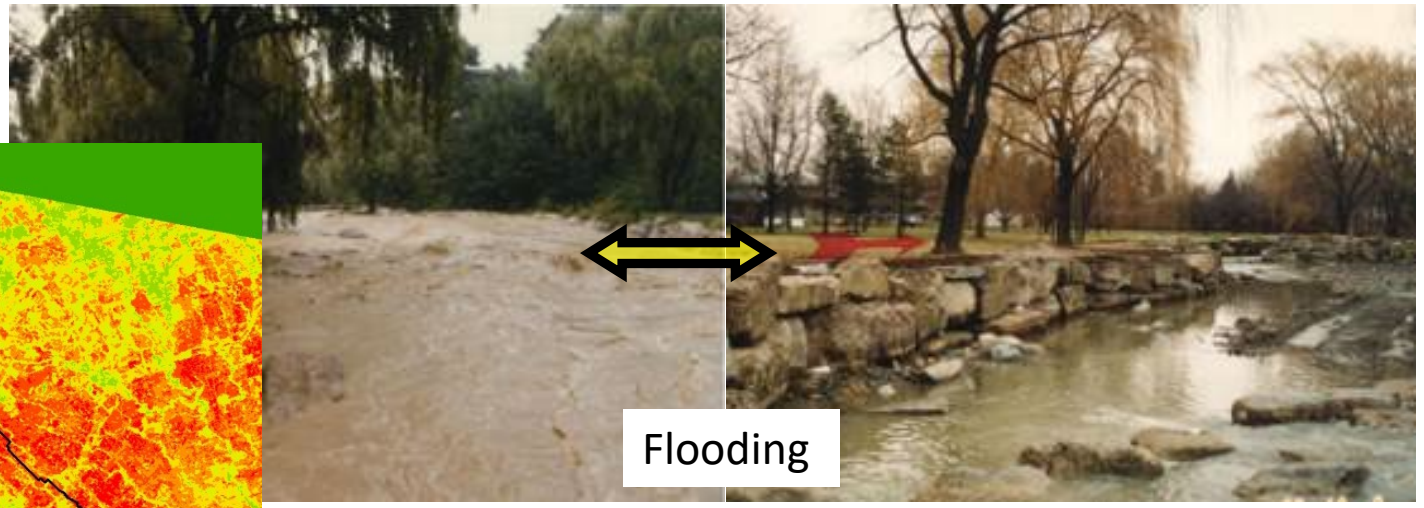
Credit: www.teenaintoronto.com

# Urban Stormwater Challenges

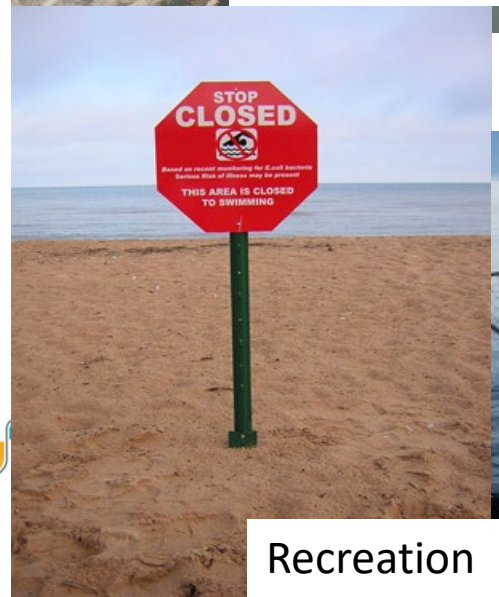
Water Quality

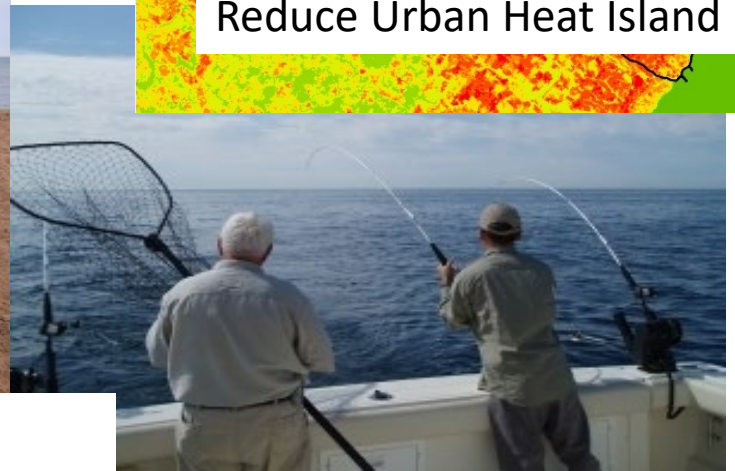


Reduce Urban Heat Island



Flooding



Recreation

Erosion

# Current Stormwater Management Approach

Majority of developed areas in municipalities have no (or limited) SWM.

SWM Retrofit plans (Master Plans) are good but limited by public land availability and ability to effectively retrofit existing infrastructure ($$$).

<u>SWM on private lands through public-private partnerships represents an untapped resource and opportunity.</u>

