



**Credit Valley  
Conservation**  
inspired by nature

## **Building Business Case for Natural Assets: Examples and Tools from Municipalities in the Credit River Watershed**

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Services

Karen Finney, Engineer, Watershed and Climate Change Risk  
Science

**September 8, 2022**



## Presentation Outline

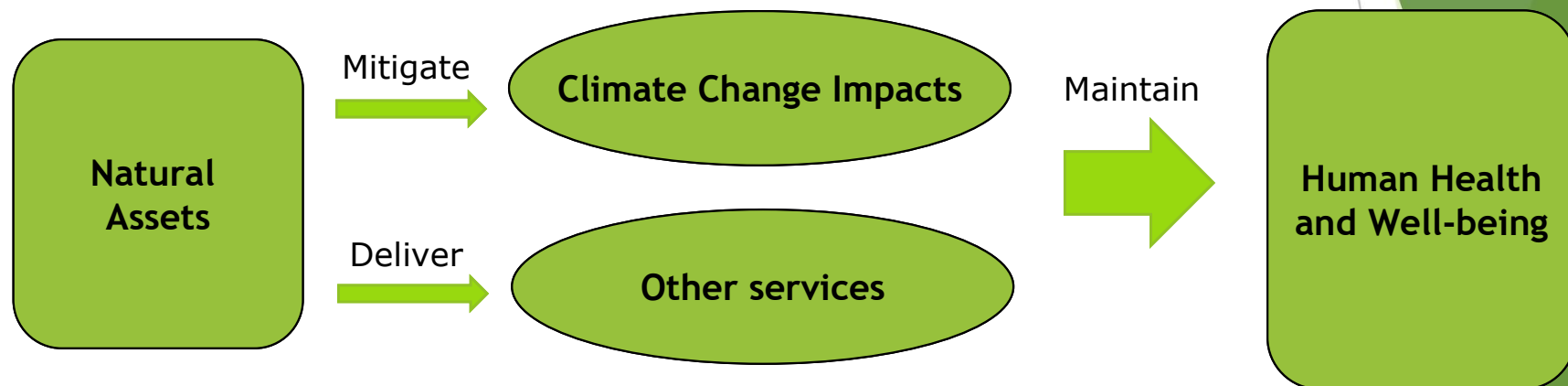
- Role of Natural Assets in Climate Resilience
- Natural Assets: What are They?
- Drivers and opportunities for protecting and enhancing natural assets and our watershed
- Tools for watershed and natural asset protection and enhancement:
  - ✓ Business Case for Natural Assets (BC4NA)
  - ✓ Risk and Return on Investment Tool (RROIT)



Climate Change: A Risk Business.....

*Photo: Rob Bieber*

# Role of Natural Assets in Addressing Climate Change



## Mitigation of Climate Change Impacts

- Carbon sequestration and storage
- Stormwater management
- Urban heat island reduction

## Delivery of Services

- Recreation and tourism
- Waste assimilation
- Real estate value appreciation
- Drinking water quality enhancement

- **Physical**
  - **Mental**
  - **Social**
  - **Economic**
- 



## Natural Heritage System Protection and Climate Resilience

*Protecting and restoring the natural heritage system and its natural assets is one of the most important climate change actions we can undertake for local ecosystems.*



## Credit Valley Conservation Watershed



## Defining Natural Assets

*... the stock of natural resources or ecosystems that are relied upon and managed, or could be managed, by a municipality for the sustainable provision of one or more local government services.*



## **Drivers and Opportunities for Natural Assets: Federal and Provincial Requirements**

### **Ontario Reg 588/17 5 (1) and 3(1) 5**

- Every municipality to prepare an asset management plan for all municipal infrastructure assets (including natural assets/green infrastructure) by July 1, 2024
- Asset management address Climate Change vulnerabilities

### **Federal Infrastructure Funding**

- Requires climate change risk assessment, ROI for best management practices including economic, social and critical infrastructure impacts

## **Major Gaps Identified in Climate Change Vulnerability Study**

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No Integrated Tools/Strategies between municipal departments to incorporate NA into Asset Management Planning or Compare with LID or Grey Infrastructure

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No Common Standard for evaluating risk and determining a feasible Level of Service under climate change to meet Reg 588/17

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No Financial Tools to evaluate adaptation and mitigation measures for their return on investment to meet Federal Funding



A background image of a dense forest with tall trees and green foliage. A blue rounded rectangle is overlaid on the top left, and a white rounded rectangle is overlaid on the bottom right.

## **CVC Studies and Tools are answering the following questions**

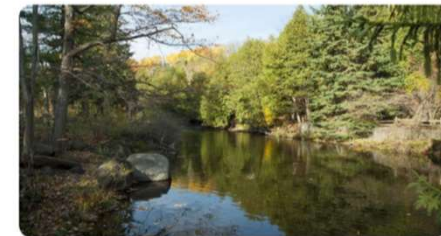
- **How do we demonstrate value to taxpayers for climate change/ natural asset investment?**
- **How do we help our municipal partners to meet Federal and Provincial Requirements wrt natural assets and/or climate change?**
- **What climate change options (specifically, those related to natural assets) have the greatest return on investment and co-benefits?**

## 1. Business Case for Natural Assets in Peel

- Natural asset registry (asset inventory, condition and risk assessment, valuation of services)
- Spreadsheet models to measure the cost of management actions in relation to the value of services
- Web-based interactive dashboard

## 2. Risk and Return on Investment Tool (RROIT)

- Focus on flood and erosion risk management
- Financial assessment of the return on investment of different management options by comparing life cycle costs to the benefits (i.e., damages averted) under various climate change scenarios



Business Case for Natural Assets in the  
Region of Peel: Benefits to Municipalities  
and Local Communities

# Business Case for Natural Assets (BC4NA) in Peel Region



Possibility grows here.





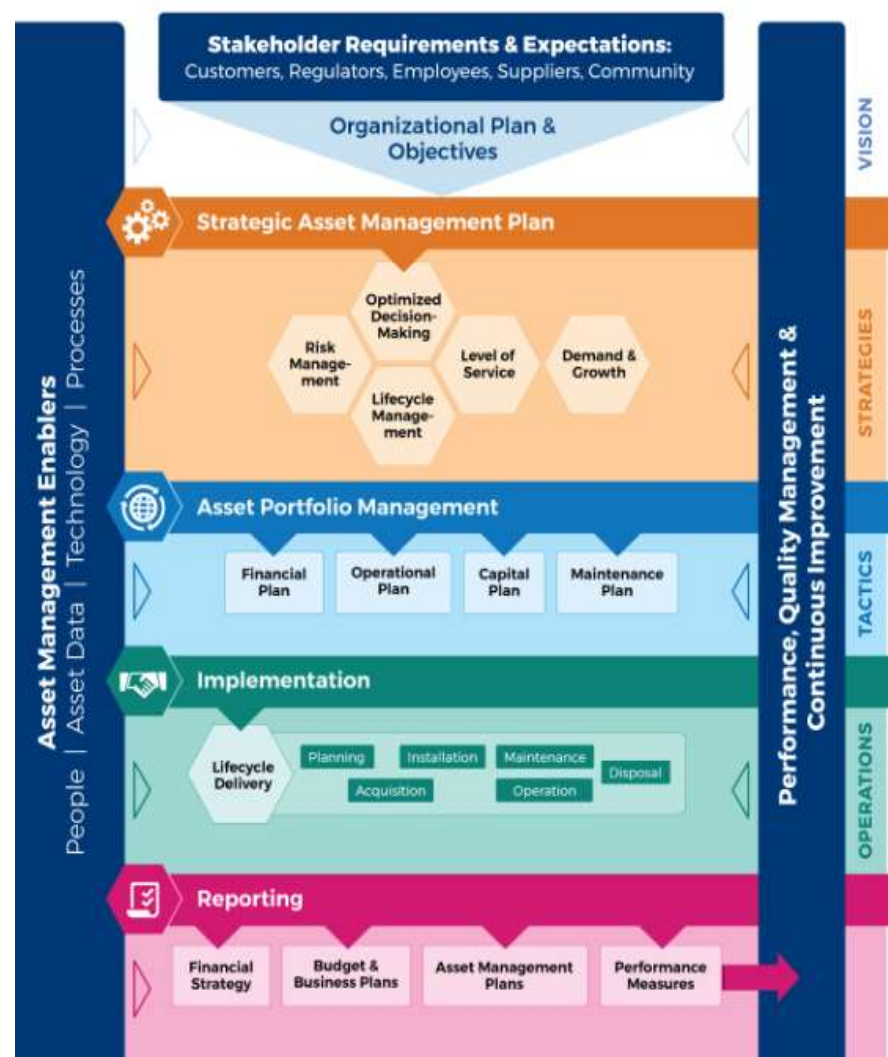
## Project Goal and Rationale

**Project Goal:** Help municipal partners measure and manage the **contribution of natural assets** to municipal service delivery using **asset management frameworks**



### Why include Natural Assets in AMP?

- Comply with the O.Reg.588/17
- Increase infrastructure asset portfolio resiliency to Climate Change
- Reduce the risk, capital and operating expenses of related grey infrastructure
- Assist in maintaining the desired level of service



