Protecting and Restoring Critically Important Great Lakes Coastal Areas

Great Lakes Freshwater Ecosystem Initiative (GLFEI) Second Annual Symposium

Canada Centre for Inland Waters, Burlington, Ontario | December 10, 2025

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Georgian Bay, Lake Huron | Lion’s Head, Ontario | Credit: Trevor Bobyk

Great Lakes Freshwater Ecosystem Initiative:

2nd Annual Coastal Symposium

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December 10, 2025
Canada Water Agency
Freshwater Management Ontario

Why Coastal Resilience Matters

- Coasts are on the front lines of change
- Storms, levels, erosion, and habitat loss are real
- Coasts as living labs for new solutions
- What we learn here can guide the world

From Investment to Innovation

- GLFEI: not just funding, it's a catalyst
- New wetland restorations and nature-based designs
- Next-generation models guiding real decisions
- Community and Indigenous-led monitoring changing the game

Data, Tools & Applied Science that Drive Decisions

- We’re rich in data, not always in value
- Open, shared data builds trust and momentum
- Tools co-designed with the people who use them
- From interesting science to indispensable decision support

Collaboration & Partnerships at the Core

- Indigenous, municipal, academic, NGO and federal partners together
- Partnerships are not peripheral; they are the work
- Resilient coasts depend on resilient relationships
- Today is a chance to deepen trust and alignment

Today's Symposium Journey

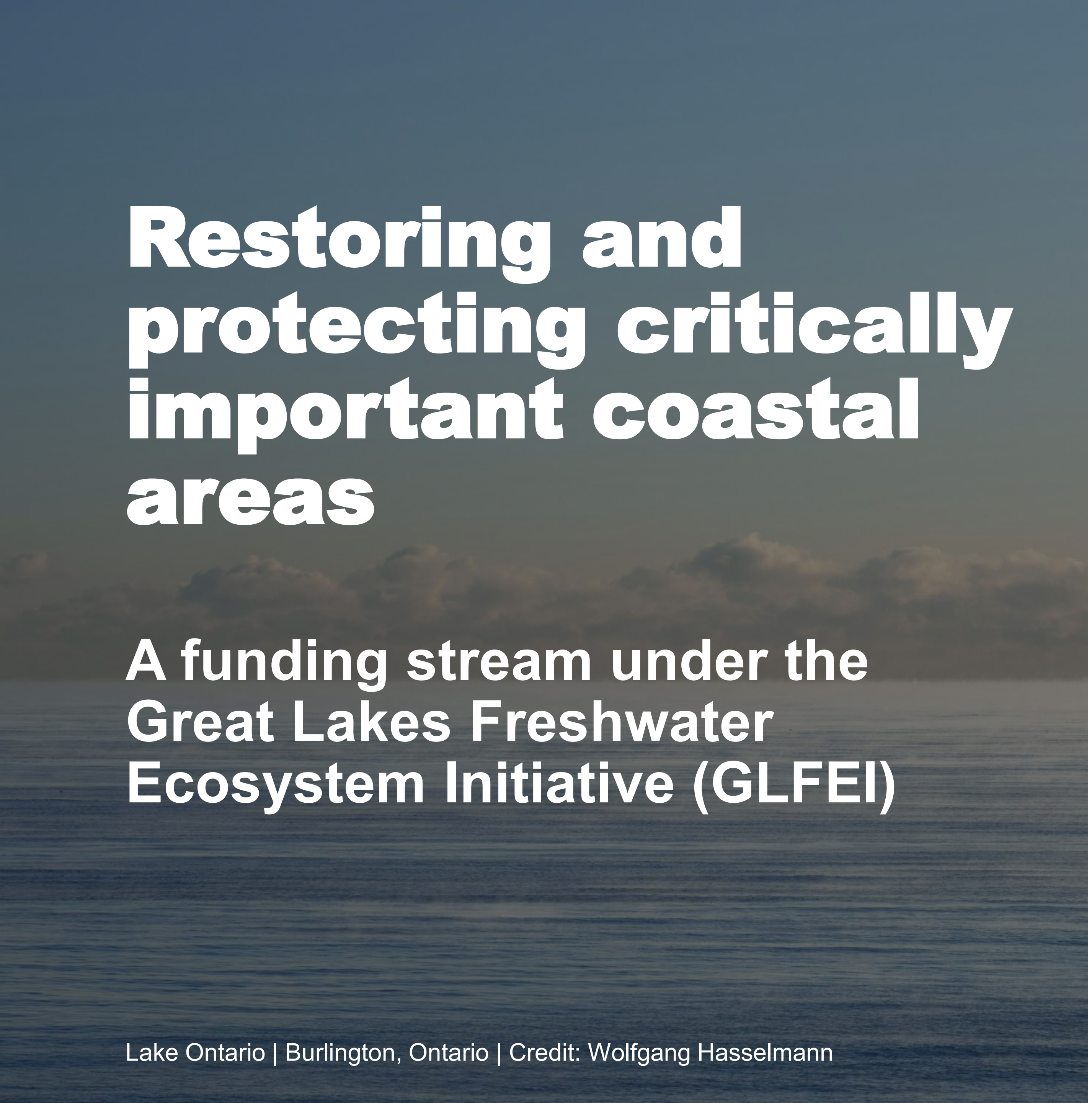
- Session 1: coastal stories and shared lessons
- Session 2: tools that turn science into action
- Session 3: partnerships that carry work forward
- A journey from connection to tools to long-term collaboration

What We Aim to Achieve Today

- Learn from real projects, wins and missteps
- Identify gaps and opportunities in science and practice
- Highlight projects that are moving the needle
- Leave with new ideas, allies and next steps

Tracking Success & Scaling Impact

- Clear indicators of coastal health and resilience
- Stories and statistics woven together
- Lessons feeding back into policy and funding
- If we can see success, we can scale it



Restoring and protecting critically important coastal areas

A funding stream under the Great Lakes Freshwater Ecosystem Initiative (GLFEI)

Lake Ontario | Burlington, Ontario | Credit: Wolfgang Hasselmann

- To support and promote local-level action to enhance water quality, ecosystem health, and the resilience of coastal areas experiencing stress due to climate risks and impacts
- **Nine** projects were awarded multi-year funding in fiscal year 2024/25
- **Ten** projects were awarded funding in fiscal year 2025/26

Symposium Objectives

FOSTER LEARNING through shared experiences and applied examples that enhance water quality, ecosystem health, and coastal resilience

IDENTIFY challenges and opportunities in applied science and modelling to inform future work

SHOWCASE effective projects that advance the state of knowledge and action in coastal systems

FOSTER COLLABORATION by creating space for open dialogue on resilient principles, restoration and adaptation approaches, and partnership opportunities

NETWORK with other researchers and practitioners who are working to improve Great Lakes quality and ecosystem health

Central Lake Ontario Conservation Authority

Lynde Shores Restoration and Resilience Planning

December 10, 2025

Lynde Shores Restoration and Resilience Planning

Making Science Actionable

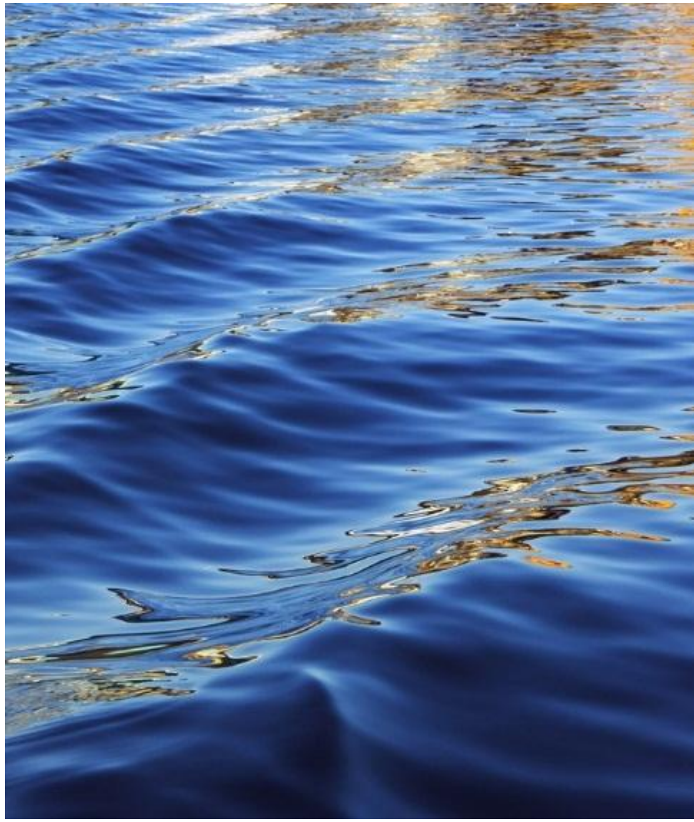
- Baseline Information
- Local Conditions and Context

Building Resilience

- Restoration and Resilience Planning
- Restoration Strategies

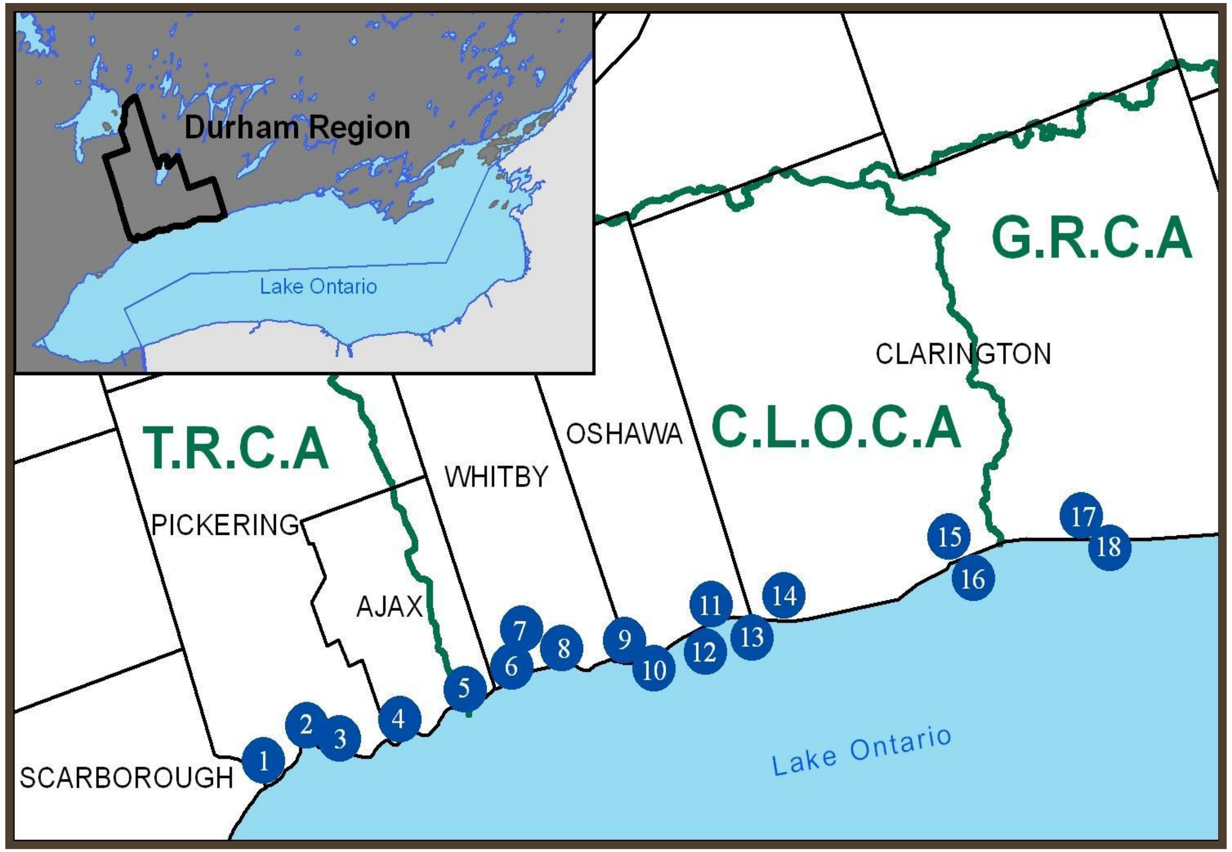
Strengthening Partnerships

Baseline Information Summary



Durham region coastal wetland monitoring program

1. Rouge River Marsh
2. Frenchman's Bay Marsh
3. Hydro Marsh
4. Duffins Creek Marsh
5. Carruthers Creek Marsh
6. Cranberry Marsh
7. Lynde Creek Marsh
8. Whitby Harbour Marsh
9. Corbett Creek Marsh
10. Gold Point Marsh
11. Oshawa Creek Marsh
12. Pumphouse Marsh
13. Oshawa Second Marsh
14. McLaughlin Bay Marsh
15. Westside Marsh
16. Bowmanville Marsh
17. Wilmot Creek Marsh
18. Port Newcastle Marsh



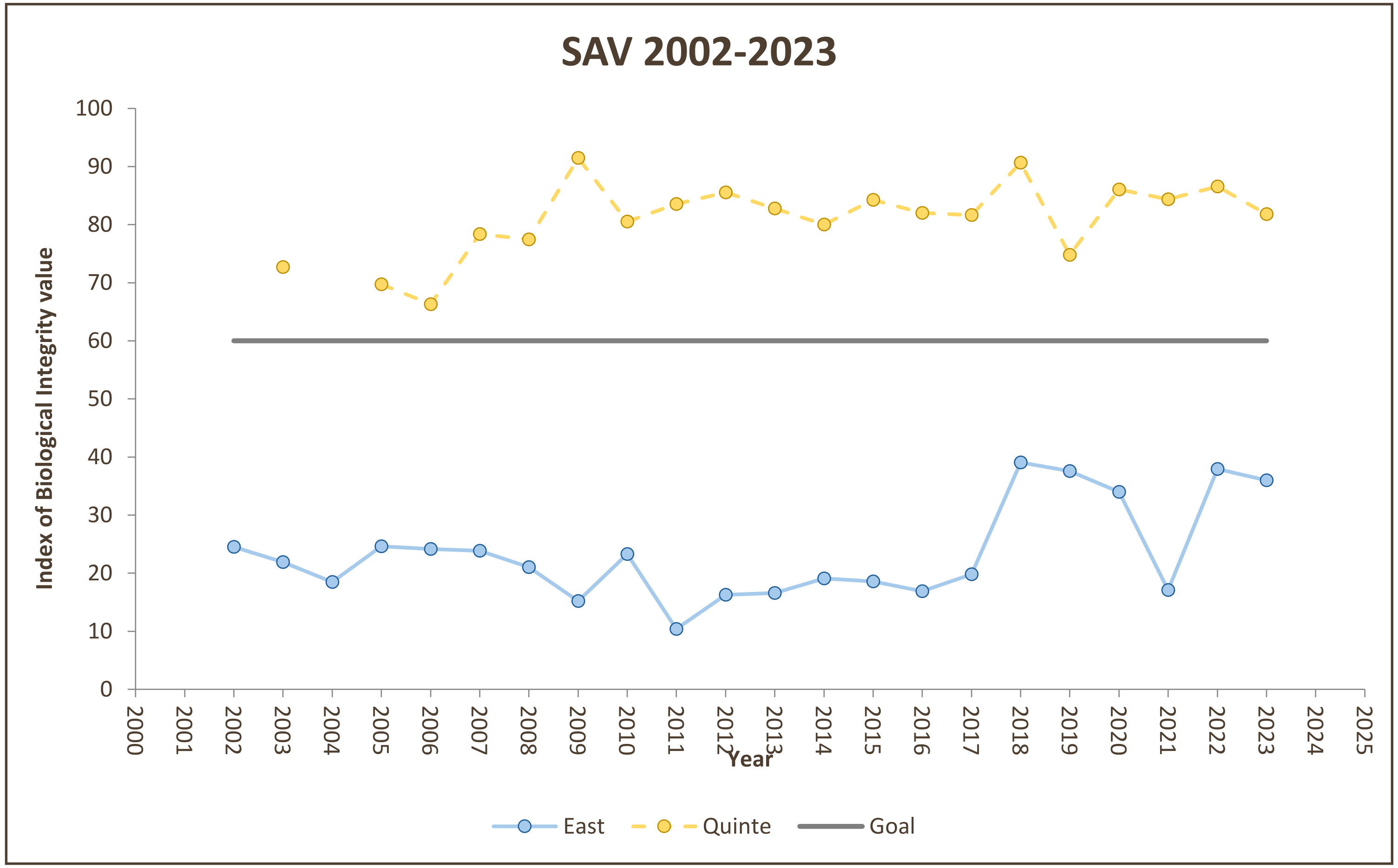
Durham region coastal wetland monitoring program

Biological

- Submerged Aquatic Vegetation Community
- Fish Community
- Breeding Bird Community
- Amphibian Community
- Aquatic Macroinvertebrate Community

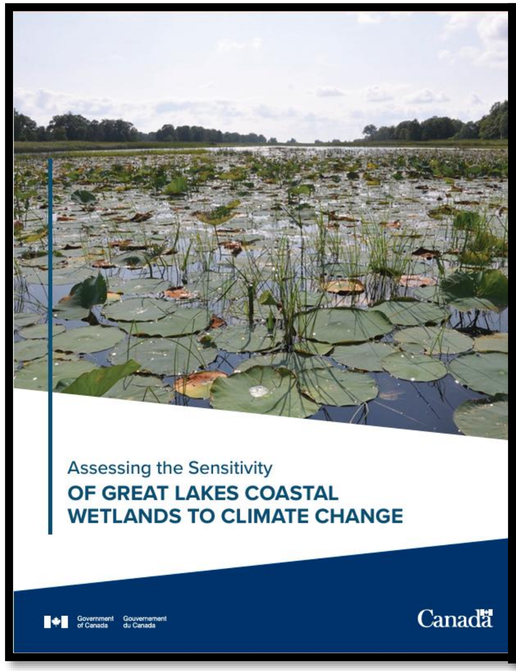
Geophysical

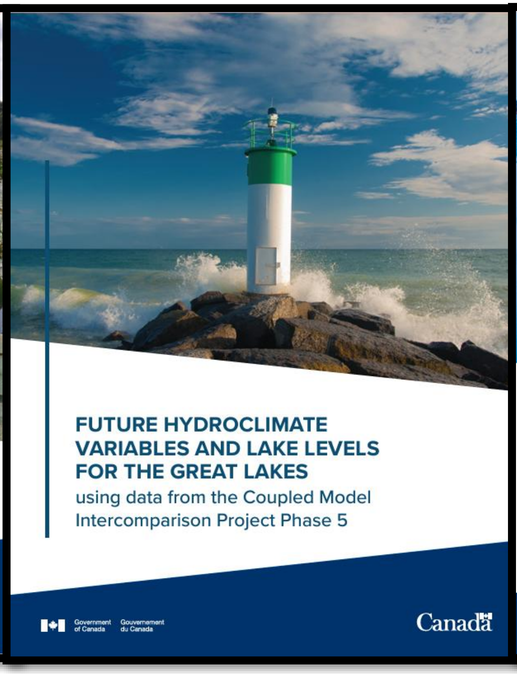
- Water Quality
- Water Levels

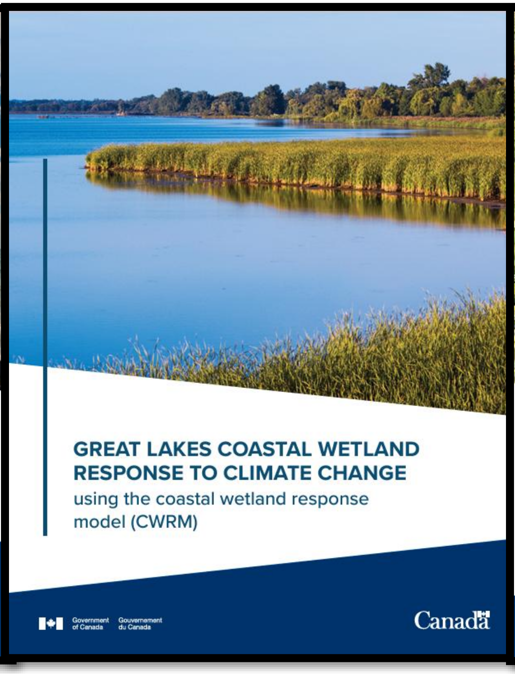


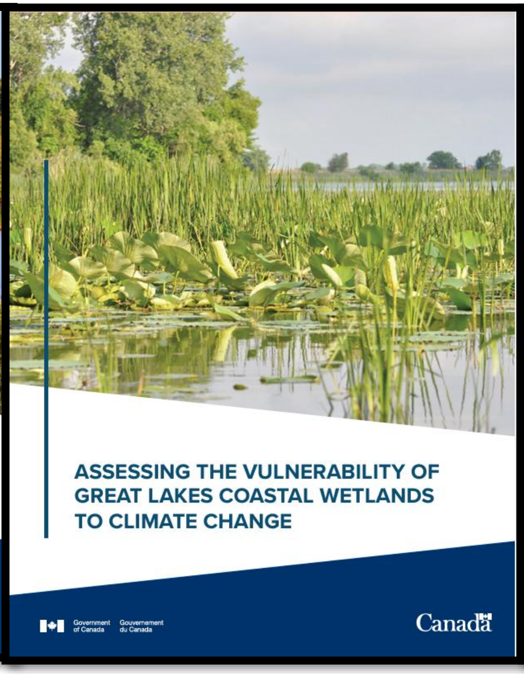
Assessment of the Resilience of Great Lakes Coastal Wetlands to a Changing Climate

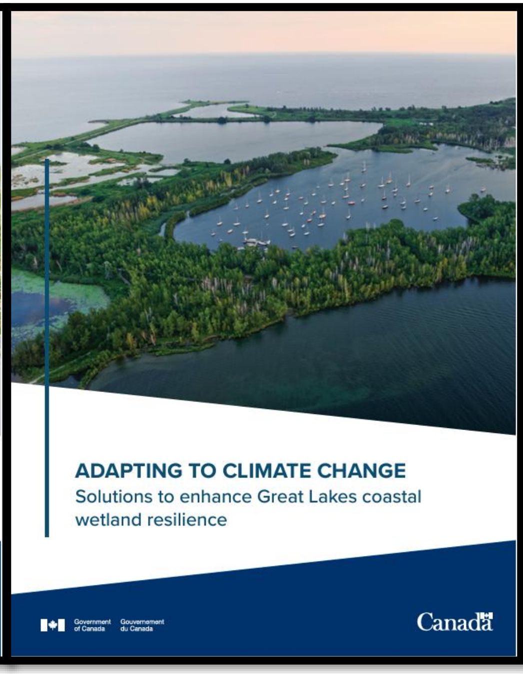
Government of Canada Gouvernement du Canada