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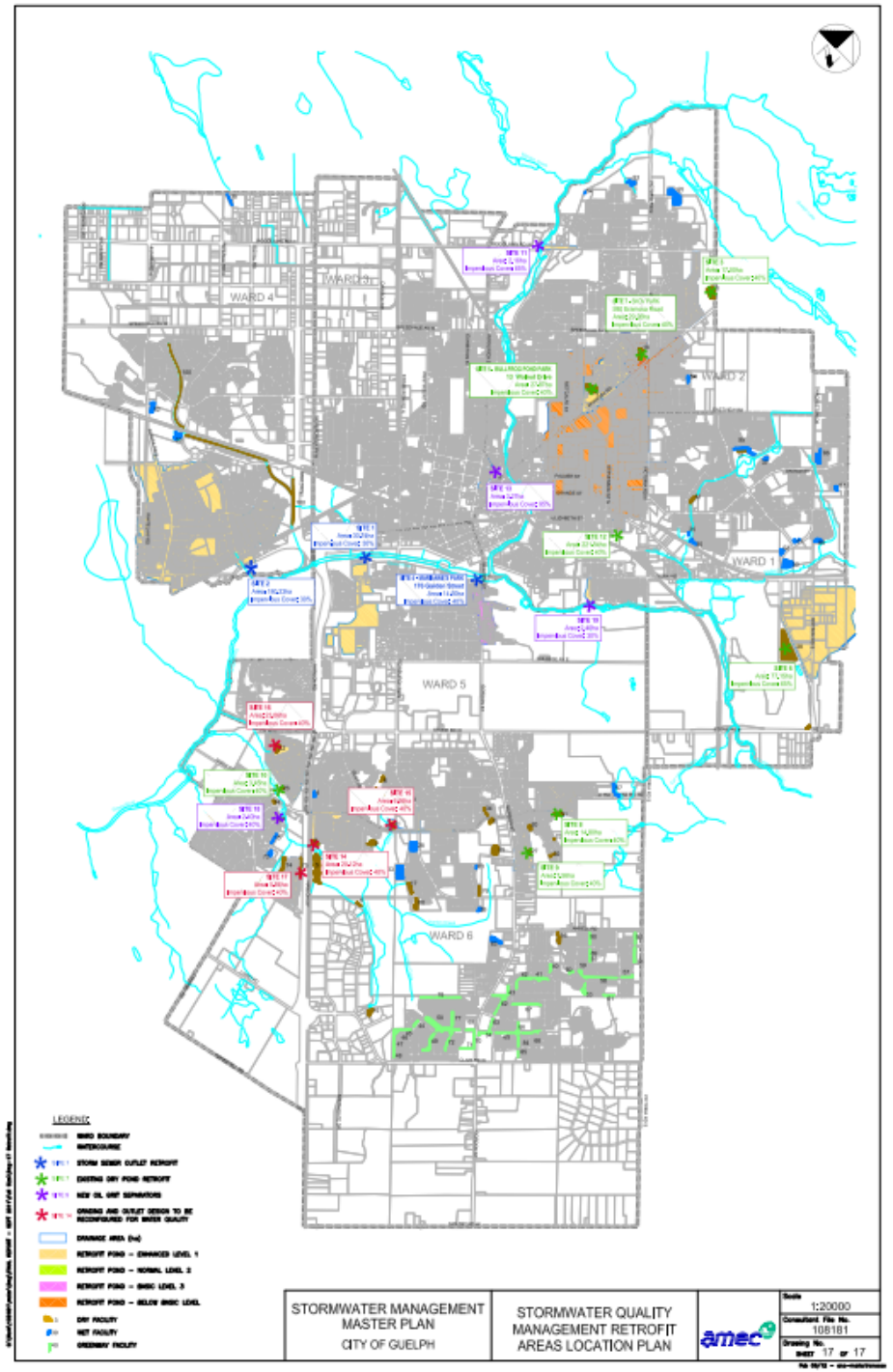
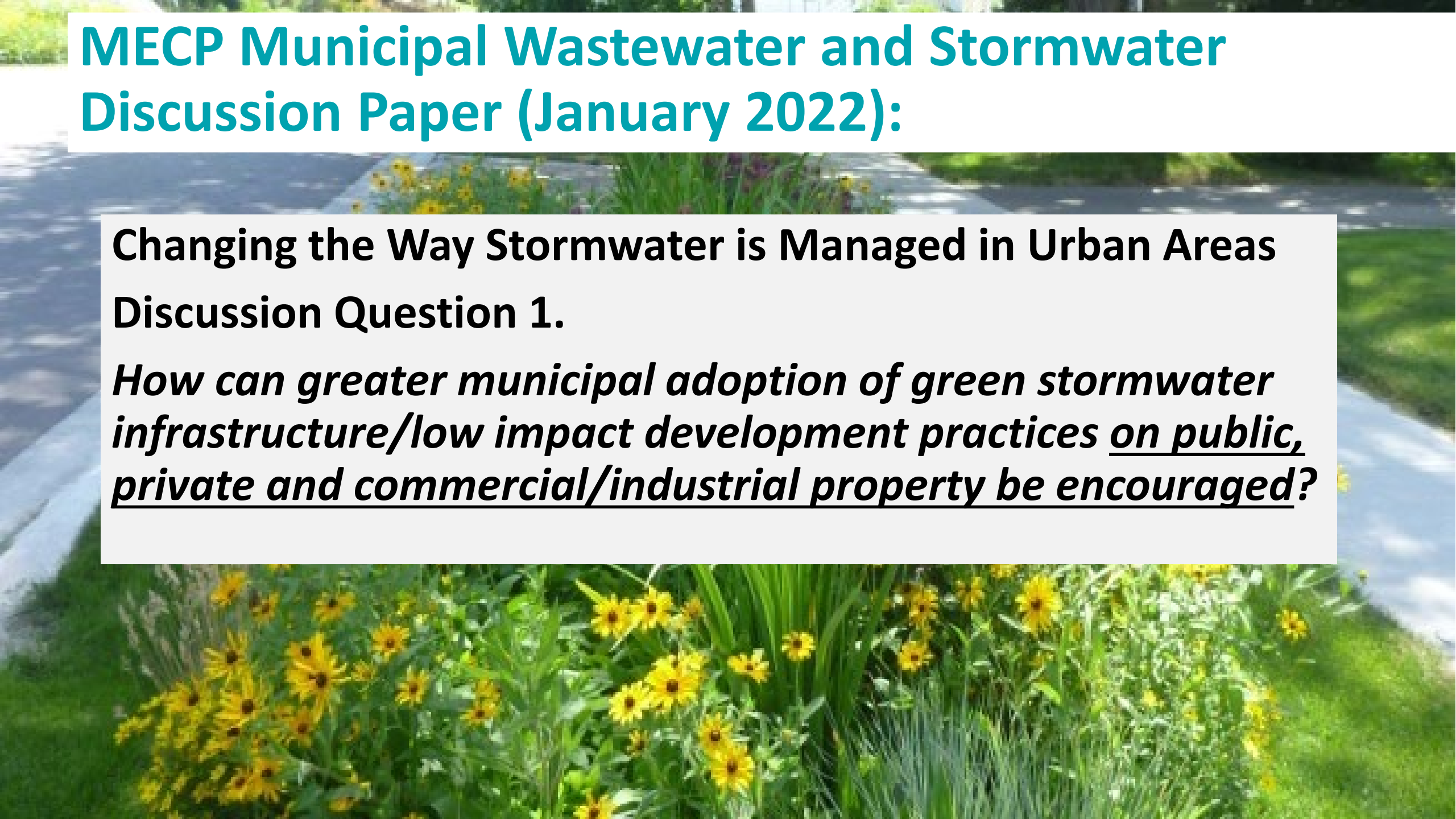


# Solution to Urban Stormwater Challenges: Low Impact Development


Source: USEPA


Source: ADS

# MECP Municipal Wastewater and Stormwater Discussion Paper (January 2022):



**Changing the Way Stormwater is Managed in Urban Areas**

**Discussion Question 1.**

***How can greater municipal adoption of green stormwater infrastructure/low impact development practices on public, private and commercial/industrial property be encouraged?***

# Barriers to Low Impact Development Uptake on Private Property

## Private Property Owner Barriers

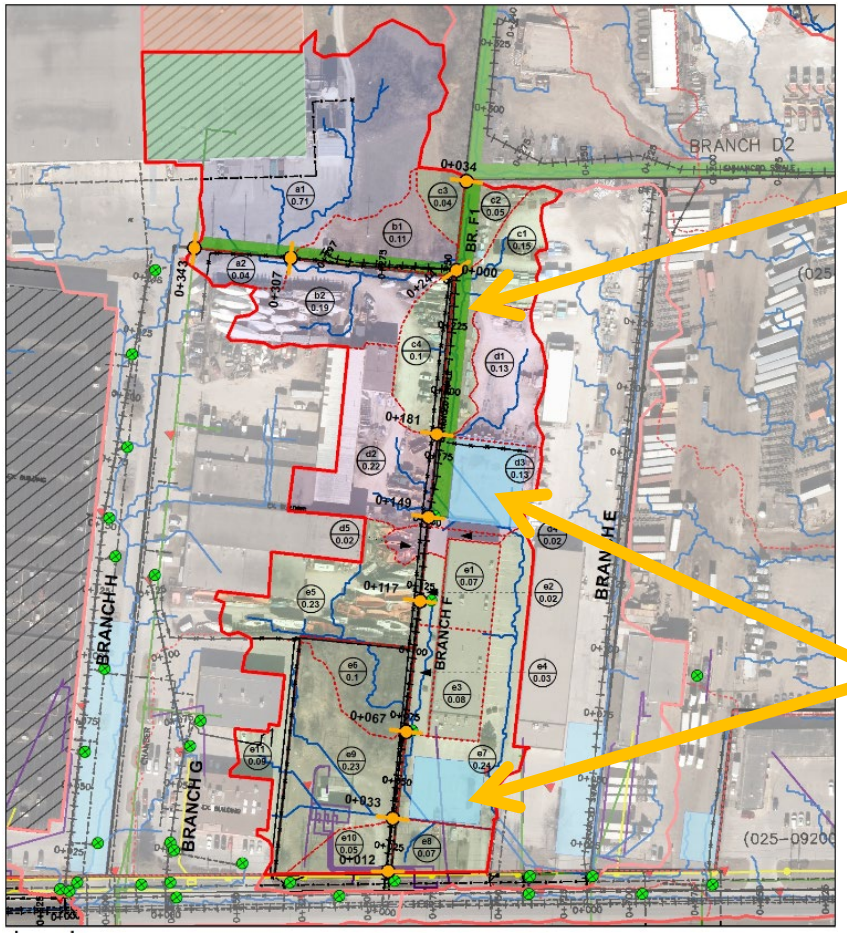
- Despite stormwater credit programs there is low uptake
- Pay back period for SWM retrofits is poor
- Lack of defined process to solve drainage problems

