

Equitable Responsibility for Transformational Design: *Optimization of stormwater management within the East Holland River watershed*

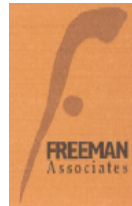
Board of Directors
November 27, 2020

Ben Longstaff, GM, Integrated Watershed Management

Tracy Patterson, Freeman Associates



Lake Simcoe Region
conservation authority

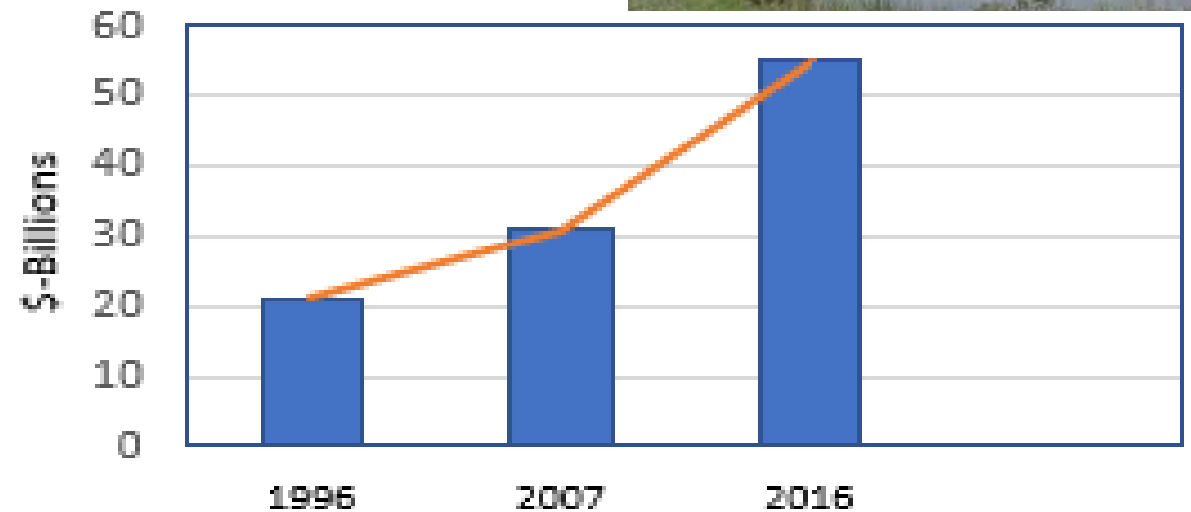


Member of Conservation Ontario

Problem statement

- Municipal boundary, public land-based stormwater planning & management
- After-the-fact mitigation a significant factor in stormwater planning
- End-of-pipe focus of SWM, with ad hoc approach to LID
- Growing municipal deficit

Lack of integrated, watershed scale, system-level cost-benefit optimization.



Municipal stormwater & wastewater deficit (1996 -2016)

Source FCM

Basis for study

A complete re-tooling of SWM is urgently needed:

- SWM plans that build toward holistic, systemic planning that mimics pre-development, watershed-scale hydrology.
- Interfacing of distributed and centralized Stormwater Control Measures (SCM), natural assets and non-structural BMPs on public and private land.
- Planning and design driven by optimal performance at greatest level of cost-efficiency.

*A **system** is a group of interacting or interrelated entities that form a **unified whole** (Wikipedia)*



Study principles

1. Using an **optimization methodology** for SWM planning will significantly expand the scope and depth of Stormwater Control Measures (SCM) evaluation, **providing for more efficient strategies.**
2. Siting SCM on **private & public properties** (vs public properties only) will provide improved performance at **greater cost-efficiency.**
3. Planning and managing stormwater using a **watershed wide framework** will provide improved performance at **greater cost-efficiency** as compared with municipal-scale planning (equitable responsibility)
4. Phosphorus reduction strategies also have significant co-benefits for peak flow control
5. Climate change and additional urbanization will exacerbate challenges and further support need for systems-based approach