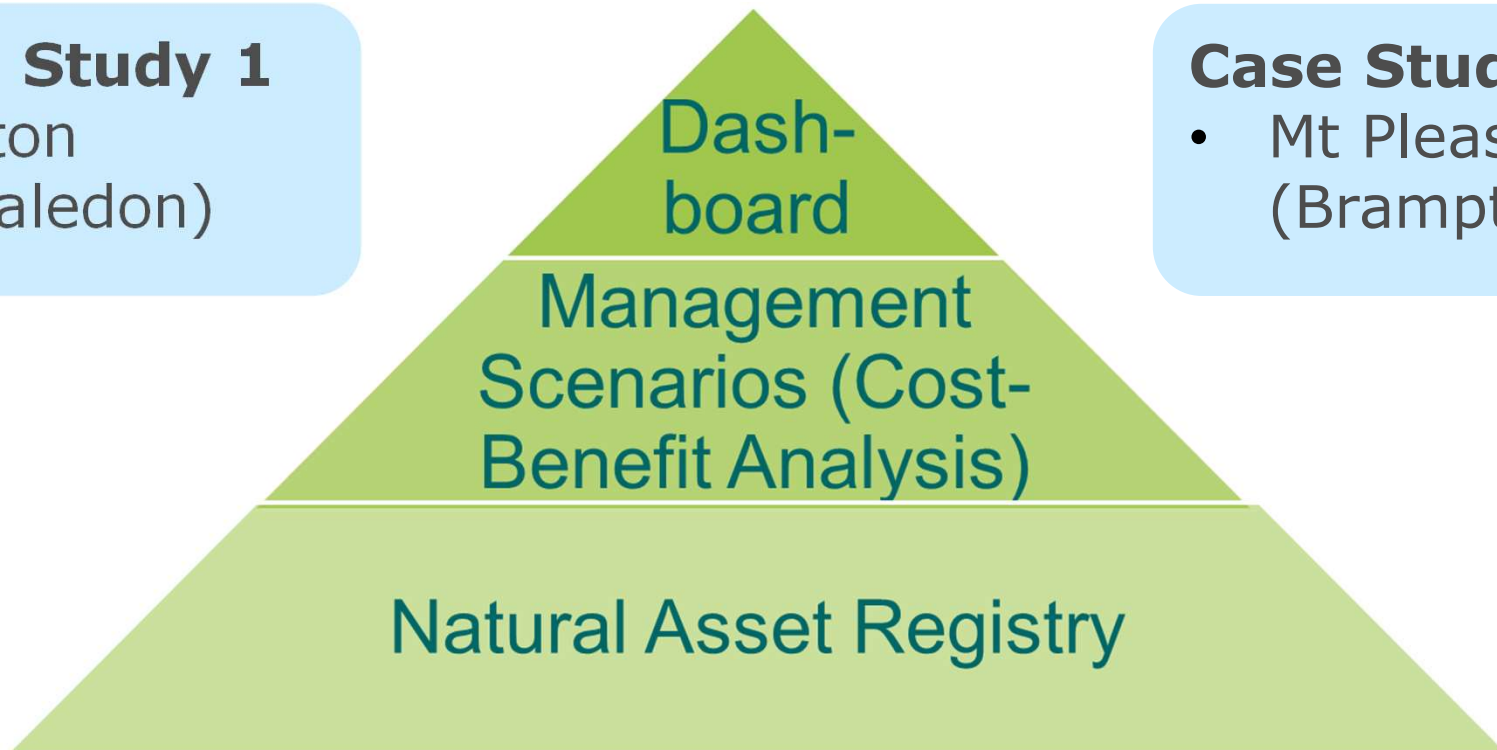
## Business Case for Natural Assets in the Region of Peel

### Case Study 1

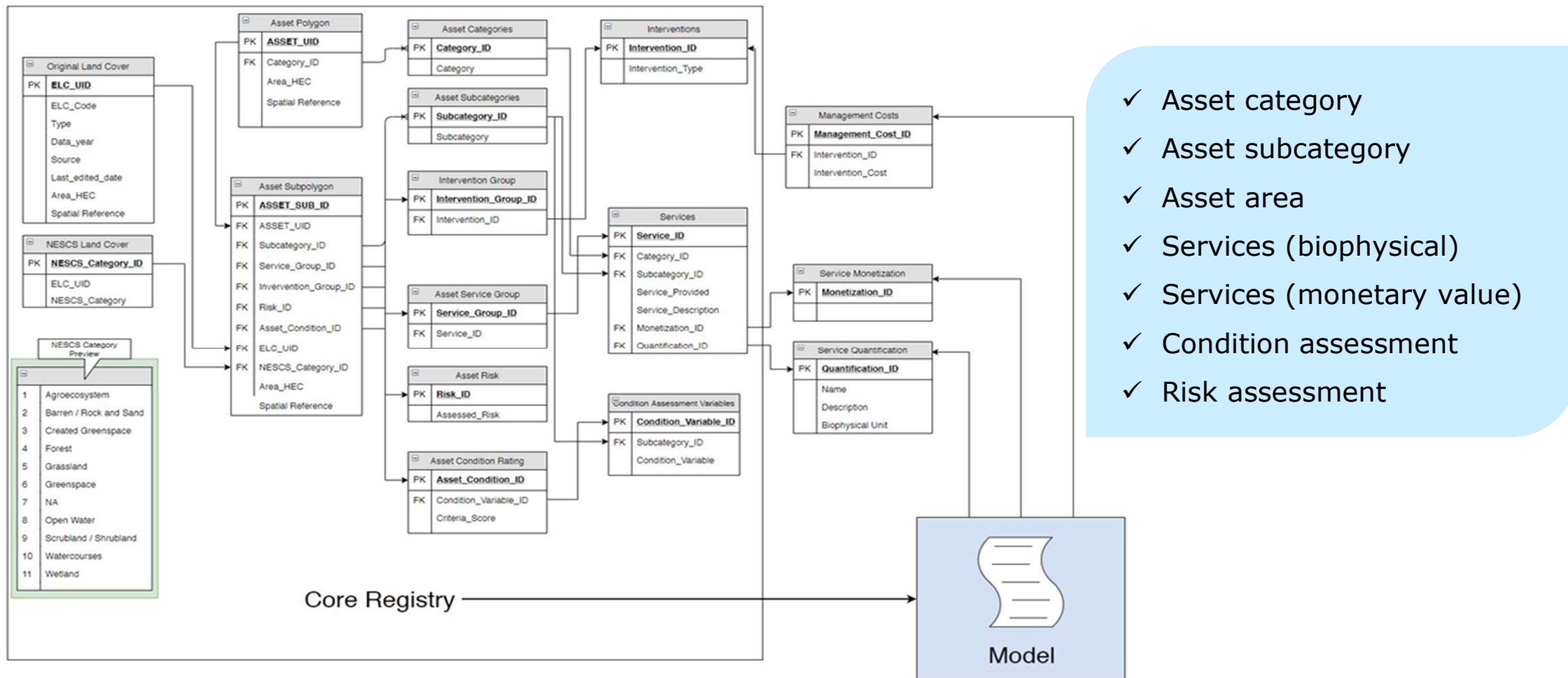
- Alton  
(Caledon)

### Case Study 2

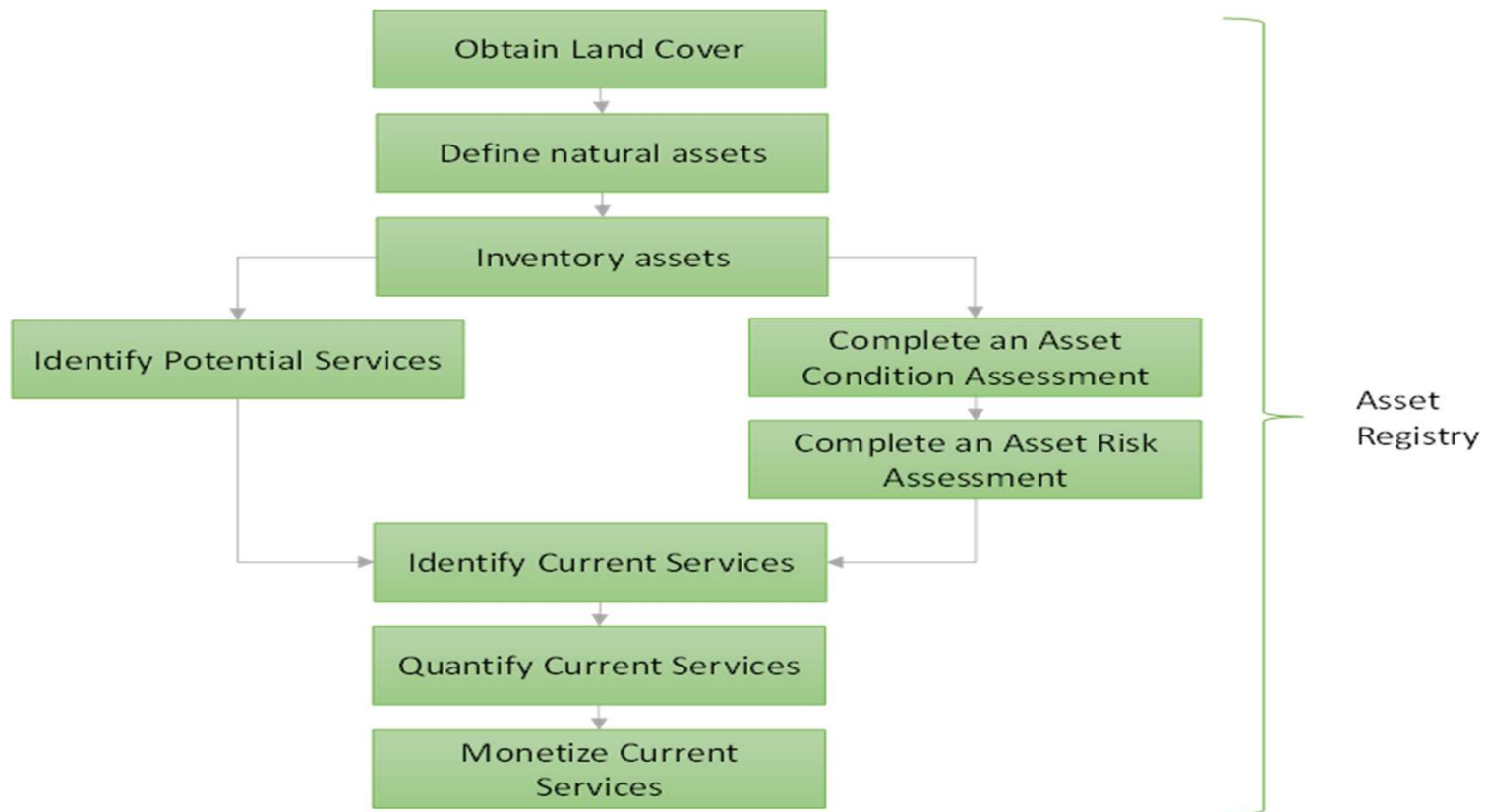
- Mt Pleasant  
(Brampton)