## Municipal Barriers

- Cost of retrofitting public lands and lack of space
- How to ensure features on private property are maintained and protected

# Aggregation of Private Landowners to build a communal LID System

Aggregation is the process by which multiple private properties are combined (or aggregated) to provide fiscal and functional benefits for the application of low impact development




Enhanced Grass Swale

Underground Storage

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# 2.0 Communal LID Retrofit Feasibility Study

*This project explored the technical and financial feasibility of implementing communal LID stormwater management systems on private property*

Credit Valley Conservation
inspired by nature

FCM
FEDERATION OF CANADIAN MUNICIPALITIES
FÉDÉRATION CANADIENNE DES MUNICIPALITÉS

Region of Peel
working with you

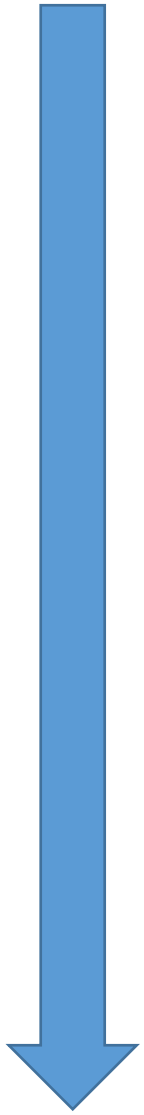
MISSISSAUGA

# Key Message

***"The Drainage Act is an exciting tool that will help with the implementation of green infrastructure low impact development practices on private property"***

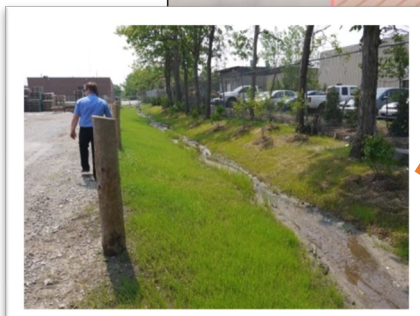
# Drainage Act Process

**The Drainage Act provides for the process to place stormwater infrastructure (drainage works) on private and/or public property and ensures it will be inspected and maintained**



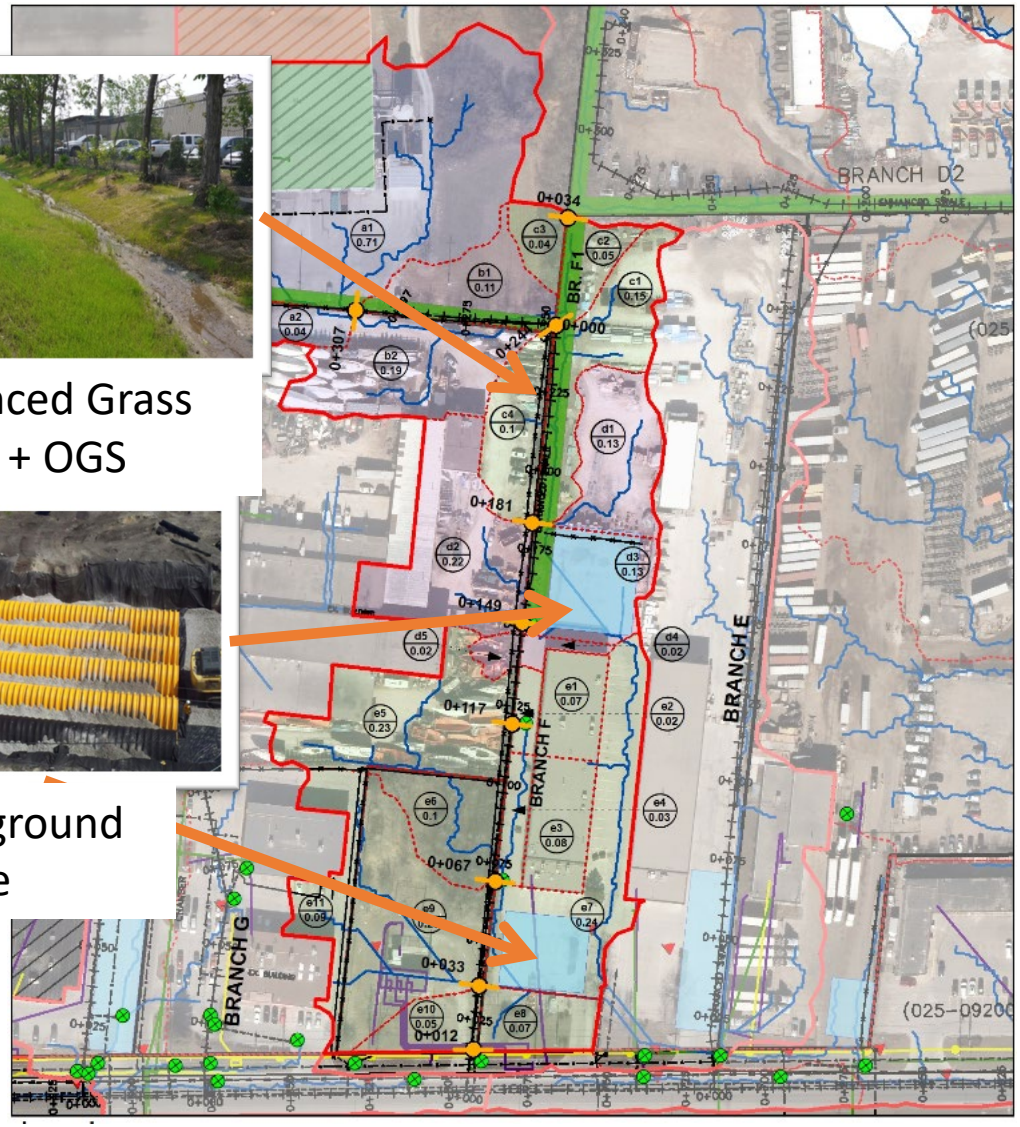
| | |
|---|---|
| Petition | • Initiated by property owners or road authority and submitted to local municipality |
| Appoint Engineer | • Appointed by council resolution<br>• Engineer holds onsite meeting |
| Engineer's Report | • Design of drainage works<br>• Project cost and cost distribution<br>• Report adopted by municipal bylaw |
| Construction | • According to construction drawings in engineer's report |
| Maintenance | • Drainage Superintendent manages inspection and maintenance |

# Cooperation is Advantageous!



Enhanced Grass Swale + OGS

Underground Storage




Meet minimum requirements to achieves 50% credit

**Why is cooperation advantageous?**

The image on the left shows the conceptual design of a communal system that manages stormwater for four (4) private properties.

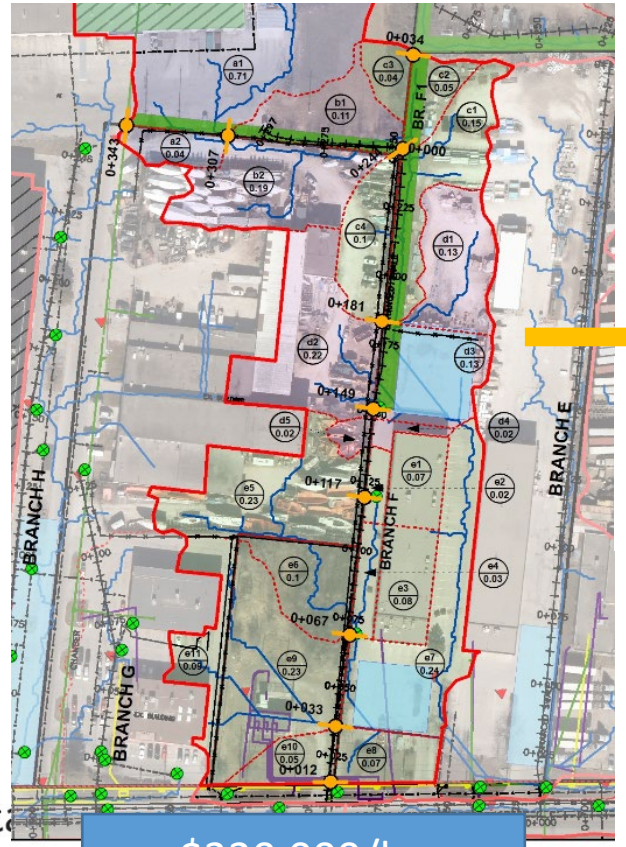
Together the four landowners can work together to implement LIDs where it makes the most sense.

