Possibility grows here.

The Business Case for Ecological Restoration: Three Case Studies from Ontario's Greenbelt

Latornell 2019

Featuring

Kawartha Lakes Conservation Authority
Hamilton Conservation Authority
Toronto Region Conservation Authority
Anielski Inc.

Session Outline

1. Introduction to the Project – Tom Bowers

2. Hamilton Project Intro – Scott Peck
3. Hamilton Project EGS Analysis (Flood) – Mark Anielski

4. Toronto Project Intro – Cliff Coppolino
5. Toronto Project EGS Analysis (Recreation) – Mark Anielski

6. Kawartha Project Intro – Debbie Balka
7. Kawartha EGS Analysis (Lake Health) – Mark Anielski

8. Questions

The Greenbelt Foundation

Possibility g

Established in 2005 as a charitable organization to:

- support the long term viability of agriculture
- strengthen rural economies
- restore and enhance natural features

The Greenbelt Foundation coordinates, funds, and supports activities that bolster the Greenbelt through a grant program, research, and public engagement.

Greenbelt Foundation

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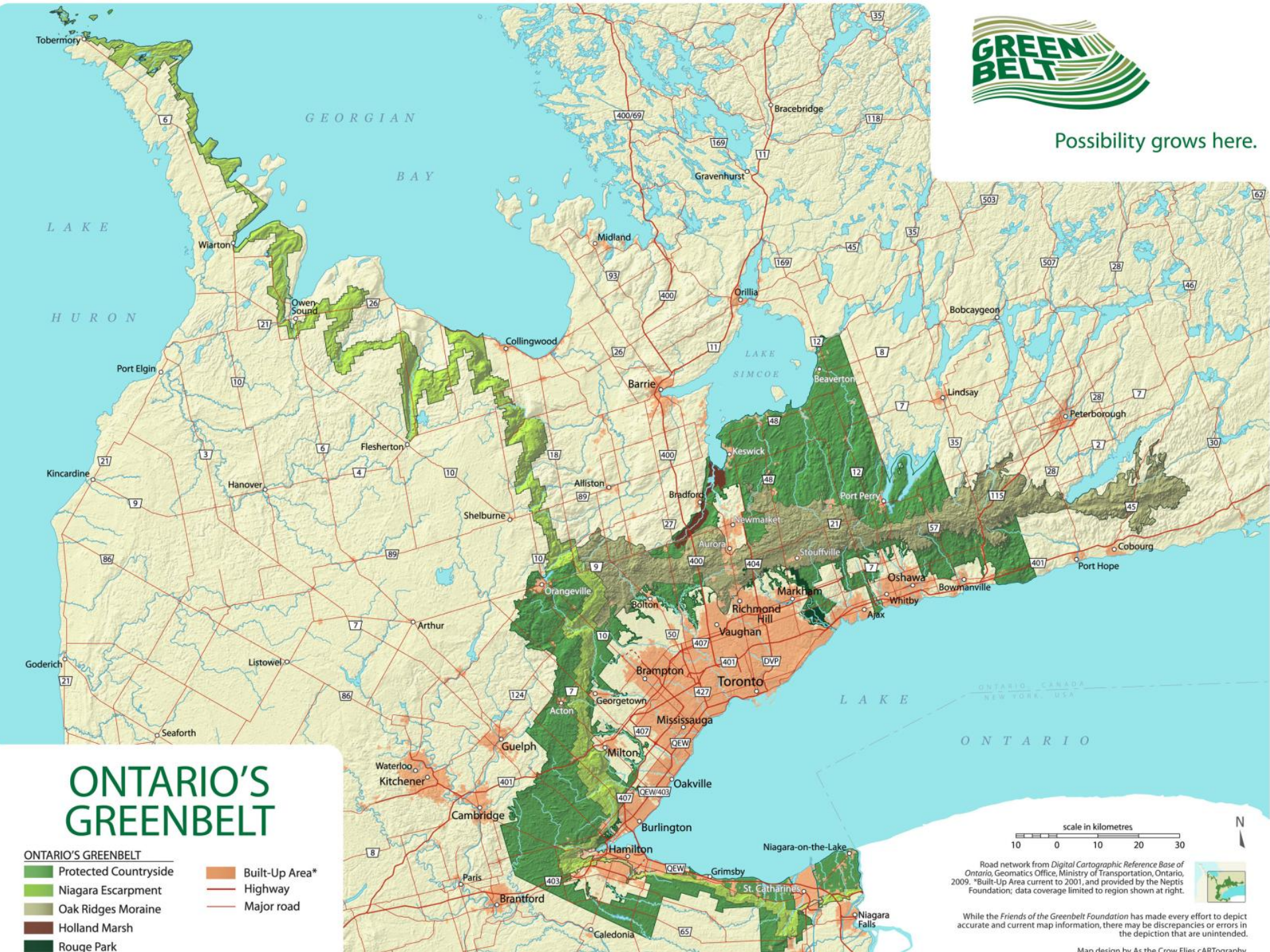
Contributing to regional health and prosperity

Regional Resiliency	Working Landscape
Regional growth and livability	Rural economy and community vitality
Climate adaptation and mitigation	Protecting prime agriculture land
Natural systems restoration	Local food and agri-business
Water quality and supply	Tourism and recreation

Communicating the Big Idea of the Greenbelt

Municipal and Community Engagement


GREEN BELT
Possibility grows here.
ONTARIO'S GREENBELT
ONTARIO'S GREENBELT
Protected Countryside
Niagara Escarpment
Oak Ridges Moraine
Holland Marsh
Rouge Park
Built-Up Area*
Highway
Major road
GEORGIAN BAY
LAKE HURON
LAKE SIMCOE
LAKE ONTARIO
ONTARIO CANADA NEW YORK USA
Tobermory
Wiarton
Owen Sound
Port Elgin
Kincardine
Goderich
Seaforth
Listowel
Arthur
Hanover
Flesherton
Collingwood
Midland
Bracebridge
Gravenhurst
Orillia
Barrie
Alliston
Shelburne
Orangeville
Bolton
Bradford
Keswick
Beaverton
Bobcaygeon
Lindsay
Peterborough
Port Perry
Newmarket
Aurora
Stouffville
Markham
Richmond Hill
Vaughan
Toronto
Brampton
Mississauga
Georgetown
Acton
Guelph
Waterloo
Kitchener
Cambridge
Milton
Oakville
Burlington
Hamilton
Grimsby
Niagara-on-the-Lake
St. Catharines
Niagara Falls
Paris
Brantford
Caledonia
Oshawa
Whitby
Ajax
Bowmanville
Cobourg
Port Hope
scale in kilometres
10 0 10 20 30
N
Road network from Digital Cartographic Reference Base of Ontario, Geomatics Office, Ministry of Transportation, Ontario, 2009. *Built-Up Area current to 2001, and provided by the Neptis Foundation; data coverage limited to region shown at right.
While the Friends of the Greenbelt Foundation has made every effort to depict accurate and current map information, there may be discrepancies or errors in the depiction that are unintended.
Map design by As the Crow Flies cARTography

The Greenbelt by some Numbers

Possibility grows here.

800,000 hectares

- 300,000 ha (6% of ON total) actively farmed by 4,800 farms (10% of Ontario total)
- 2 speciality crop areas and 25% of Ontario's irrigated farmland
- 180,000 ha of forests, 100,000 ha of wetlands, 10,000 ha of urban river valleys, 8,600 ha of water, and 8,000 ha of hedgerows
- 66,000 ha of rural communities with a population of 1.7 million people
- 78 species at risk
- 260Mt CO2e valued at $11.17 billion

$9.1 billion of economic activity

161,000 jobs supported

$3.2 billion in Ecosystem Goods and Services

- Water supply to 415,000 households
- $380 million in water based recreation
- $5.5 million m3 of water for crop irrigation
- $2.3 million m3 of water for livestock

It enjoys the public support of 9/10 residents of the region

- 9 million people live within 20KM of the Greenbelt

Greenbelt Foundation: Natural Assets and EGS

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Our goal is to support the creation of policies, programs, tools and resources that result in better management of natural assets and sustainable long-term government financing for conservation and restoration that build regional resilience.