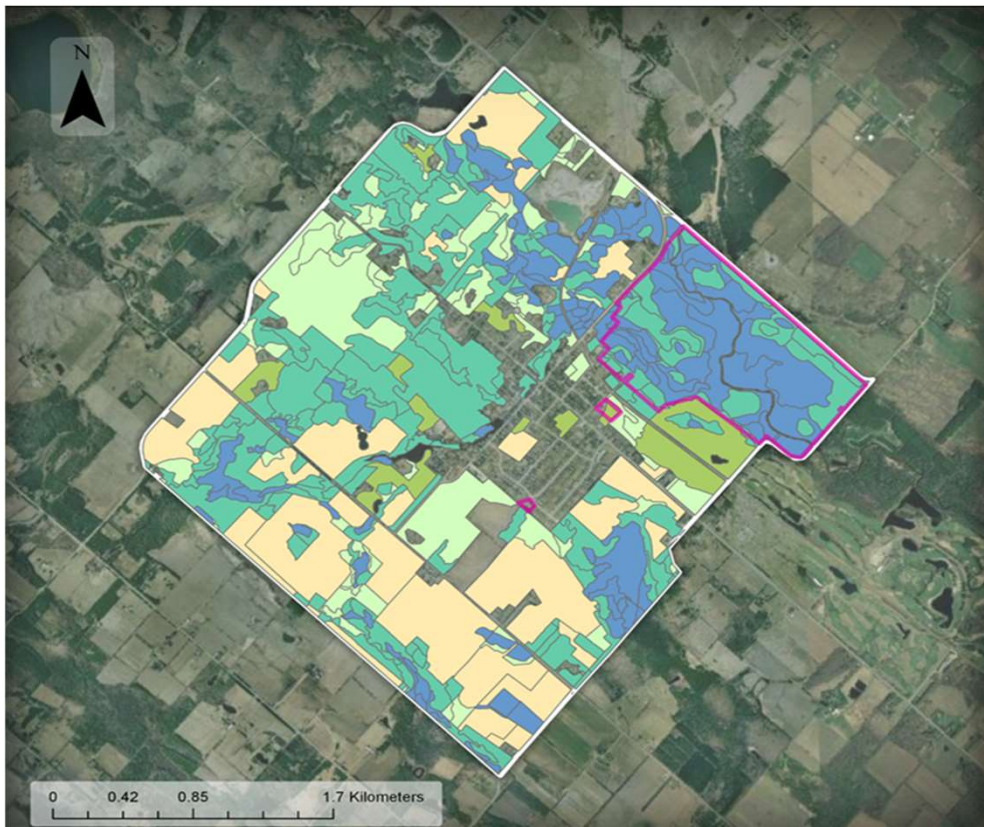
# Natural Asset Registry



## Natural Asset Registry - Key Steps



# Natural Asset Registry – Inventory (Alton)



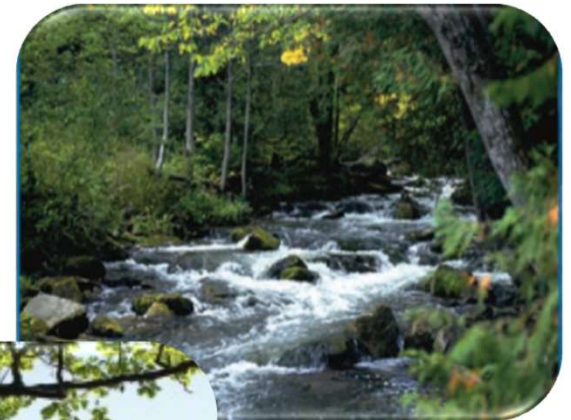
## Natural Asset Classes in BC4NA:

- Forests/Woodlands
- Wetlands
- Grasslands/meadows
- Parks/Manicured green space
- Agroecosystem
- Streams/Lakes
- Aquifers/groundwater



## Natural Asset Registry - Scope of Services

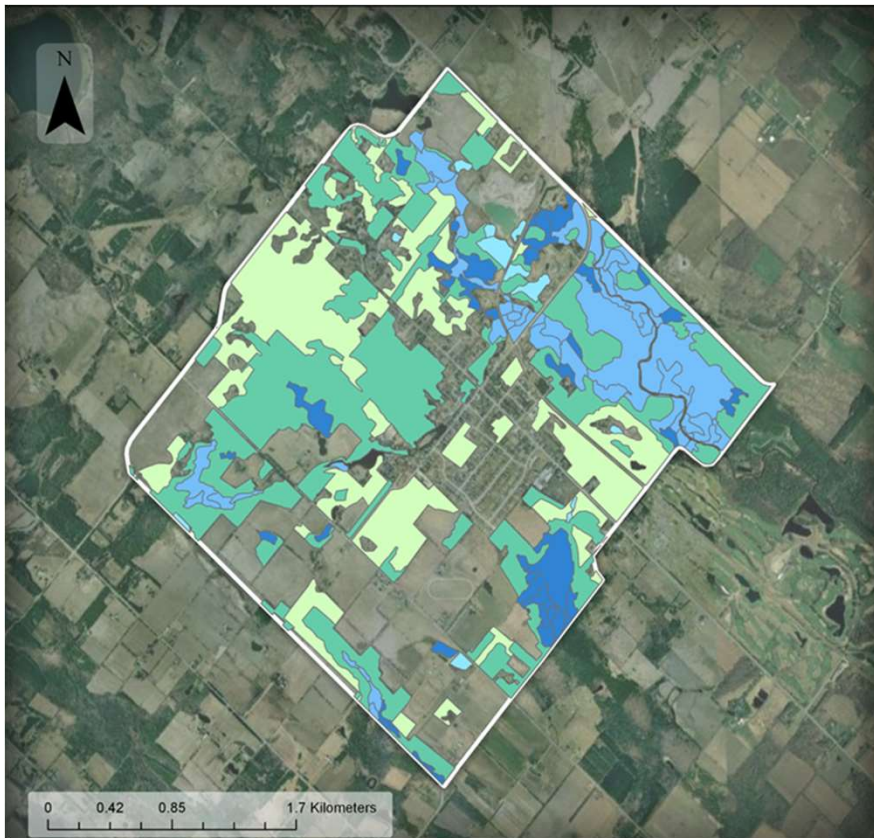
- Air Quality
- Carbon Sequestration
- Property Value
- Urban Heat Reduction
- Stormwater Management
- Recreation



## Linking Services to Relevant Assets

Benefit Provided by Natural Assets	Link to Municipal Services	Relevant Natural Assets
Reduce stormwater impacts	Stormwater management	Forests, wetlands, grassland
Recreation provision and tourism attraction	Parks, recreation and tourism objectives Public health	Forests, wetlands, grassland, greenspace
Reduction in urban heat	Public health and climate change adaptation objectives	Forests, wetlands, greenspace, and other natural urban areas
Air quality improvement	Public health	Forests, wetlands, greenspace, and other natural urban areas
Carbon sequestration	Climate change mitigation objectives	Forests, wetlands, grassland, pasture
Property value	Tourism objectives and property tax collection	Forests, wetlands, grassland, greenspace

# Natural Asset Registry Summary Table Stormwater Management Services (Alton)



Stormwater Quantity Reduction  
and Quality Improvement  
Assets in Alton

- Alton Boundary
- Isolated Wetland
- Palustrine Wetland
- Riverine Wetland
- Woodland
- Open Green Space

Asset Type	Count of Asset Polygon	Total Area of Assets (ha)	Total ESV (\$ Millions)
Woodland	52	278	\$52.9
Isolated	11	10	\$28.1
Palustrine	40	51	\$5.5
Riverine	50	108	\$93.0
Open space	32	195	\$88.2

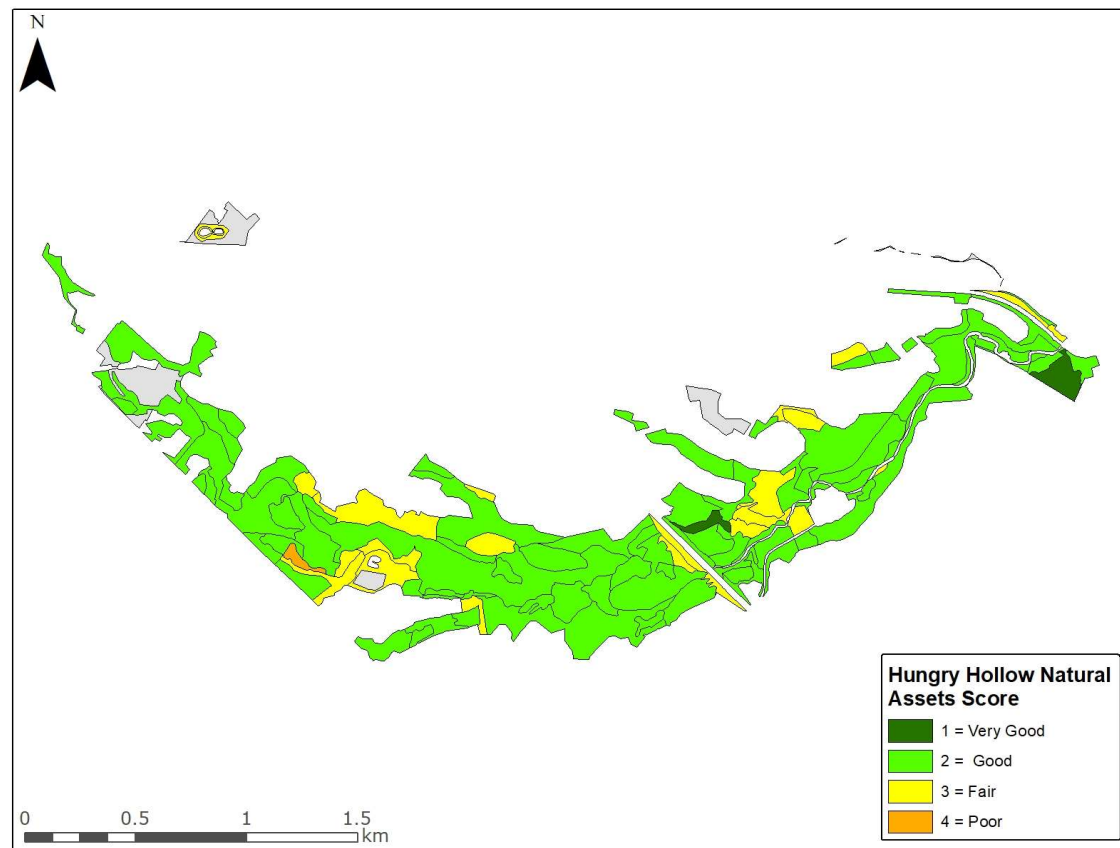


## Natural Asset Condition - Rapid Conditions Assessment Method (RCAM)

**GAP:** lack of approach to assess the condition of municipal natural assets

RCAM allow municipalities to:

- Document assets
- Assess asset condition
- Compare similar assets
- Rank assets
- Prioritize asset for management
- Monitor assets



## Natural Asset Registry – Risk Assessment

- Workshops considered a range of risks
- Selected based on:
  - Level of concern
  - Ability to model changes in services
  - Link management actions and changes in services

### Alton

- Wildfire
- Contamination due to salt applications

### Mount Pleasant

- Invasive Species
- Contamination due to salt applications
- Overuse and dumping