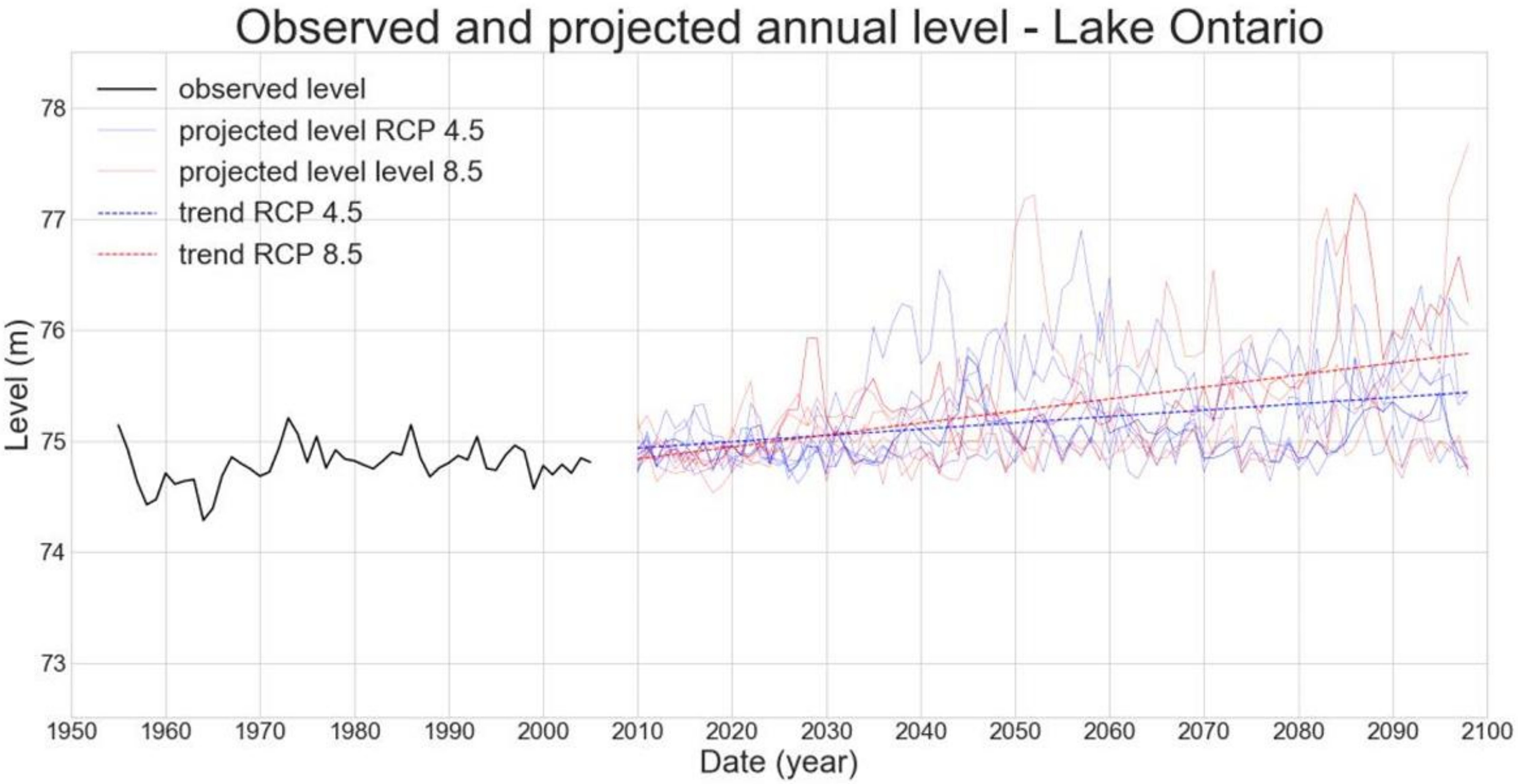








https://www.canada.ca/en/environment-climate-change/services/great-lakes-protection/taking-action-protect/coastal-wetlands/assessment-coastal-wetlands.html



ECCC, 2022 (Future Hydroclimate Variables and Lake Levels for the Great Lakes Using Data from the Coupled Model

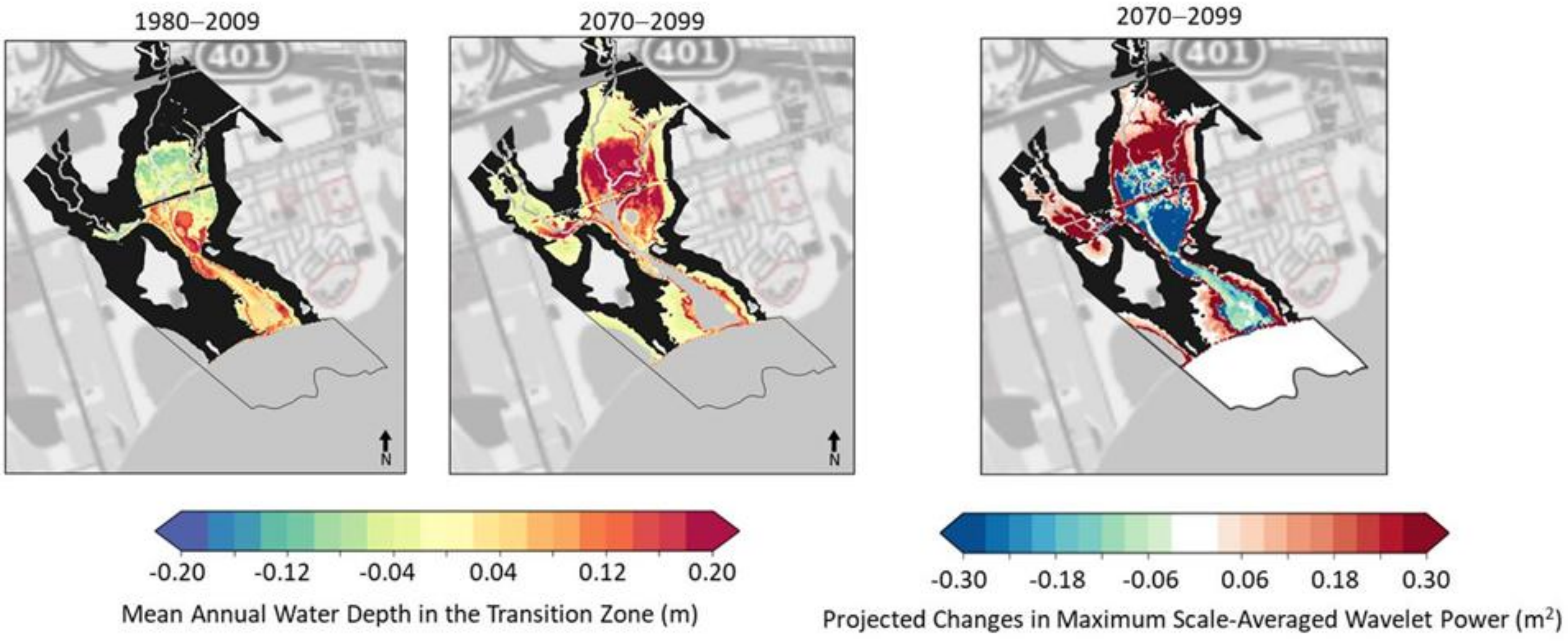


Figure 84: Example of changes in mean water depth across the transition zone for Lynde Creek Marshes, in Lake Ontario, for past and future periods (left panels), as well as projected changes in the maximum scale-averaged wavelet power (right panel). Black shaded areas in all maps indicated zones that remain strictly dry during the 30-year periods.

ECCC, 2022 (Great Lakes coastal wetland response to climate change using the CWRM (Coastal Wetland Response Model))

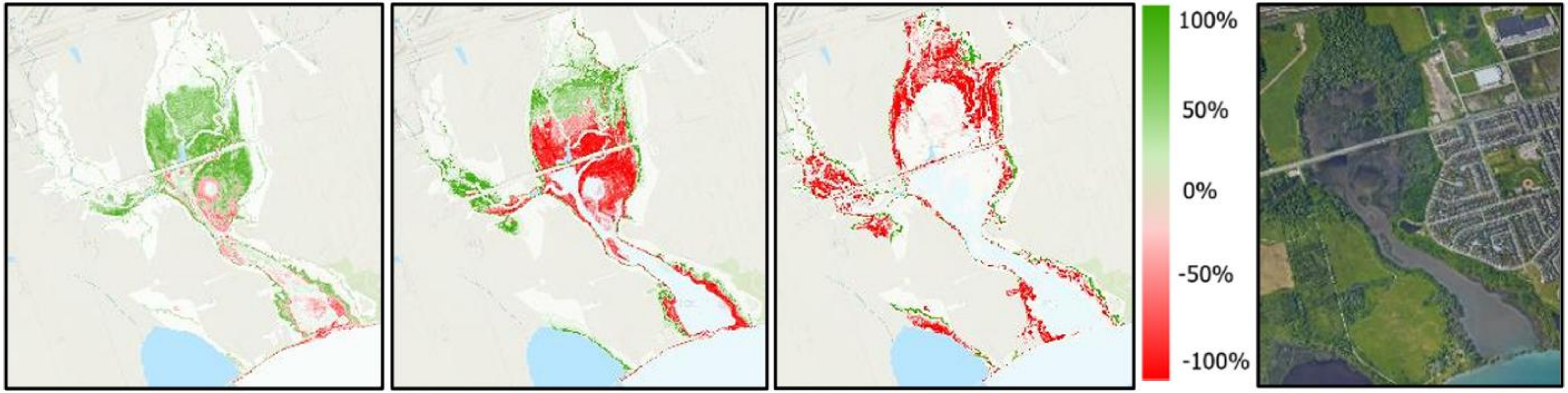
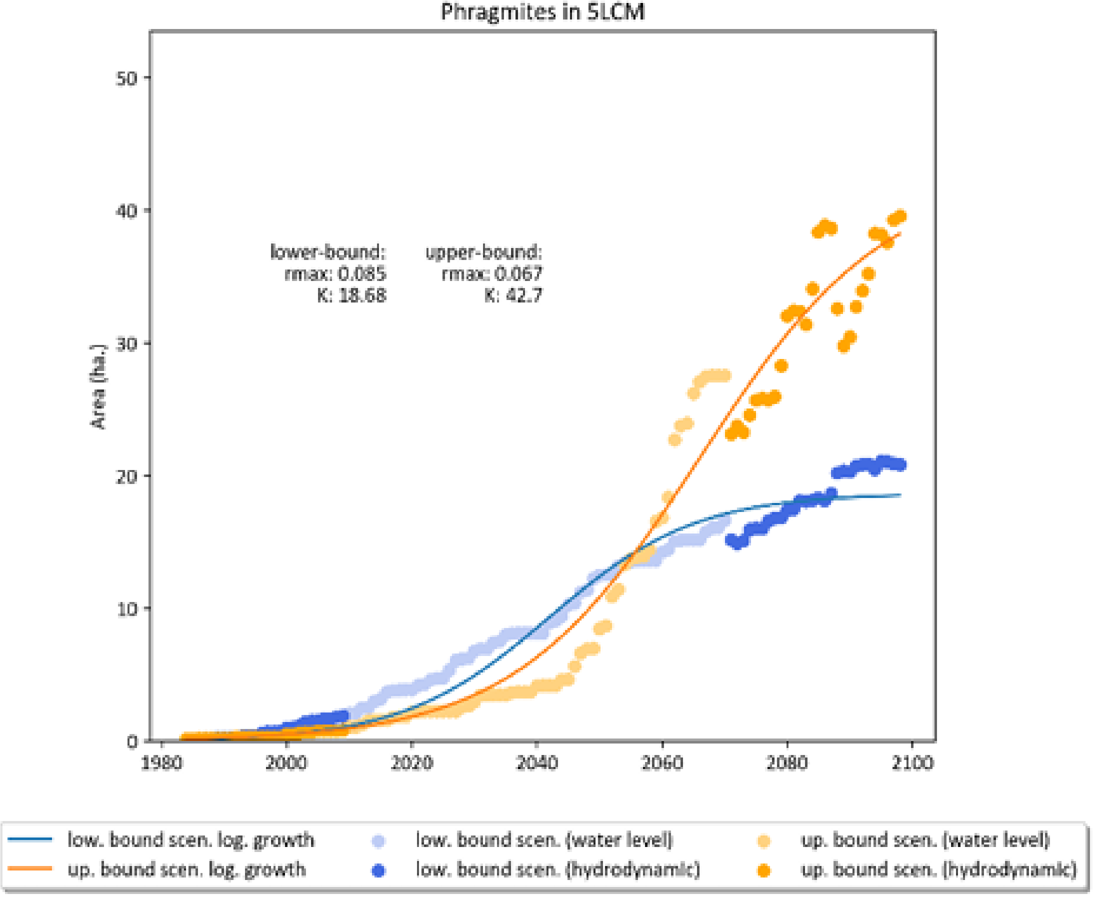


Figure 7. *Changes in wetland class distribution between recent past and simulated future under the upper-bound RCP 4.5 scenario for Lynde Creek, Lake Ontario (red: loss, green: gain). Left panel shows upland migration of emergent marsh. Middle-Left panel shows loss of submerged aquatic vegetation. Middle-right panel shows a loss of swamp. Right panel is a Google satellite image of Lynde Creek.*

ECCC, 2022 (Assessing the vulnerability of Great Lakes coastal wetlands to climate change)



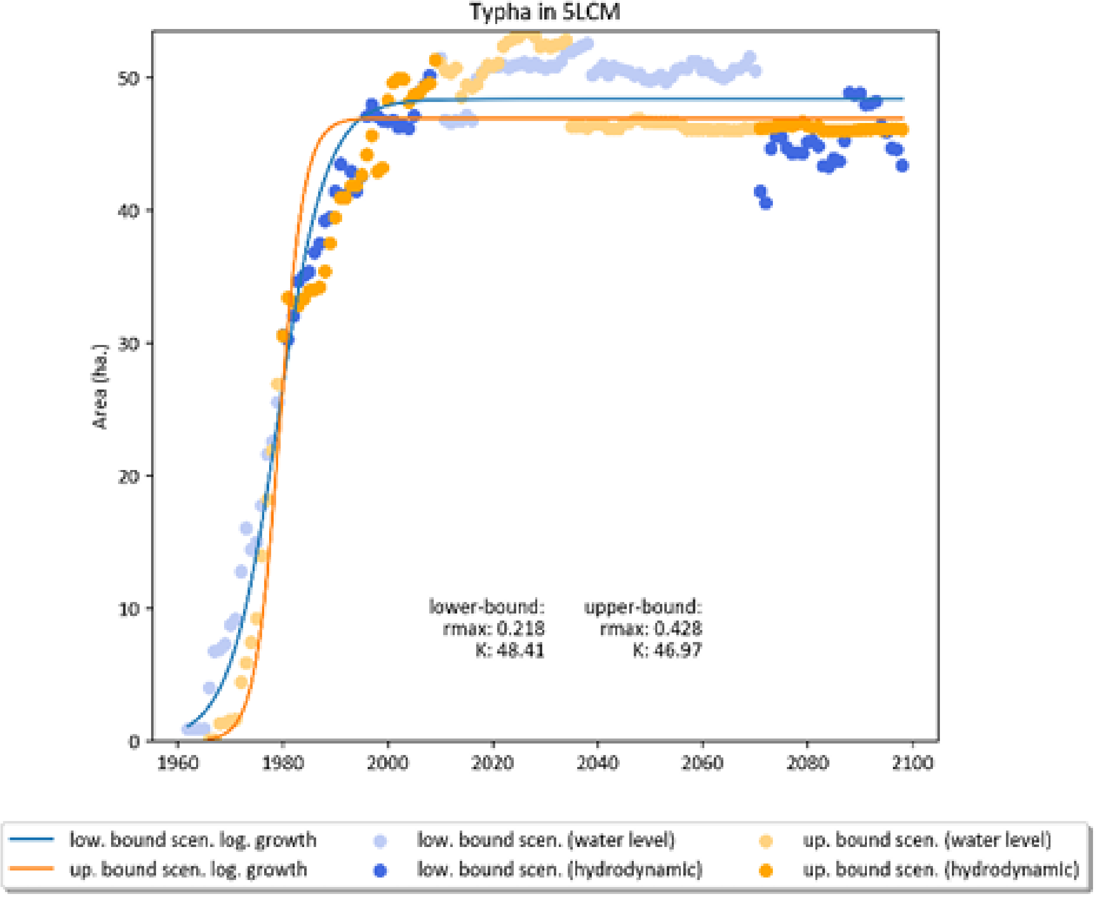


Figure 207: Phragmites (left) and Typha (right) evolution and logistic growth model in Lyndee Creek Marsh (5LCM) for lower (blue) and upper (orange) bound simulations.

ECCC, 2022 (Great Lakes coastal wetland response to climate change using the CWRM (Coastal Wetland Response Model))

5.6.1 Measure 5A: Identify and Manage Refugia Retreat Areas

Ensuring the availability of land for migration into upslope areas and protecting nearshore physical and biological conditions for downslope migration are important adaptive measures. Lake level fluctuations will continue to occur, and wetland plant communities can transition, provided that land is available for wetlands to form during sustained high and low lake levels (**Figure 32**). An assessment of the potential for wetland migration at 26 Canadian wetland sites found that, aside from constraints including geomorphic conditions (bluffs, cliffs, rock barrens), land use (agriculture and development), and landscape connectivity, the main impediments to landward wetland migration under prolonged high lake levels are shoreline development, roads, and infrastructure (Zuzek, 2020d). Approximately 39% of the Lake Erie shoreline and 37% of the Lake Ontario shoreline is hardened (ECCC, 2021). Future lake levels are projected to be variable with periods of high and low water levels. The physical environment - wave energy, bottom substrate type, water depth, and slope of the lake bottom in the waters adjacent to wetlands - influences the potential for downslope migration and wetland expansion.

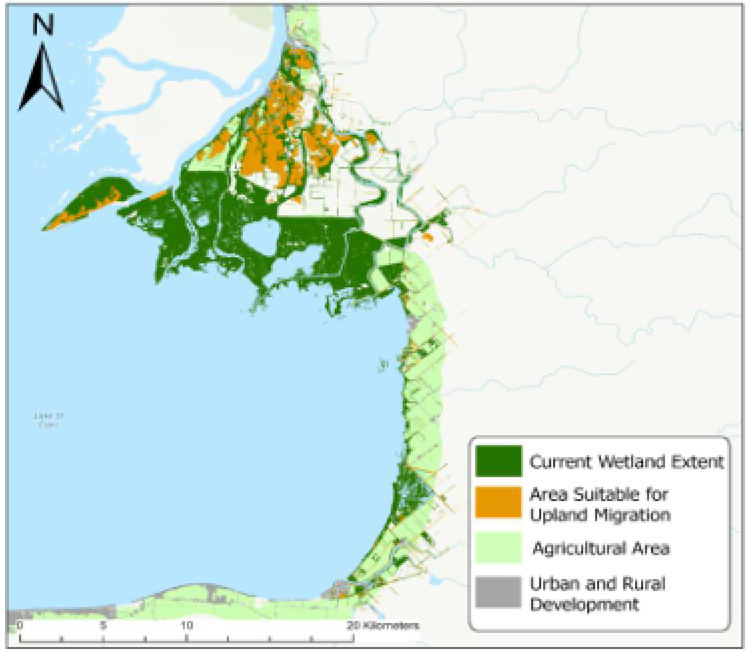
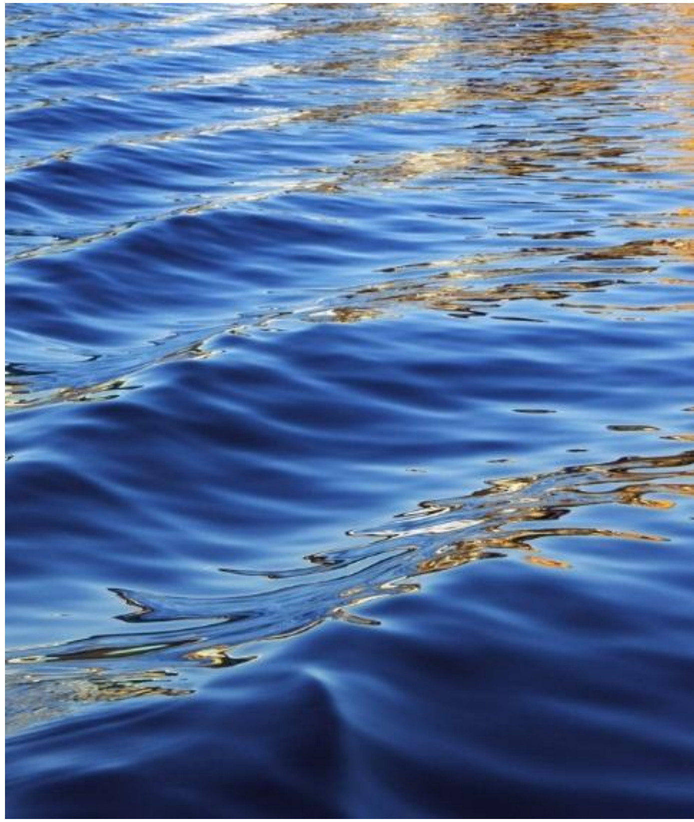


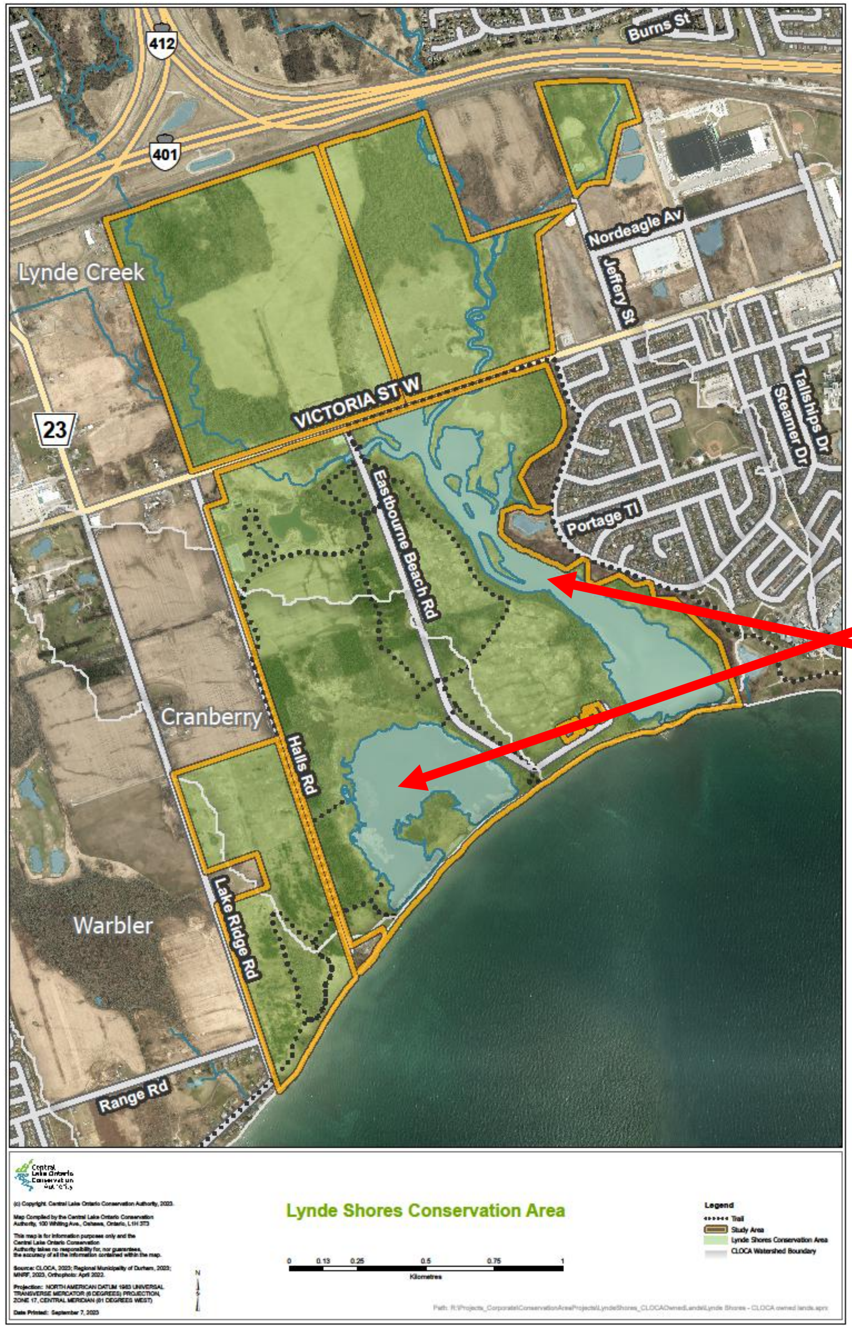
Figure 32. *Potential landward wetland migration in Lake St. Clair and the Walpole Delta (ECCC, 2021).*