Projects

- Studies in 2008 and 2016 were both very effective communication tools and helped introduce some of the key evaluation techniques to new audiences
- Municipal Natural Asset Initiative started in 2016 and moving EGS into formal decision making and financial management processes
- 2019 Business Case project focusing on ‘restoration’, comparing before and after situations for smaller scale ecological projects – new work to support Positively Green

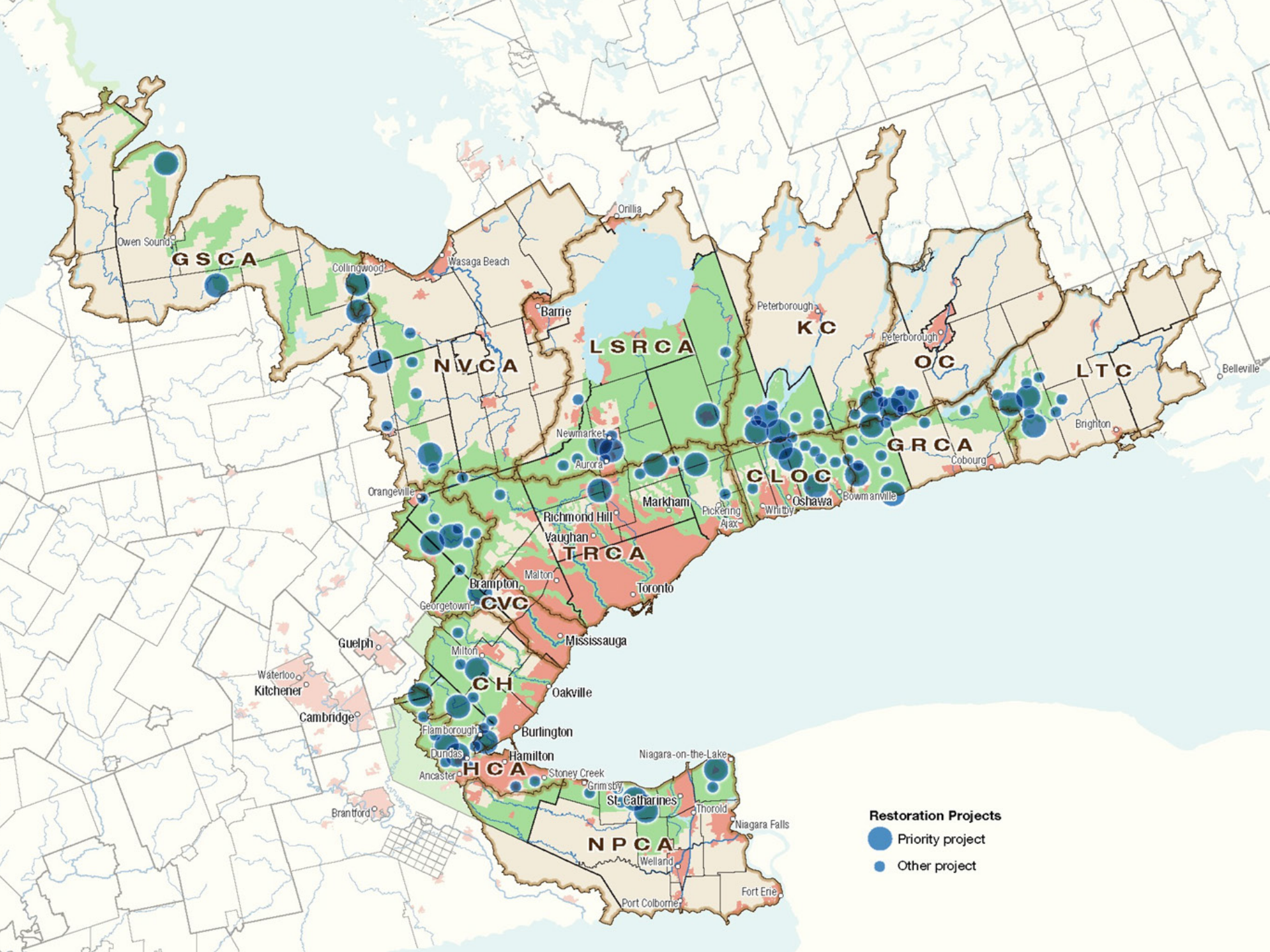
POSITIVELY GREEN

100+ Priority Projects to Enhance our Greenbelt

$100 million investment – 100 + projects

Positively Green invests in nature to protect communities to mitigate the impacts of climate change and build resiliency

- ✔ An increasingly urgent initiative
- ✔ Strengthens nature's role in protecting and enhancing communities
- ✔ Delivers unparalleled environmental services and green infrastructure in the most densely populated region in Canada


GSCA
NVCA
LSRCA
KC
OC
LTC
GRCA
CLOC
TRCA
CVC
CH
HCA
NPCA
Owen Sound
Collingwood
Wasaga Beach
Orillia
Barrie
Peterborough
Peterborough
Belleville
Brighton
Cobourg
Newmarket
Aurora
Orangeville
Markham
Pickering
Ajax
Whitby
Oshawa
Bowmanville
Richmond Hill
Vaughan
Malton
Brampton
Toronto
Georgetown
Mississauga
Guelph
Milton
Waterloo
Kitchener
Cambridge
Oakville
Flamborough
Burlington
Dundas
Hamilton
Ancaster
Stoney Creek
Grimsby
St. Catharines
Niagara-on-the-Lake
Thorold
Niagara Falls
Brantford
Welland
Port Colborne
Fort Erie
Restoration Projects
Priority project
Other project

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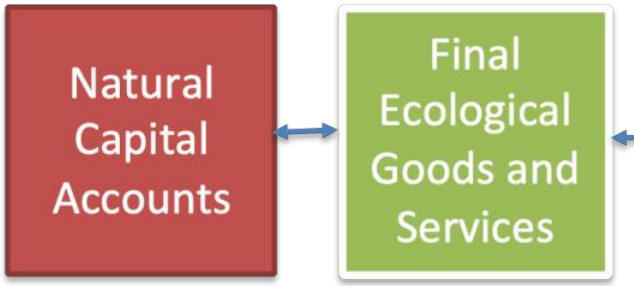
Goals for Business Case 2019

- Pilot the application of EGS valuation techniques for ‘incremental benefit’ projects, with a focus on flooding, recreation and improving lake water quality
- Use a ‘business case’ approach to communicate economic value, uncertainty, identify local data gaps and general lessons for investing in ecological enhancement projects
- Support fundraising and communication tools for Positively Green

System of Economic and Environmental Accounts (SEEA)

Governance and Decision Making



Land Accounts

Ecosystem Service Accounts

Natural capital projects

- Land securement
- Ecological restoration
- Ecological enhancement

What is the incremental improvement in EGS?

Who are the main beneficiaries?

What types of benefits will they experience?

What are the marginal economic benefits, including avoided costs?

What are the economic costs?