The upstream landowners have space for enhanced grass swales to filter and treat the drainage while the downstream owners have space for underground chambers/infiltration trenches to gulp up the water.

It is much more cost effective when they work together versus acting alone

# Bottom Line: Its 20 % Cheaper to Build Communal LID on Private Property than Pond on Public Property

**Communal LID on 4 Private Properties**

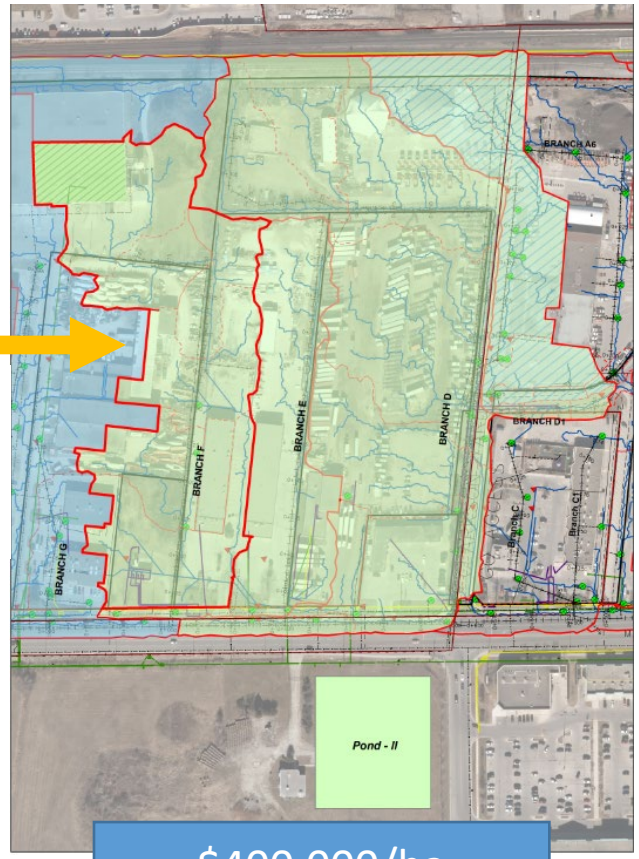



$320,000/ha

VS

Apples to Apples Comparison

**End of Pipe on Public Property**




$400,000/ha

It is **cheaper** than conventional stormwater management on public lands, achieves a higher standard of treatment and **a host of co-benefits**.

This approach can help cities become more climate resilient in the face of fiscal constraints and a looming timeline.

End of pipe scenario, the capital and O&M costs fall entirely on the municipality.

# Communal Infrastructure Requires Cost Sharing between landowners

The study adapted methods used by engineers working under the *Drainage Act* to develop detailed cost-sharing schedules that apportion costs to stakeholders based on who uses the infrastructure and who benefits from it.

Assessment schedules were created to demonstrate how capital and future maintenance costs would be shared between the private landowners and municipalities.

The *Drainage Act* is an Ontario statute that provides a democratic process to plan, design, construct and operate/maintain drainage infrastructure on private property. Drainage works constructed under the act are protected under a bylaw, which prevents landowners from interfering with it and grants municipalities the right to access private property for inspection and maintenance.

# 3.0 Application of the Drainage Act in Urban Areas

# Key Steps - Applying Drainage Act

- Estimating Total Cost
  - Construction, Engineering & Admin, Net HST
  - Allowances (Compensation for existing and proposed assets)
- Types of Assessments (Who is Benefitting?)
- Assessment Schedules (Dividing up the costs)
- Future Operation & Maintenance Schedules
- Engineer's Report (Adopted under By-law)

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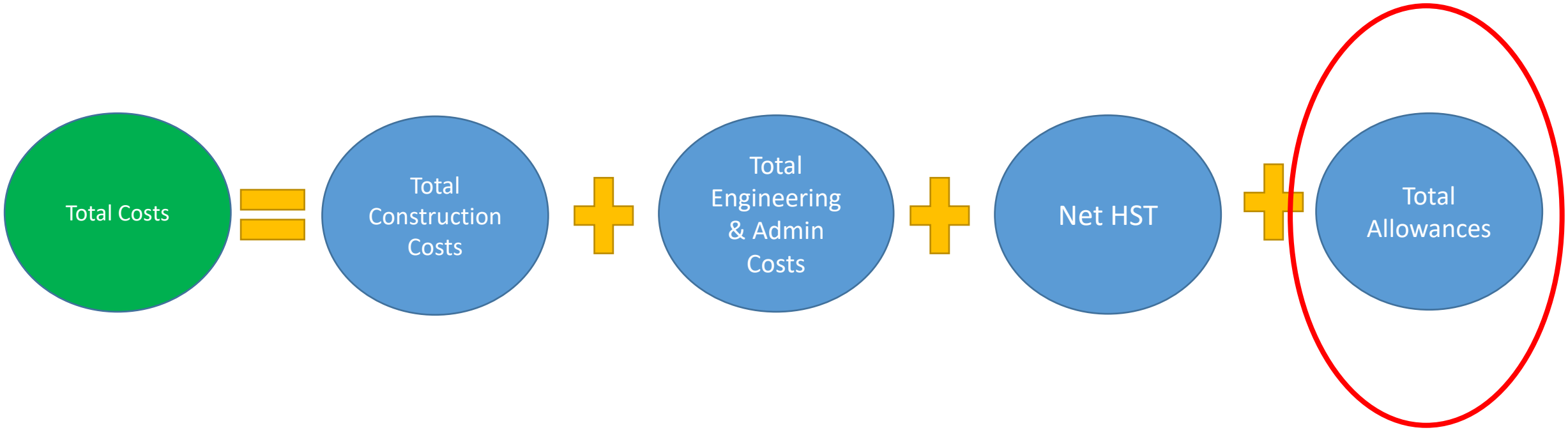
# Estimating Total Cost



# What are Allowances?

- An allowance is compensation that must be given to a property owner for the assets on their land incorporated into the drainage design
- Compensation should be fair to property owner affected by the drainage design and the other property owners in the watershed that are paying the allowances
- Allowance allows for features to be incorporated as quasi public infrastructure