ECCC, 2022 (Adapting to Climate Change: Solutions to Enhance Great Lakes Coastal Wetland Resilience)

Local Context and Conditions – Lynde Shores Conservation Area

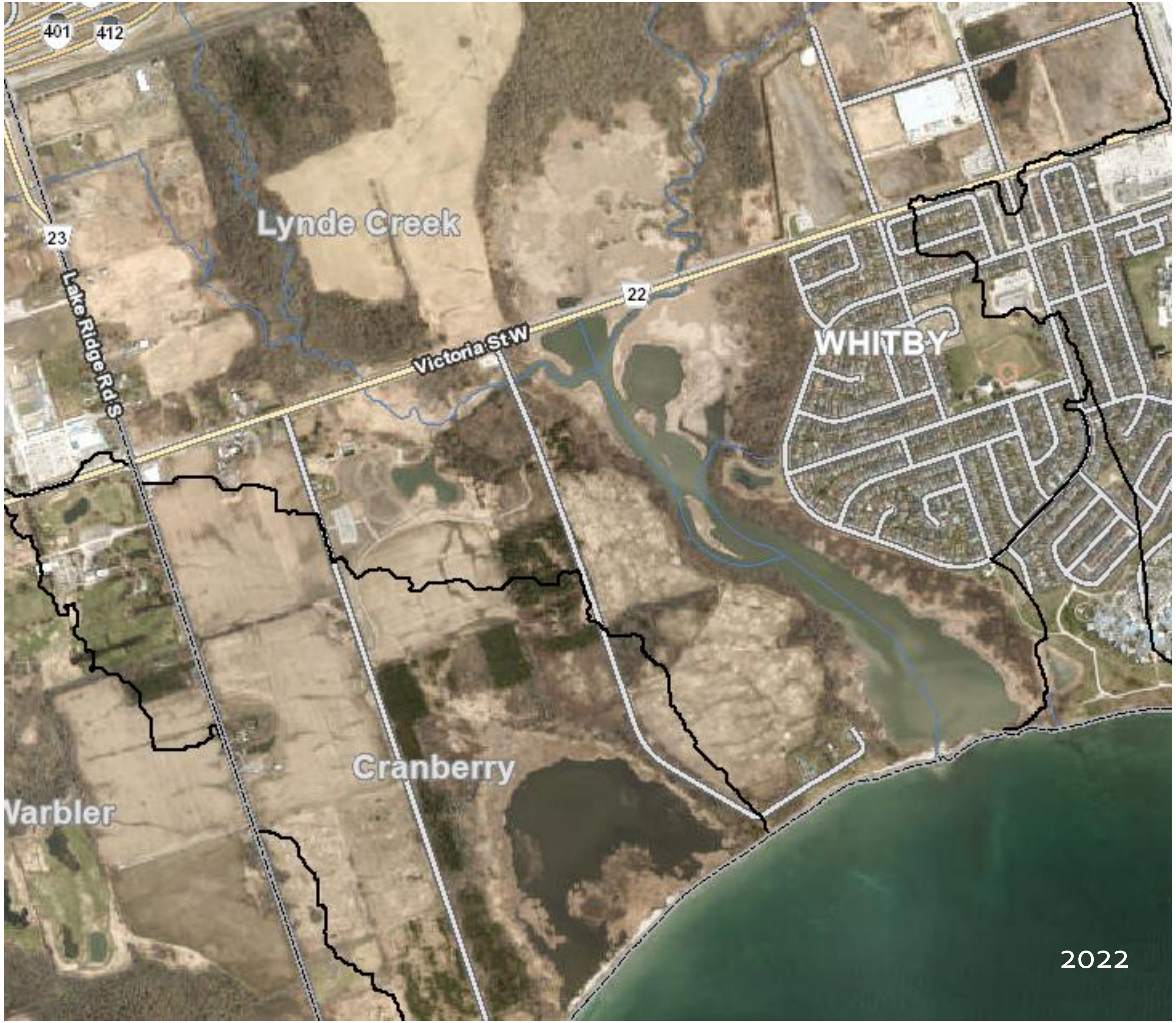


- High diversity of plant and animal species
- Strong community involvement
- Three parking lots
- Washroom facilities
- Abundant Wildlife
- Excellent bird watching



- ~200,000 visitors per year
- Waterfront trail
- Two coastal wetlands
  - Cranberry Marsh
  - Lynde Creek Marsh
- 5 km of trails
- Canoe/kayak launch
- Marsh viewing platforms
- 312 hectares


1931


401
412
23
22
Lynde Creek
Lake Ridge Rd S
Victoria St W
WHITBY
Cranberry
Warbler
2022

Lynde Creek Marsh, 2007. Note the poor water quality, in part because of the lack of interspersion and diversity of habitats that can be resilient and support aquatic vegetation.

Lynde Creek Marsh, 2012. Note the low water level conditions. Lack of diversity in bathymetry results in little resilience to low water conditions. Poor water quality in these years given no aquatic vegetation.

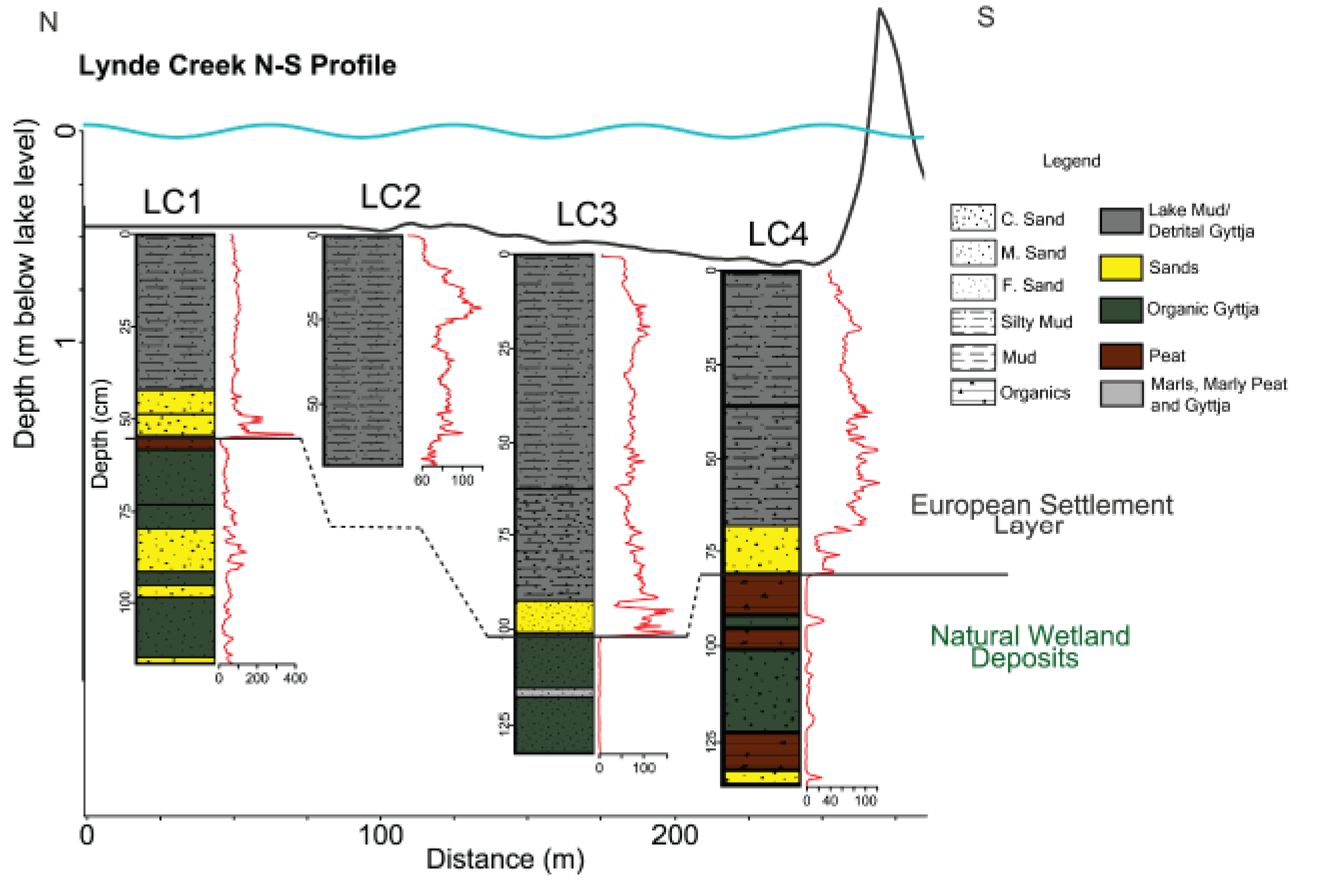


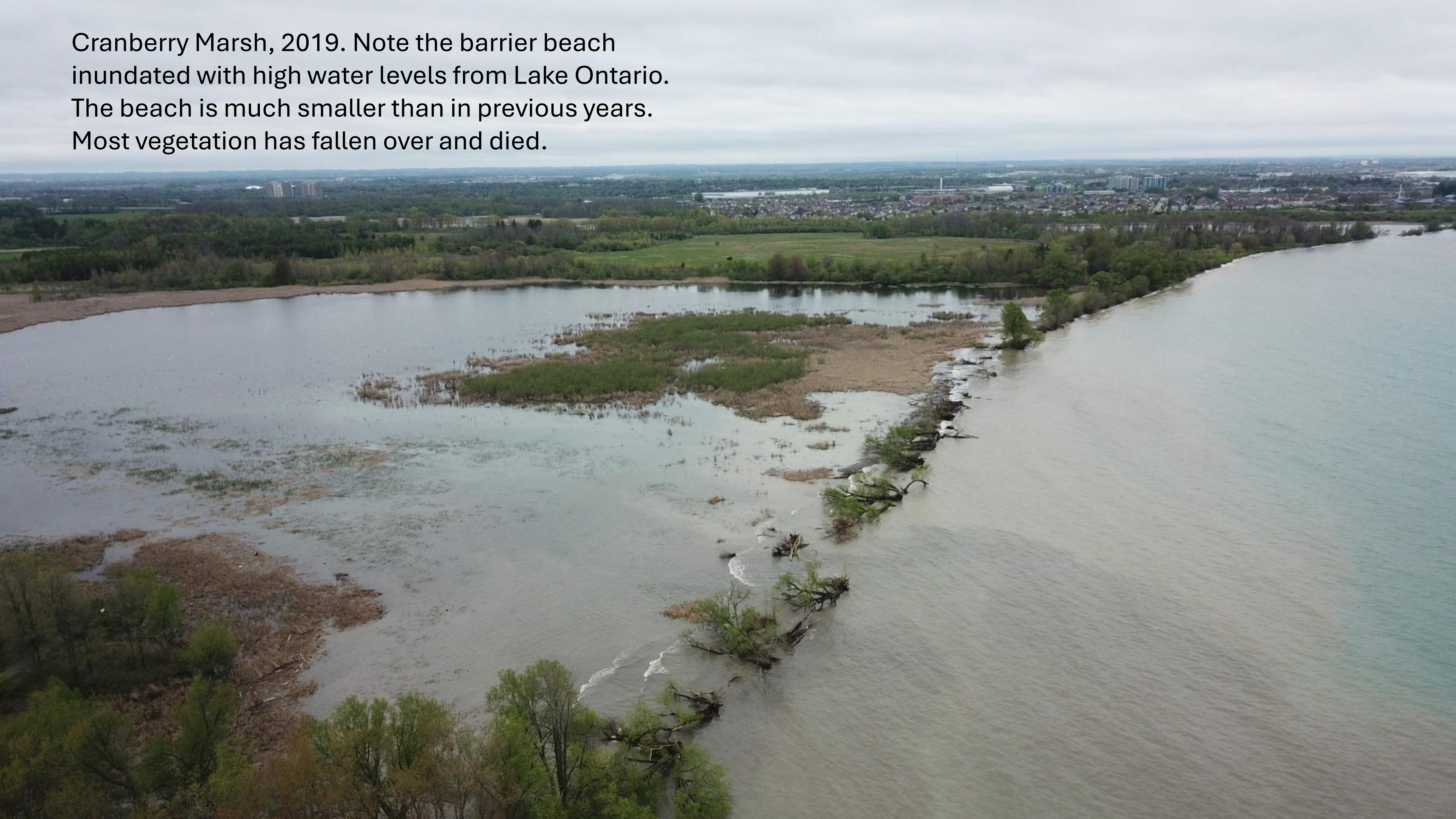
Figure 2.13: North-south lithostratigraphic and magnetic susceptibility log profile across the Lynde Creek outlet. The transect extends from the central basin (LC1) towards the beach barrier. ESL and NW facies are separated by a basin wide unconformity (bold line).

Michalchuk, 2025

Cranberry Marsh 2007

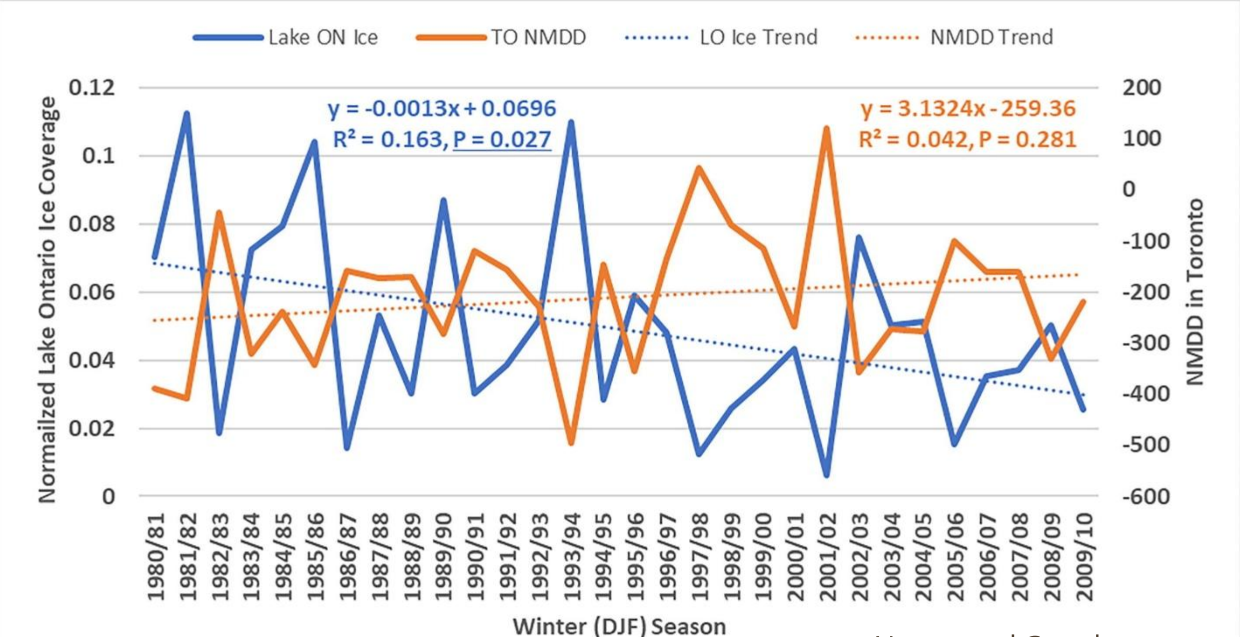
Note the intact and vegetated barrier beach

Cranberry Marsh, 2017. At the control structure. Beach is inundated and eroding. Trees starting to fall due to lack of soil.



Cranberry Marsh, 2019. Note the barrier beach inundated with high water levels from Lake Ontario. The beach is much smaller than in previous years. Most vegetation has fallen over and died.

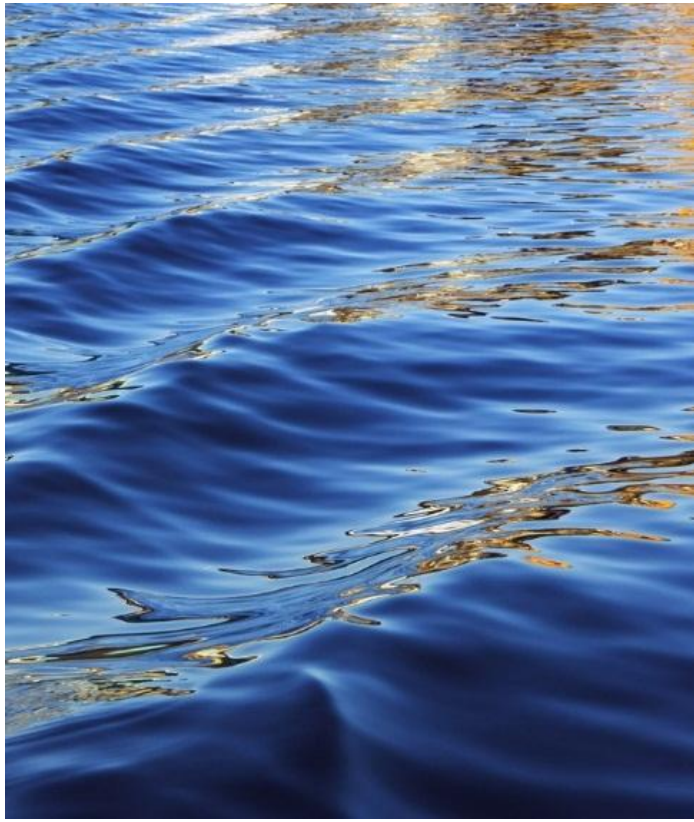
Living shorelines seem to provide a less ecologically disruptive alternative to bulkheads and riprap. Credit: NOAA/University Maryland Center for Environmental Science



Hewer and Gough, 2019

A pier at Whitby harbour.

Restoration and Resilience Planning

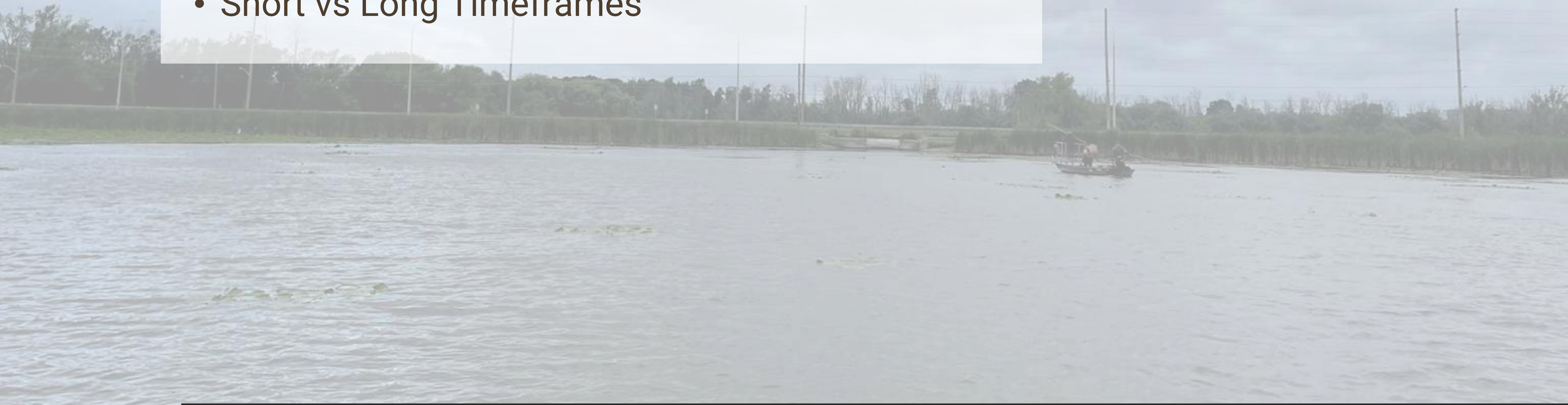


Strength through Partnership

- Ducks Unlimited Canada
- Canada Water Agency
- Canada Wildlife Services
- Town of Whitby
- Ontario Power Generation
- Toronto and Region Conservation Authority
- SJL Engineering, DHI, Zuzek Inc.
- Alderville First Nation
- Curve Lake First Nation
- Hiawatha First Nation
- Mississaugas of Scugog Island First Nation

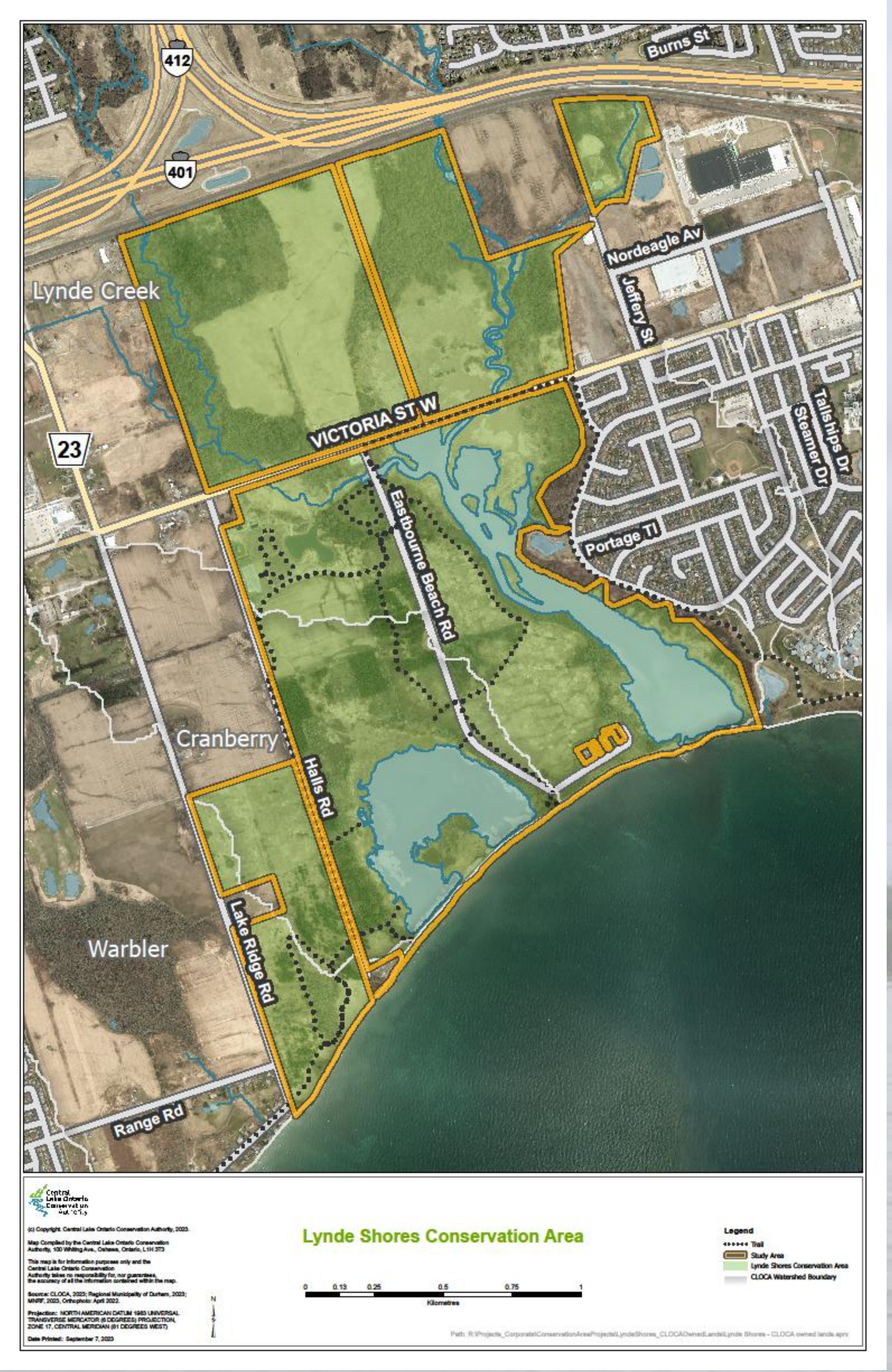
Strength through Partnership

- Culturally Significant Species
- Local to National Objectives
- Local to National Stressors
- Engineers, biologists, members of the community
- Short vs Long Timeframes



Vision

The Lynde Shores Conservation Area Coastal Wetlands are diverse and resilient ecosystems whose natural features and functions are valued and protected for present and future generations.