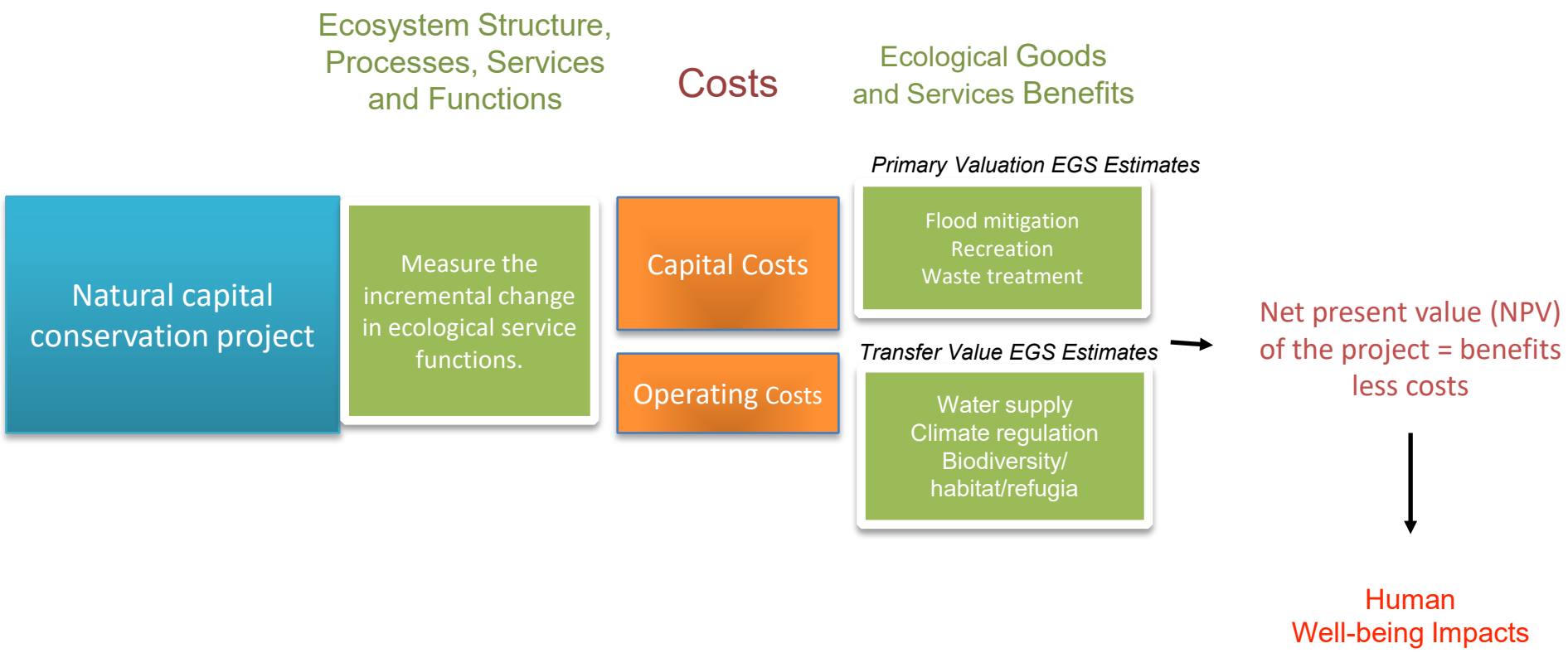
How are the costs and benefits expected to change over time?

What is the Net Present Value (NPV) of future EGS benefits and costs?

What the expected human well-being impacts (perceptional value)?

Full Cost -Benefit Life-Cycle Accounting
Benefit-Cost Analysis (BCA)
Social Return on Investment (SROI)
Well-being Impact Analysis

Conservation Project Impact Evaluation Framework



Hamilton Wetland Project

Possibility grows here.

Overview

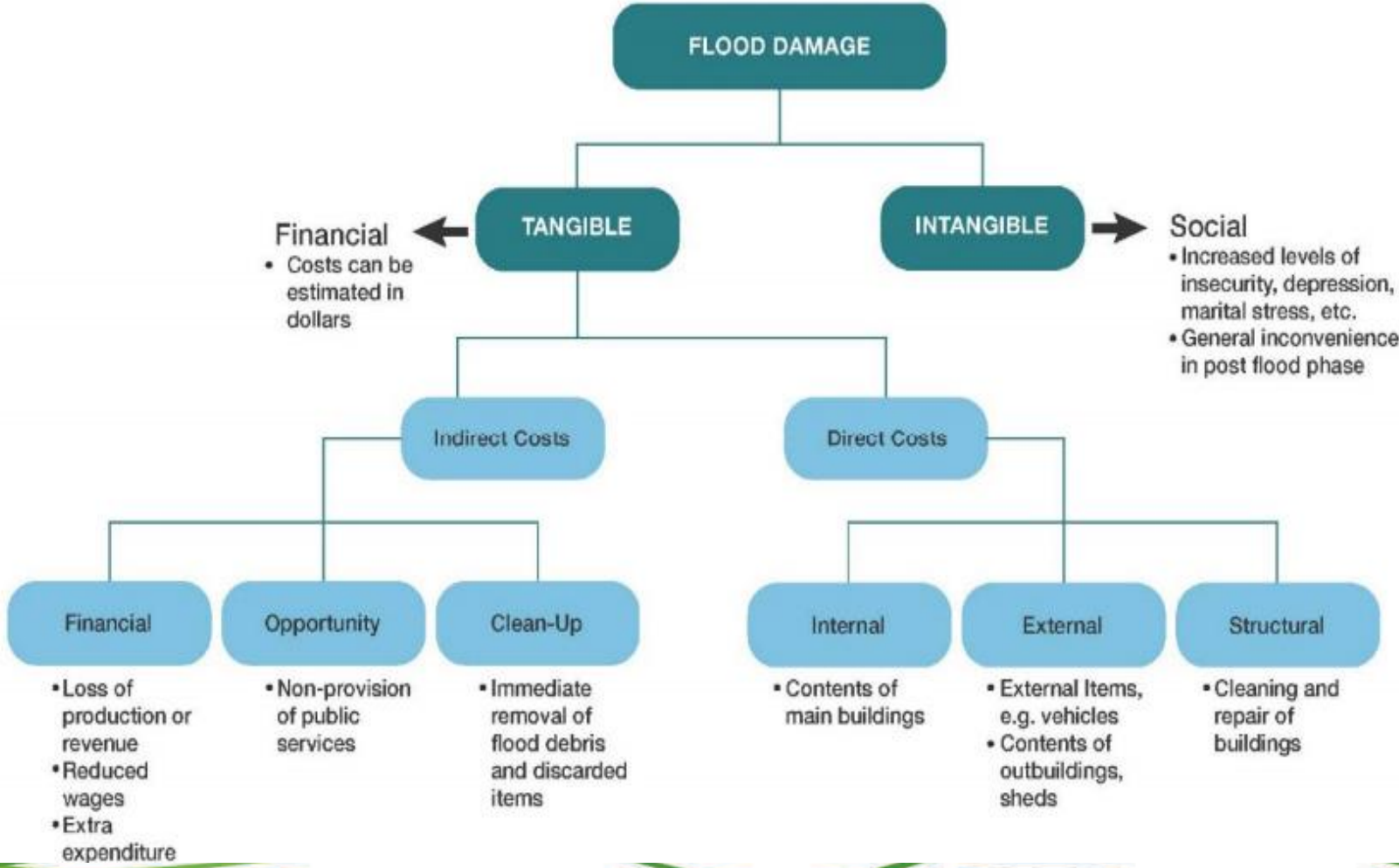
- Project entails restoring former agricultural land to a wetland complex at a cost of $15 million.
- Down stream of the site are 306 residential, commercial and properties at significant risk of flooding. It is estimated that flood damages in any year could range from $0 to $95.1 million.
- Due to climate change, it is predicted there will be an overall increase in occurrence and intensity of extreme rainfall events making the more costly flood events more likely.

Project Goals:

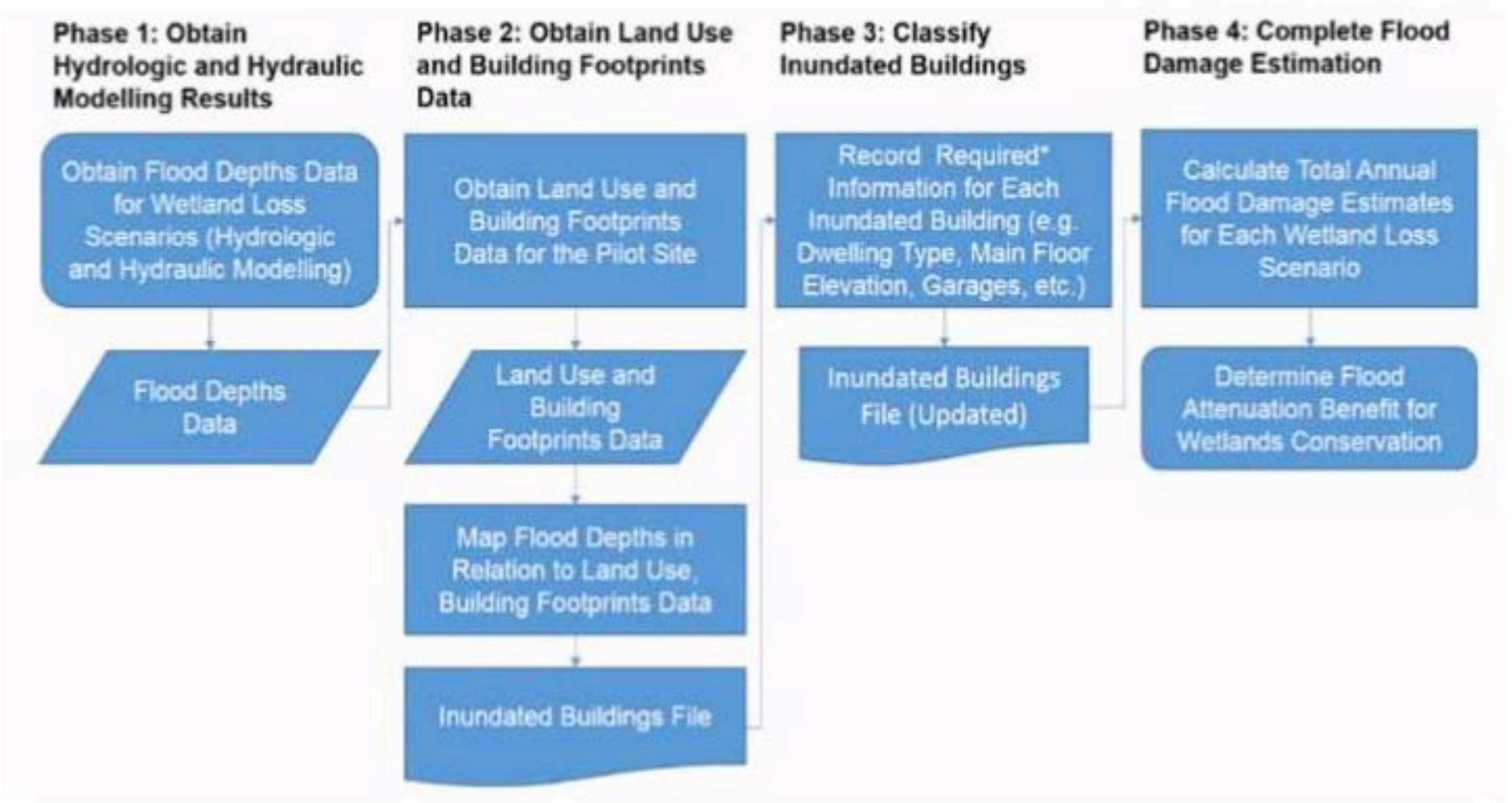
- Reduce downstream flood risk by enhancing and enlarging existing wetland areas, creating new wetland areas, and restoring the natural features and functions of watercourses in the area
- Support community well-being by creating new recreational opportunities and linking to the Dofasco Trail.
- Support biodiversity by creating new wildlife habitat and connective corridors to other conservation areas.

Focus on Flood Control

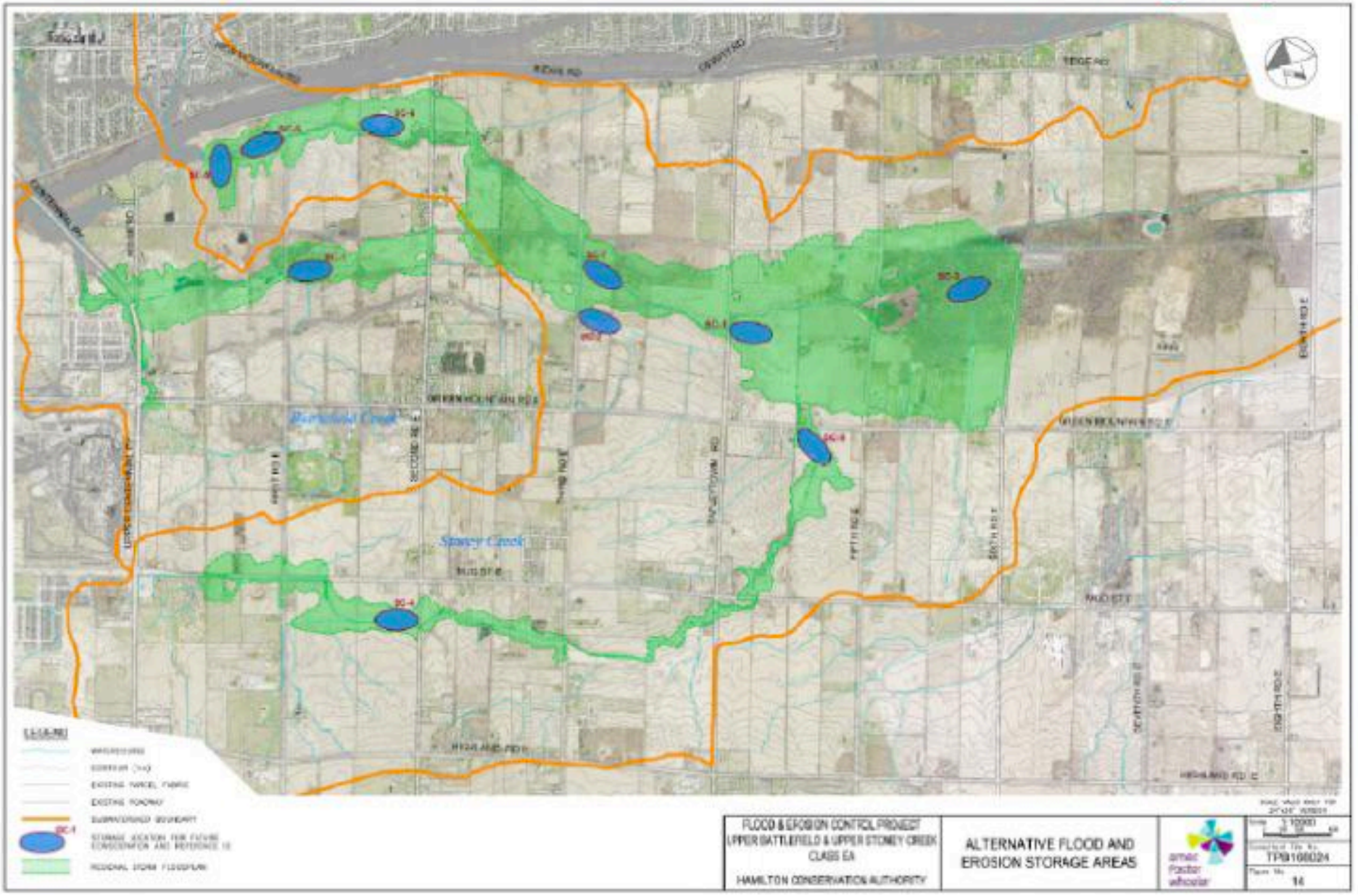
To understand the potential benefits that wetlands have in terms of flood control, the study estimated damages associated with floods of different sizes (frequencies) within and without the wetlands.



Four stages of estimating flood damages



*Information requirements differ based on the method of flood damage estimation chosen. For example, the inputs required for flood damage estimation using Ontario's *Flood Damage Estimation Guide* (2007) differ from the inputs required for flood damage estimation using Alberta's *Provincial Flood Damage Assessment Study* (2014).


FLOOD & EROSION CONTROL PROJECT
UPPER BATTLEFIELD & UPPER STONEY CREEK
CLASS EA
HAMILTON CONSERVATION AUTHORITY
ALTERNATIVE FLOOD AND EROSION STORAGE AREAS
TPB108024
14

Flood Magnitude (Return Period)		10	25	50	100	Regional
Assumed Depth of Flooding (metres relative to floor level)		-2.4	-1.5	0	0.3	1.5
One Story Houses	Number	2	5	15	28	64
	Floor Space (m^2)	235	599	1711	3337	7530
	Damage per m^2	$637	$751	$899	$1,713	$2,004
	Total Damages	$145,600	$499,600	$1,537,800	$5,717,900	$15,093,700
Split Level Houses	Number	0	1	3	6	13
	Floor Space (m^2)	0	119	348	679	1,533
	Damage per m^2	$0	$0	$720	$915	$1,495
	Total Damages	$0	$0	$250,700	$621,800	$2,291,100
Two Story Houses	Number	0	1	2	5	11
	Floor Space (m^2)	0	88	177	431	973
	Damage per m^2	$605	$759	$946	$1,855	$2,292
	Total Damages	$0	$67,100	$167,300	$799,900	$2,229,900
Total Houses	Number	2	7	20	39	88
	Floor Space (m^2)	235	807	2,237	4,448	10,036
	Damage per m^2	$637	$640	$874	$1,605	$1,955
	Total Damages	**$149,600**	**$516,700**	**$1,955,800**	**$7,139,500**	**$19,614,700**

Climate Change

- Warmer, more floods and more droughts
- To address this uncertainty we modelled two scenarios for 1% and 2% increases for each type of storm event

Hamilton Wetland Project

Possibility grows here.