Not this type of allowance…

# Allowances

**Partial Market Value**
Parking lot retrofitted with permeable pavement still functions as a parking lot

**Land and Right of Way**
Swale along periphery of property

**Damages**
Asphalt damage after construction of LID feature

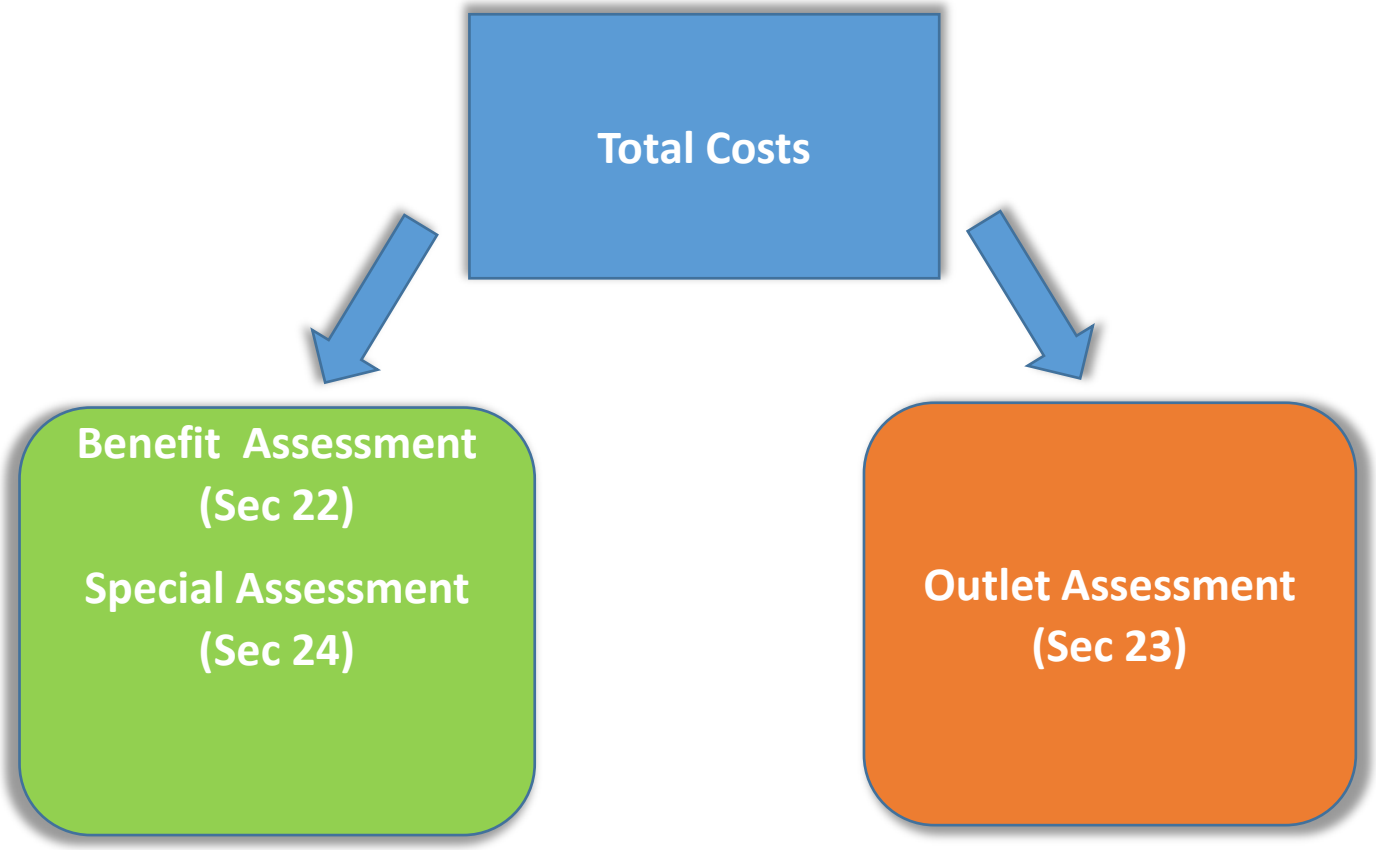
# Allowances for Existing Natural Assets

Urban Forest Cover

Meadow on a Mississauga property.

Pocket wetland in an urban area

# Using the Drainage Act Methodology to Assess out Costs



# Benefit Assessment

- Value for Increased Market Value/Appearance/Easier Maintenance/Business Operations
- Value for Improved Surface Drainage
- Value for Improved SWM (Quality/Water Balance)
- Value for Improved SWM (Flood)
- Benefit by cut-off
  - Value to downstream lands by managing stormwater upstream

# Special Benefit Assessment

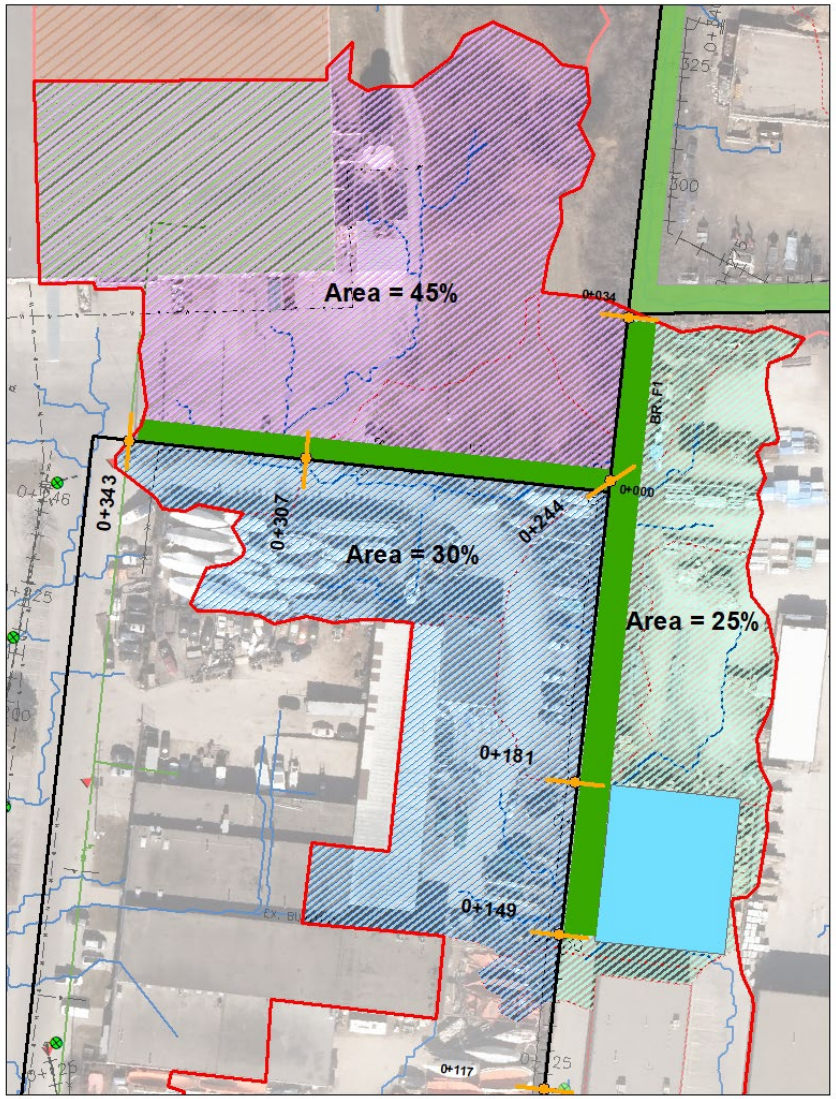
## Basic Swale


## Enhanced Swale


Special benefits as defined by the Act are any additional works or features included in the construction, repair, or improvement of the system and have no effect on the functioning of the drainage system

# Outlet Assessment

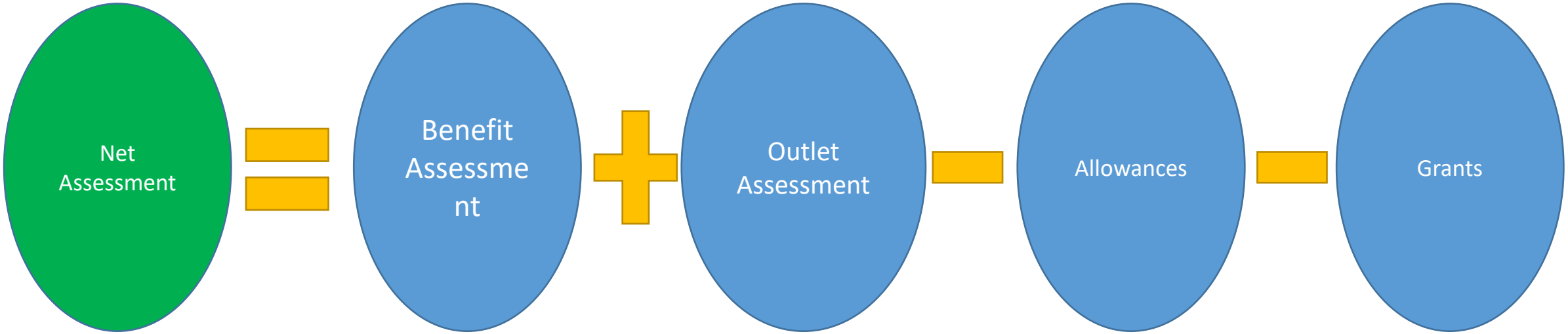
- Your responsibility for the water that runs off of your property.
- Method for proportionate cost-sharing according to who contributes what amount of runoff into the drainage works