## Natural Asset Management Scenarios and Cost-Benefit Analysis

**Risks to Assets**



### Management Scenarios

**Do Nothing: Loss of assets**

**Maintain: Mitigate risks**

**Enhance: Increase area of assets**



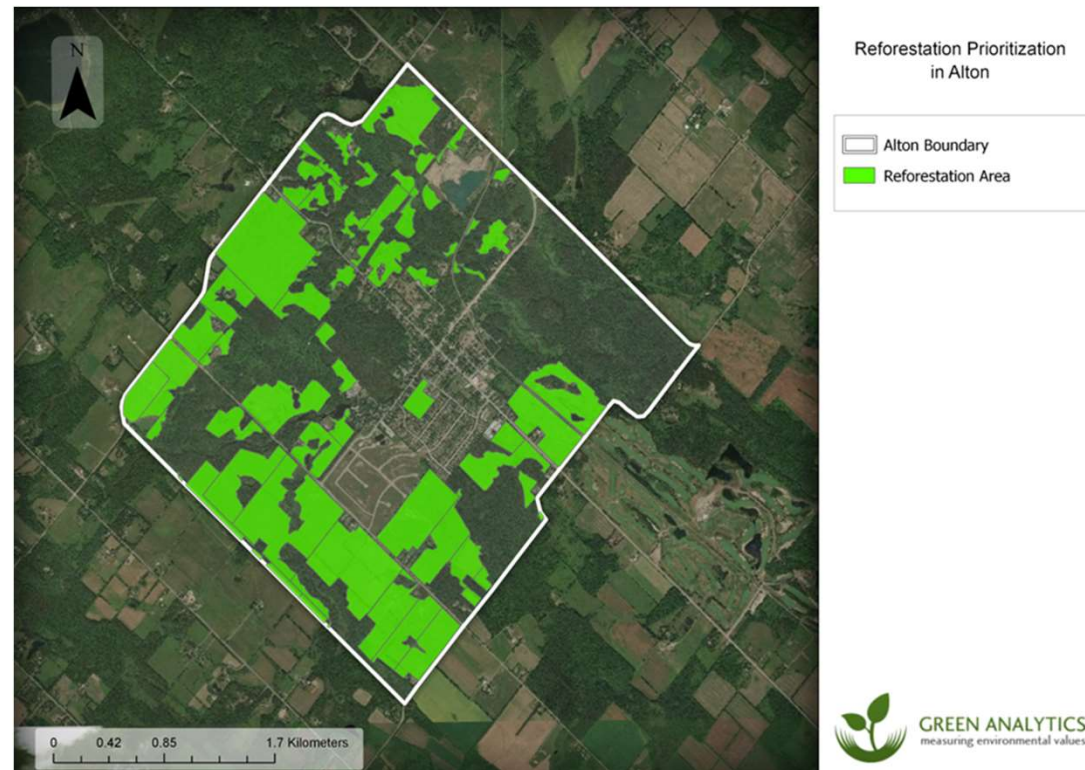
**Cost-benefit Analysis**

## Natural Asset Management Scenarios - Enhance (Alton)

Asset	Reforestation Area (ha)	Naturalization Area (ha)
Woodlands	3	3
Grasslands	14	20
Agro-ecosystems	32	18
Created Greenspace	11	16

### Increased services due to enhancement actions:

- Stormwater: by \$826,200
- Carbon Sequestration: by \$146,146
- Air Quality: by \$115,679,495



# Cost-benefit Models

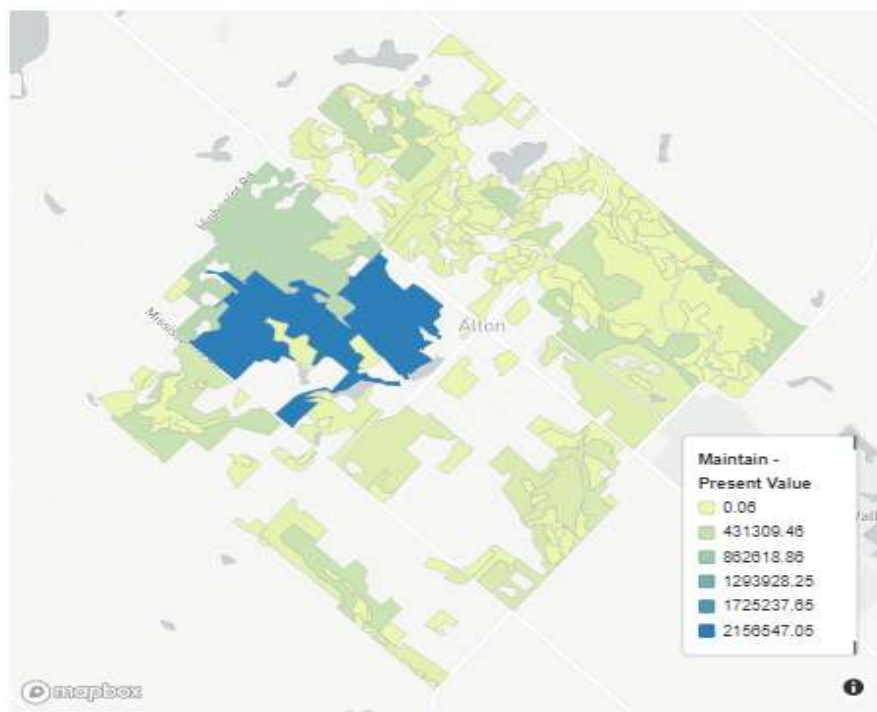
## INPUTS

- Discount rate
- Risk reduction under Maintain (set at 90%)
- Per hectare value of assets
- Risk probability profiles
- Cost of Maintain and Enhance action



## OUTPUTS

- Net present value (NPV) of services
  - Do Nothing (declining services)
  - Maintain (90% of risk removed)
  - Enhance (added services)
- NPV of costs
  - Maintain Costs
  - Enhance Costs
- Benefit-cost ratios



### Mt Pleasant | Stormwater Assets | Salt Risk

Wildfire

Salt



To recognize the uncertainty associated with the probabilities employed in the business case models, the models and the dashboard demonstrate the implications of low, medium and high likelihoods for the priority risks. You can adjust the probability using the selection menu below:

Low

Moderate

High

### Maintain: Benefits Stream (in \$)

779,187.59 Year 1	672,139.19 Year 6	579,799.00 Year 11	500,146.22 Year 16
756,493.83 Year 2	652,563.50 Year 7	562,912.97 Year 12	485,580.32 Year 17
734,461.09 Year 3	633,558.00 Year 8	546,518.79 Year 13	471,438.70 Year 18
713,070.10 Year 4	615,106.09 Year 9	530,602.15 Year 14	457,709.00 Year 19
692,302.19 Year 5	597,191.64 Year 10	515,149.13 Year 15	444,379.22 Year 20

MAINTAIN  
11.94M



AREA  
643.04  
Hectares

COST  
5.26M



SUMMARY: LOST  
VALUE OF DO  
NOTHING

55.37K



SUMMARY: COST  
BENEFIT RATIO

0.89

<https://cvc.ca/ecosystem-goods-services/business-case-for-natural-assets-in-peel/>

## Links to BC4NA Report and Dashboards

### **BC4NA Report:**

[https://cvc.ca/wp-content/uploads/1970/01/BC4NA\\_in\\_RoP\\_f\\_20210816\\_GA\\_rt071021.pdf](https://cvc.ca/wp-content/uploads/1970/01/BC4NA_in_RoP_f_20210816_GA_rt071021.pdf)

### **BC4NA Dashboards:**

<https://cvc.ca/ecosystem-goods-services/business-case-for-natural-assets-in-peel/>

**Questions? Please contact Tatiana Koveshnikova**  
[tatiana.koveshnikova@cvc.ca](mailto:tatiana.koveshnikova@cvc.ca)



# Risk and Return on Investment Tool (RROIT)



Public Safety  
Canada

Sécurité publique  
Canada



Credit Valley  
Conservation  
inspired by nature



THE CITY OF  
**CALGARY**



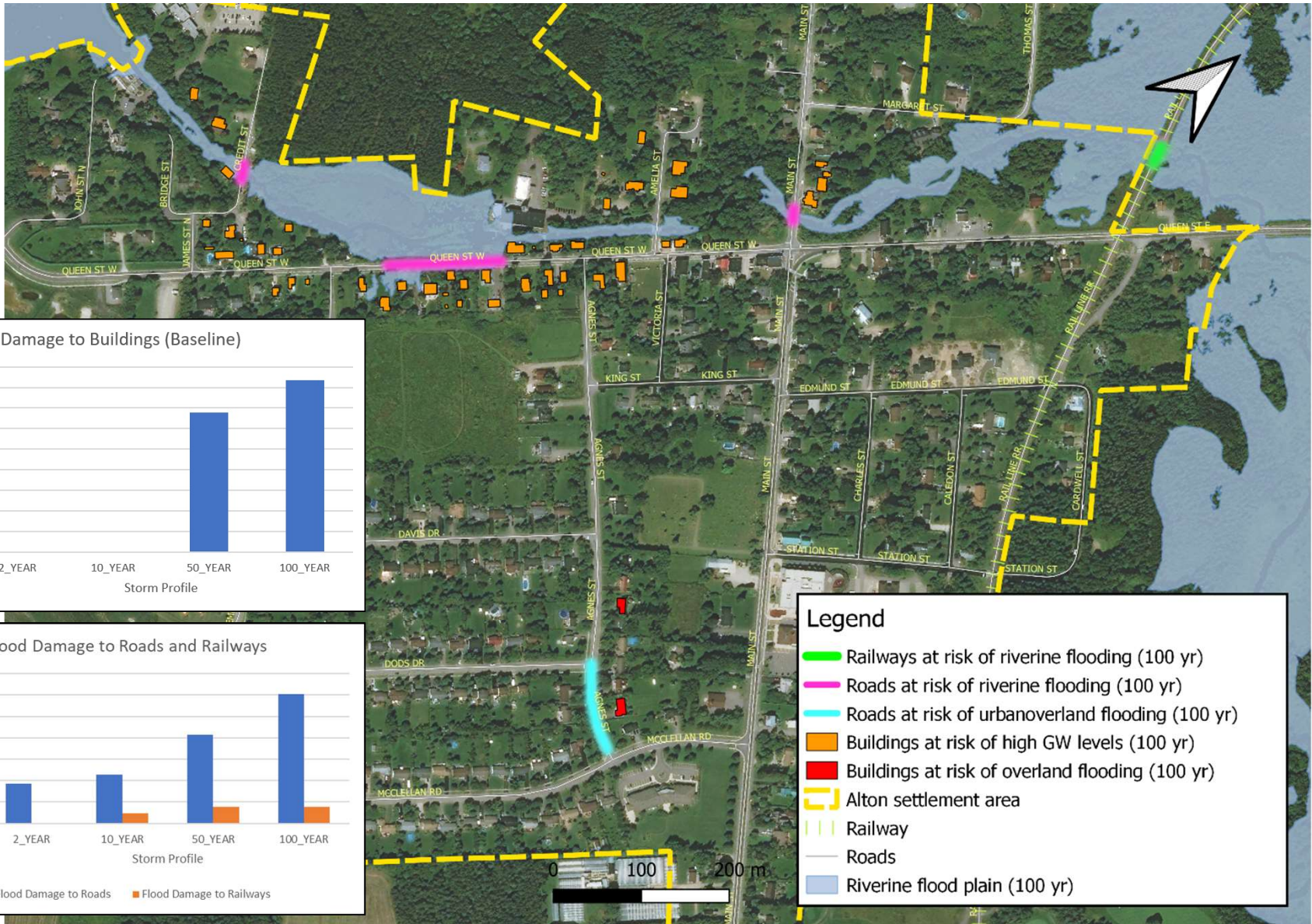
UNIVERSITY OF  
**WATERLOO**



Toronto and Region  
**Conservation**  
for The Living City<sup>®</sup>

**UPPER THAMES RIVER**  
CONSERVATION AUTHORITY







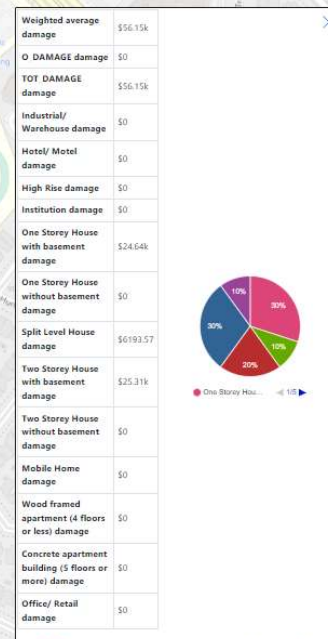
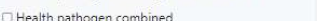
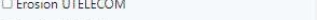
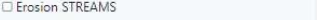
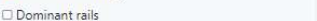
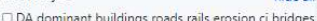
## Downloads