Viability Assessment Table

Target Ecosystem	Key Ecological Attribute	Indicator		Condition Rating (Current Condition)				Desired Condition
		Primary	Secondary	Poor	Fair	Good	Excellent	
Wetland Condition	Marsh Obligate Breeding Birds	Breeding Bird IBI		0-25	26-50	51-75 (LYN: 55, CRN: 63)	76-100	Lynde: Maintain and Protect; Cranberry: Maintain and Protect; Reference: 60
		IBI Metrics	Mean spp richness of area-sensitive marsh nesting obligates	<0.1 (**LYN: 0.03**)	0.1-0.2	0.2-0.3 (CRN: **0.27**)	>0.4	Reference: 0.25
			Mean relative abundance of marsh nesting obligates	<10	10-20	21-30 (LYN: **22.8**)	31-40 (CRN: **32.4**)	Reference: 21.5
			Mean relative abundance of non-aerial foragers	0-25	26-50	51-75 (CRN: **52**)	75-100 (LYN: **75**)	Reference: 71.2
	Water Quality	Water Quality Index (WQI)		< -0.35 (LYN: -1.51; CRN: -0.51)	-0.35 to 0.36	0.36 to 0.80	> 0.80	Lynde: Improve to Fair; Cranberry: Improve to Fair; Reference: 0.42
		WQI Metrics	Turbidity (NTU)	>10 (**LYN: 10.8**)	10.0-7.5 (**CRN: 8.4**)	7.4-5	<4.9	Reference: 1.7
			Conductivity (mS/m)	>800 (**LYN: 880**)	800-601	600-400 (**CRN: 452**)	<400	Reference: 322
			Temperature (Celsius)	**LYN: 22.3; CRN: 23.97**				Reference 23.9
			pH	**LYN: 7.6, CRN: 7.6**				Reference: 7.6
	Submerged Vegetation Community	SAV IBI		0-25 (LYN: 19)	26-50 (CRN: 37)	51-75	76-100	Lynde: Improve to Fair; Cranberry: Improve to Good; Reference: 81
		SAV IBI Metrics	Coefficient of Conservatism	<4.0	4.0-4.5 (**LYN: 4.1**)	4.5-5 (**CRN:4.72**)	>5.0	Reference: 5.1
			Number of turbidity intolerant species	0-1 (**LYN: 0; CRN: 0.7**)	1-2	2-3	>3	Reference: 3.8
			SAV coverage (% of quadrats with SAV)	0-25	26-50 (**LYN: 30**)	51-75	76-100 (**CRN: 90**)	Reference: 93
			Native species richness	0-5	6-10 (**LYN: 6**)	15-Nov	>15 (**CRN: 18**)	Reference: 19
	Fish Community	Fish IBI		0-25	26-50 (LYN:46)	51-75	76-100	Lynde: Improve to Good; Cranberry: N/A; Reference: 85
		Fish IBI Metrics	Native species richness	0-5	6-10 (**LYN: 9.7**)	11-15	>15	Reference: 12
			Number of Centrarchid Species	<1	1-2 (**LYN: 1.6**)	2-3	>3	Refernce: 3.6
			Percent Piscivore Biomass	<15 (**LYN 4.7**)	16-30	30-45	>45	Reference: 65
			Number of Native Individuals	<75	76-150 (**LYN: 101**)	151-225	>225	Reference: 238
			Percent Non-Indigenous Biomass	>30 (**LYN: 55**)	30-20	19-10	<10	Reference: 0.1%
			Biomass of Yellow Perch	<100	100-250 (**LYN: 139**)	250-500	>500	Reference: 804

Viability Assessment Table

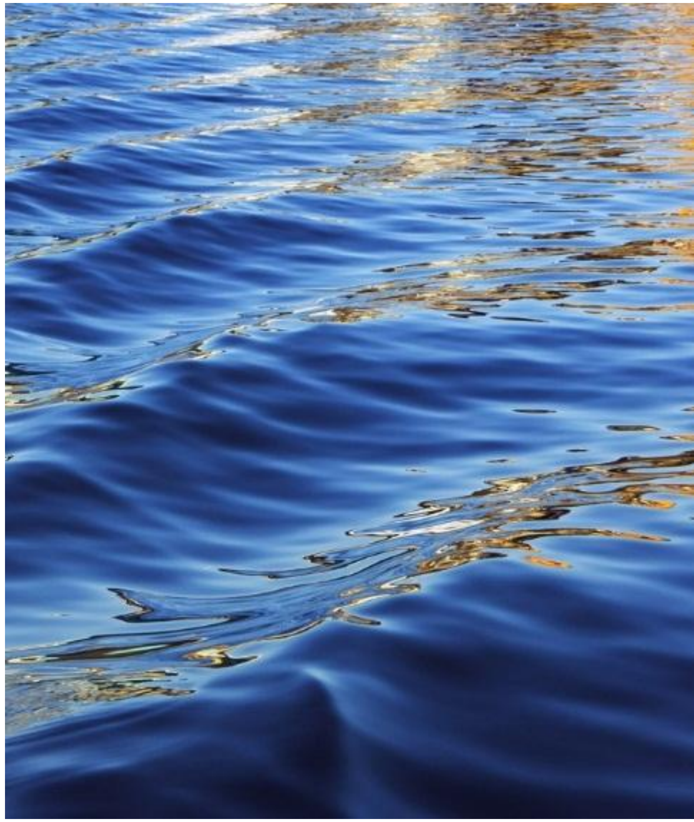
Target Ecosystem	Key Ecological Attribute	Indicator		Condition Rating (Current Condition)				Desired Condition
		Primary	Secondary	Poor	Fair	Good	Excellent	
Protective Wetland Features	Barrier Beach	Length of Shoreline Remediated (m)		TBD – based on feedback from coastal engineers				
Wetland Habitat Structure	Wetland Habitat Classes	Total Extent (ha - Marsh, Swamp, Meadow Marsh, Open Aquatic)		Continued tracking of Habitat Diversity to ensure long-term wetland functions and services.				
	Interspertion	Amount of linear edge habitat (meters between open water and emergent vegetation)		Increase by 7.5%	Increase by 10%	Increase by 12.5%	Increase by 15%	Lynde: 12.5% (1250m increase); Cranberry: Maintain and Protect; Current Conditions: LYN: 9604; CRN: 4939m
	Heterogenous Bathymetry	Amount of thermal refugia area (ha)		Increase by 10%	Increase by 15%	Increase by 20%	Increase by 25%	Lynde: 20% (5.34 ha increase); Cranberry: Maintain and Protect
Wetland Migration Potential	Vegetation Transitional Areas	Extent (ha) available for wetlands to migrate inland/lakeward to adapt to variable water levels		Increase by 0%	Increase by 1%	Increase by 2%	Increase by 3%	Lynde: 2% (1.85 ha increase); Cranberry: Maintain and Protect; Current Conditions: LYN: 43.1 ha; CRN: 12.3 ha)
Habitat Connectivity	Wildlife Passage	% of roads with wildlife-safe passage		0-25	26-50 (32%)	51-75	76-100	Improve to Good
	Wildlife Corridors	% of terrestrial area identified as function corridor naturally vegetated		0-25	26-50	51-75	76-100 (78%)	Currently Excellent but opportunities to Improve further (e.g. Halls Road and Agricultural Field north of Victoria Street)

Target Ecosystem Component	Protective Wetland Features	Wetland Condition				Wetland Habitat Structure			Wetland Migration Potential	Habitat Connectivity		
Key Ecological Attribute	Barrier Beach	Marsh Obligate Breeding Birds	Water Quality	Submerged Vegetation Community	Fish Community	Wetland Habitat Classes - extent of habitat	Interspersion	Heterogeneous Bathymetry	Refugia	Wildlife Passage	Wildlife Corridors	Threat Ranking
Scoring system - Scope/Severity/Irreversibility - Low = L, Medium = M, High = H, Very High = V												
1 Residential & commercial development												
1.1 Housing & urban areas	M/M/M	M/M/M	M/M/M	L/L/H	L/L/H	M/H/V		M/L/M	M/H/V	M/H/V	M/H/V	High
1.2 Commercial & industrial areas	M/M/M	M/M/M	M/M/M	L/L/H	L/L/H	M/H/H		L/L/M	L/V/V	M/H/V	M/H/V	High
1.3 Tourism & recreation areas	M/M/L	M/M/L	M/M/L	L/L/L	L/L/L	M/L/L		L/L/L	M/L/L	M/L/L	M/L/L	Low
2 Agriculture & aquaculture												
2.1 Annual & perennial non-timber crops		L/L/L	L/L/L	L/L/L	L/L/L	L/L/L		L/L/L	L/M/L	L/M/L	L/M/L	Low
3 Energy production & mining												
3.2 Mining & quarrying (stonehooking)	H/M/H											Low
4 Transportation & service corridors												
4.1 Roads & railroads		L/M/H	L/M/H	L/L/H	L/L/H	M/H/V	M/M/V	M/M/V	M/V/V	M/V/V	M/V/V	Very High
4.3 Shipping lanes (associated dredging)	L/L/M											Low
4.4 Flight paths		L/L/L										Low
5.0 - Biological resource use												
5.2 Gathering terrestrial plants	L/L/L											Low
5.4 Fishing & harvesting aquatic		L/L/L	L/L/L	L/L/L	L/M/L	L/L/L	L/L/L					Low
6 Human intrusions & disturbance												
6.1 Recreational activities	H/L/L	M/L/L	M/L/L	M/L/L	M/L/L					L/M/L	L/M/L	Low
6.3 Work & other activities	L/L/L	L/L/L	L/L/L	L/L/L	M/L/L					L/L/L	L/L/L	Low
7. Natural systems modifications												
7.2 Dams & water management/use	H/M/H	V/H/H	V/H/H	V/H/H	V/H/H	V/H/H	V/H/H	V/M/H	H/H/H	M/L/L	L/L/L	Very High
8 Invasive & other problematic species, genes & diseases												
8.1 Invasive non-native/alien	M/L/L	H/M/V	H/M/V	H/M/V	H/M/H	H/H/H	H/M/H	M/M/V	H/M/H		M/M/V	Very High
8.2 Problematic native	M/L/L					M/M/M	M/M/M	M/M/H				Medium
8.3 Introduced genetic material (E.G.					M/L/L							Low
8.5 Viral/prion-induced diseases					H/L/H							Low
9 Pollution												
9.1 Domestic and urban storm and waste	H/L/L	H/M/H	H/H/V	H/H/V	H/H/V	H/L/V	H/L/V	V/H/V		H/M/V		Very High
9.2 Industrial effluents	H/L/L	H/L/H	H/L/H	H/L/H	H/L/H	H/L/V	H/L/V	H/L/H		M/M/V		Medium
9.3 Agricultural & forestry effluents	H/L/L	H/M/H	H/H/H	H/H/H	H/H/H	H/L/H	H/L/H	V/H/H		M/M/H		High
9.4 Garbage & solid waste	H/L/L	H/L/L	H/L/L	H/L/L	H/L/L							Low
9.5 Air-borne pollutants	H/L/L	H/L/L	H/L/L	H/L/L	H/L/L							Low
11 Climate change & severe weather												
11.1 Habitat shifting & alteration	V/M/V	V/M/V	V/L/V	V/M/V	V/M/V	V/H/V	V/L/V	V/M/V	V/L/H	M/M/V	V/M/V	Very High
11.2 Droughts	V/M/V	V/M/V	V/M/V	V/M/V	V/H/V	V/H/V	V/L/V	V/L/V		V/M/V	H/H/V	Very High
11.3 Temperature extremes		V/M/V	V/H/V	V/H/V	V/H/V	V/H/V	V/L/V	V/H/V		V/M/V	H/M/V	Very High
11.4 Storms & flooding	V/H/V	V/M/V	V/H/V	V/M/V	V/M/V	V/M/V	V/M/V	V/H/V	V/M/V	H/M/V	H/M/V	Very High
Total Threat Score by Ecosystem	High	Very High	Very High	Very High	Very High	Very High	High	Very High	High	Very High	Very High	Very High

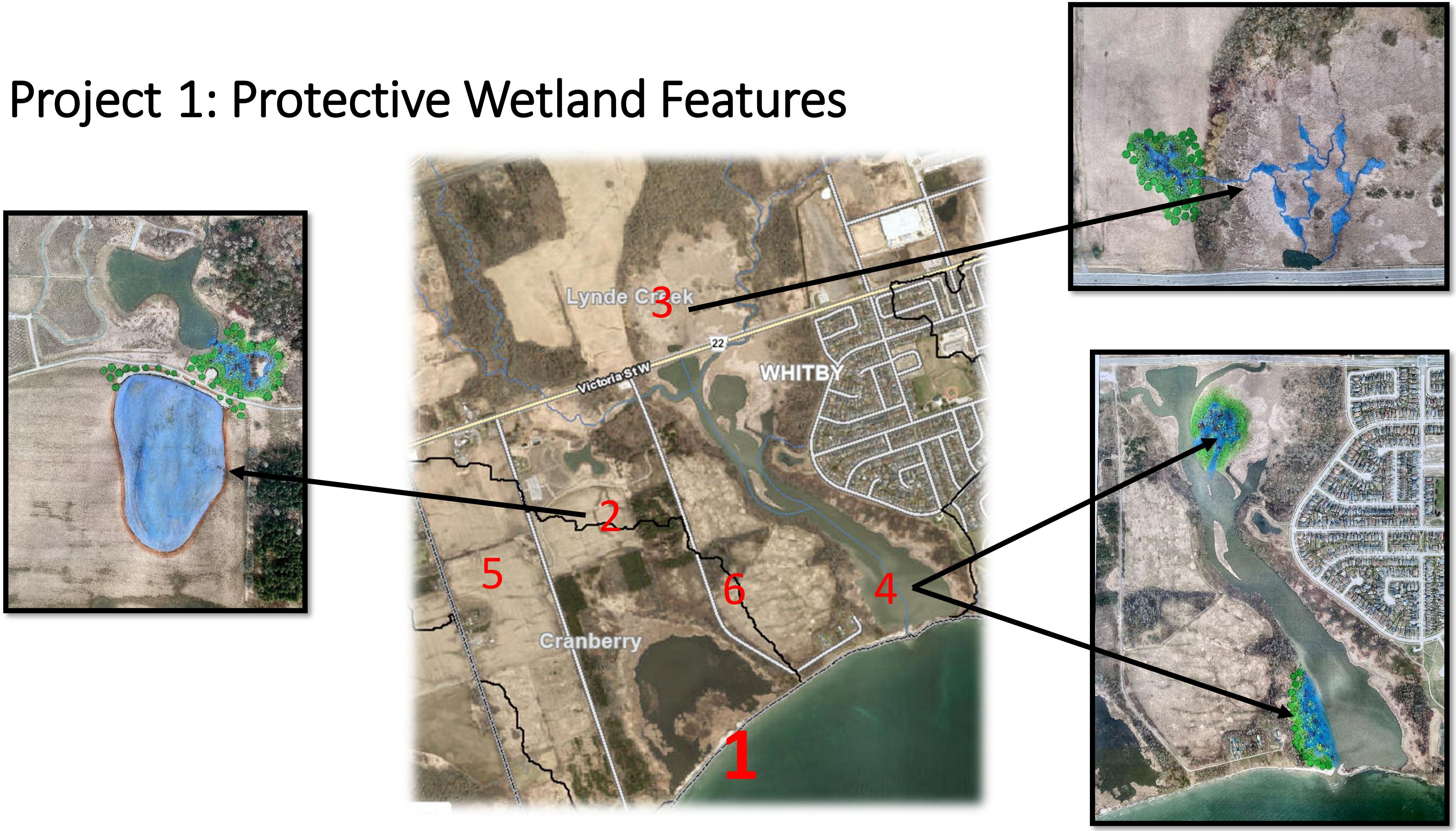
Top Threats:
- Roads
- Water Management (Lake Ontario Water Level Regulation)
- Non-native species
- Water quality (watershed sources)
- Climate Change

All Target Ecosystems under High or Very High ranking

Strategies Identified



Project 1: Protective Wetland Features



Project 1: Protective Wetland Features

- Dynamic Beach(es):

Start (lat, long)	End (lat, long)	100-year Erosion Rate (m/year) or Stable	Dynamic Beach Name
43.8385, -78.9657	43.8433, -78.9585	0.34	Cranberry Marsh
43.8433, -78.9585	43.845, -78.954	0.15	Eastbourne Beach Road
43.845, -78.954	43.8458, -78.949	0.34	Lynde Creek Barrier
43.8491, -78.939	43.8511, -78.9353	Stable	Iroquois Beach

A long-term barrier beach restoration plan is recommended for Lynde Shores Conservation Area, including beach nourishment and re-vegetation to improve the resilience of the barrier.

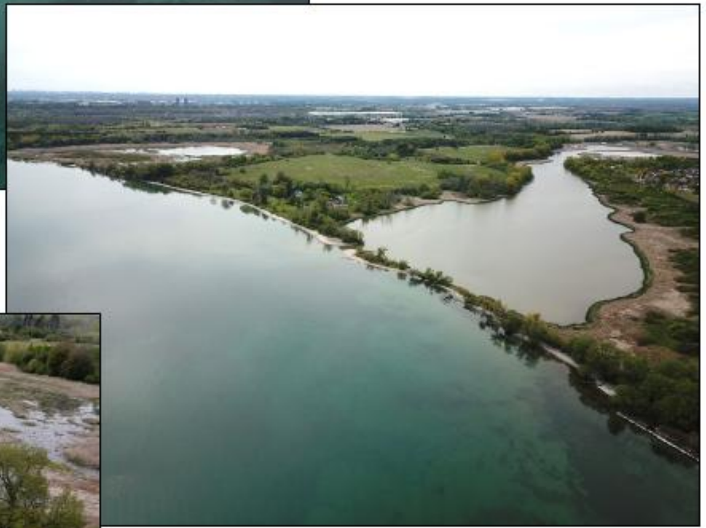
Zuzek Inc LOSMP, 2020

Cranberry Marsh, 2024
Note the break in the barrier beach, the smaller beach that as moved landward, and the isolated control structure in the lake. Also note the lack of vegetation on the beach.

CTV News Windsor

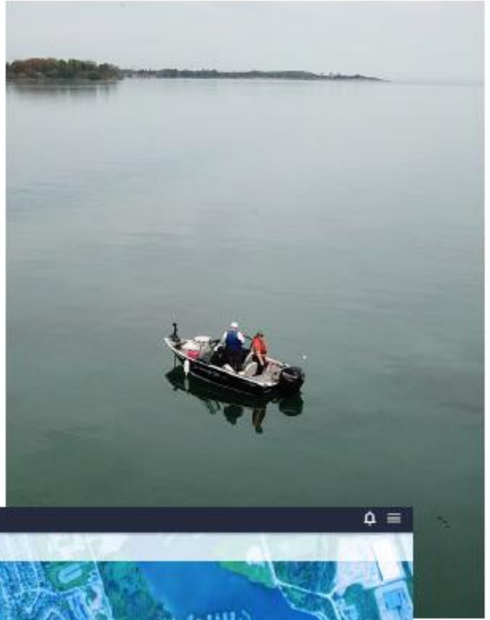
Field Work and Data Acquisition

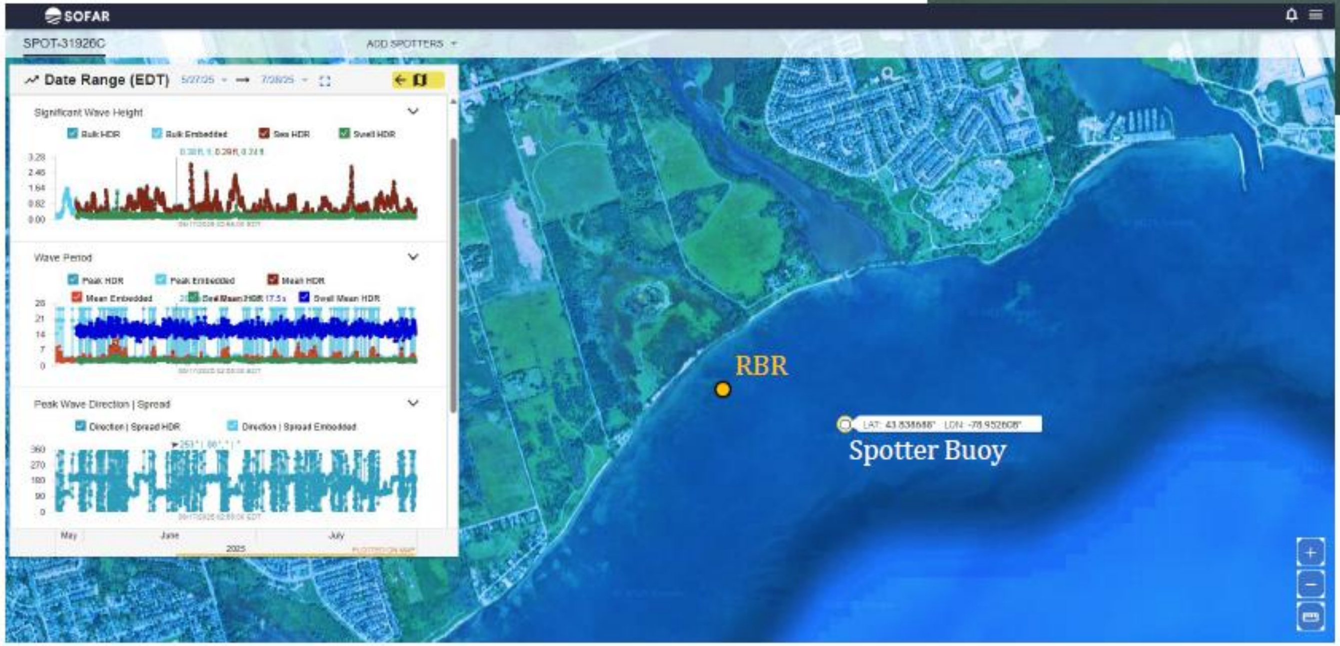
- Bathymetric survey & sonar imaging
- Topographic survey
- Drone imagery