# Assessment by Property per Interval

| | | In Watershed | | Interval 1 (0+012 to 0+033) | | | Interval 2 (0+033 to 0+067) | | | Interval 3 (0+067 to 0+117) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cost estimate (Refer to Table 15-6)** | | | | | | | | | | | | |
| **Allowances ($)** | | | | | - | | | 40,550.00 | | | - | |
| **Construction ($)** | | | | | - | | | 144,077.32 | | | - | |
| **Engineering and eligible municipal administration ($)** | | | | | - | | | 26,964.08 | | | - | |
| **Net HST ($)** | | | | | - | | | 3,012.36 | | | - | |
| **Total Cost ($) (G)** | | | | | - | | | 214,603.76 | | | - | |
| Roll No. | Owner | Total Affected (Ha) (Refer to Table 15-3) | Total Adjusted (Ha) (Refer to Table 15-3) | Benefit assessment ($) (Refer to Table 15-9) | Adjusted (Ha) (A) (Refer to Table 5-3) | Outlet liability ($) (B = A x F) | Benefit assessment ($) (Refer to Table 15-9) | Adjusted (Ha) (A) (Refer to Table 5-3) | Outlet liability ($) (B = A x F) | Benefit assessment ($) (Refer to Table 15-9) | Adjusted (Ha) (A) (Refer to Table 5-3) | Outlet liability ($) (B = A x F) |
| | | | | | | | | | | | | |
| 21-05-020-XXX | Property 6 | 0.86 | 0.76 | - | 0.00 | - | - | 0.00 | - | - | 0.00 | - |
| 21-05-020-XXX | Property 7 | 0.89 | 0.82 | - | 0.27 | - | - | 0.27 | 6,099.20 | - | 0.17 | - |
| 21-05-020-XXX | Property 8 | 0.38 | 0.24 | - | 0.24 | - | 39,348.15 | 0.20 | 4,517.93 | - | 0.05 | - |
| 21-05-020-XXX | Property 10 | 1.00 | 0.99 | - | 0.53 | - | 52,464.20 | 0.48 | 10,843.03 | - | 0.23 | - |
| | | | | - | | | - | | | - | | |
| Road Allowance - Municipality | | | | - | - | | 101,331.25 | - | | - | - | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **TOTALS** | | 3.13 | 2.81 | - | 1.04 | - | 193,143.60 | 0.95 | 21,460.16 | - | 0.45 | - |
| **TOTAL BENEFIT ASSESSMENT ($) (C)** | | | | - | | | 193,143.60 | | | - | | |
| **OUTLET LIABILITY ($) (D= G - C)** | | | | - | | | 21,460.16 | | | - | | |
| **Land in Interval (Ha) (E)** | | | | 1.04 | | | 0.95 | | | 0.45 | | |
| **Outlet Liability Rate ($/Ha) (F=D / E)** | | | | - | | - | 22,589.64 | | | - | | |

# Net Assessment



# Net Assessment Schedules

| Con | Lot | Roll No. | Owner | Total Ha Affected | Benefit ($) | Outlet ($) | Total ($) | General Grants ($) | Allow-ances ($) | NET ASSESS. ($) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 21-05-020-XXX | Property 6 | 0.86 | 0.00 | 66,244.47 | 66,244.47 | | 36,900 | 29,344.47 |
| 1 | 11 | 21-05-020-XXX | Property 7 | 0.89 | 419.14 | 54,526.60 | 54,945.74 | | 0 | 54,945.74 |
| 1 | 12 | 21-05-020-XXX | Property 8 | 0.38 | 56,242.50 | 9,096.18 | 65,338.69 | | 0 | 65,338.69 |
| 1 | 13 | 21-05-020-XXX | Property 10 | 1.00 | 164,851.47 | 47,452.90 | 212,304.37 | | 272,500 | -60,195.63 |
| | | Road Allowance | Municipality | | 523,536.29 | | 523,536.29 | | 0 | 523,536.29 |
| **Total Assessments for Branch F:** | | | | 3.13 | 745,049.40 | 177,320.15 | 922,369.55 | 0.00 | 309,400 | 612,969.55 |

Notes:

1. Roll numbers are per the Municipality's last revised assessment roll, names included for convenience.

General Grants could include:

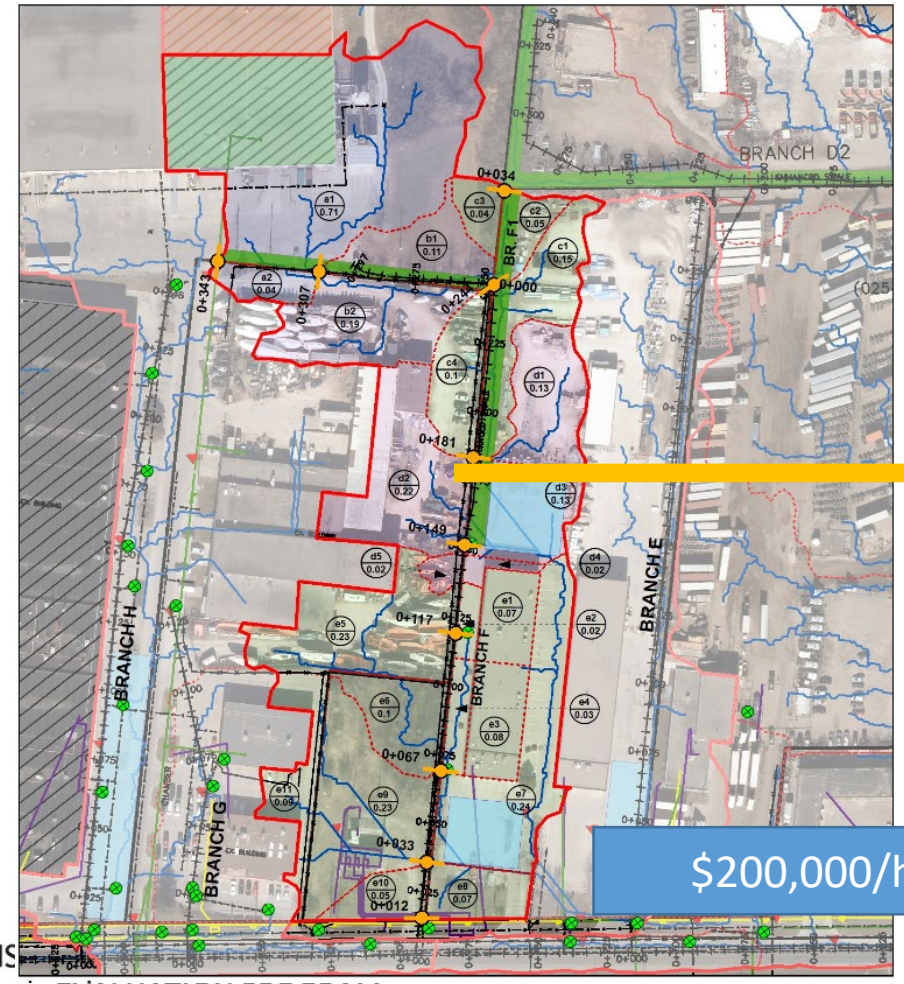
- OMAFRA grant 1/3 for agricultural lands
- Municipal grant
- Environmental grants
- Other funding and government grants