## Click on

[illegible][illegible]

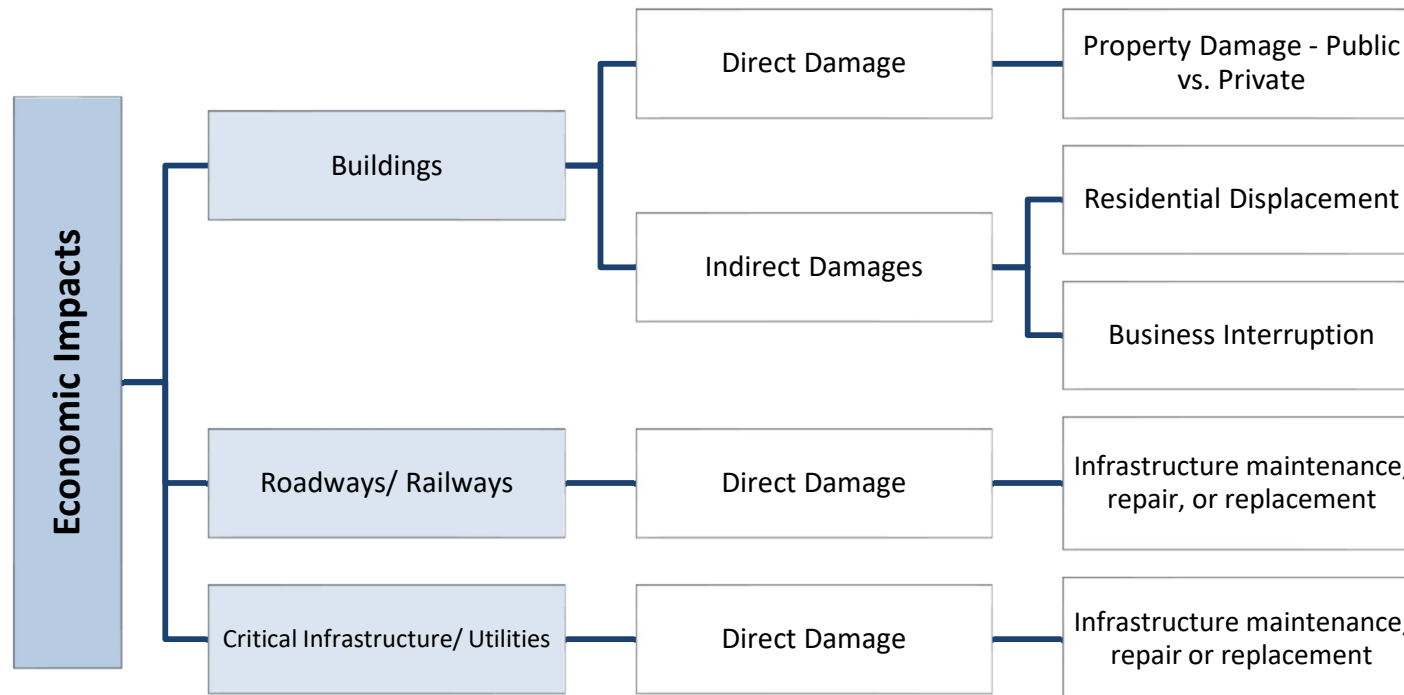
Refresh

Result layers [hide all](#)



## Tool Features – Economic Impacts

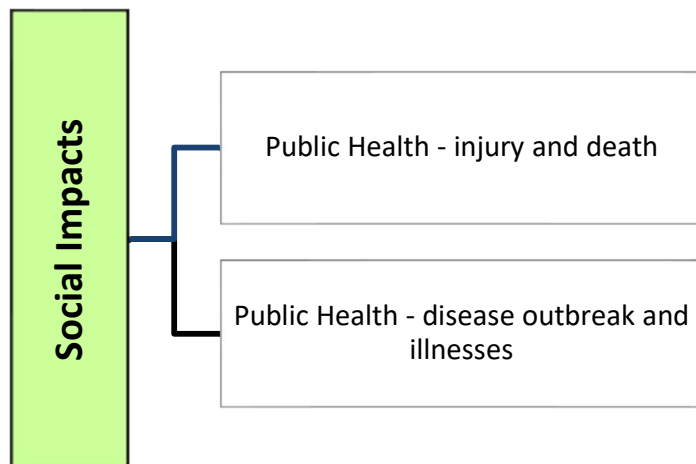
*Impacts determined based on event based riverine flooding, urban overland flooding, groundwater flooding, sanitary sewer backup and erosion*





## Tool Features – Social Impacts

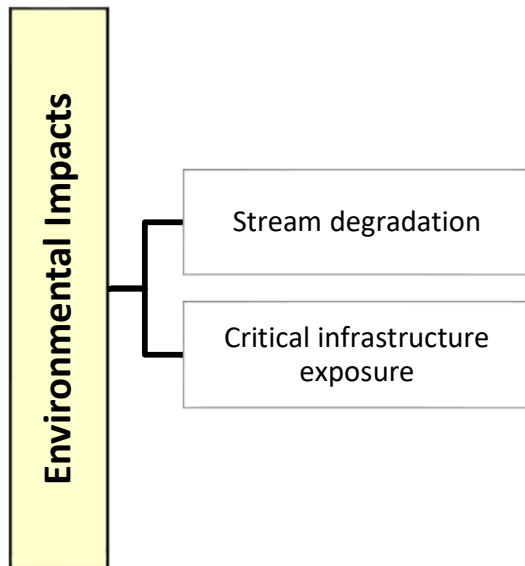
*Impacts determined based on event based riverine flooding, urban overland flooding, groundwater flooding, sanitary sewer backup and erosion*



<https://www.theglobeandmail.com/news/toronto/one-year-later-toronto-remembers-the-flood-of-2013/article19511329/>

## Tool Features – Environmental Impacts

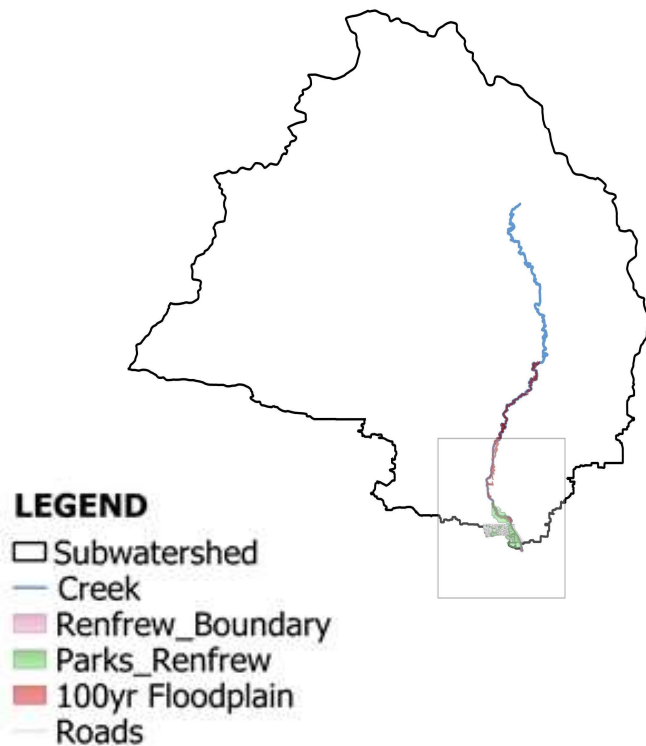
*Impacts determined based on event based riverine flooding, urban overland flooding, groundwater flooding, sanitary sewer backup and erosion*



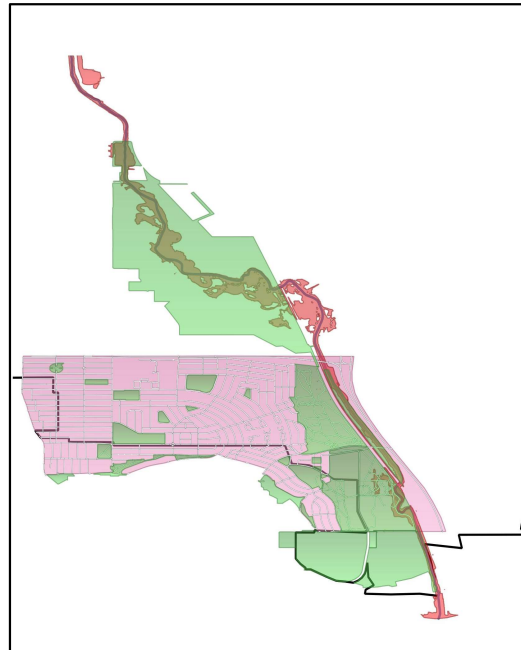
<https://cvc.ca/conversations/streambank-erosion-washing-away-misconceptions/>