Field Work and Data Acquisition

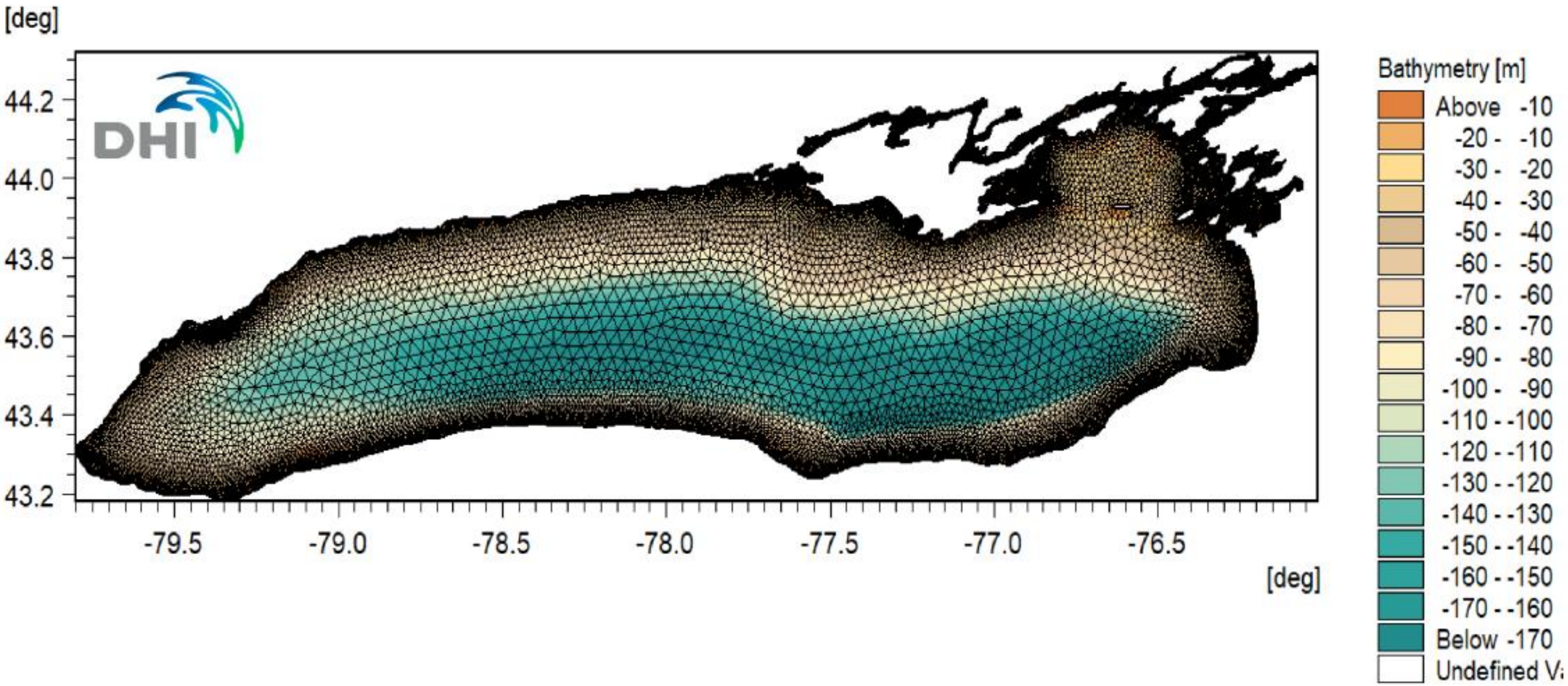
- Offshore, directional wave buoy (Spotter Buoy)
- Nearshore, RBR pressure sensor (waves and water levels)



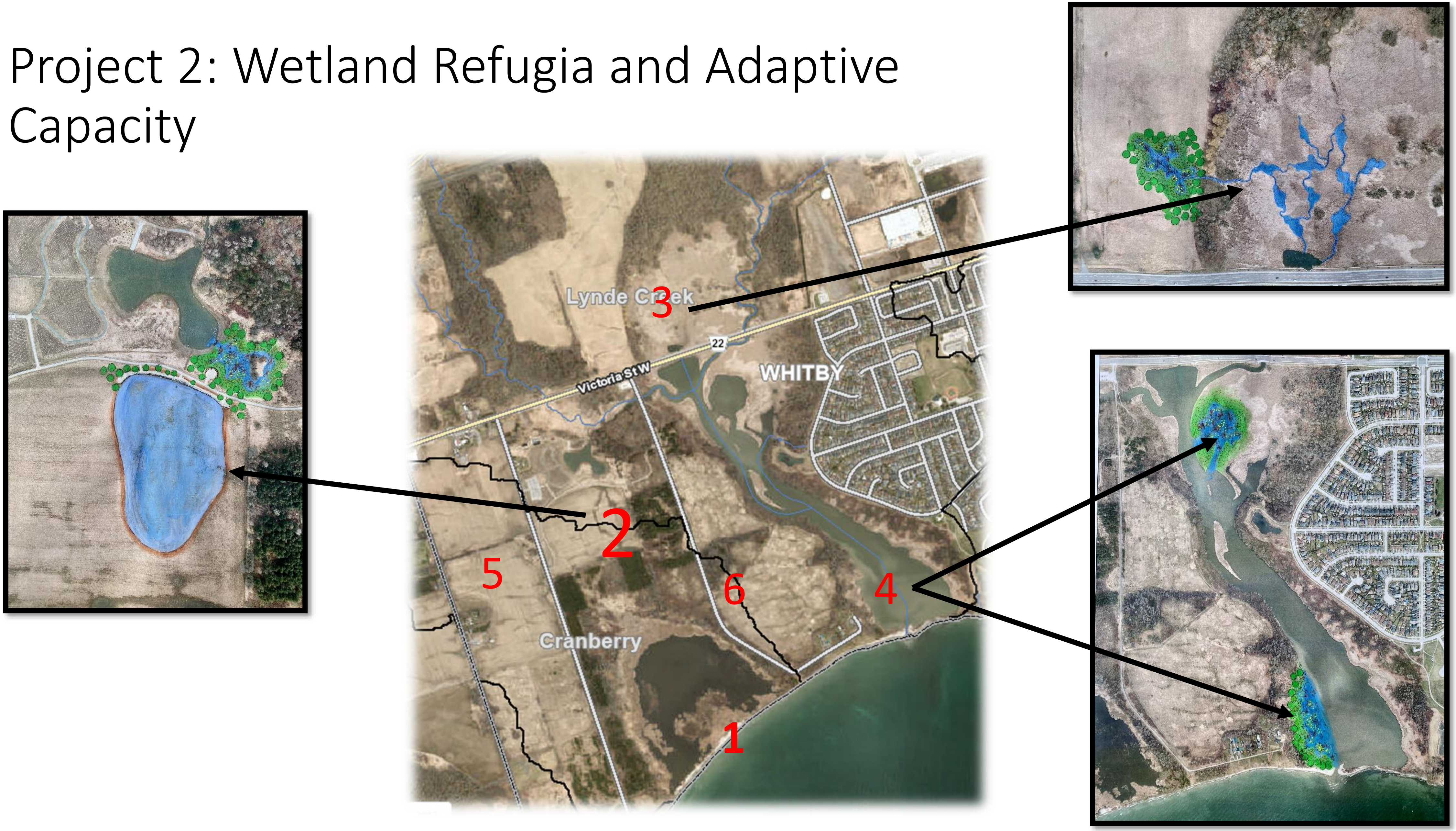


TECHNICAL WORK

- Offshore wave climate:
  - USACE Wave Information Study (WIS)
  - DHI's in-house wave hindcast for Lake Ontario



Project 2: Wetland Refugia and Adaptive Capacity



Project 2: Wetland Refugia and Adaptive Capacity

- Restoring Historical Wetland Loss in the area
- Important habitat for species, including shorebirds, waterfowl, reptiles and amphibians
- Builds resilience through further establishing metapopulations and incorporating climate resilient design

Wetland Migration Potential

- Based on LO Water Level of 75.11

-Blue: the amount of area flooded when water levels increase by 1 meter (76.11)

-Purple: the amount of area flooded when water levels increase by 2 meters (77.11)

Project 2: Wetland Refugia and Adaptive Capacity

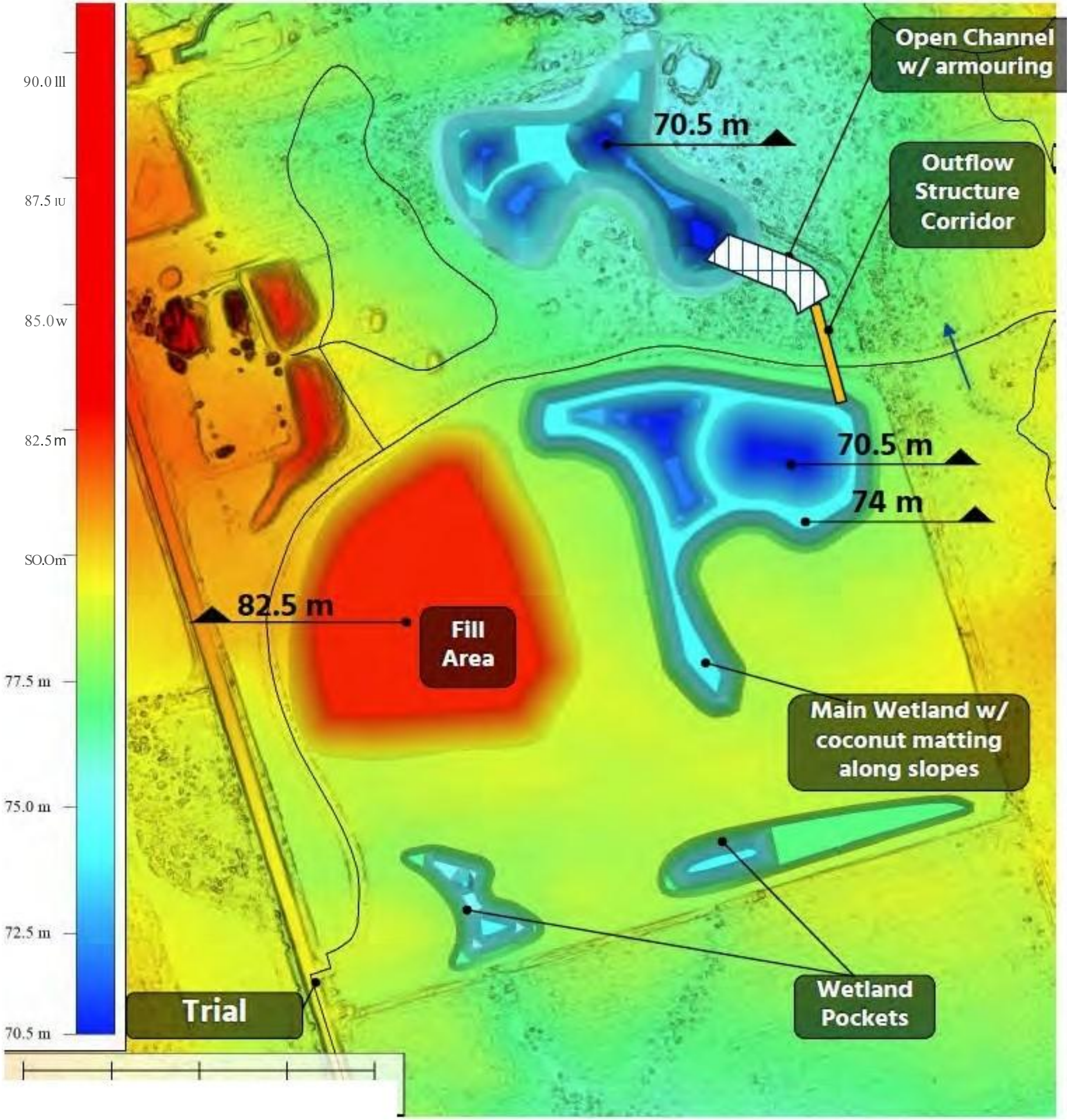
- High-use area would provide lots of visibility and nature appreciation opportunities to the public


Shorebird habitat creation

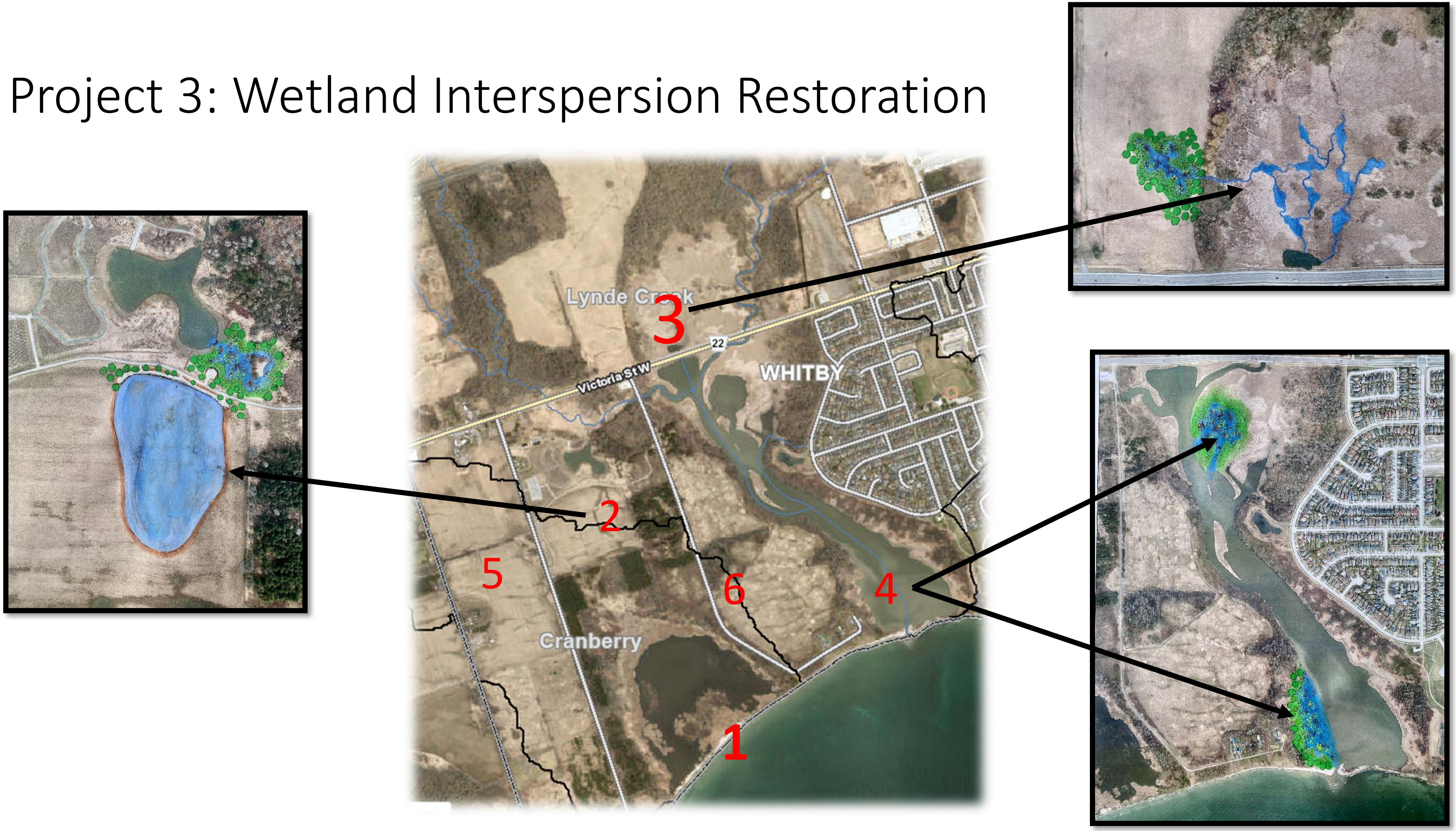

Wetland Creation

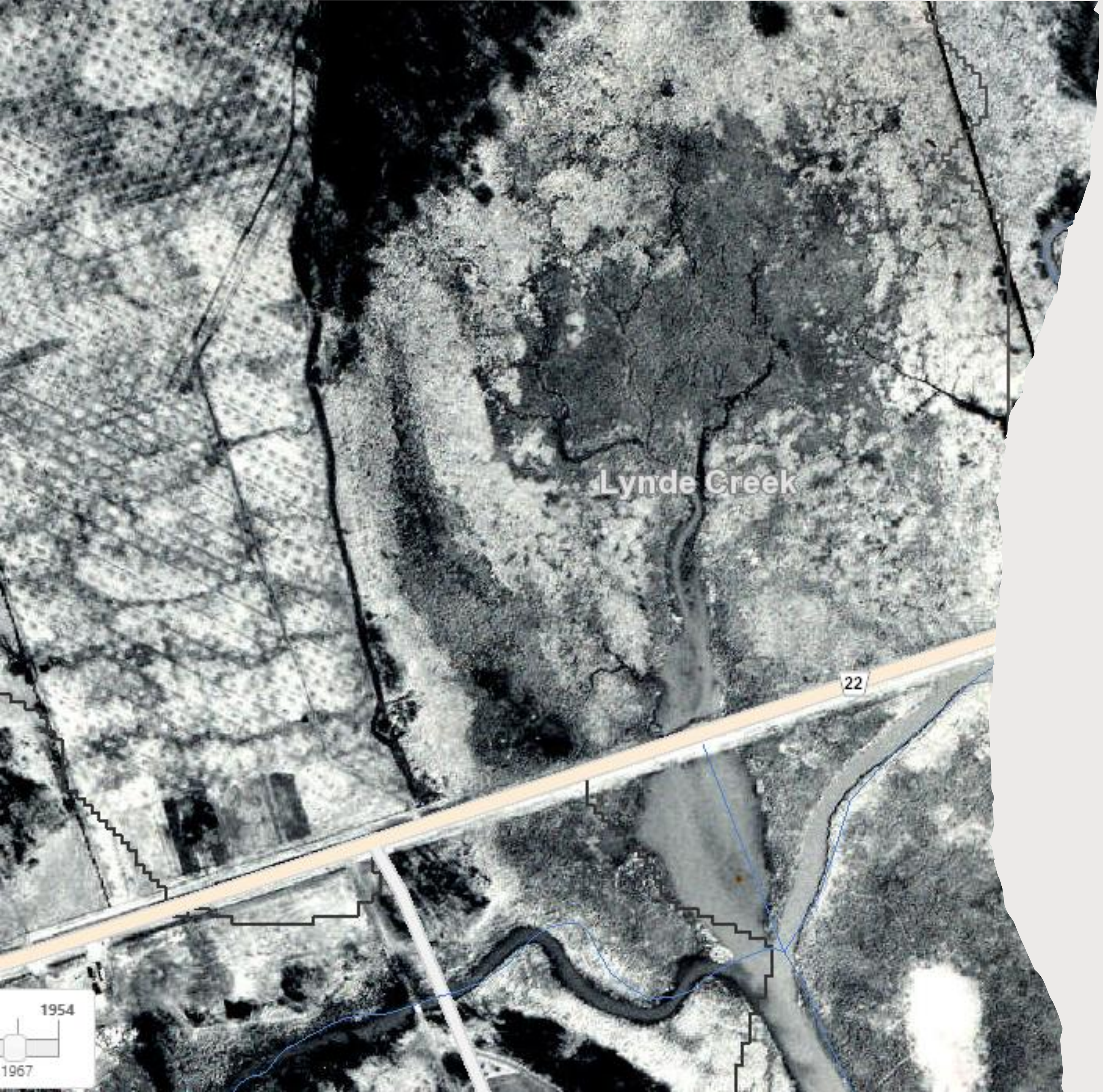
Project 2: Wetland Refugia and Adaptive Capacity

- Increased resilience
- Increased connectivity
- Increased visibility



Project 3: Wetland Interspersion Restoration





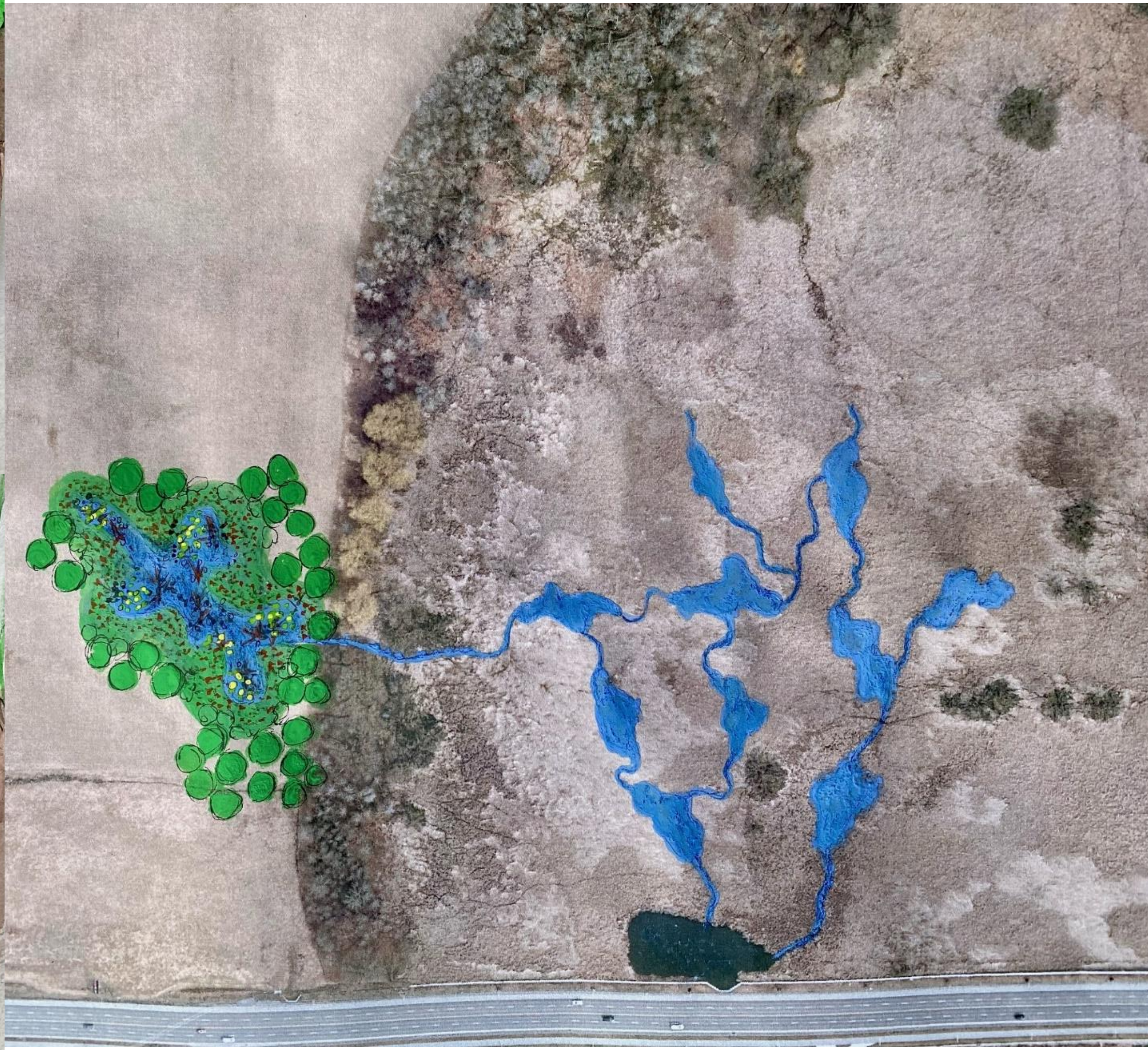
Project 3: Wetland Interspersion Restoration