Flood damage mitigation benefits:

- Flood incidence models considers range from 1, 10, 20, 50 to 100 year flood events
- Annual estimated benefit of flood mitigation ranges $171,400 per annum (AMEC baseline study), $251,979 per annum (1% increase in flood frequency) to $332,358 per annum (2% increase in flood frequency).
- Net present value of just flood damage mitigation benefits range from $5.5 million (AMEC baseline) to $14.8 million with 2% increase in flood frequency.

Hamilton Wetland Project

Possibility grows here.

Recreation benefits

- Incremental recreation benefits from the construction of the wetlands are estimated to result in 13,100 trips per year, and annual benefits associated with redistributed trips will increase over time as the population of the City of Hamilton increases .

- Estimated economic benefit (NPV) of incremental recreation value is between $2.4 million to $3.5 million

Other Ecological Goods and Service benefits:

- Other ecological goods and services that normally associated with wetlands are expected over a 50-year period following project completion. The benefits include biodiversity, water quality regulation and climate regulation (carbon sequestration).

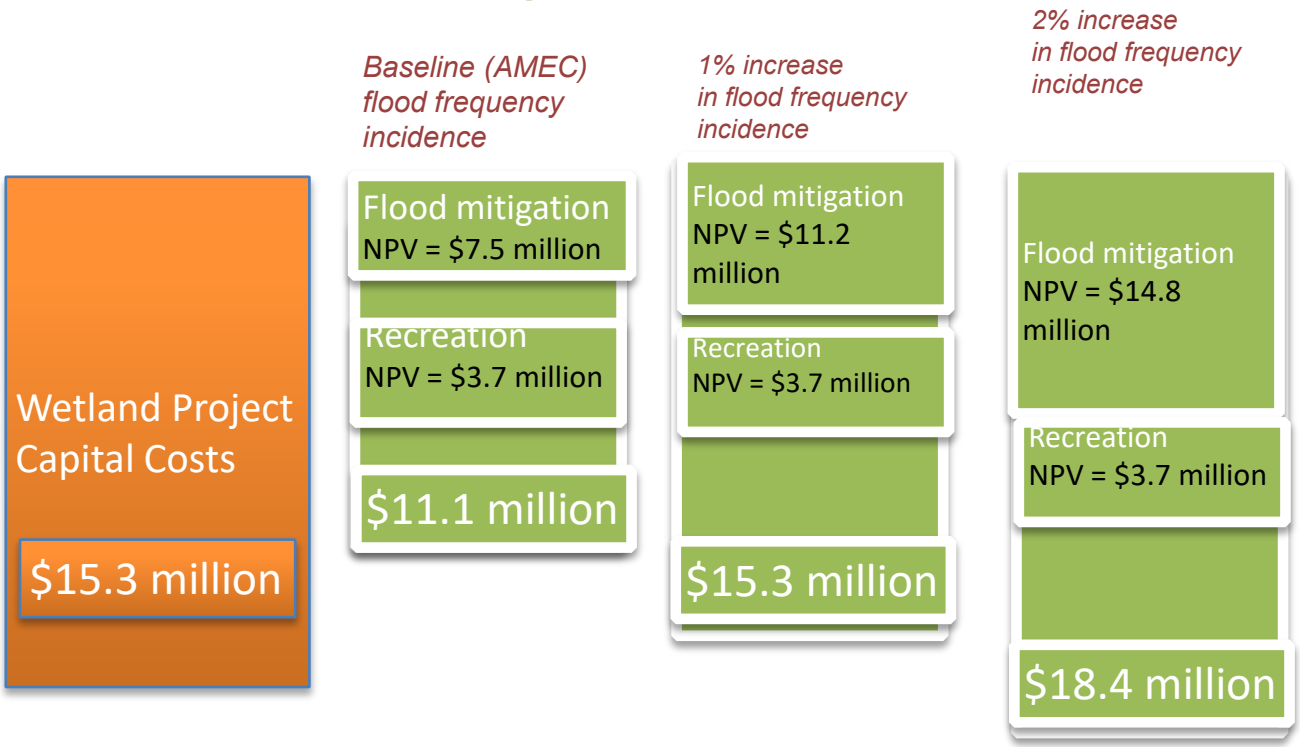
- Using a benefit value transfer approach these other EGS benefits could amount to an NPV of between $11.0 million and $17.7 million

Wetland Project Results Table

Ecological Goods and Services	**Annual Value $/yr (2018$)**	**Total EGS Value Range over 50 years using 0.5% and 2.0% discount rates**		
Primary Valuation				
		AMEC baseline	*1% flood incidence increase*	*2% flood incidence increase*
Flood Mitigation	$171,400 (AMEC) $251,979 (1%) $332,358 (2%)	$5.5 million to $7.5 million	$8.0 million to $11.2 million	$10.7 million to $14.8 million
Recreation	$63,695	$2.5 million to $3.7 million	$2.5 million to $3.7 million	$2.5 million to $3.7 million
Subtotal		**$7.9 million to $11.1 million**	**$10.6 million to $15.3 million**	**$13.2 million to $18.4 million**
EGS benefit transfer value of wetland functions fully functional within 50 years				
Biodiversity	$719,507	$9.9 million to $15.6 million	$9.9 million to $15.6 million	$9.9 million to $15.6 million
Climate Regulation	$87,497	$0.95 million to $1.8 million	$0.95 million to $1.8 million	$0.95 million to $1.8 million
Water Regulation (quality)	$10,119	$0.149 million to $0.230 million	$0.149 million to $0.230 million	$0.149 million to $0.230 million
Waste (nutrient) treatment	$376,091	$5.2 million to $8.2 million	$5.2 million to $8.2 million	$5.2 million to $8.2 million
Subtotal	$1,193,216	$16.1 million to $25.8 million	$16.1 million to $25.8 million	$16.1 million to $25.8 million
Human well-being	Not currently available			
TOTAL POTENTIAL EGS VALUES		**$24.0 million to $33.7 million**	**$26.8 million to $40.7 million**	**$29.4 million to $44.2 million**

Upper Stoney Creek and Upper Battlefield Creek Wetland Project

Ecological Goods and Services Benefits



Using 0.5% discount rate
50 year discount period

Other EGS Benefits of Forests, Wetlands and Meadows (Benefit Transfer)

	Annual EGS Benefits per year	NPV @ 0.5%
Biodiversity	$719,507	$15.6 million
Climate Regulation	$87,497	$1.8 million
Water Regulation (quality)	$10,119	$0.23 million
Waste (nutrient) treatment	$396,091	$8.2 million
Total Other EGS Benefits	$1,193,216	$25.8 million

Conclusions

Possibility grows here.

- A $15.3 million engineered wetland complex would constitute an adaptive management investment given the risk of future flooding events related to ongoing climate change conditions.
- The flood benefits alone would pay off the investment under several scenarios for future flooding frequencies.
- The alternative ‘grey’ flood attenuation infrastructure is estimated at a much higher capital cost of $28.5 million.
- We are not currently able to capture the additional value to local communities in creating new green space legacy assets, e.g. improvements to human wellbeing and health.


Picture

TRCA Brockland Landfill Reclamation Project

- The Toronto Region Conservation Authority developed a Restoration Plan to restore the former 411 hectares of industrial land at a cost of $4.3 million.

- The expected results will be new recreational space and improved terrestrial habitat, enhanced wetland habitat, restore ground water catchments, improve stream edge habitat, improve headwater streams for fisheries and promote self-sustaining natural cover.