# Assessment Can be done at different Scales

## Watershed-wide Erosion assessment



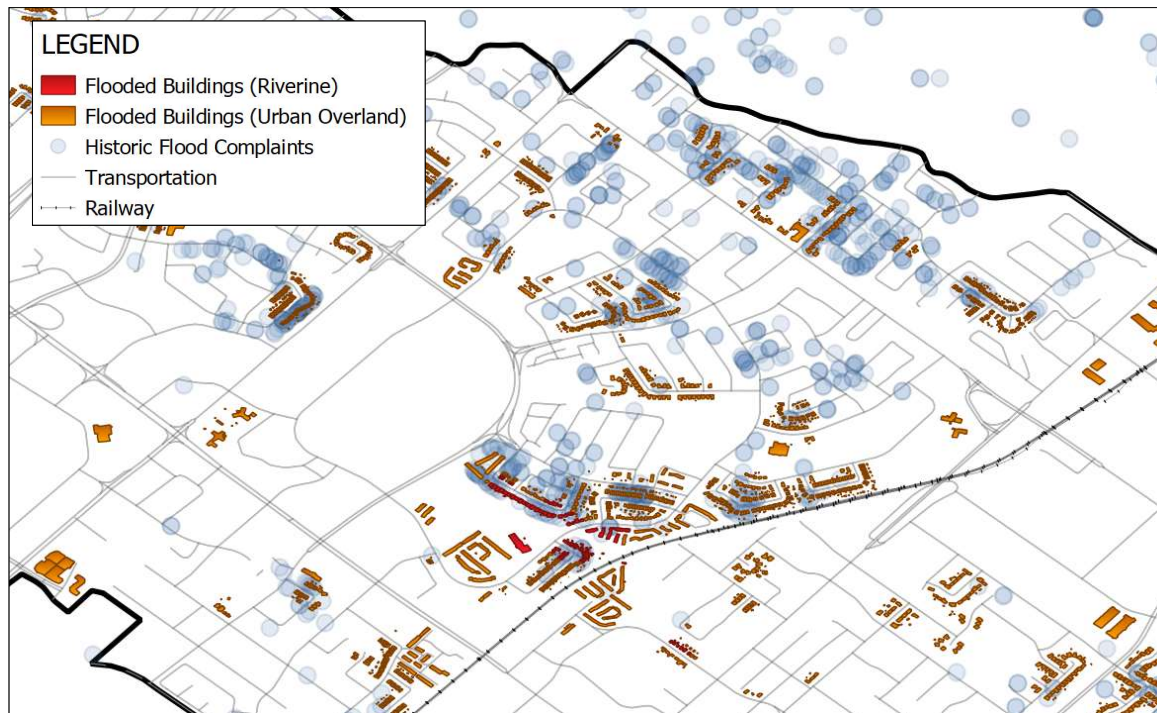
## Community-wide Urban flood risk



## Other Assessments:

- Riverine Flooding
- Sanitary Sewer backup
- Groundwater flooding
- Health impacts

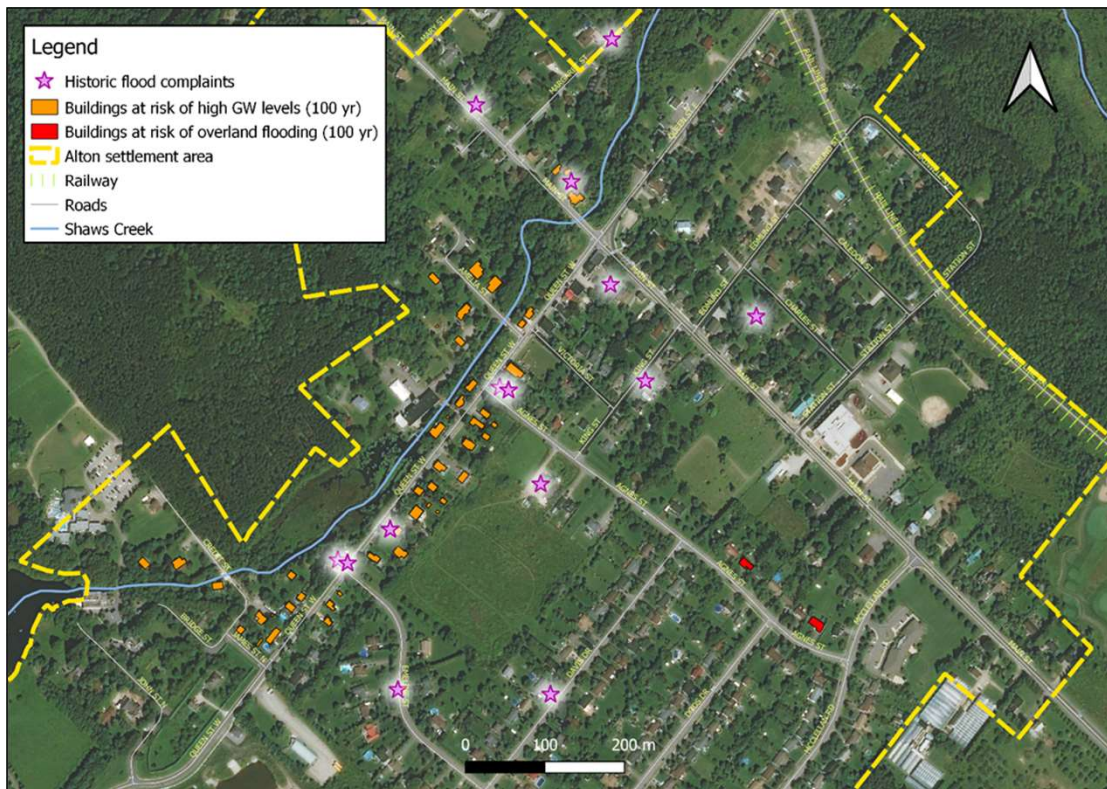
## Economic Impacts – Case Study #1



Flood Type	Flooded Buildings (100- yr)	Total Damages (\$)
Riverine flooding	150	\$21M
Urban flooding	2400	\$400M



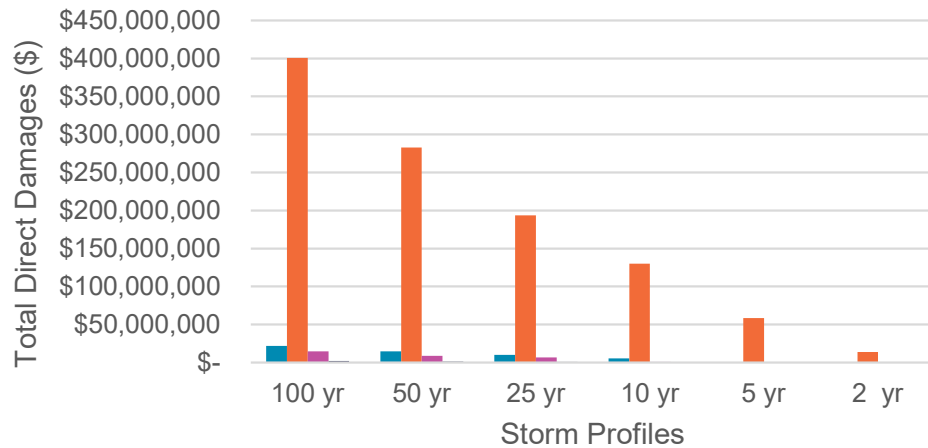
## Economic Impacts – Case Study #2



Flood Type	Flooded Buildings (100- yr)	Total Damages (\$)
Urban overland flooding	150	\$38M
Groundwater flooding	52	\$13M

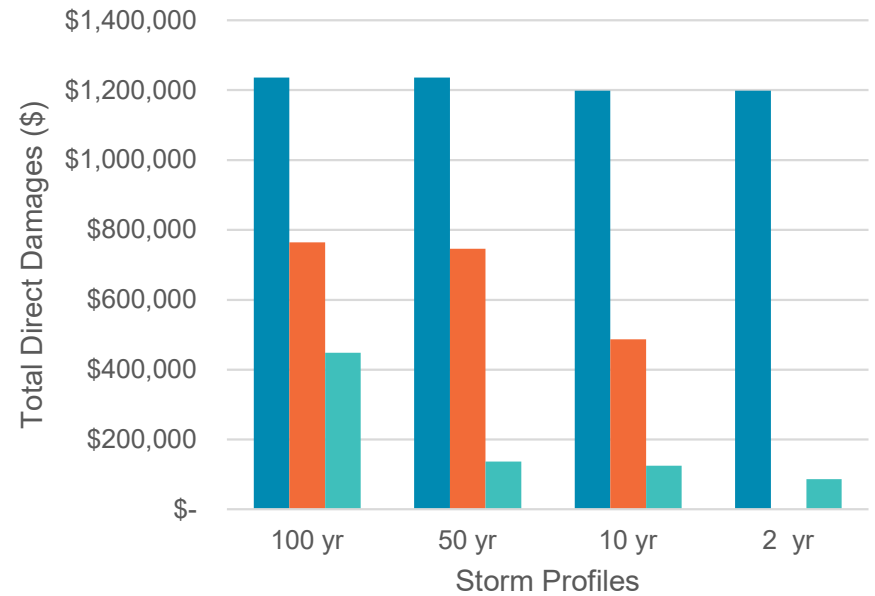
# Event- based Damage Quantification (Public and Private)

## Case Study 1

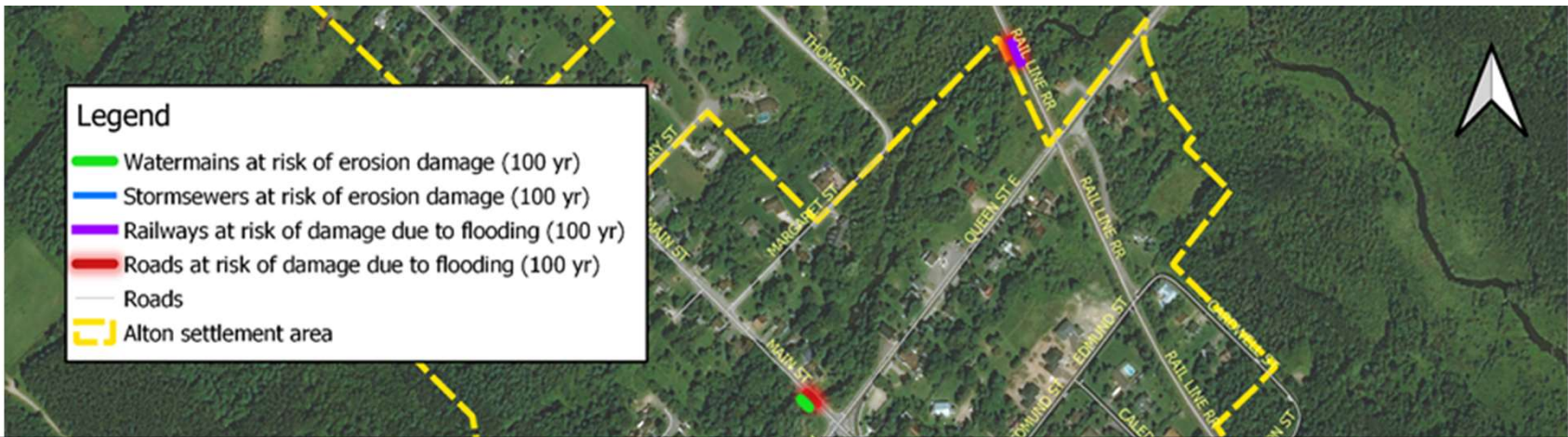


- Flooded Buildings - Riverine
- Flooded Buildings - Urban Overland Flooding and Storm Sewer Backup
- Flooded Roads (Riverine & Urban)
- Flooded Railways (Riverine and Urban)