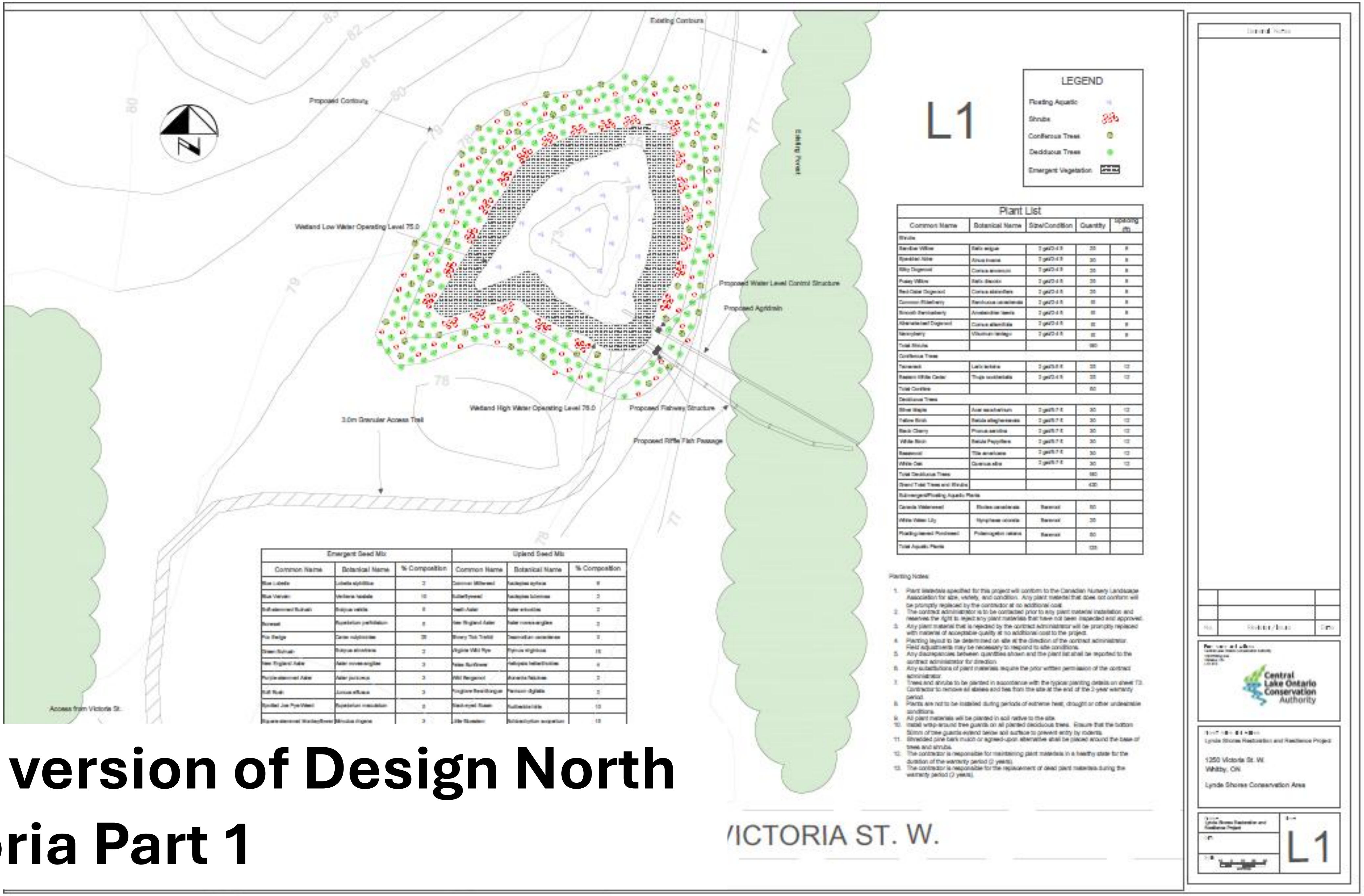
- Note the historical conditions with more open water, diversity of habitat north of Victoria
- Before influences of water level regulation and domination of Typha-Glauca

Project 3: Wetland Interspersion Restoration

- Current conditions are largely a monoculture of Typha Glauca that doesn’t have standing water other than during spring or large flood events


Wetland Creation

Pools and canals




Final version of Design North Victoria Part 1

centrallakeontarioconservation

centrallakeontarioconservation Restore the wetland, and the pike will come! CLOCA's aquatic monitoring team caught and released this beauty today in the newly restored section of the Lynde Creek Marsh at Lynde Shores Conservation Area. Finding a pike less than two months after the draglines finished digging is an excellent sign!

"Northern Pike is one of our target species for the Lynde Shores Restoration Project because Lynde Shores has been supporting very low numbers of them, and they are important indicators of wetland health," said Dan Moore, CLOCA's Senior Ecologist and Project Lead. We're thrilled to see them already in the new interspersion area!

Swipe to view the before (Jan 2025) and after (March 2025) pictures of the Lynde Creek Marsh. Many pools and channels were added as part of a wetland interspersion project this winter. This is the first of

103 likes

May 8

Add a comment...

Post

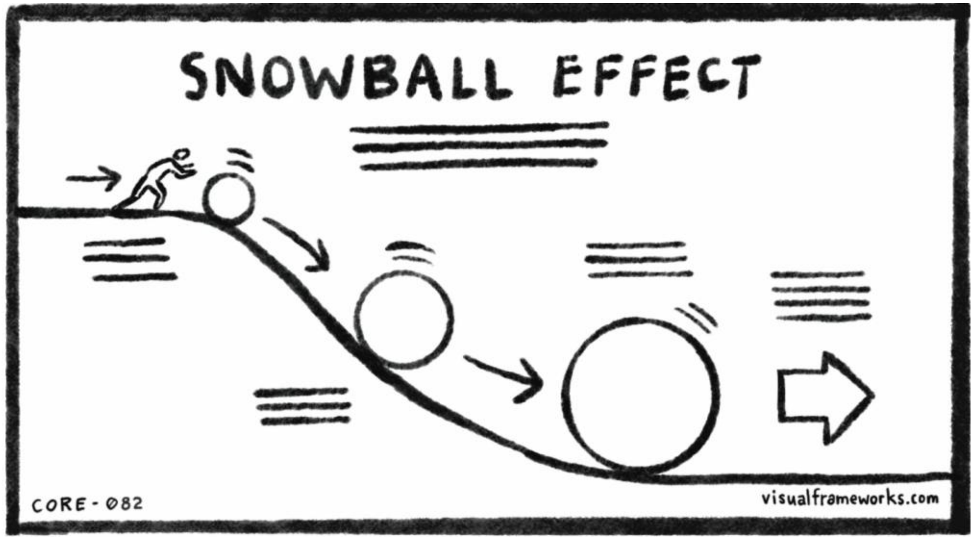
centrallakeontarioconservation ...

A few of the plant species that have been spotted are not common in the Lynde Creek Marsh. Diverse plant life helps support a diversity of wildlife. While monitoring the new area, some newly hatched fish were also spotted (young of the year) - several schools totaling around 100 individuals!

Submerged aquatic plants that have been found include:
🌿 Tape grass (an unexpected find!) - image on the left
🌿 Duckweed - upper right image
🌿 White water lily -lower right image
🌿 Bladderwort
🌿 Coontail
🌿 Canada waterweed
🌿 Sago pondweed
🌿 Curly-leaf pondweed
🌿 Arrowhead
🌿 Water smartweed

31 likes
July 24

Add a comment... Post



- A vision to understand the wetlands
- A $40,000 contract
- A plan with a hope
- CWA funding
- Press coverage, political tours
- Provincial interest
- Private interest

Canada Water Agency
Agence de l'eau du Canada

Funding was generously provided under the Great Lakes Freshwater Ecosystem Initiative

Central Lake Ontario Conservation Authority

Ducks Unlimited Canada

Thank you!

Questions?
dmoore@cloca.com

Want to learn more – visit https://www.cloca.com/lynde-shores-restoration

Autonomous Bionic Sea Turtle Robot for Ecological Monitoring

Evan Budz

December 10, 2025

INTRODUCTION

- Grade 10 student from Burlington
- Passionate about the outdoors, water-related sports
    - Backcountry canoe camping, avid swimmer
- Visit local conservation areas and the Great Lakes – explore, immerse myself in nature
- Interested in robotics and engineering
- Engaged in environmental protection
    - Aiming to support stewardship efforts in the future – Youth Council

BACKGROUND

71% of Earth covered with water

Produce 50% of all oxygen

Mitigate climate change by absorbing CO_2

Coral reefs support 1/3 of all marine species

+240,000 marine species, 94% of wildlife

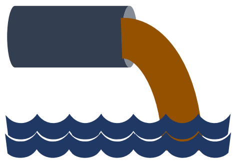
Great Lakes are extremely biodiverse

- Sustain 4000 species
- Contain ~ 20% of surface freshwater

IMPORTANCE OF ECOLOGICAL PROTECTION

Face multitude of threats

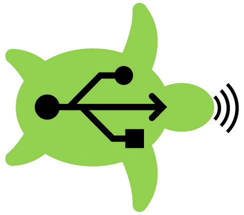
- Climate change
- Pollution
- Invasive species



Since 2023, coral bleaching has occurred in ~84% of reefs, in 82 countries

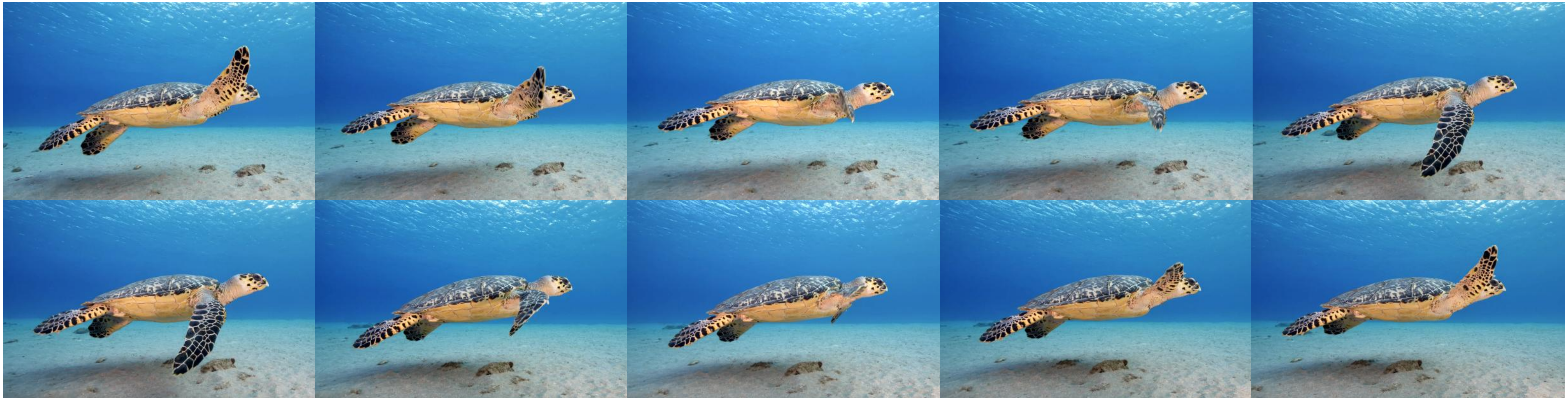
Human intervention → 50x higher survival rate

Routine, autonomous monitoring reduces intensive human-based efforts

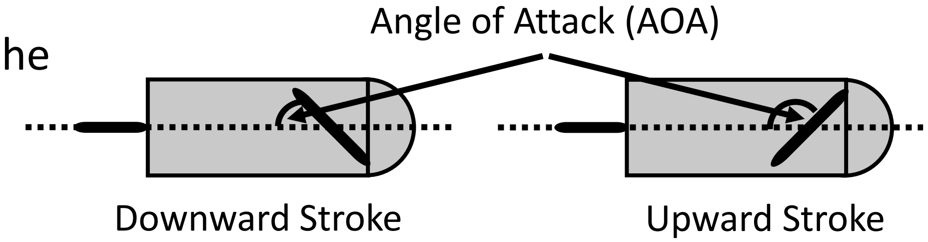


Up to 90% of coral reefs could disappear by 2045

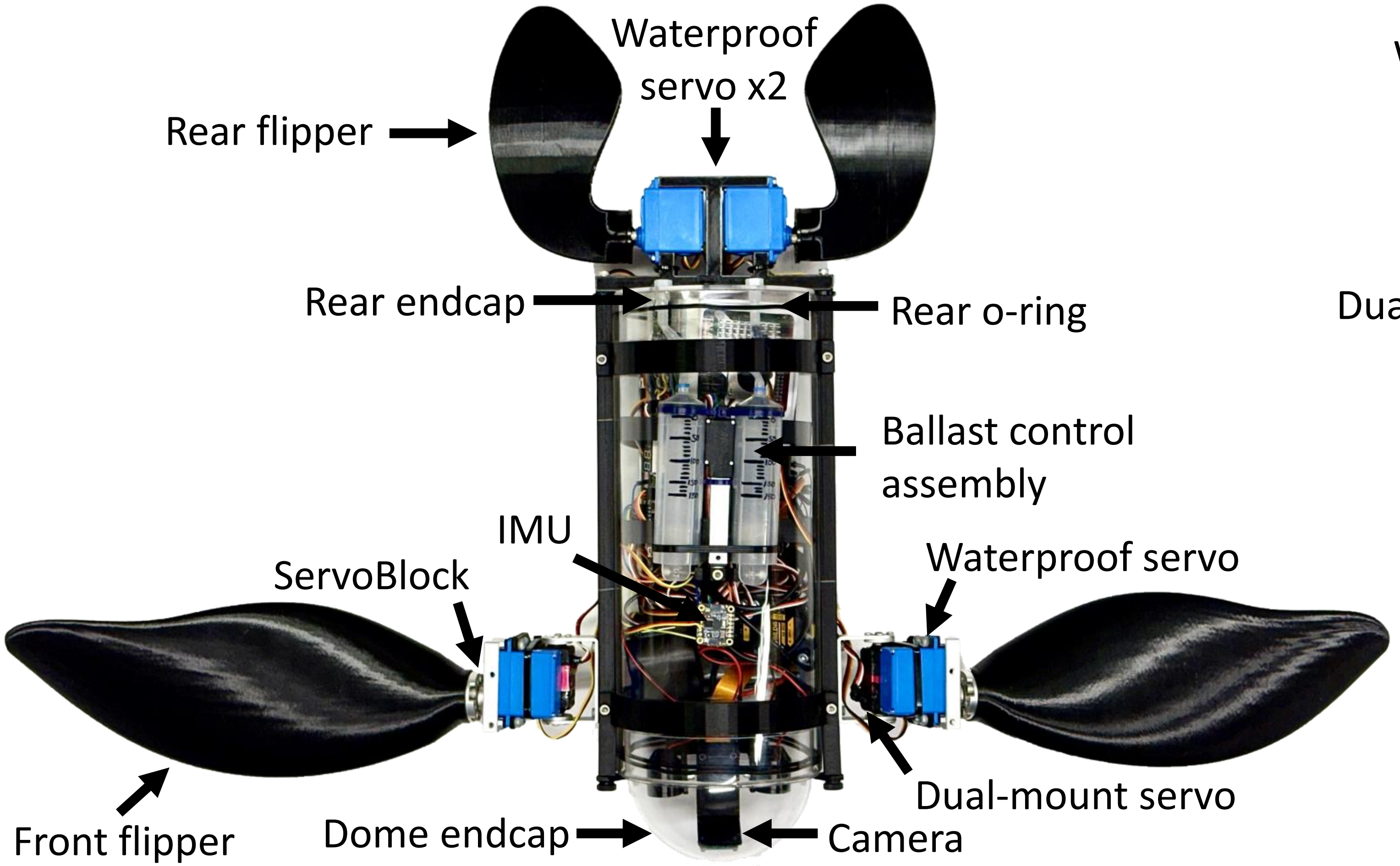
BIOMECHANICS

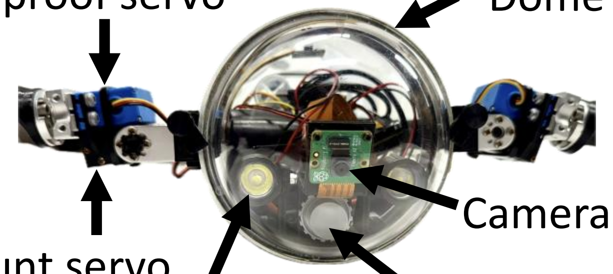


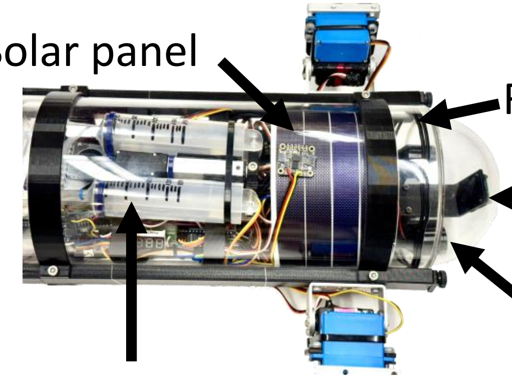
- Green sea turtles – ideal candidate for eco-friendly, low impact robot compared to traditional ROVs
  - Graceful and efficient, maneuver easily, inhabit oceans across the globe
  - Achieve forward thrust by varying flipper AOA between the upstroke and downstroke
  - Main principle behind bionic turtle's swimming gait



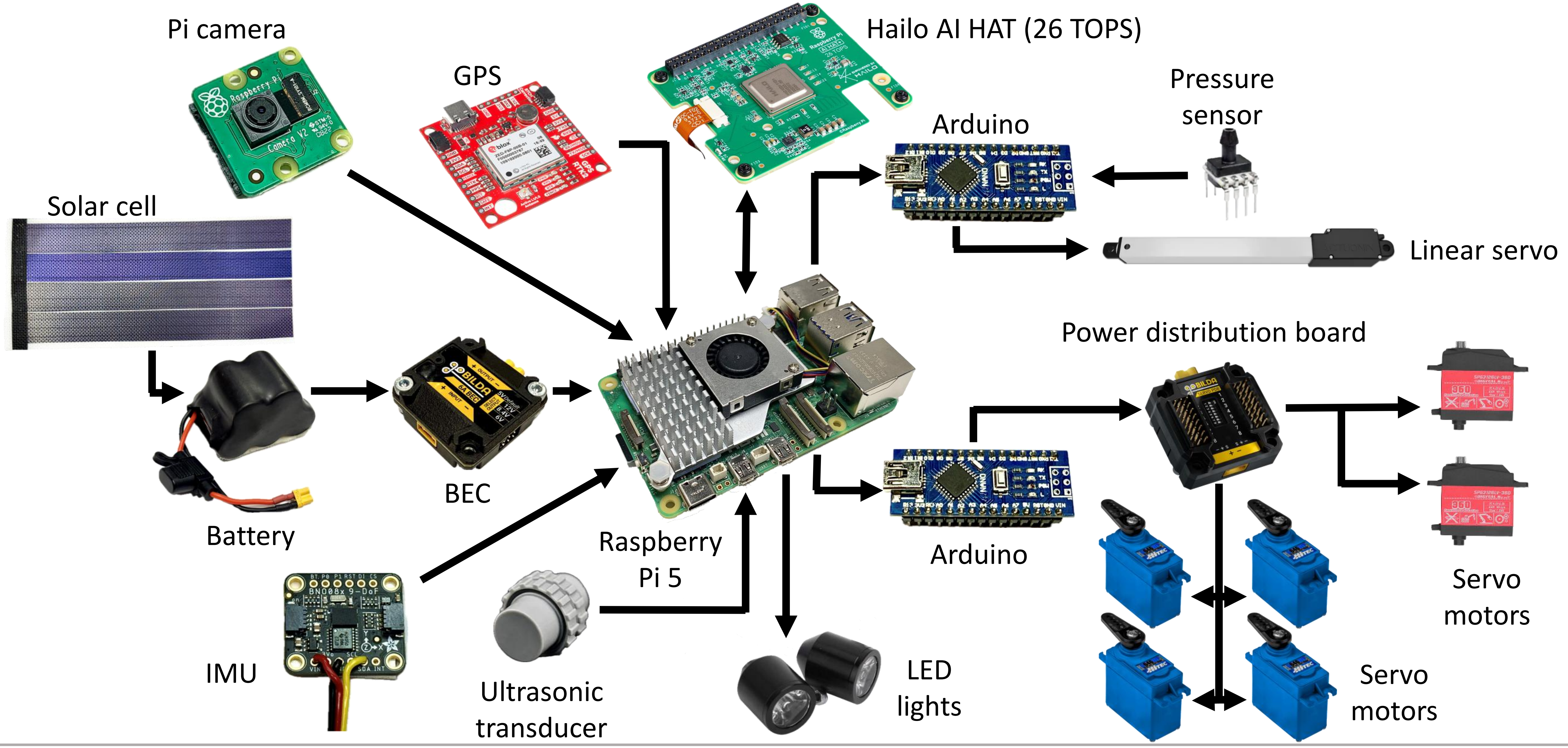
ROBOT DEVELOPMENT – HARDWARE







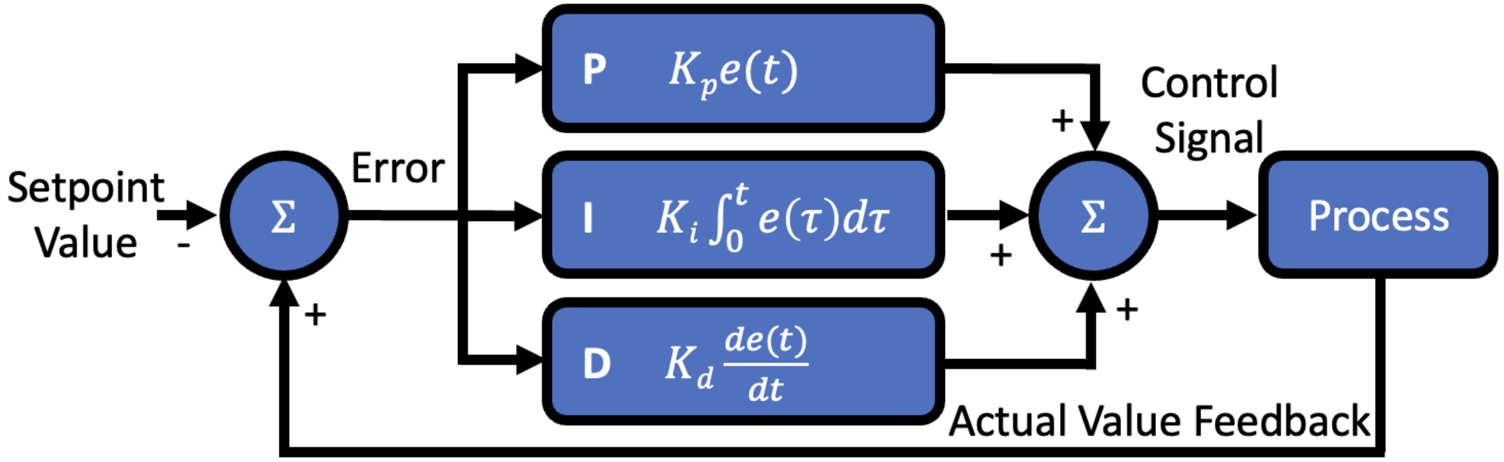
ROBOT DEVELOPMENT – ELECTRONICS

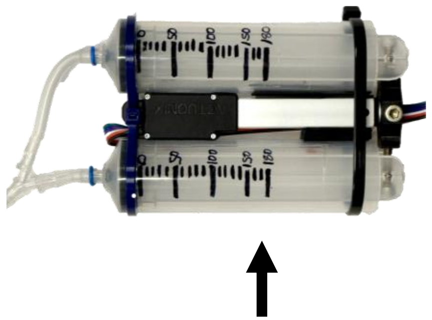


ROBOT DEVELOPMENT

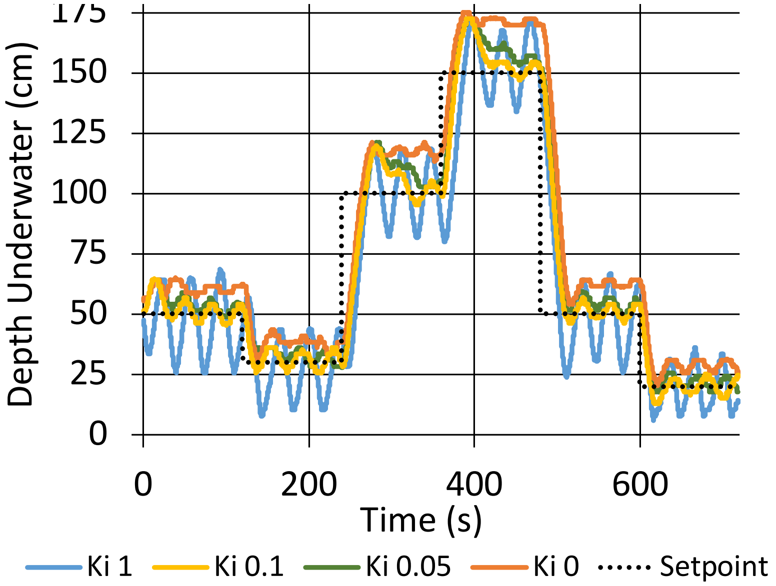
CONTROL SYSTEMS

- PID control loops – used for depth control and autonomous locomotion
- Depth – controller varies ballast based on pressure sensor readings
  - Custom tuning, <5 cm
- Autonomous – accomplished through variation of flipper AOA
  - Second PID loop, readings from inertial measurement unit (IMU)
  - Heading tracking error <5°