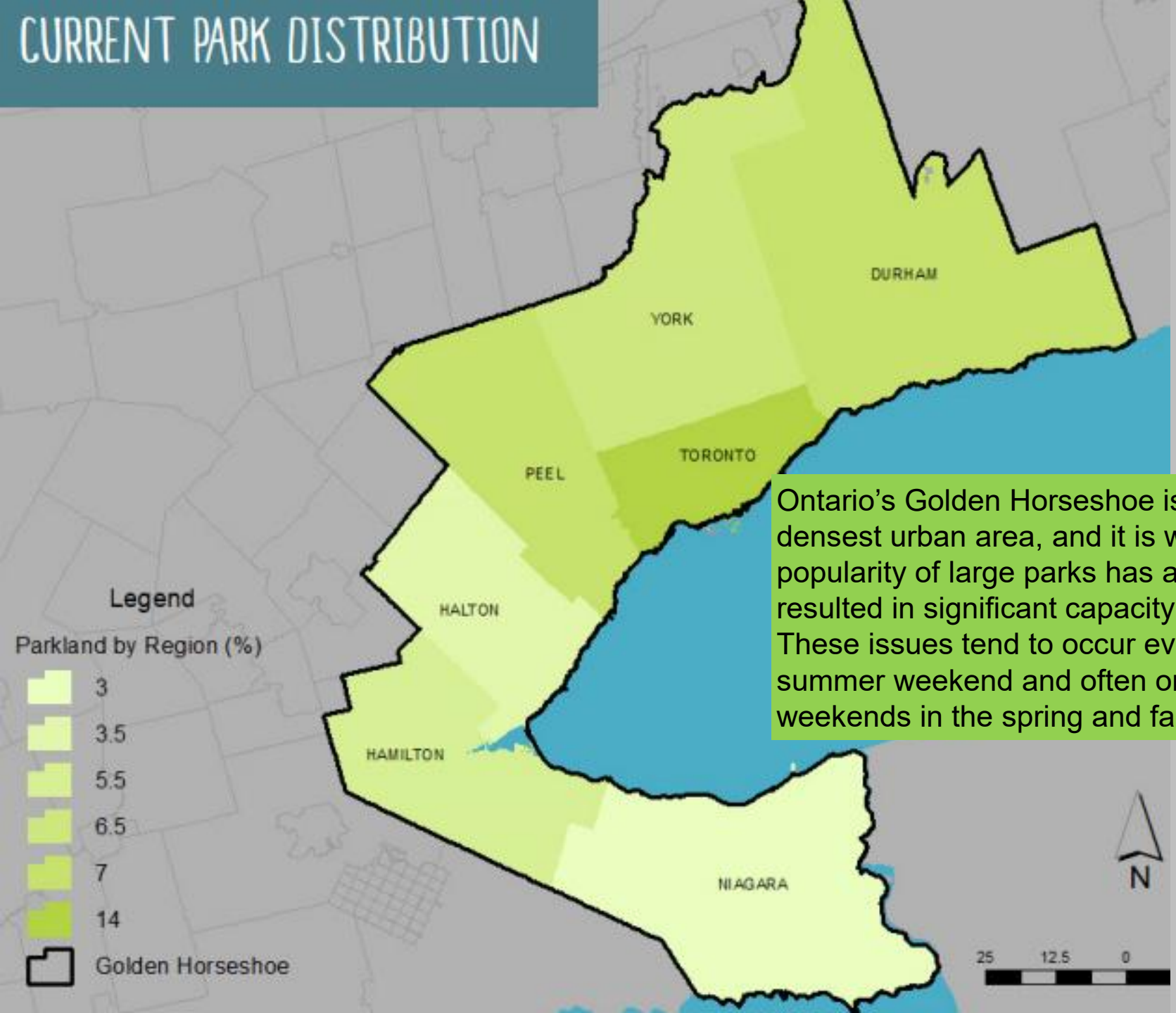
- Annual maintenance and operating costs for the are expected to be $88,000 per annum.

STATE OF LARGE PARKS IN ONTARIO'S GOLDEN HORSESHOE

Unique Value of Large Parks

- Large parks are more likely to be used for physical activity than smaller parks
- Large, natural parks allow for better wilderness experiences, providing an opportunity for solitude
- There are health and well-being benefits associated with reduced noise and visual stimulation
- Large parks contribute more ecosystem services, including cooling benefits and air quality improvements
- Large parks help contribute more to climate change mitigation by sequestering more carbon
- Large parks help foster biodiversity and often harbour more native species. This directly supports recreational and nature-appreciation activities such as bird watching
- Large parks are economic generators, driving tourism in many communities
- Large parks are the best natural classrooms, helping encourage public understanding, appreciation and enjoyment of nature

CURRENT PARK DISTRIBUTION



Ontario's Golden Horseshoe is Canada's densest urban area, and it is where the popularity of large parks has already resulted in significant capacity issues. These issues tend to occur every summer weekend and often on weekends in the spring and fall

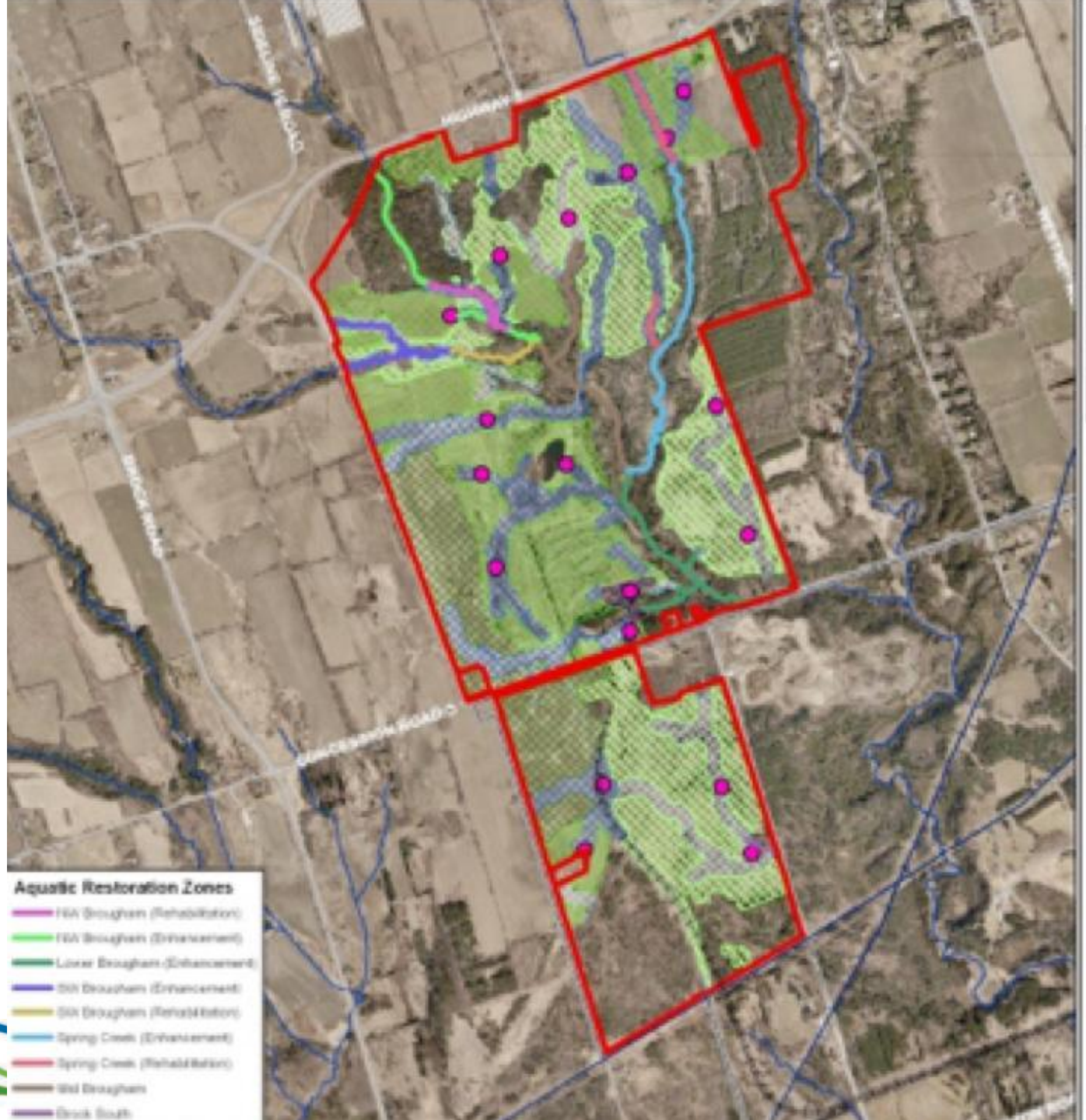
Possibility grows here.

Focus on Terrestrial Recreation

- The approach involved estimating the current pattern of recreational activity in a selected area and then predicting how changes in recreation features and/or quality of experience would change as a result of proposed projects.