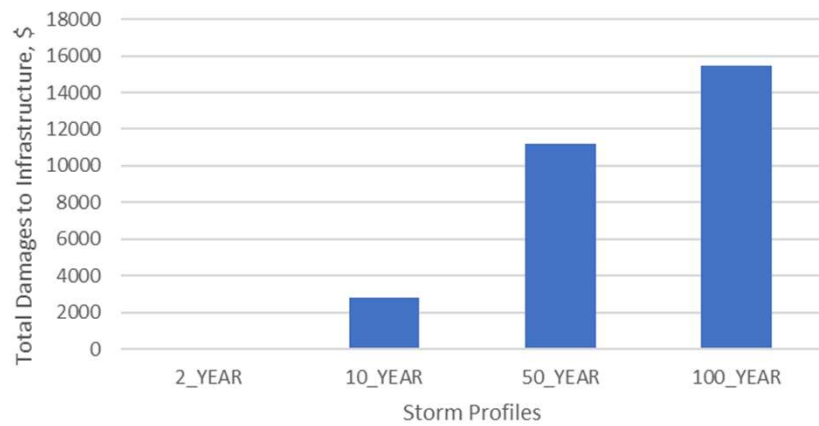
## Case Study 2



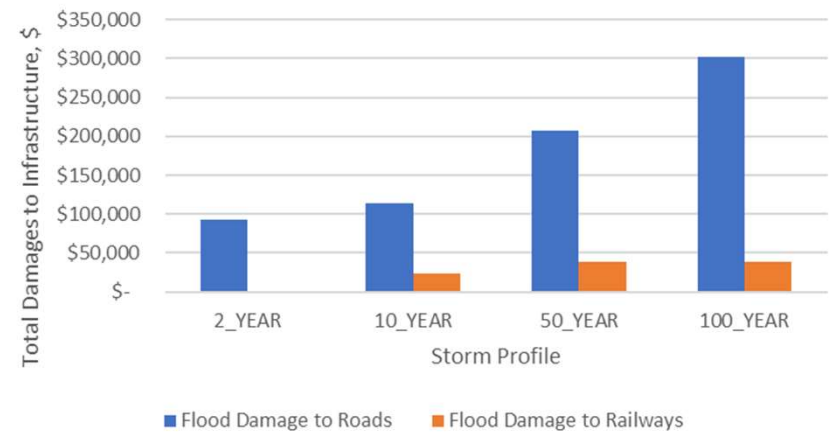
- Groundwater Flooding
- Urban Overland Flooding and Storm Sewer Backup
- Roads



Watermains utility damage (baseline)

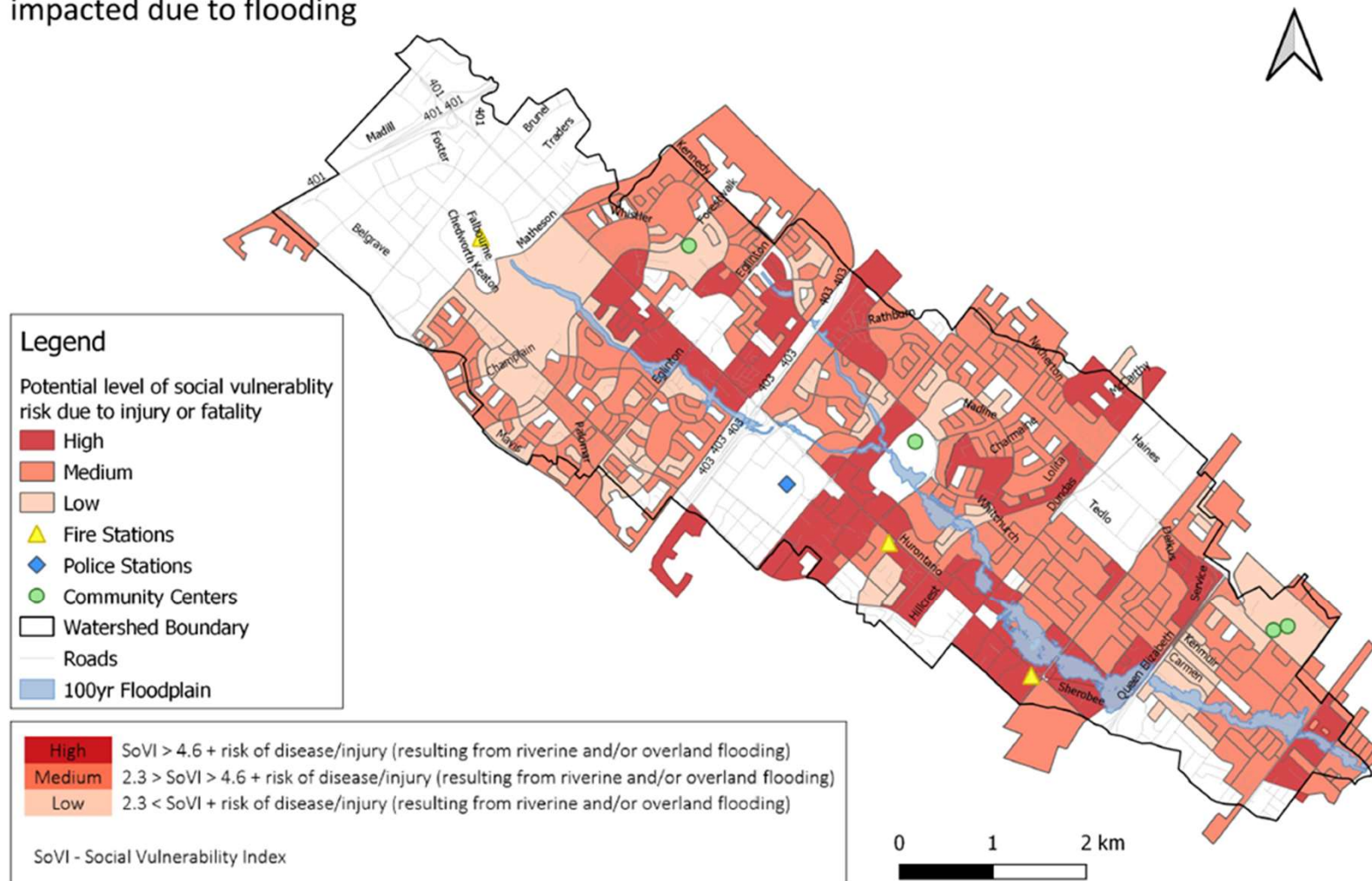


Flood Damage to Roads and Railways





Social vulnerability risk and municipally owned services whose emergency response ability may be impacted due to flooding

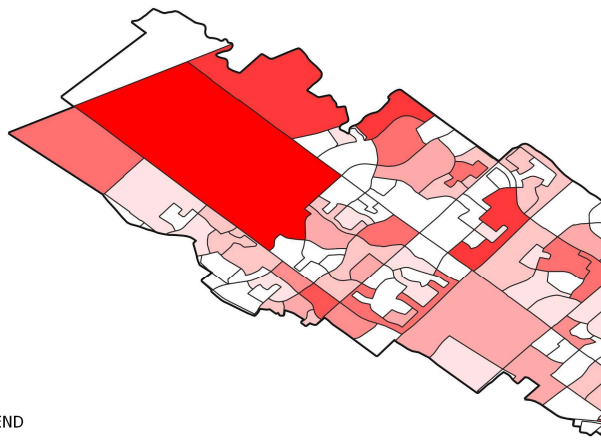


## Striking the Right Balance



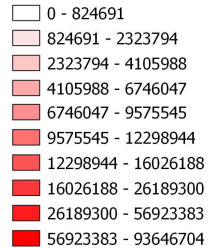
# Priority Assets for Infrastructure Upgrades

## Total

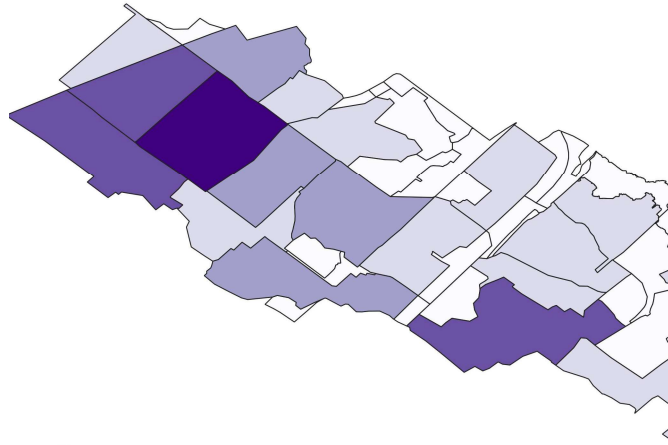


LEGEND

damage-DA-dominant-buildings-roads-rails-erosion-ci-bridges-350YR\_FUT

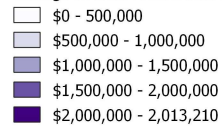


## Riverine

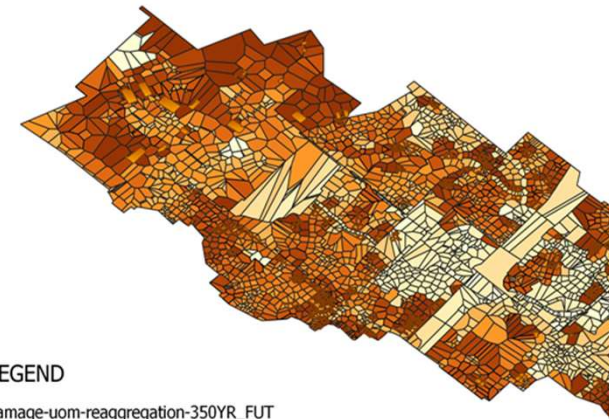


LEGEND

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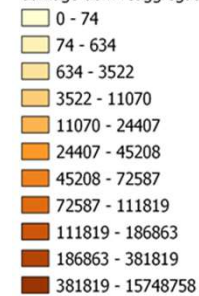


## Urban



LEGEND

damage-uom-reaggregation-350YR\_FUT





# Identify communities that maybe vulnerable to health and safety risks associated with flooding to prioritize land acquisition and EMS Preparedness