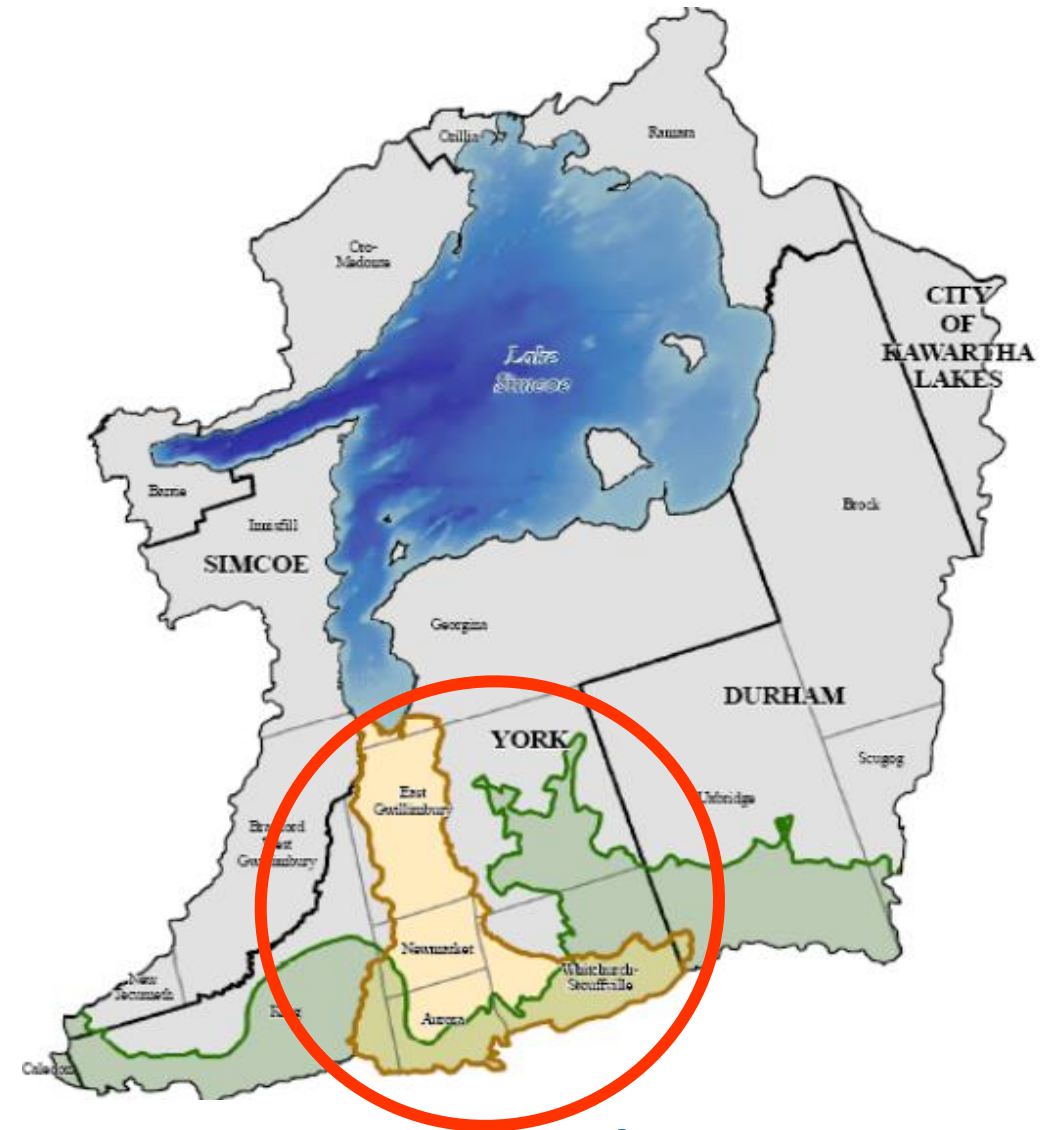
Study area and participants

East Holland River

- Peri-urban
- Growth and intensification
- Municipal Boundary \neq Watershed Boundary
- Five municipalities

Technical Advisory Committee

- East Holland River municipalities
- MECP
- TRCA and CVC (STEP Partners)
- Project team