# Bottom Line: Cost Savings Increase to 50 % when Cost Sharing is Employed

## Communal LID on 4 Private Properties

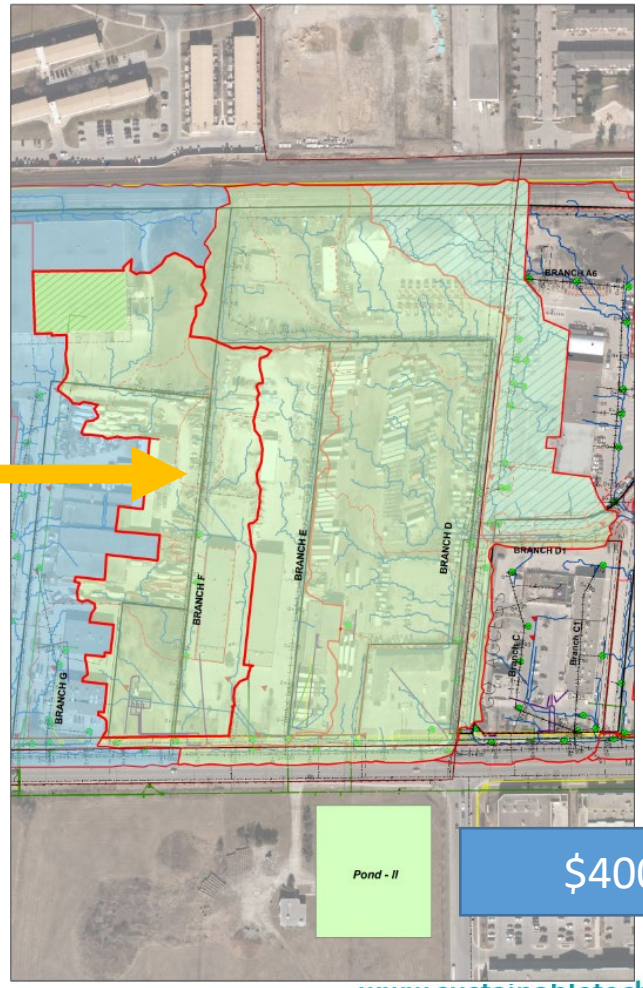
VS

## End of Pipe on Public Property




Apples to Apples Comparison

$200,000/ha




$400,000/ha

# Ongoing Operation & Maintenance

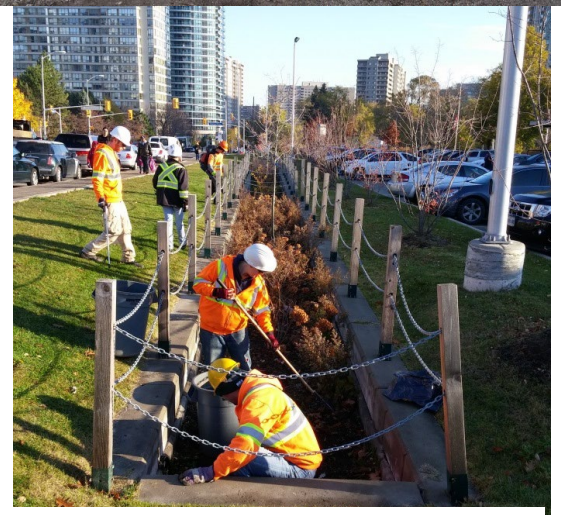
Clearing Invasive Species

Replacing dead plants

Replacing Mulch

Sweeping Pavers

Cleaning Filters



Removing garbage/debris

# Operation & Maintenance Schedule

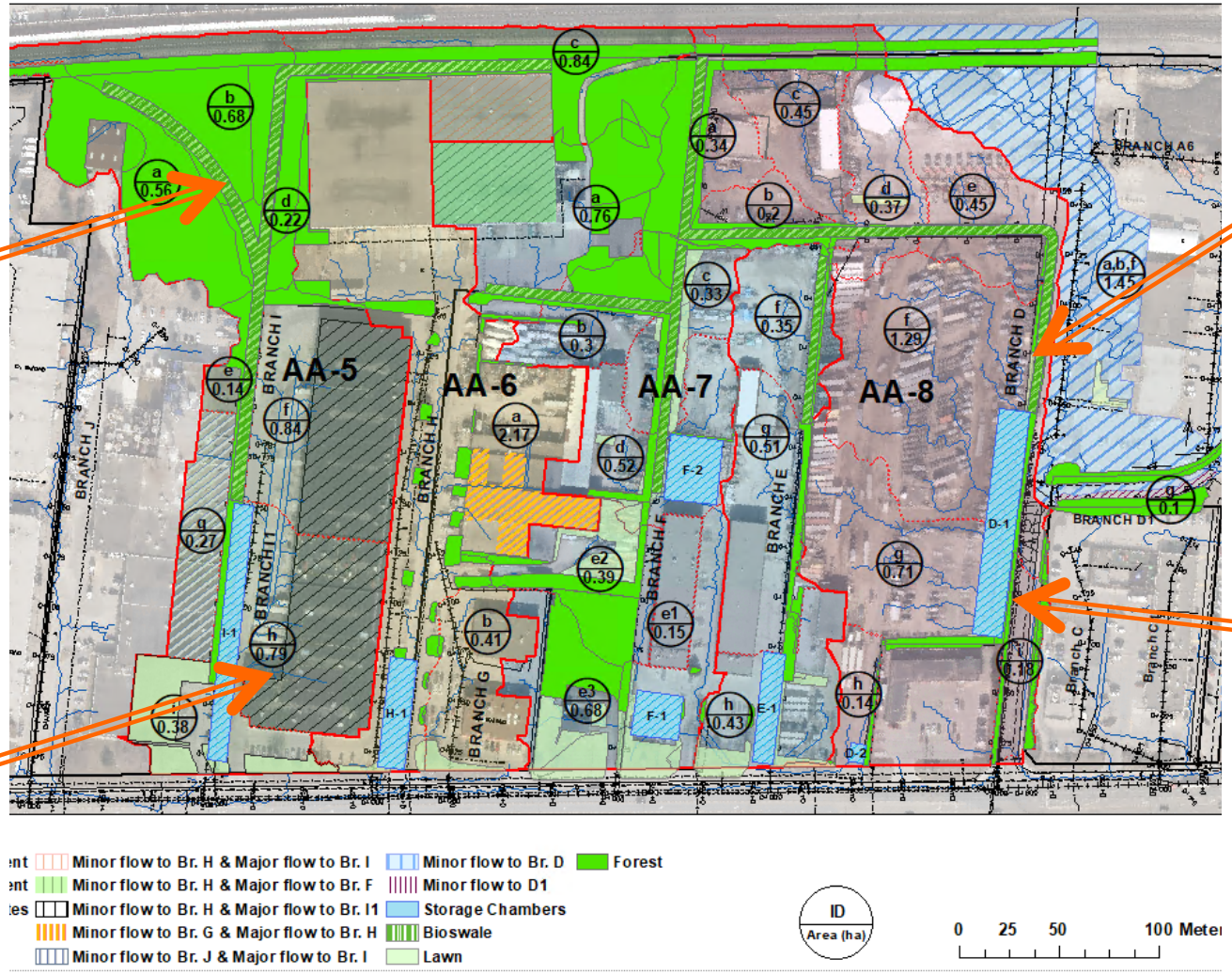
| Roll No. | Owner | Interval 1<br>Sta. 0+012 to 0+033<br>$ | <br><br>% | Interval 2<br>Chamber System #1<br>Sta 0+033 to 0+067<br>$ | <br><br>% | Interval 3<br>Sta 0+067 to 0+117<br>$ | <br><br>% | Interval 4<br>Sta 0+117 to 0+149<br>$ | <br><br>% | Interval 5<br>Chamber & Enhanced Grass Swale<br>Sta 0+149 to 0+181<br>$ | <br><br>% | Interval 6<br>Enhanced Grass Swale<br>Sta 0+181 to 0+244<br>$ | <br><br>% | Interval 7<br>Enhanced Grass Swale<br>Sta 0+244 to 0+307<br>$ | <br><br>% | Interval 8<br>Enhanced Grass Swale<br>Sta 0+307 to 0+343<br>$ | <br><br>% |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21-05-020-XXX | Property 6 | 0.00 | 0.00% | 200.00 | 5.00% | 0.00 | 0.00% | - | 0.00% | 1,000.00 | 20.00% | 800.00 | 40.00% | 1,100.00 | 55.00% | 975.00 | 65.00% |
| 21-05-020-XXX | Property 7 | 25.61 | 25.61% | 800.00 | 20.00% | 37.14 | 37.14% | 11.11 | 11.11% | 1,000.00 | 20.00% | 300.00 | 15.00% | 300.00 | 15.00% | 75.00 | 5.00% |
| 21-05-020-XXX | Property 8 | 23.17 | 23.17% | 800.00 | 20.00% | 11.43 | 11.43% | - | 0.00% | 500.00 | 10.00% | - | 0.00% | - | 0.00% | - | 0.00% |
| 21-05-020-XXX | Property 10 | 51.22 | 51.22% | 1,000.00 | 25.00% | 51.43 | 51.43% | 88.89 | 88.89% | 1,000.00 | 20.00% | 300.00 | 15.00% | - | 0.00% | - | 0.00% |
| Royal Windsor Drive - City of Mississauga | | 0.00 | 0.00% | 1,200.00 | 30.00% | - | 0.00% | - | 0.00% | 1,500.00 | 30.00% | 600.00 | 30.00% | 600.00 | 30.00% | 450.00 | 30.00% |
| **TOTAL O&M Costs - Branch F:** | | 100.00 | 100.00% | 4,000.00 | 100.00% | 100.00 | 100.00% | 100.00 | 100.00% | 5,000.00 | 100.00% | 2,000.00 | 100.00% | 2,000.00 | 100.00% | 1,500.00 | 100.00% |