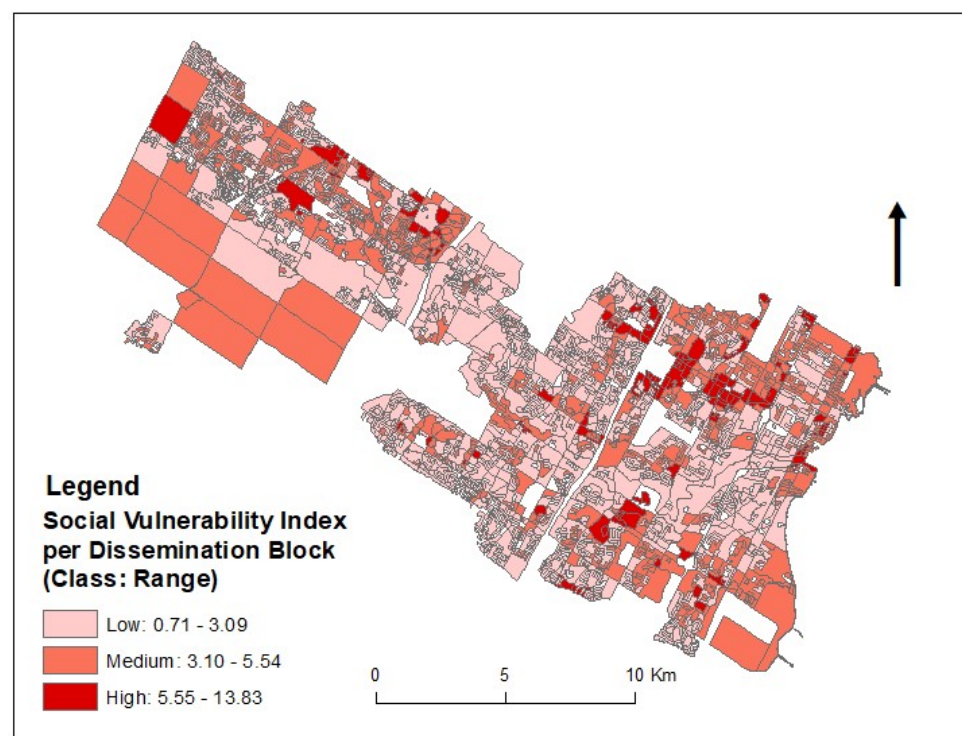
## GTA

News / GTA

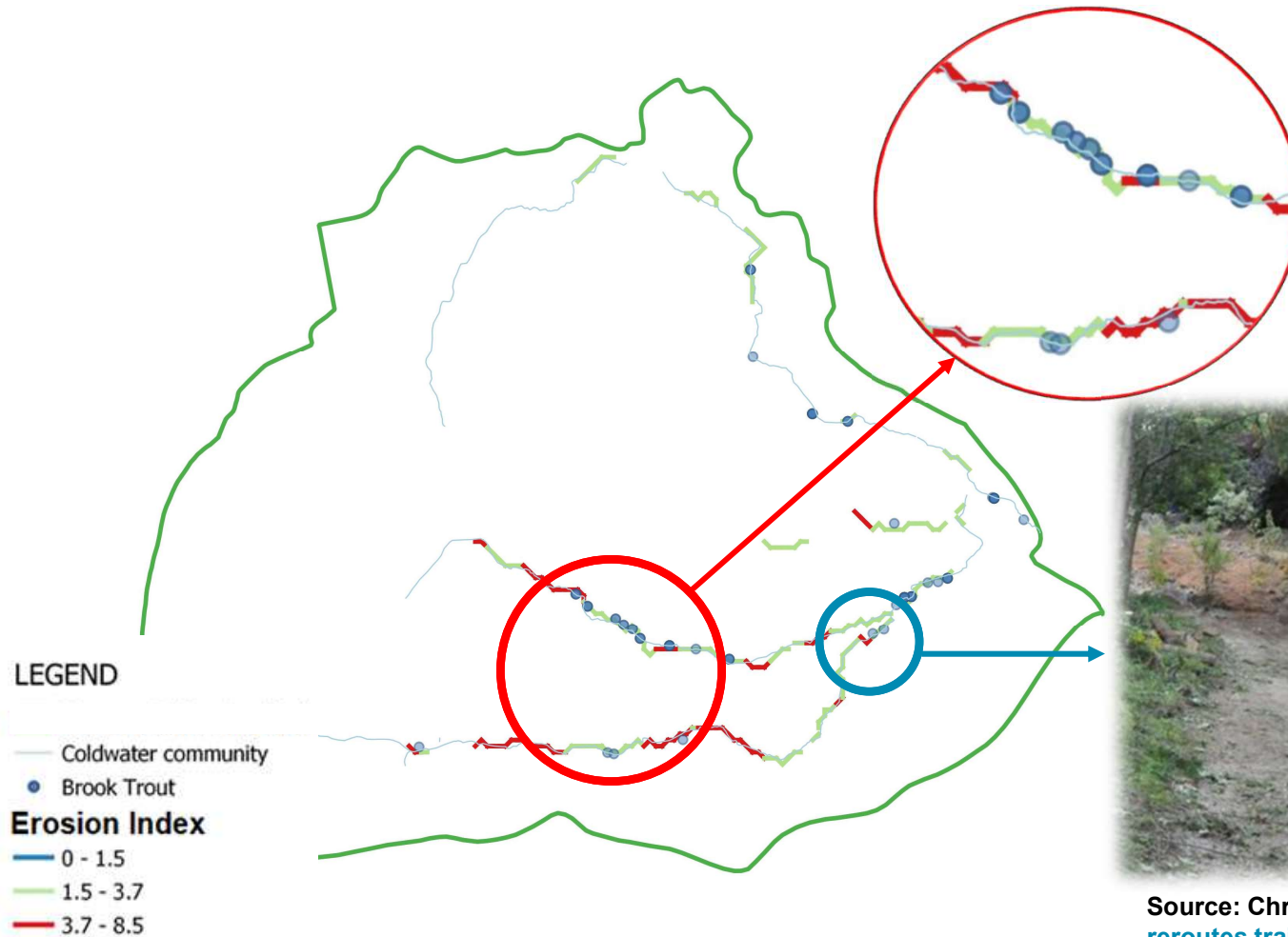
### Mississauga resident living in tent since flood

Ken Hills, 60, is one of hundreds living near Cooksville Creek displaced since last week's storm.

[f](#) [Tweet](#) 32 [G+](#) 0 [reddit this!](#)



## Erosion Mapping can help identify win-win opportunities for municipal infrastructure, aquatic and natural heritage system restoration



Source: Chris Halliday, Orangeville Banner. [Orangeville reroutes trail near area suspected of aggravating flood waters](#)

# Identify and make the case for win-win opportunities for park land acquisition, flood mitigation and our Natural Heritage System



## Making the Case for Green Development Standards



Sample output: comparing various solutions for their return on investment (in terms of damage reduction/avoidance)



## Natural Assets and Flood Mitigation

- Protecting and restoring natural assets (wetlands, forests and open space) in developing landscapes prevent runoff that would have occurred if the natural asset was otherwise developed.
- Natural asset protection is most relevant in greenfield or 'new development' settings, whereas natural asset restoration/creation is most relevant in infill or retrofit developments.

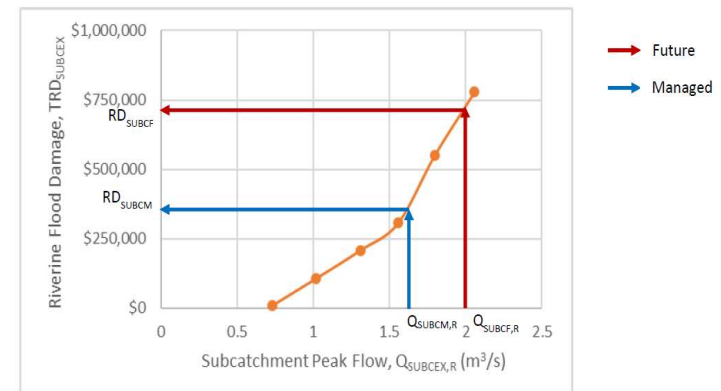
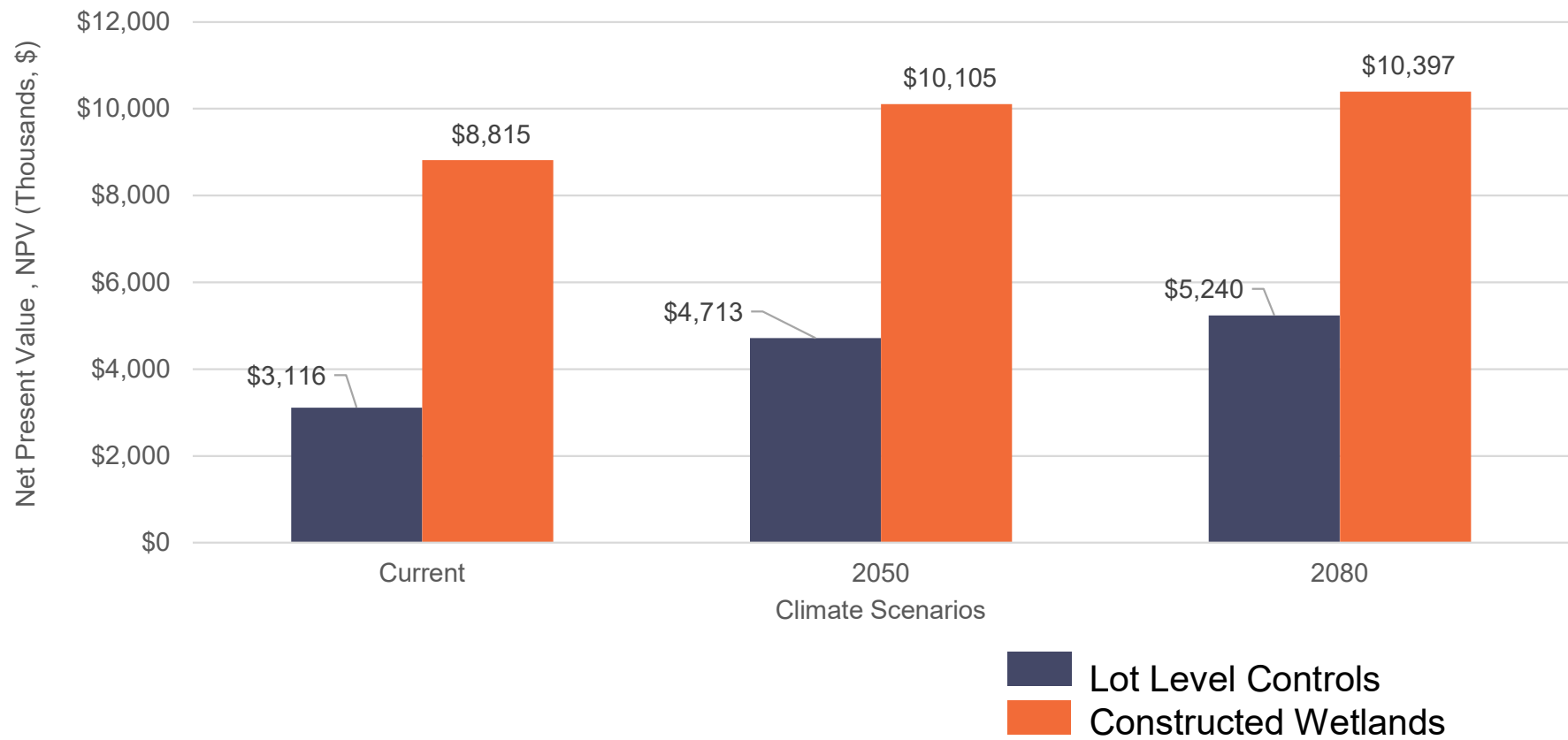


Figure 34. Illustrative Example of How the Subcatchment Runoff Rate-Damage Curve is Used to Estimate Riverine Damages Before and After Wetlands are Restored or Protected

## Making the Case for Natural Assets





## Contact us

- If you are interested in RROIT, please contact Christine Zimmer [christine.zimmer@cvc.ca](mailto:christine.zimmer@cvc.ca) and Karen Finney [karen.finney@cvc.ca](mailto:karen.finney@cvc.ca)

**questions?**