Management objectives

- Phosphorus reduction (40%)
- Flood mitigation

Study methodology

Simulate current conditions

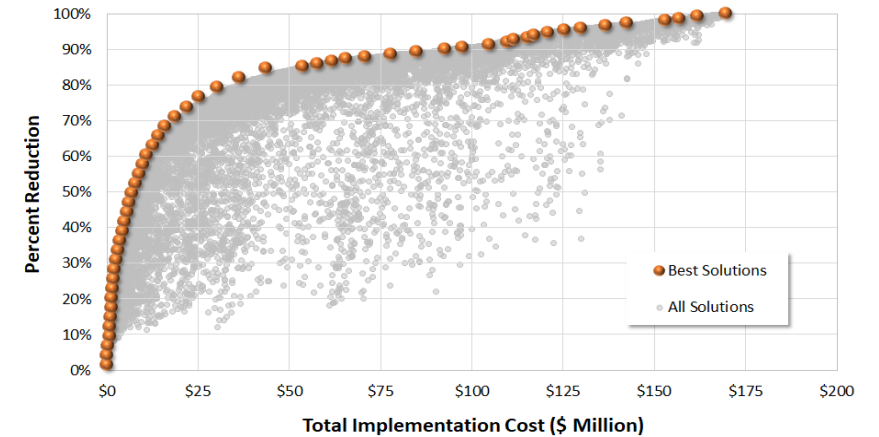
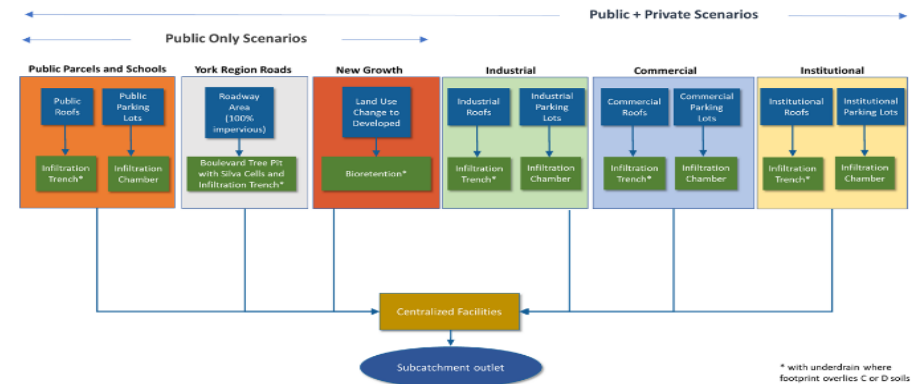
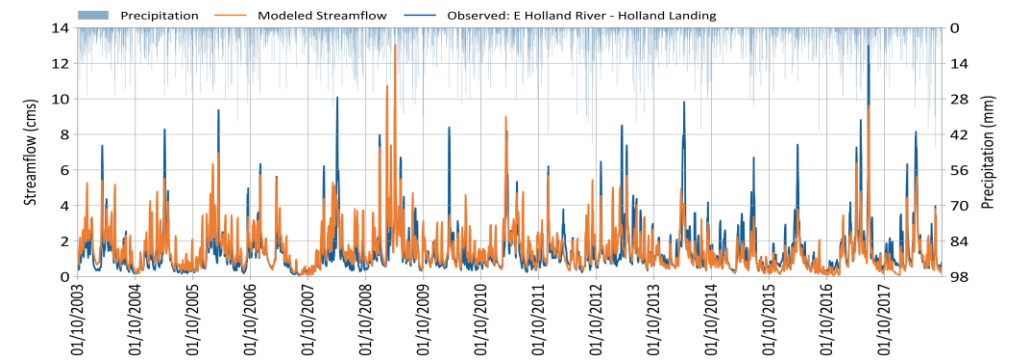
- Phosphorus
- Stream flow

Build future state model

- Select stormwater control measures
 - Decentralized (LID) & Centralized (e.g. hybrid ponds)
- Performance of selected stormwater controls (e.g. P removal)
- Cost of selected Stormwater control (capital, O&M)

Optimization simulations

- Watershed scale
- Public vs public and private lands
- Watershed vs Jurisdictional

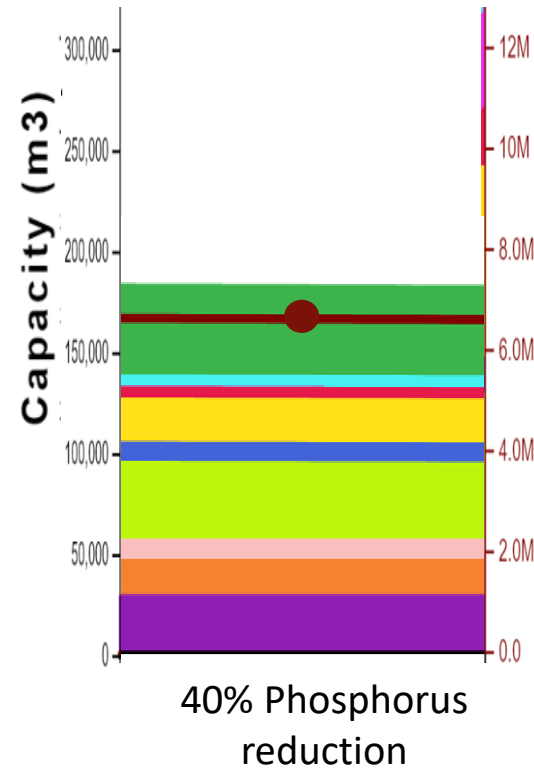
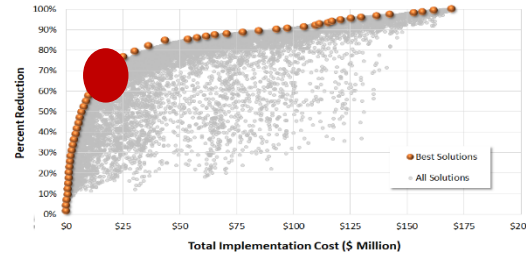