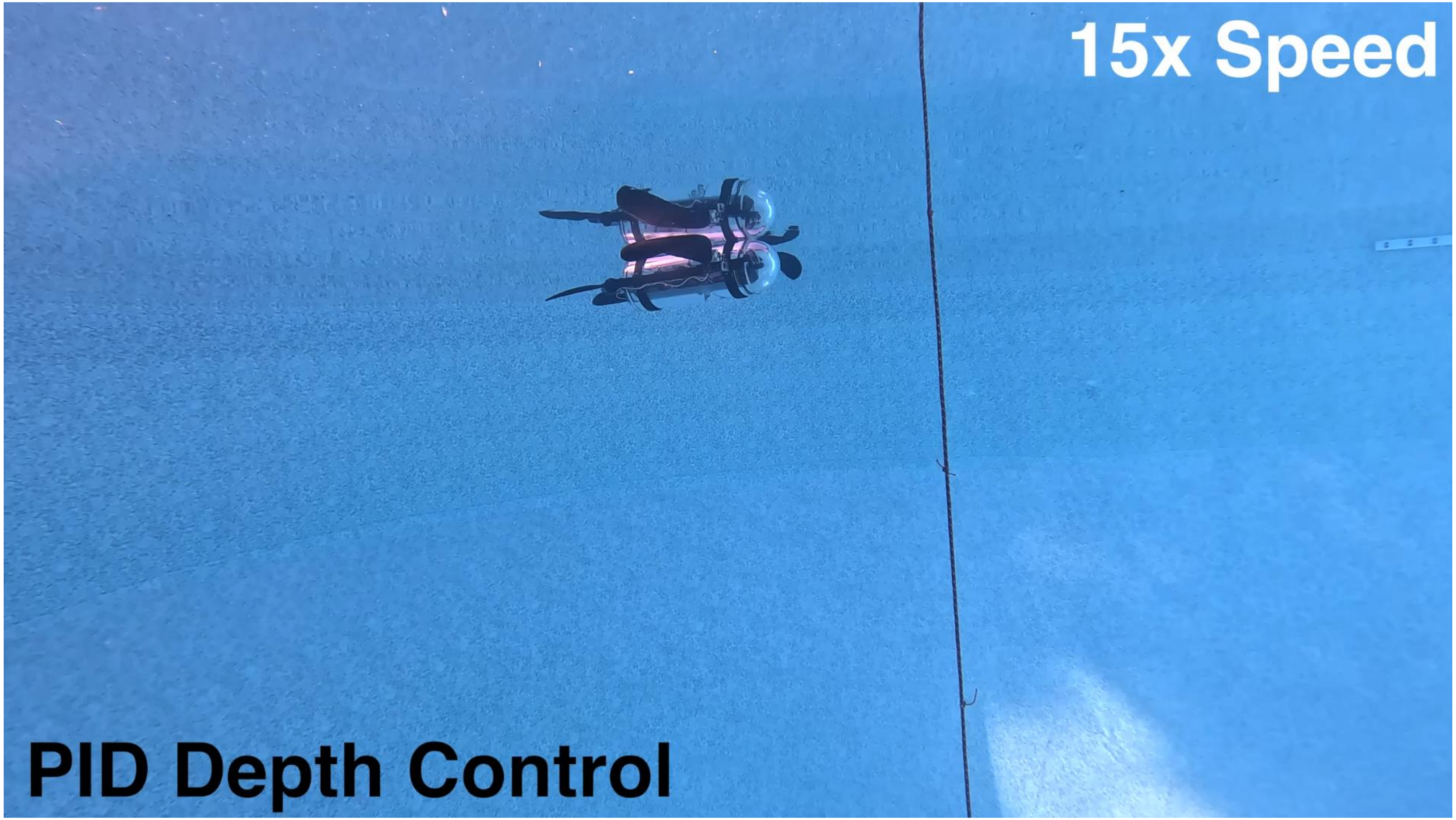




Ballast control assembly

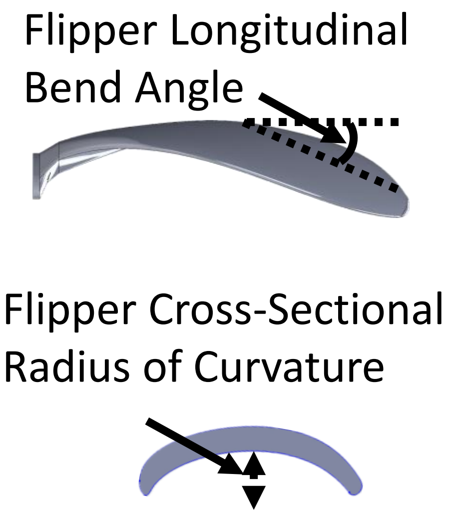


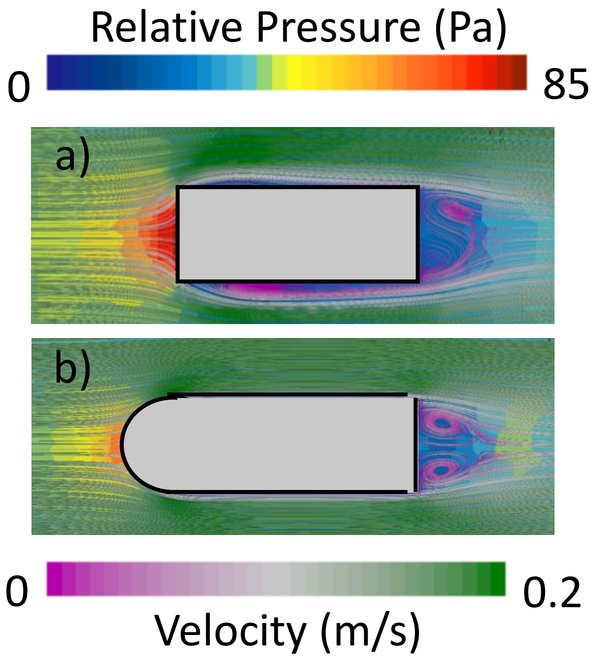
CONTROL SYSTEMS



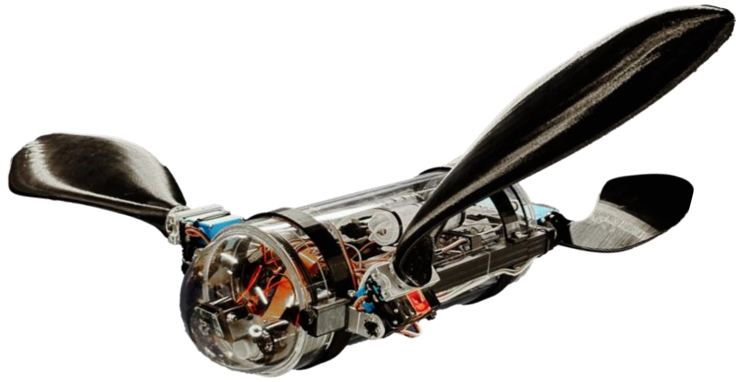
OPTIMIZATION

- Used computational fluid dynamics simulations and experimental testing to refine swimming gait
- Flipper curvature, motion, chassis
  - Goal to be as realistic as possible, with highest possible efficiency
- Achieved highly similar kinematics





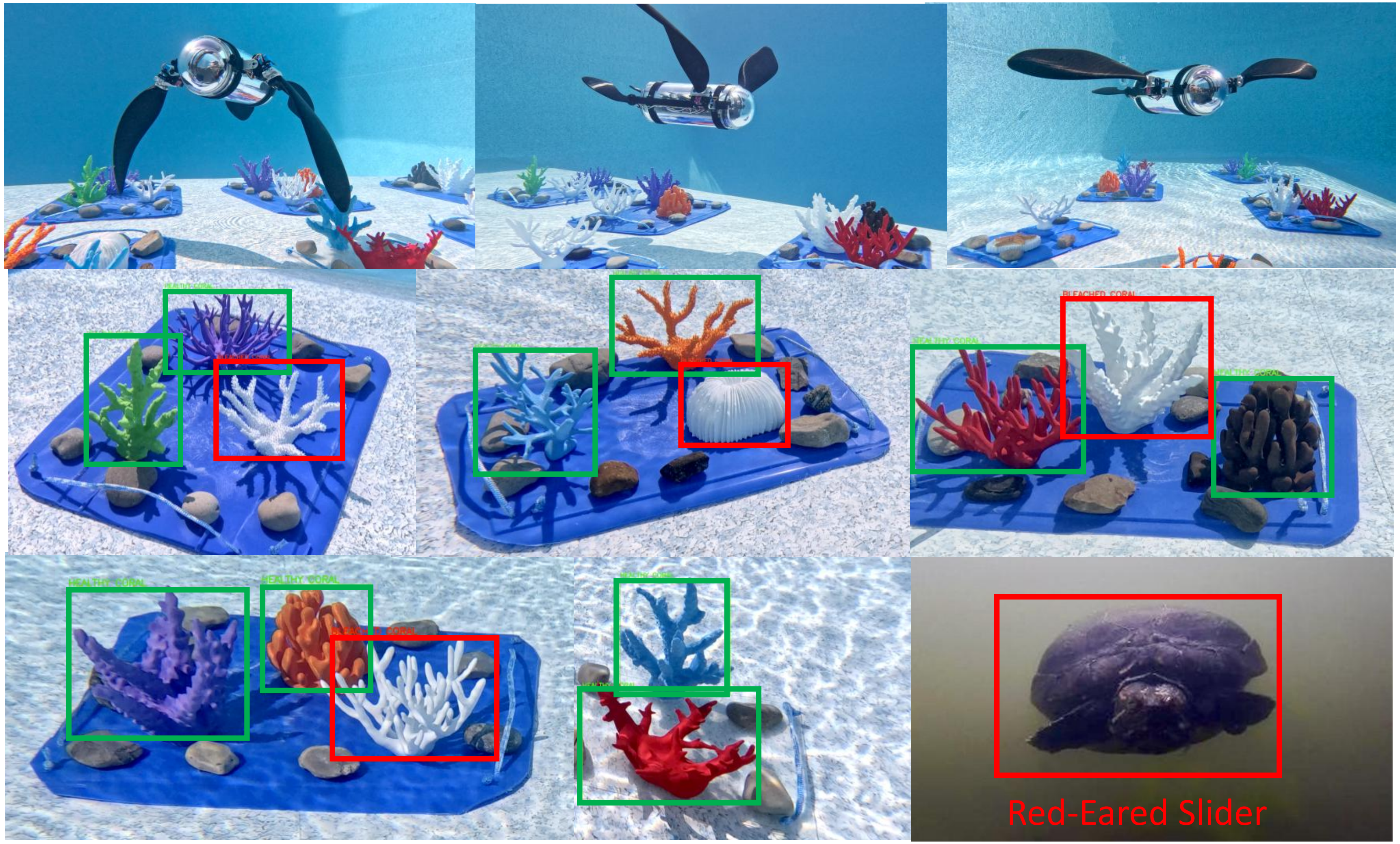
Parameter	Green Sea Turtle	Bionic Turtle
Cost of Transport	0.3 – 0.4	0.43
Reynolds Number	$2 \cdot 10^5 - 6 \cdot 10^5$	$1.3 \cdot 10^5$
Speed	0.7 – 3.6 km/h	0.83 km/h



OPTIMIZATION

APPLICATIONS

- Proof-of-concept AI models developed to quantify coral bleaching – replicated 3D-printed corals
- Operates in real-time, 96% accuracy
- Invasive species detection
  - Currently supports red-eared sliders
  - Looking to expand to other species in the future

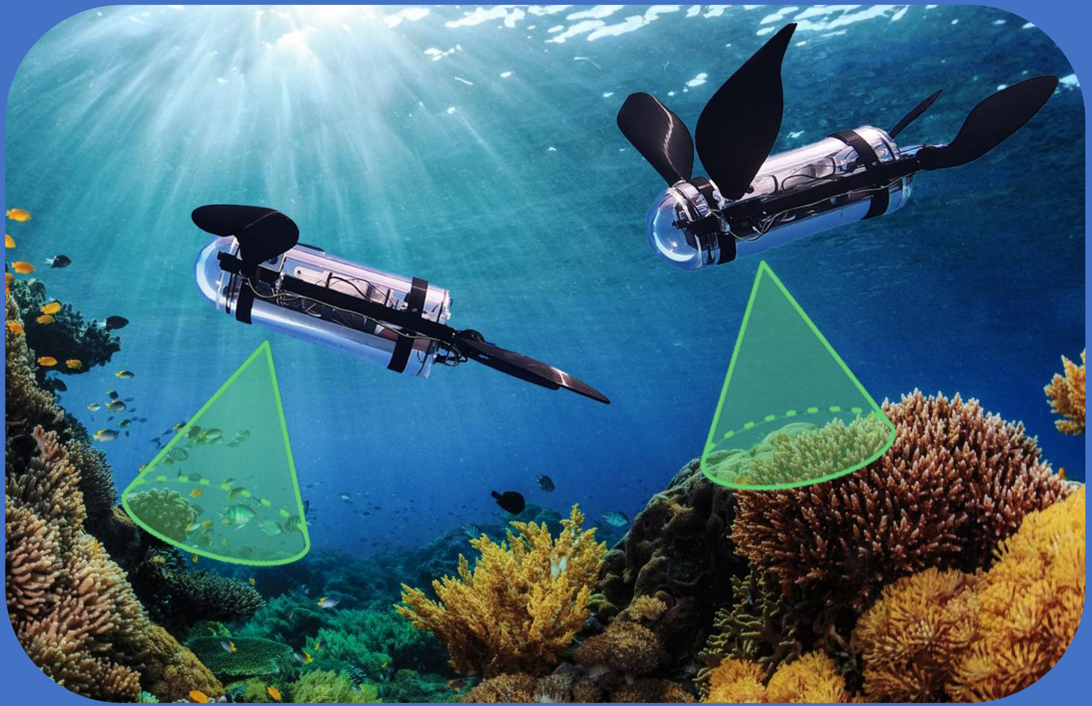


FUTURE POTENTIAL

Water sample collection and analysis (e.g., salinity, pH, chemicals, and microplastics)

Resource exploration

Detailed mapping and surveying



Remote surveillance

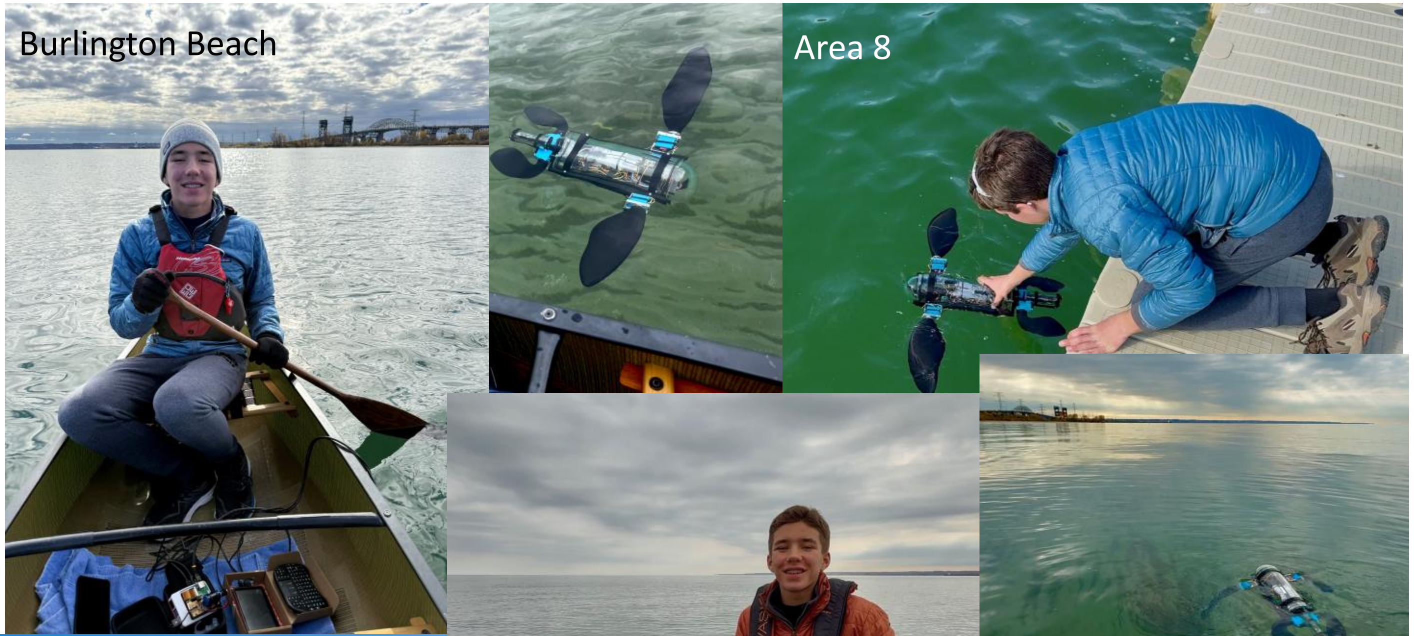
Exploration of underwater archeological sites

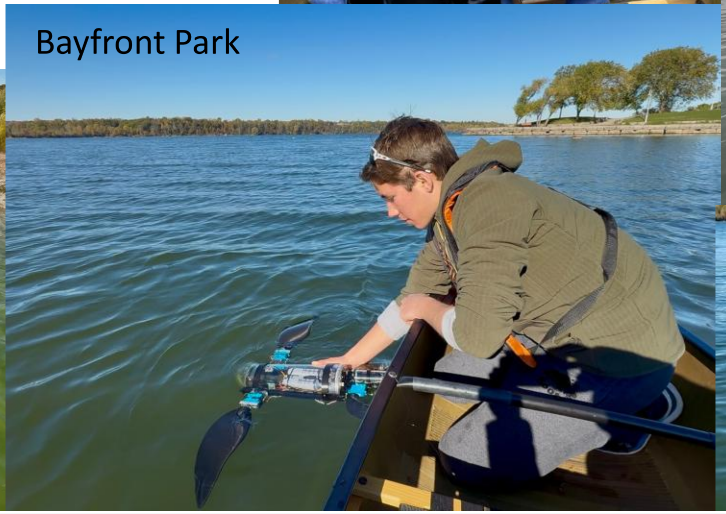
Assess damage caused by underwater disasters

Tracking the population movement of aquatic species

IN SITU TESTING

- Currently testing in natural bodies of water
- Multiple successful tests in real-world conditions – turbulence, low water visibility
- Continuing to explore new testing environments, gathering more quantitative results
- Working to evaluate water quality in these areas





CONCLUSIONS

- Biomimetic robotics – rapidly advancing field, many advantages compared to traditional approaches
- Bionic turtle – replicated the natural locomotive technique of wild green sea turtles
    - Robust autonomous operation, real-time ecological monitoring
- Multitude of future scientific applications
    - Low impact assessment, novel method of marine stewardship

THANK YOU!