- By comparing with and without project cases, it is possible to identify the net shift in recreational activities resulting from project development, allowing estimation of the associated net incremental economic benefits

BROCK NORTH AND SOUTH PROPERTY: RESTORATION CONCEPT PLAN MAP



Aquatic Restoration Zones

- Hill Brougham (Rehabilitation)
- Hill Brougham (Enhancement)
- Lower Brougham (Enhancement)
- Still Brougham (Enhancement)
- Still Brougham (Rehabilitation)
- Spring Creek (Enhancement)
- Spring Creek (Rehabilitation)
- Mid Brougham
- Brook South

Legend

- Road
- Railway
- Hydro Line
- Watercourse
- Brock North/South Property Boundary
- Wetland Opportunities
- on-line pond

Terrestrial Restoration

- Terrestrial Enhancement
- Terrestrial Rehabilitation
- Terrestrial Creation

Drainage Restoration

- Drainage Enhancement
- Drainage Rehabilitation
- Municipal Boundary

0 125 250 500 750 Meters

Conservation for The Living City

Date: September 2011
Created By: Information Systems/Information Technology

Possibility grows here.

Steps taken in analyzing the recreational user benefits:

- Geospatial mapping of population (and socio-economic characteristics (households, household income) within 5, 10 and 20 km of the project site.
- Population of people ages 18 years and older living within 20 km of the project area used to estimate the recreation value.
- Percentage participated in hiking, climbing or horse riding
- Estimated participants, based on estimated households and persons per household
- Estimated days per year of participation in nature-based recreation within 20 km of home
- Redistributed trips as a result of new and improved sites
- Average cost per km of driving (based on $0.52/km CRA mileage rates for 2018)
- Estimated total travel cost savings
- Average value of time per trip
- Total time of travel saving
- Total travel cost savings as a proxy for incremental recreation value of the project

Recreation Data

Possibility grows here.

- Approx 1.12 million people live within 20 km of the Brocklands, with 215,770 within 10 km and 45,500 within 5 km.
- Between 2011 – 2016 there was a very large increase in the population (a 21.1% increase) that lived within 5 km of the site. This compares to population growth rates of 6.1% for the larger region living within 20 km of the site and growth of 7.5% for people living within 10 km of the site.
- The population closest to Brocklands are younger (22.2% of the population consisted of children under the age of 15) and features a higher percentage of immigrants (45.5%) than in the larger region
- In the absence of local recreational user statistics, the 2016 Greenbelt study was applied that used the Canadian Nature Survey for participation rates for relevant activities (http://publications.gc.ca/site/eng/9.698872/publication.html)

Possibility grows here.

Study Limitations

- It is noted that there are limitations to impact analysis using only economic or monetary valuation methods.
- Measuring perceptional values or human well-being impacts will require new impact analysis tools, e.g. the value associated with the quality of a green space rather than just the economic savings associated with reduce travel costs.
- Undertaking perceptual value research was beyond this study's scope but is a factor many decision makers will in effect include within their deliberations.

Results

Possibility grows here.

Costs:

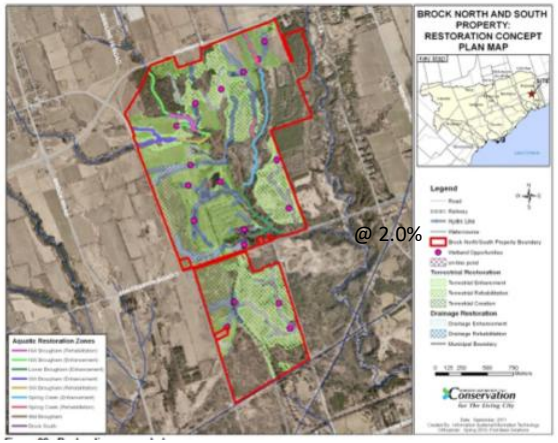
- The estimated NPV of both capital costs ($4.3 million) and annual operating costs ($88,000 per yr) over a 50-year discount period ranges from $7.0 million to $8.1 million

Benefits:

- The estimated annual EGS benefits from recreation benefits are $603,514 per annum or an NPV of between $25.0 million (2.0% discount rate) to $36.1 million (0.5% discount rate).
- Other EGS benefits, including improved air quality, biodiversity (protection of keystone species habitat), and carbon storage and sequestration (restored forest and vegetation cover) are likely to accrue over the 50 year discount period.
- These other future EGS benefits could amount to an additional $2.58 million per annum within 50 years of restoration. This would equate to an additional NPV of EGS values of between $35.5 million (2.0% discount rate) to $56.1 million (0.5% discount rate), over and above recreation benefits.

Brocklands EGS Summary

Natural capital projects



Costs

Site Restoration Capital Costs
($4.3 million)

Annual operating costs
($88,000)
NPV = $3.81 million (@ 0.5%)
NPV = $2.73 million (@ 2.0%)

@ 0.5% $8.11 million

@ 2.0% $7.03 million

Net Present Value Benefits less Costs

Ecological Goods and Services Benefits

@ *0.5% discount rate*
50 year discount period

Recreation

NPV = $25.01 million

$25.0 million

$17.98 million

@ *2.0% discount rate*
50 year discount period

Recreation

NPV = $36.08 million

$36.1 million

$27.97 million

Other EGS Benefits of Forests, Wetlands and Meadows (Benefit Transfer)

- Gas regulation/Air Quality
- Climate regulation (carbon stored)
- Flood Control
- Erosion control
- Water regulation
- Water filtration
- Waste treatment
- Pollination
- Biological control
- Biodiversity/Habitat/Refugia
- Recreation & Aesthetics

$2.58 million per yr.

Conclusions

- The net result of the discounted (NPV) of recreation benefits less capital and operating costs are estimated to range from between $18.2 million (2.0% discount rate) to $28.6 million (0.5% discount rate).
- The incremental recreational benefits alone would be between 3.6 to 4.5 greater than estimated capital costs of the project.
- Other EGS are in the region of $2.58 million / yr
- The significant positive NPV using only recreation benefits suggests there is a very strong economic argument for the project. It will generate a substantial net positive economic well-being return on investment.

Possibility grows here.

picture

Lake Scugog Project

Possibility grows here.

- Lake Scugog is a shallow lake (6,578 hectares) located in the southwest portion of the Kawartha Conservation watershed one-hour drive from Toronto.

- An estimated 21,748 people live in the vicinity of Lake Scugog, including 9,453 in Port Perry.

- The proposed the Lake Scugog Enhancement Project, estimated at a capital cost of $3.0 million, has the following components:

    - Dredging to remove sediment and invasive aquatic plant (temporary);

    - Installation of storm water management features

    - Construction of new wetlands, and shoreline extensions (including a berm) and naturalization for habitat enhancement and recreational use.

Scugog Benefits

Possibility grows here.

- The construction of the wetland complex is expected to alleviate problems with sediment and organic matter accumulation, as well as provide benefits to storm water impacts, improve recreational use, and create aquatic and wetland habitat (biodiversity benefits) for birds and muskellunge spawning areas.
- The boardwalk will create new recreational amenity.
- The grasses and oil and grit separators are expected to help reduce phosphorous, nitrogen and sediment loading by roughly 10% per annum.
- Dredging part of the lake in the vicinity of Port Perry Bay will address shallow water issues.
- The dredged material would be used to create a large engineered wetland that enhance habitat and have some benefits to stormwater management in a localized area.

Sources of Phosphorus

Possibility grows here.

Phosphorous and nitrogen loading into the lake's ecosystem is contributing to the eutrophication of the lake biology. An estimated 9,100 to 9,600 tonnes of phosphorous enter the lake every year from sources that include:

- 24% coming from agriculture;
- 18% from urban run-off;
- 10% from private septic systems;
- 6% from rural road run-off;
- 2% from the Port Perry Sewage Treatment Plan, and;
- Another 21% comes from natural sources while 19% comes from precipitation.