Principle #1

An optimization methodology will result in more efficient stormwater management strategies



Cost Optimized Implementation Strategy



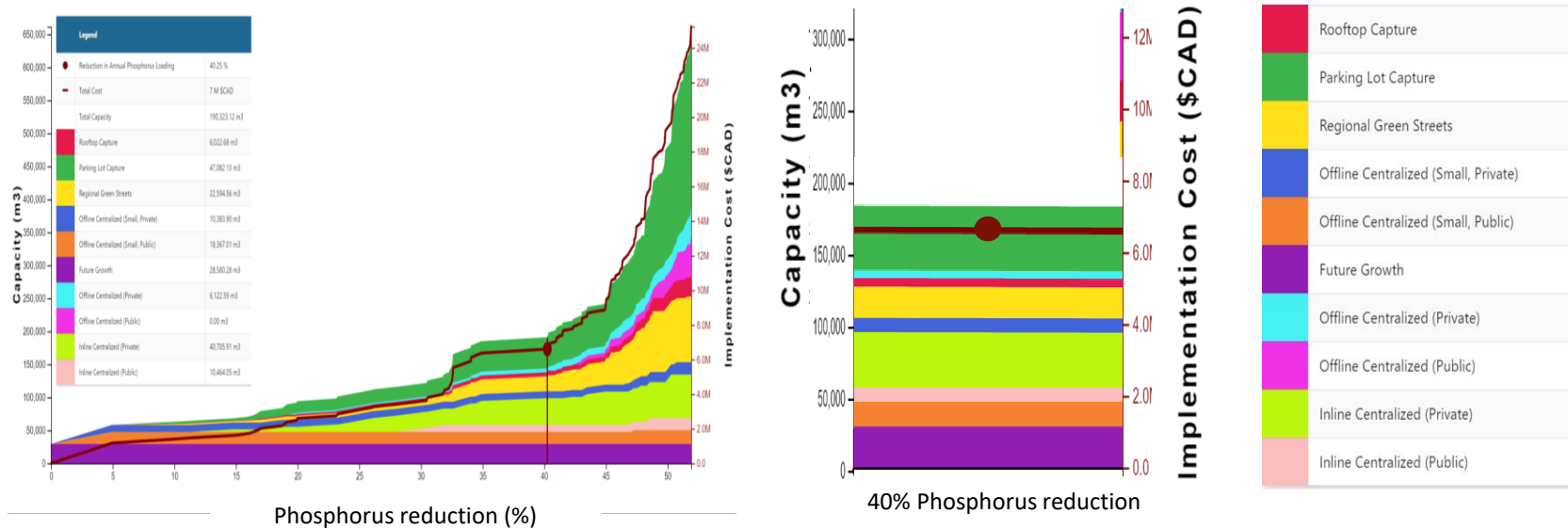
Implementation Cost (\$CAD)



Overall costs to achieve 40% Phosphorus reduction at East Holland Landing Station \$6.5 million/yr*

* Includes capital, operational and maintenance expenses annualized over 30 time period