Notes:
End of pipe facility maintenance is assessed 100% to the municipality

# Building Climate Resilience in a Collaborative Cost-Effective Manner

Natural Assets - Forest

Bioswale




Communal Rainwater Harvesting

Underground Storage with infiltration trench

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# Who can share in the cost for special benefit assessments?

- Conservation Authorities (Source water protection)
- Various municipal departments depending on strategic goals (Forestry, Stormwater Management, Public Health)
- Environmental Funding Programs (Increased biodiversity)
- Provincial Agencies (Water Quality, Air Quality)
- Federal Government

OMAFRA provides a 1/3 grant for municipal drains on agricultural lands for capital and future maintenance costs

Could something for similar grants for municipal drains in urban areas be considered?

# 4) Next Steps

# Conclusions and Take Aways

- The Drainage Act can be used for implementing LID features on private land!
  - Assessments can be determined in a transparent and fair manner
  - Maintenance can occur on private lands
  - Cheaper approach to public lands
  - Additional environmental co-benefits by adding additional features

# Road Blocks to Overcome

- Road blocks we have overcome
  - Overcame technical challenges
  - Overcame financial challenges
- Road blocks that remain
  - Raising awareness about the Drainage Act
  - Institutional knowledge within municipalities, consulting sector (limited number of drainage engineers), development community and private landowner about Drainage Act
  - Getting municipal buy-in
    - Existing Bylaws
  - Financial incentives to initiate work

# 5.0 For more information

# More Information – STEP Website

## Aggregated, Communal Approaches to Green Infrastructure Implementation

The STEP Water partners have developed and monitored many successful projects that demonstrate the benefits of green infrastructure (GI) and low impact development (LID) for stormwater management. Despite the proven success and benefits of GI, there are still barriers preventing wide-scale implementation, particularly on private property in existing developments. This is largely due to the associated capital costs. The aim of this project is to find ways to overcome this hurdle through aggregation, where private and public properties are grouped together to facilitate the communal and cost-efficient management of stormwater. As part of this project, the potential of the provincial Drainage Act (R.S.O., 1990) to assist in the aggregation process is being considered, since applying the mechanisms available within the Act will result in cost savings as well as the optimization of feature selection, sizing and overall performance.

- https://sustainabletechnologies.ca/home/urban-runoff-green-infrastructure/aggregated-communal-approaches-to-gi-implementation/

# More Information - Free Webinars

## Webinar – Use of the Drainage Act for Greenfield Development (Previously Recorded)

**FREE – Online anytime!**
**Estimated time requirement: 4 hours**

This webinar is mainly intended for development, infrastructure and/or stormwater engineers looking to gain knowledge of the Drainage Act and how it can assist in developing sustainable stormwater solutions

### Learning objectives:

- Gain a deeper understanding of the Drainage Act and its potential to facilitate economically sustainable, mutually-beneficial public-private drainage infrastructure
- Explore how the Draining Act can be used to facilitate adoption of communal, low impact drainage infrastructure in urban greenfield re-development
- Understand the role of the Drainage Superintendent in greenfield development
- Learn from two case studies in Ontario municipalities where the Drainage Act has been used for greenfield development
  - Radcliffe Subdivision Town of Erin, Wellington County
  - Villages of Long Point Bay Subdivision (Port Rowan), Norfolk County

**Agenda and Presenters** – Click Here

**OFFER!** With the purchase of any two LIVE or PRE-RECORDED webinars, receive FREE access to a third webinar of choice. Email proof of purchase (e.g. your email receipt) to STEP@trca.ca along with the title of the additional webinar you would like access to.

**New Booking: Fri Oct 21, 2022**

Workshop: Use of the Drainage Act for Greenfield Development

AVAILABLE

Book Now

Availability

https://sustainabletechnologies.ca/events/webinar-use-of-the-drainage-act-for-greenfield-development-previously-recorded/

# More Information - Free Webinars

## Operationalizing the Drainage Act: Lessons Learned in Greenfield Application and Operations

### Previously Recorded – FREE – Online anytime!

**Estimated time requirement: 2 hours**

Municipalities across Ontario are faced with the challenge of managing and treating stormwater, while contending with increased flooding, rapid urban growth, climate change and aging, limited or no stormwater infrastructure. In fact, approximately 60% of Ontario communities' urban area were built before current stormwater management or flood control standards were developed. The extreme cost of retrofitting stormwater infrastructure within public lands (road right of ways) makes it untenable for most municipalities. This leaves communities, the Province, businesses, and its residents at greater risk of flooding and water quality impairments. A new approach is needed.

https://sustainabletechnologies.ca/events/operationalizing-the-drainage-act-lessons-learned-in-greenfield-application-and-operations/

# More Information

Making Green Infrastructure Mainstream: Improving the Business Case for Green Stormwater Infrastructure
https://sustainabletechnologies.ca/app/uploads/2021/06/CVC_Making_Green_Infrastructure_Mainstream_English_May_2021_Final.pdf

Drainage Act FAQ for Urban Municipalities

https://sustainabletechnologies.ca/app/uploads/2021/06/Drainage-Act-FAQ_06292021.pdf

The Drainage Act as a Tool to Facilitate the Aggregation and Wide-Scale Implementation of Green, Low Impact Drainage Infrastructure on Private Property

https://sustainabletechnologies.ca/app/uploads/2020/11/Position-Paper-Drainage-Act-and-GI.pdf

http://www.omafra.gov.on.ca/english/landuse/drainage.htm

# Thank You

For more information:

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