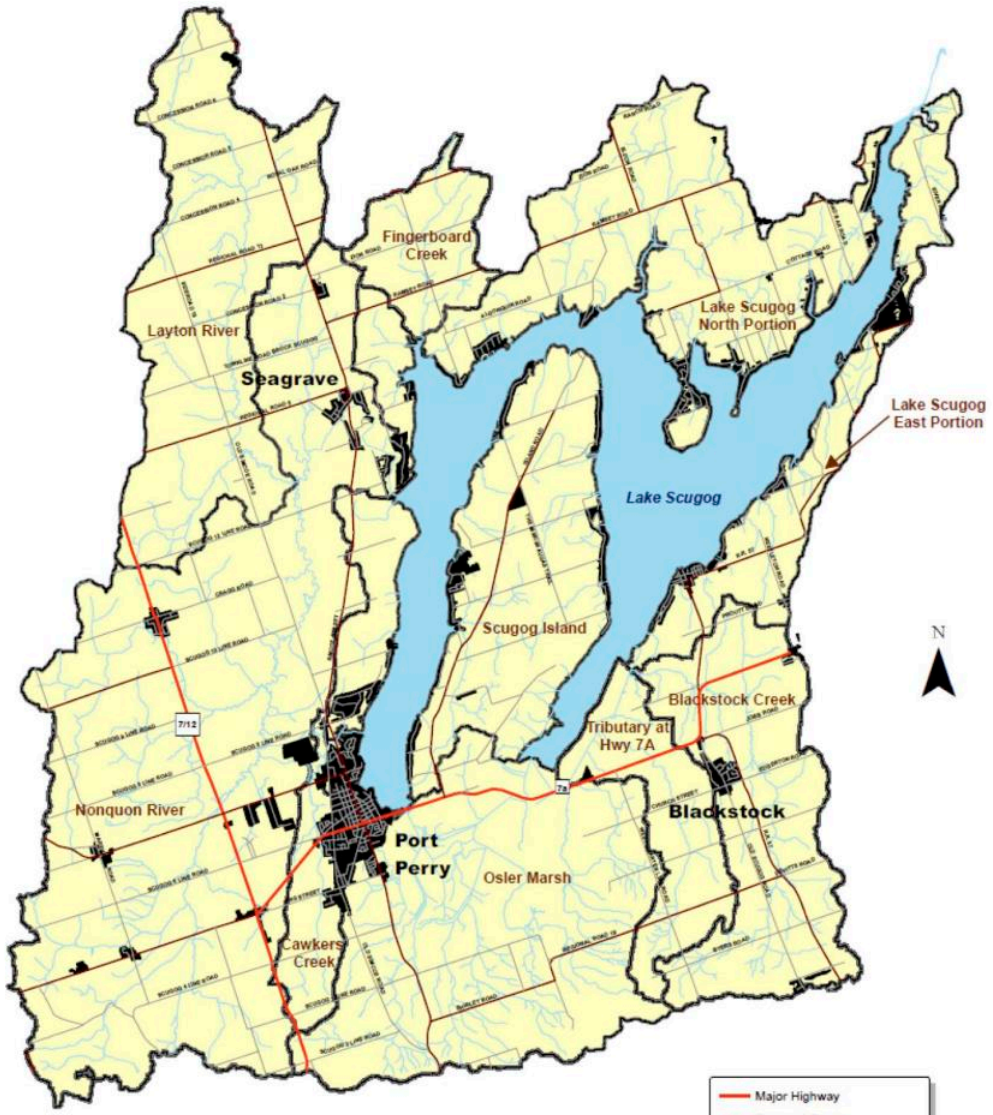
Analytical Challenges

- Lack of available data on the physical or biological conditions (current and historical) of recreation, tourism, lake nutrient budget and water quality conditions to assess the potential increment benefits of the capital investments.

- Without an ecosystem health baseline of a healthy or sustainable Lake Scugog ecosystem it is difficult to determine how enhancement capital investments might contribute to a net positive improvement or benefit in future ecosystem services.

- By considering the current value generated by the Lake and its watershed, the project was able to evaluate the potential risk associated with further declines in ecological function.

LAKE SCUGOG SUBWATERSHEDS



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Potential Costs from EGS decline

Possibility grows here.

Cost Category	Nature of costs imposed
Commercial fishing	Reduced value added due to reduced flows or quality of freshwater fish and/or increased costs to harvest fish
Water users: Industries (including municipal drinking water treatment plants) that use water from the lake for various purposes	Increased capital and operating costs due to reduced raw water quality
Recreational users: Individuals that participate in lake-based recreation	Reduced utility due to reduced enjoyment from beach activities, fishing, boating, birdwatching and hunting
Non-users: Individuals that do not make direct use of the lake but that are concerned about its quality	Reduced utility due to reduced well-being associated with knowledge of the lake's condition
Tourism: Businesses operating in the "tourism industry"	Reduced value added due to lost business as a result of reduced numbers of visitors to the lake
Property owners along the lakeshore	Reduced wealth due to reduced value of lakefront property
Human health: Individuals exposed to increased disease threat	Reduced utility and increased health care costs due to increased individual morbidity/mortality

Protection Value

Possibility grows here.

- **Reduced P nutrient loading:** The NPV of these benefits of reducing phosphorous loading to the lake is estimate to range from $716,101 to $936,062 per annum, based on a 2.0% to 0.5% discount rate.
- The estimated opportunity cost of removing phosphorus was based on the capital cost of tertiary phosphorus removal technologies now in use in Canada which can have unit costs of $1,000 per kilogram per annum.
- **Recreation/Tourism benefits:** The work should help maintain and possibly increase the current levels recreational and tourism benefits over time, which are at potential risk from eutrophication and algae blooms. Recreational and tourism expenditures in the Durham County region, which includes Lake Scugog as a main attraction, were over **$309 million** in 2018.
- **EGS benefits of the watershed:** The Lake Scugog watershed as a whole would generate roughly $220.9 million per annum in a wide range of EGS services based on estimates from the an earlier Greenbelt study. Declining ecological integrity and ecological functionality will result in economic losses and reduced ecological goods and services.

Lake Scugog Watershed EGS

Ecological Goods and Services	Annual Value $/yr (2018$)	Total Value Range ($ over 50 years)
Reduced phosphorous loading on water quality related to the new wetland and filters	$32,260	$716,101 to $936,062
Estimated EGS values associated with the Scugog Lake watershed area (benefit - transfer)		
Gas regulation/Air Quality	$3,966,525	
Climate regulation (carbon stored)	$17,173,658	
Climate regulation (annual carbon uptake)	$5,439,356	
Flood Control	$32,405,401	
Erosion control	$682,846	
Water regulation	$16,040,793	
Water filtration	$5,073,131	
Waste treatment (removal of excess N and P runoff)	$26,235,206	
Pollination	$28,079,964	
Biological control	$672,365	
Biodiversity/Habitat/Refugia	$46,715,170	
Recreation & Aesthetics	$38,474,055	
Subtotal	$220,958,469	

Lake Scugog Project Summary

Natural capital projects

Costs

- Lake Dredging ($834,940)
- Berm Construction ($979,795)
- Wetland Features ($150,700)
- Oil & Gas Separators ($538,000) (%rs
- Other Costs/Contingencies ($520,415)

$3.02 million

Ecological Goods and Services Benefits

@ *0.5% discount rate* *50 year discount period*

Phosphorous reduction
NPV = $936,062

@ *2.0% discount rate* *50 year discount period*

Phosphorous reduction
NPV = $716,101

L. Scugog watershed EGS

- Gas regulation/Air Quality
- Climate regulation (carbon stored)
- Flood Control
- Erosion control
- Water regulation
- Water filtration
- Waste treatment (removal of excess N and P runoff)
- Pollination
- Biological control
- Biodiversity/Habitat/Refugia
- Recreation & Aesthetics

$220.9 million per yr.

Conclusions

Possibility grows here.

- The Lake Scugog project is attempting to protect against future EGS benefit losses.
- At the heart of the project analysis is whether the proposed management strategies and capital investments will have any incremental impact on mitigating against the ecological pressures on the lake ecosystem from ongoing phosphorous loading, lake eutrophication and algal blooms.
- In a business-as-usual (do nothing) scenario, water quality concerns and ongoing risk of algal blooms driven by phosphorous loading is likely to continue to occur without serious policy and management interventions, similar to what is being attempted with Lake Simcoe.
- Despite these analytic challenges, planners and decision makers are provided with insights into the necessary information required for evaluating the economic, ecological and human well-being impacts of the proposed and future Lake Scugog projects.

Possibility grows here.

Final Thoughts

- The valuation framework for ecological enhancement projects provides important information for decision-makers – not perfect but best available information.
- Capturing future conditions, especially in light of climate change, is challenging. Local climate models could help.
- Good quality local data is vital. E.g. we don't know how much local communities value nature and new survey work could be useful to a wide range of stakeholders.
- Decision-makers still need to consider subjective well-being outcomes alongside economic analysis – and probably do!
- We need more examples of how EGS valuations actually influence funding decisions to understand what is critical information to provide.

Possibility grows here.

Questions?