Cost Optimized Implementation Strategy

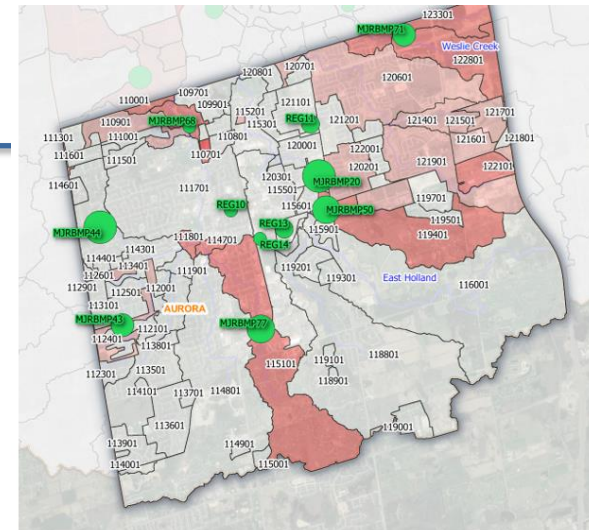
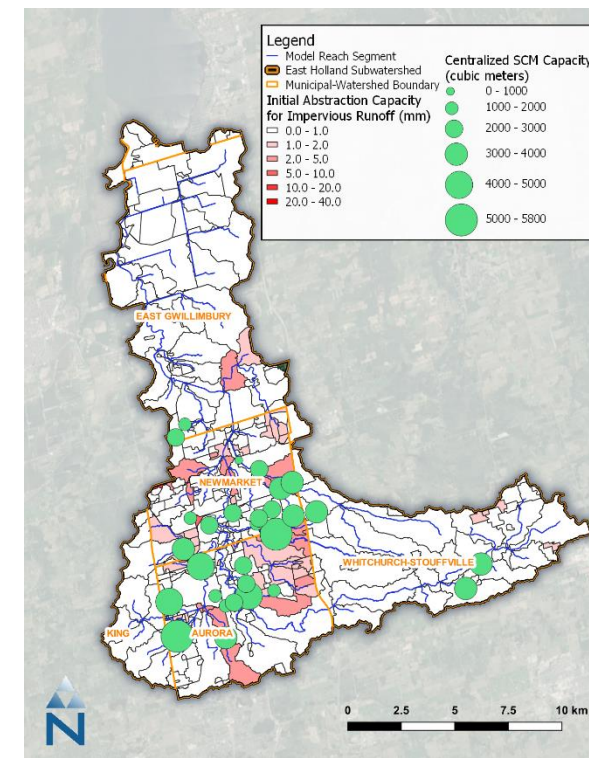
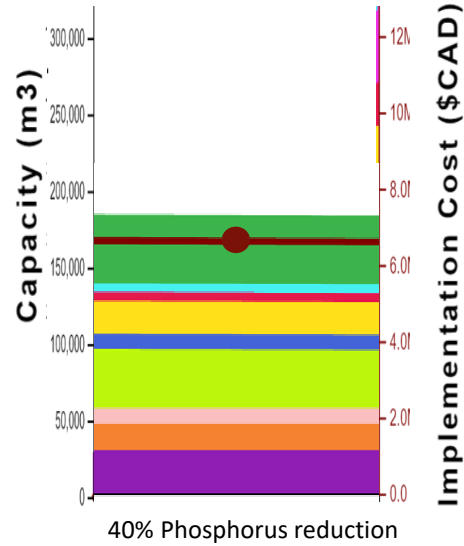
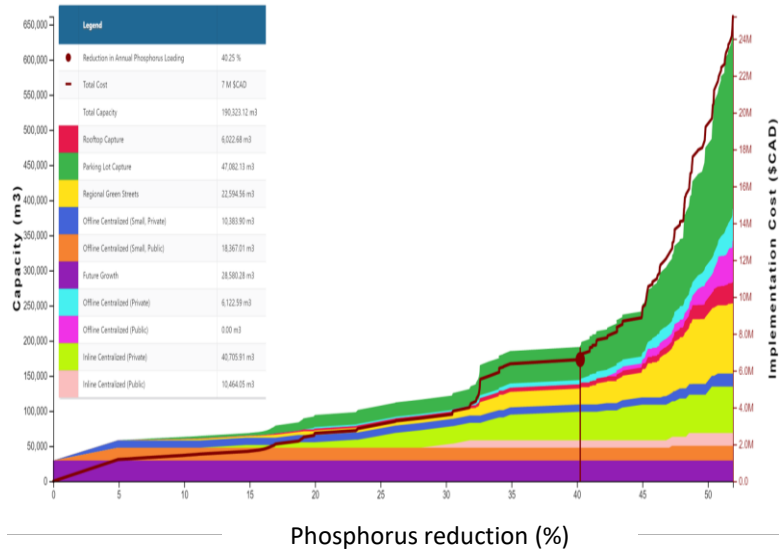


A "strategy" for all phosphorus reduction (%) amounts

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Cost Optimized Implementation Strategy



A "strategy" for all phosphorus reduction (%) amounts

Map SWM control measures

Overall costs to achieve 40% Phosphorus reduction at East Holland Landing Station \$6.5 million/yr*

* Includes capital, operational and maintenance expenses annualized over 30 time period

Principle #2

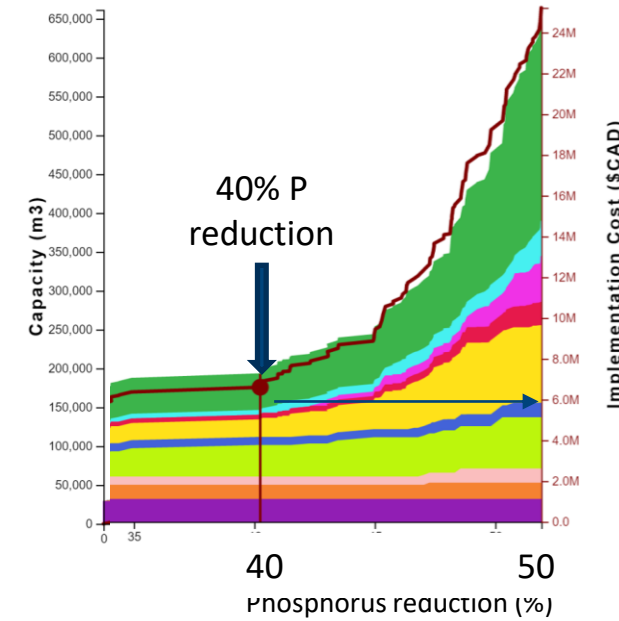
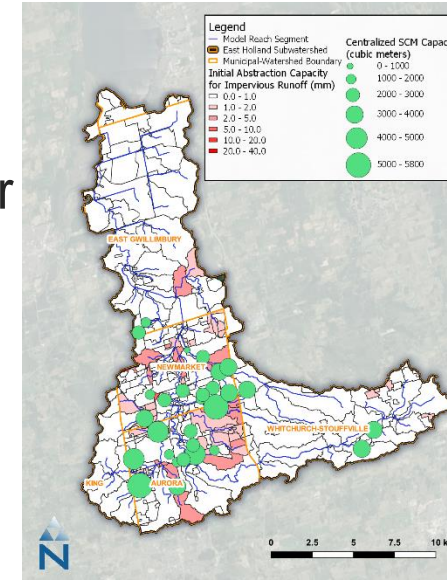
Siting stormwater control measures on private & public properties (vs public properties only) will provide improved performance at greater cost-efficiency.



Public vs public & private lands

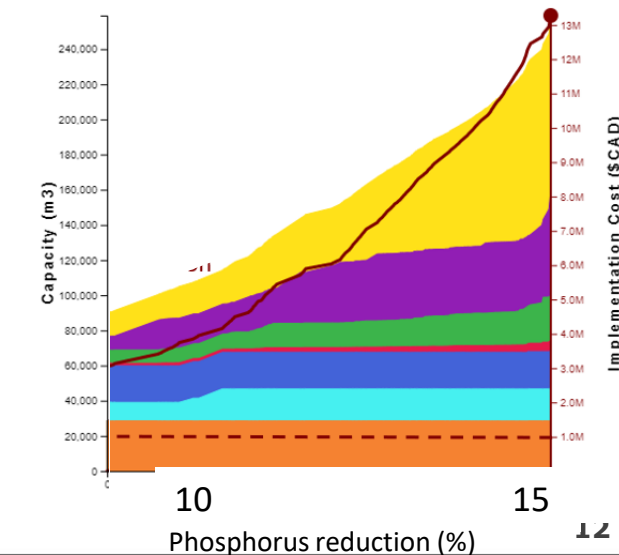
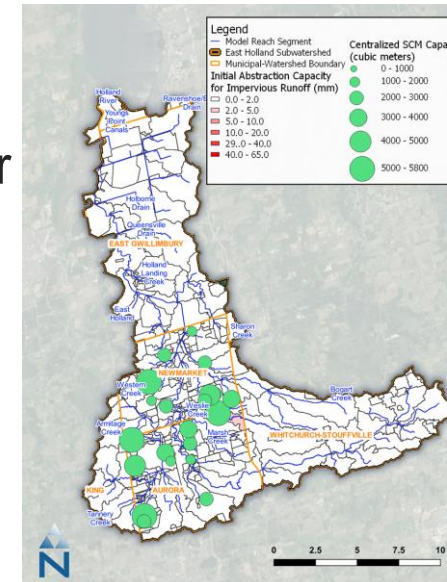
Private & Public land:

- 40% phosphorus reduction achieved at \$6.5 million/year



Public lands only

- 15% maximum phosphorus reduction at \$13 million/year

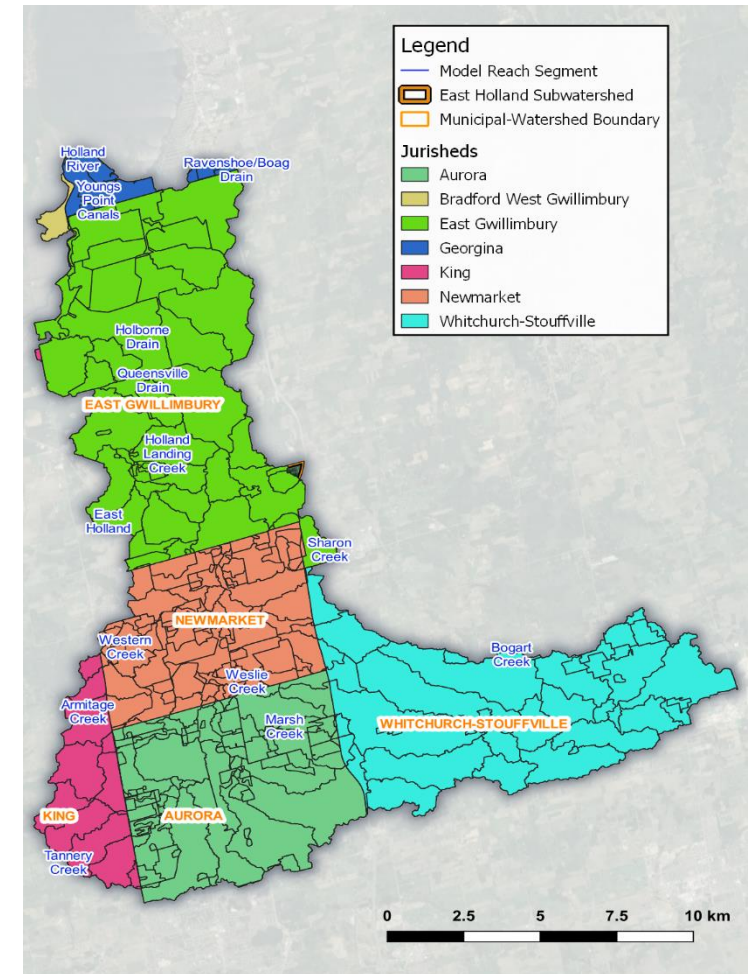


Public – Private Partnership examples:

- Wetland projects on private farmland, (Norfolk County, Alus, AgCan, OMAFRA, Weston Corp)
- District energy partnership (City of Markham, Mattamy Homes Canada and Enwave Energy)

Principle #3

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

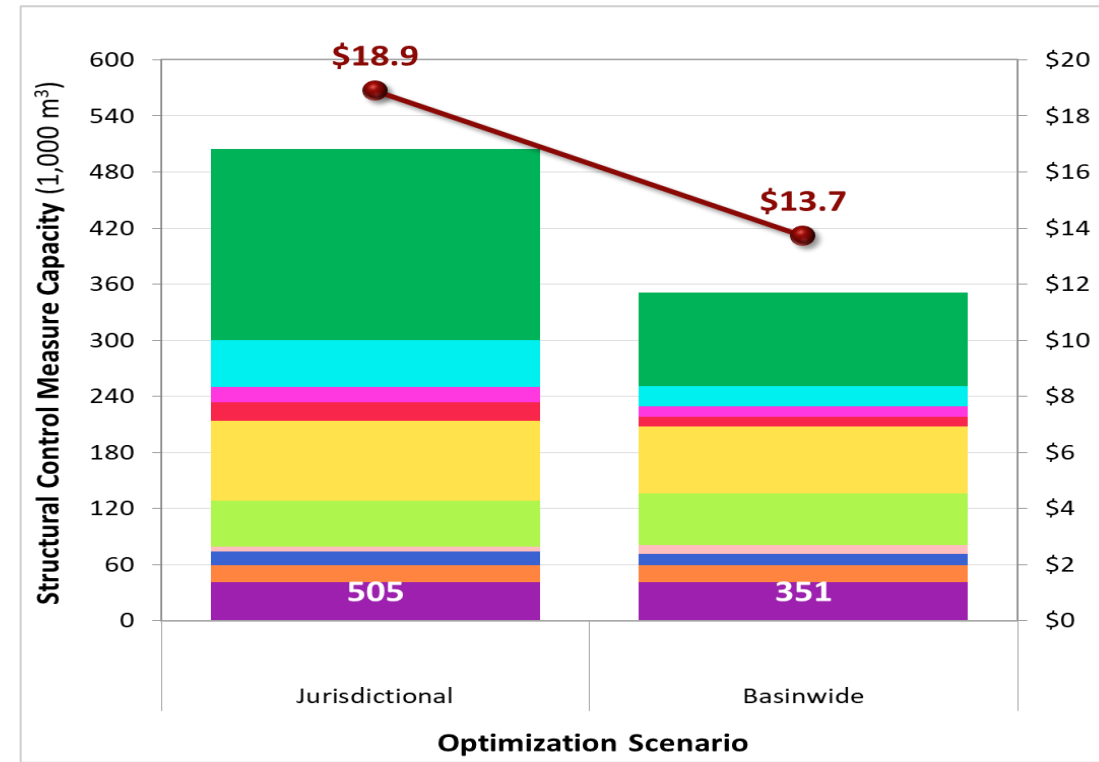


Jurisdiction vs Basinwide Results

- Watershed-wide collaboration leads to a 28% cost savings and 30% reduction in SCM capacity.
- Intermunicipal collaboration provides for more efficient distributed SCM (e.g. parking lots), economies of scale and increased capacity (e.g. centralized hybrid ponds).

Intermunicipal collaboration examples:

- Central York Fire Services (Aurora and Newmarket).
- Animal Services (Aurora, Georgina and Newmarket).
- Holland Marsh Drainage System Joint municipal Services Board
- York Purchasing Cooperative (all municipalities in Region).



Study outcomes and findings

- **Demonstrated the multiple benefits** of undertaking watershed scale cost-optimization modeling.
- **Identified the most cost-effective opportunities** to achieve 40% phosphorus reductions in support of the LSPOP and the LSPP phosphorus reduction strategy's target.
- **Demonstrated how the tool can be used to assess peak flow/ flood reduction** associated with P reduction control measures, the associated costs and damage reduction.
- **Developed a methodology** that can be further refined and applied to other watersheds within the Lake Simcoe basin and beyond.
- **Prepared critical datasets**, such as stormwater management lifecycle costs that can be readily applied to future studies.
- Ensured modeling was completed in **opensource (non-proprietary) software** facilitating flexibility in future application.



Key recommendations

- Establish a **senior-level working group**, possibly an extension of the existing study Technical Advisory Committee (TAC), to develop a work plan and strategy for the implementation of system-wide SWM and public-private projects.
- **Meet with senior municipal staff, council, industry/sector representatives and First Nations** to discuss findings and explore opportunities for support and collaboration
- **Develop guidance and training materials** and tools to support area municipalities in the use of optimization analysis for SWM planning.
- Evaluate the application of **system-wide SWM principles Lake Simcoe-wide**
- Evaluate **integrating the use of non-structural SCMs and natural assets** as integral parts of the SWM system



Opportunities

- Major federal infrastructure stimulus dollars with specific emphasis on:
 - Green Infrastructure
 - Local economic development/stimulus
- Funding of this magnitude will be available for a limited time.
- Opportunity to create the first Green Infrastructure (GI) economic hub in Canada and the second in North America.
- GI is a rapidly emerging sector globally
- GI investment goes into local economies.
 - most importantly, the investment compounds at the local scale feeding further local investment and growth.
 - It is the basis of hubs and how economic centres of specialty expand and prosper (e.g., Kitchener-Waterloo technology hub, Montreal biotech hub, Edmonton hydrogen energy hub).



Opportunities – Philadelphia example

- The first 5 years (2011-2016) of Philadelphia’s GI incentive program led to the development of a *“GSI industry cluster having an economic impact of \$60-million to date”*:
 - *“operations associated with the Philadelphia’s GI projects account for \$35 million of total annual revenues for 60 firms”*.
 - *“GSI companies generate an annual economic impact of \$57 million, supporting 430 direct, indirect, and induced jobs and \$27 million in annual labor income”*
- While conventional goods manufacturing in Philadelphia experienced a decline of 12% between 2007 and 2012; GI-related business have experienced doubled digit growth since 2011. In one year (2013-2014) GI business growth was 14% or over \$146.8-million.
- *“Over the course of the GI program, conservatively, aggregate private investment will be equivalent to half the total value of public investment, or \$600 million.”*

(Source: Econsult Solutions for the Sustainable Business Network; The Economic Impact of Green City, Clean Waters: The first five years)



Acknowledgements

TECHNICAL ADVISORY COMMITTEE MEMBERS

Municipalities

- York Region
- Town of Newmarket
- Town of Aurora
- Town of East Gwillimbury
- Town of Whitchurch-Stouffville

Conservation Authorities

- Toronto Region
- Credit Valley
- Lake Simcoe

Provincial Government Consultants

- Ministry of Environment, Conservation & Parks

- Freeman Associates Ltd.
- Paradigm Environmental
- Fortin Economics
- Barry Hassler

Funding Partners

- Federation of Canadian Municipalities (FCM)
- Natural Resources Canada (NRCAN)
- National Disaster Mitigation Program (NDMP)
- York Region
- Lake Simcoe Conservation Foundation
- Toronto Region Conservation Authority (TRCA)
- Credit Valley Conservation (CVC)
- Town of Newmarket



Thank you