Morning break and networking

Session 1 Panel:

Coastal Connections: Building Resilience Across the Great Lakes

Charles Priddle,
Conservation Halton

Dan Moore,
Central Lake Ontario Conservation Authority

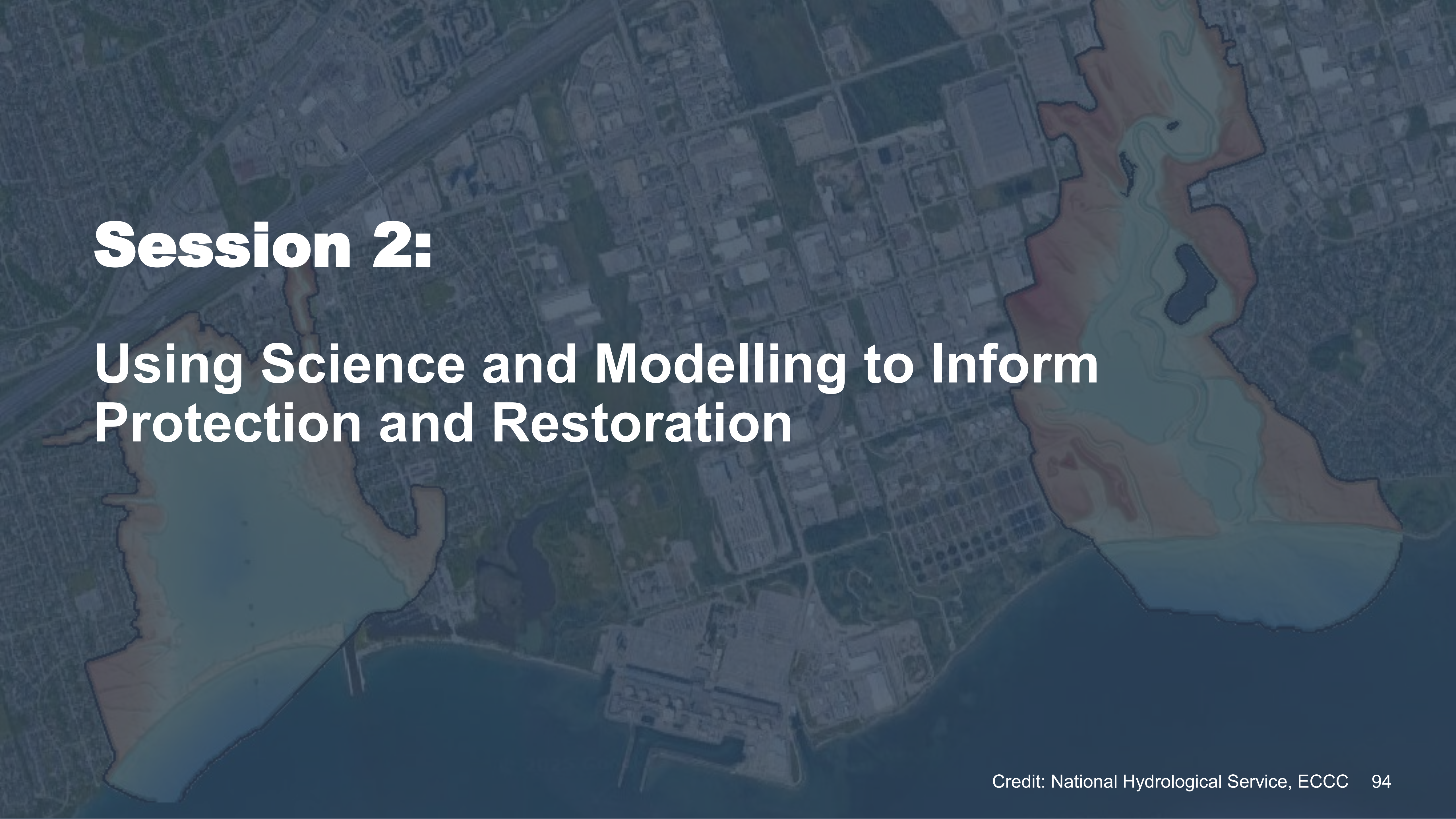
Kevin Money,
Essex Region Conservation Authority

Namrata Shrestha,
Toronto and Region Conservation Authority

Lake Ontario | Burlington, Ontario | Credit: Nadine E

Session 2:

Using Science and Modelling to Inform Protection and Restoration



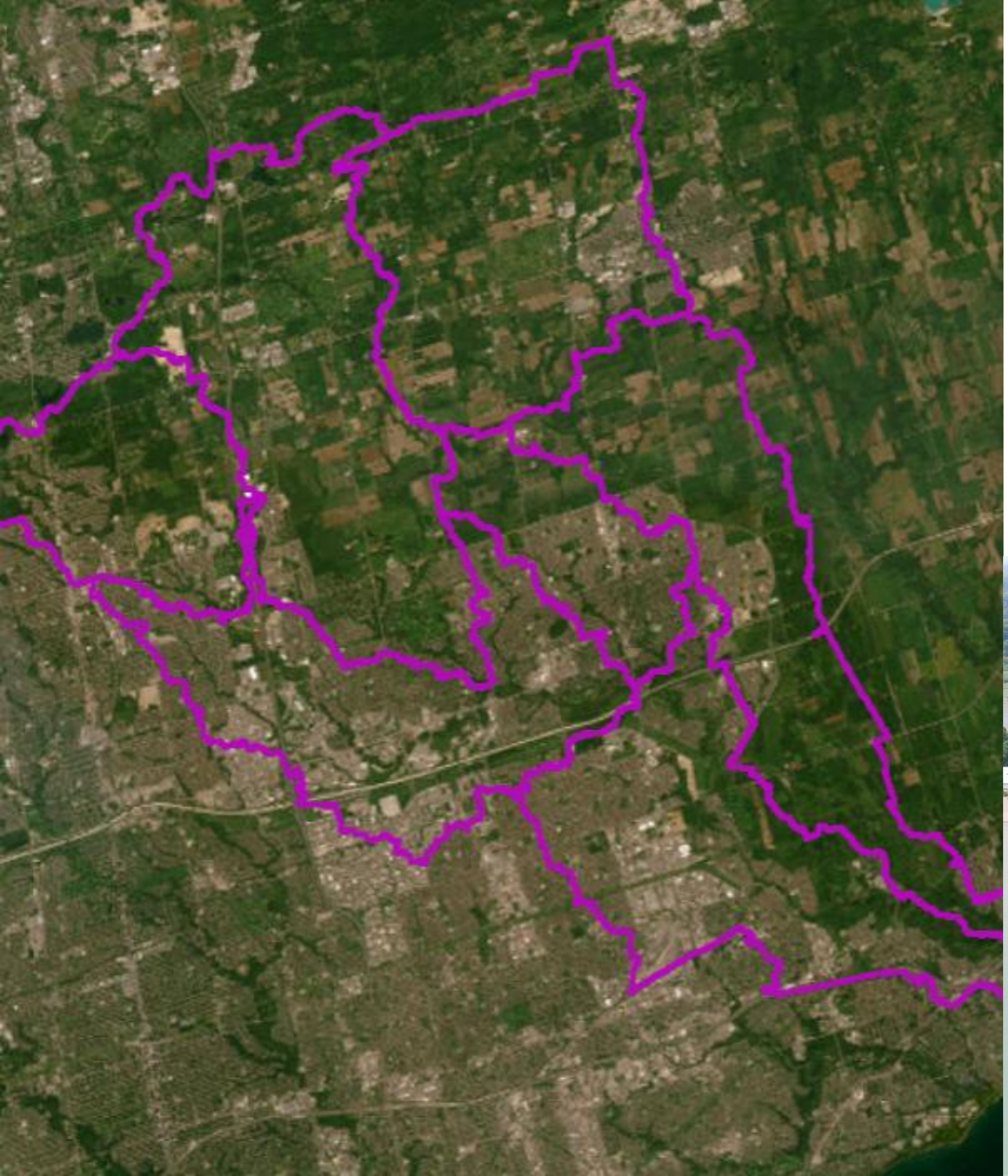
Credit: National Hydrological Service, ECCC

Leveraging Big Data to Connect Watershed Plans to Nearshore Lake Health: Rouge River Case Study

Krista Chomicki, Andrew Chin, Namrata Shrestha

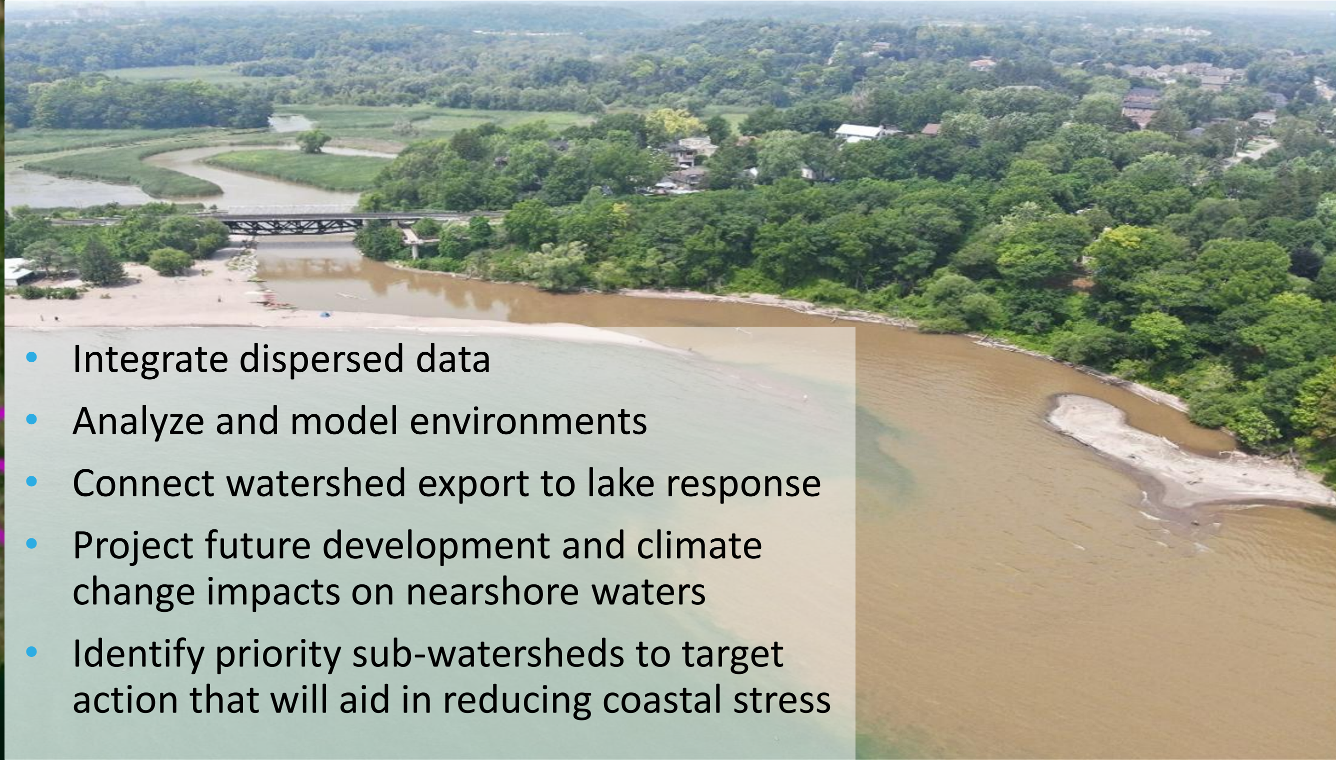
December 10, 2025

Toronto and Region Conservation Authority



The Challenge:

Communicate expected impacts future development and climate change will have on nearshore water quality and ecosystem health



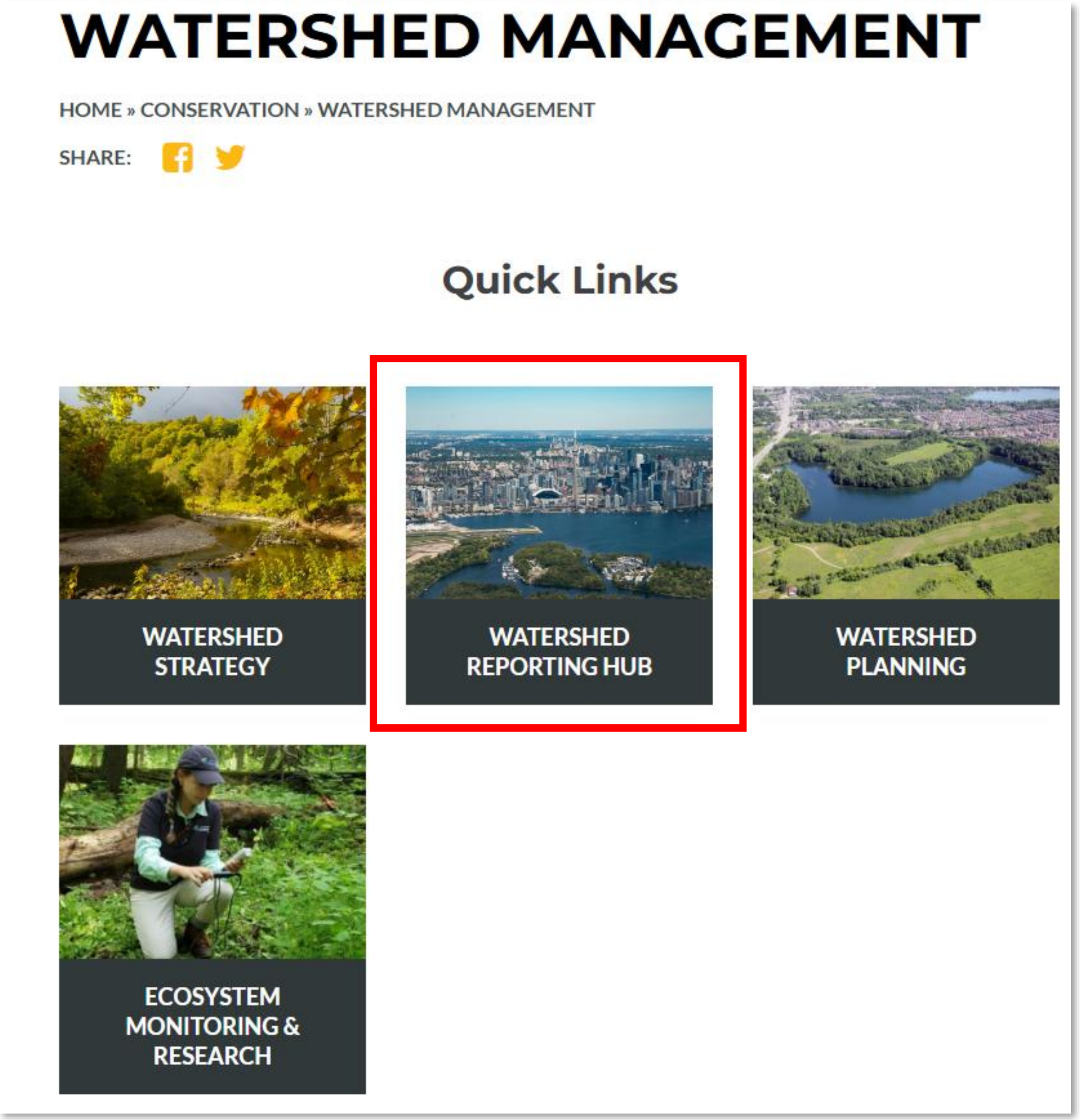
- Integrate dispersed data
- Analyze and model environments
- Connect watershed export to lake response
- Project future development and climate change impacts on nearshore waters
- Identify priority sub-watersheds to target action that will aid in reducing coastal stress

Why does it matter for decision making?

- Disconnect between the watershed and the lake
- Recreation
- Drinking water intakes
- “Ownership”
- Cobenefits
- It takes a village!

The Innovation: Navigating Resources

- Static and interactive online resources
- Informs public about TRCA's approach to managing the health and sustainability of local watersheds
- Outlines the goals, methods, and importance of watershed management program



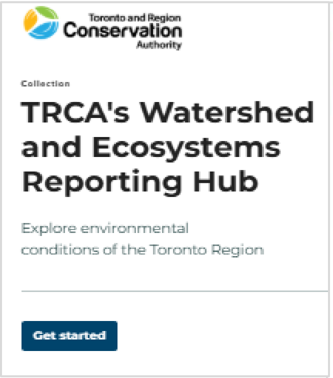
- trca.ca/conservation/watershed-management/

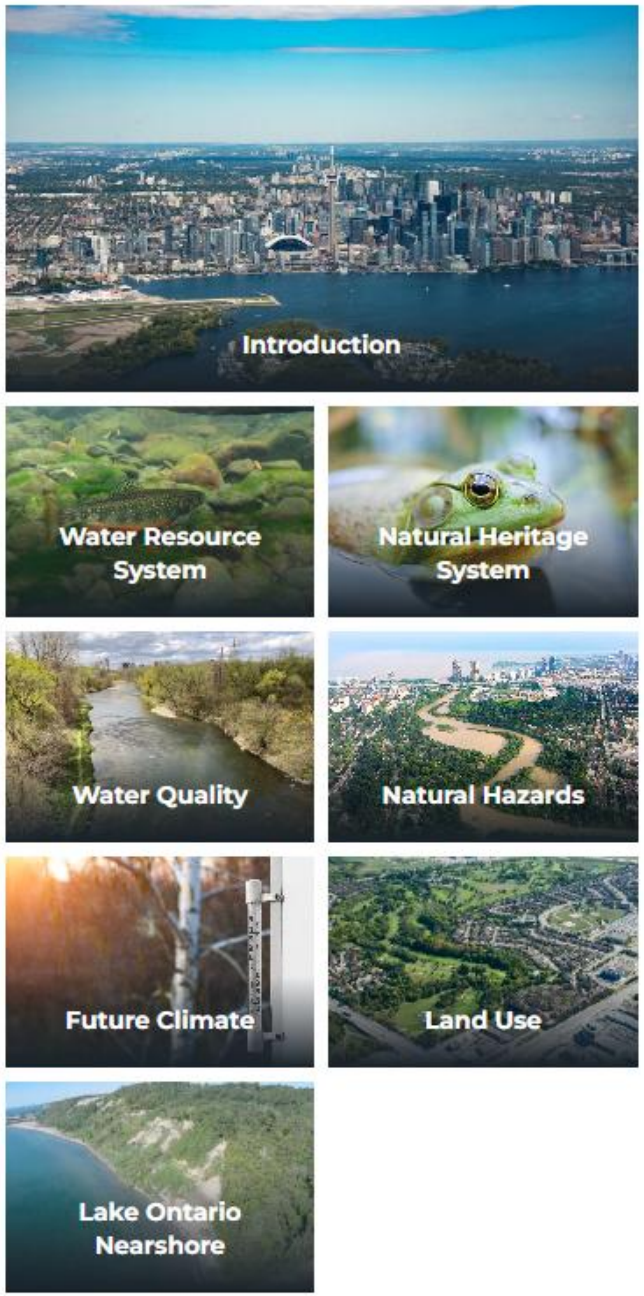
What is the Reporting Hub?

- TRCA's Watershed & Ecosystem Reporting Hub (RHUB)
  - An online and interactive tool
  - Share knowledge on the current conditions and trends
  - Engage partners, stakeholders, and the public
- Launched in 2021; Updated annually
- Align with the CO Watershed Report Cards

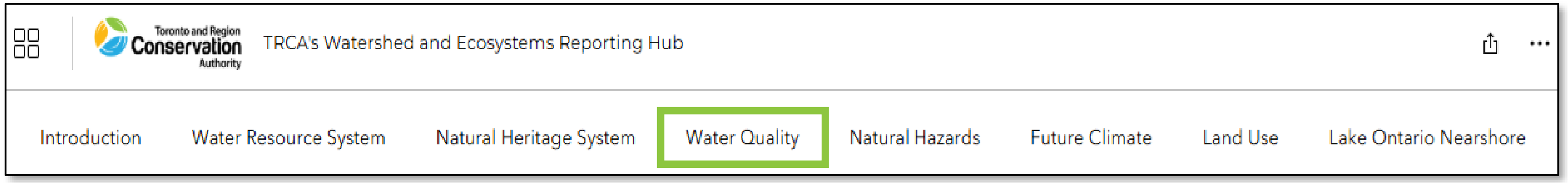
Benefits

- Watershed health reporting
- Accessible data
- TRCA staff support

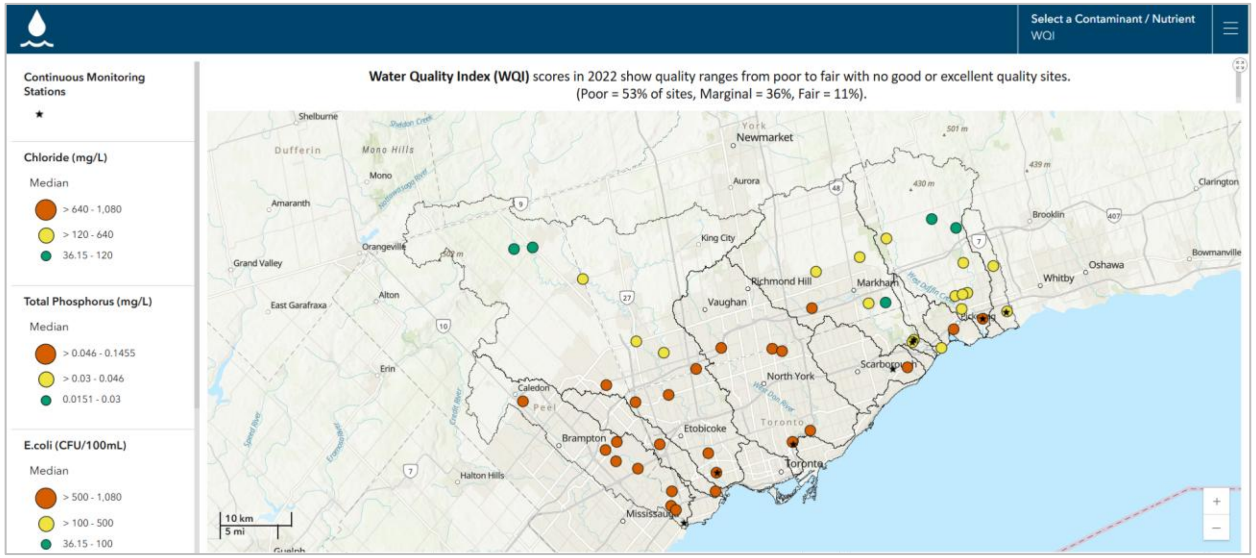


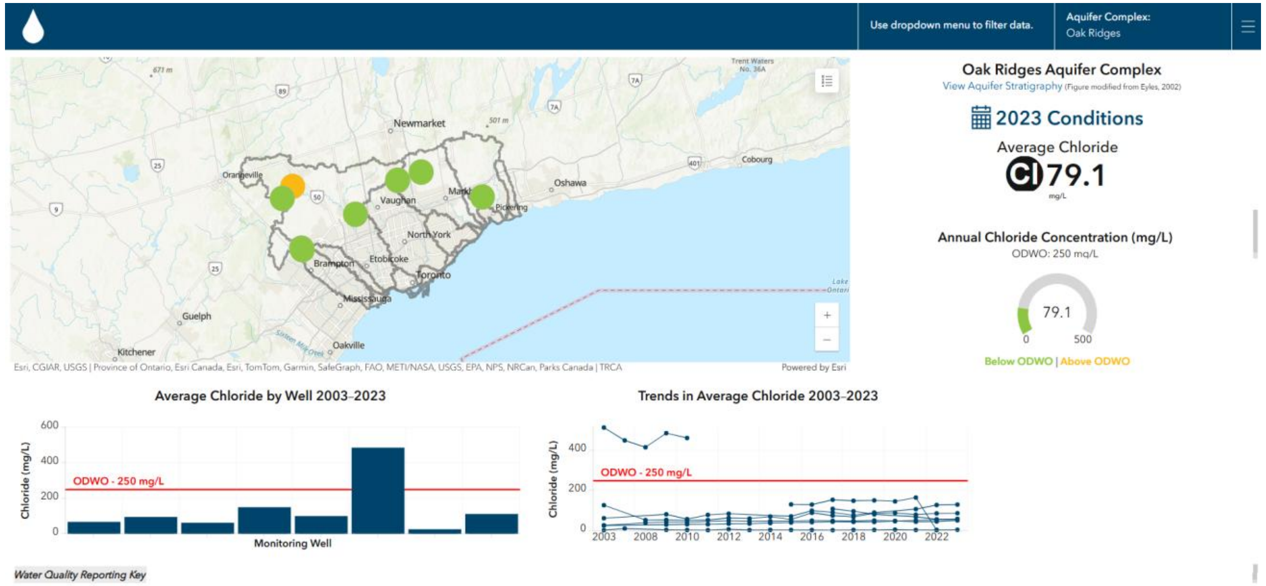


RHUB: Water Quality

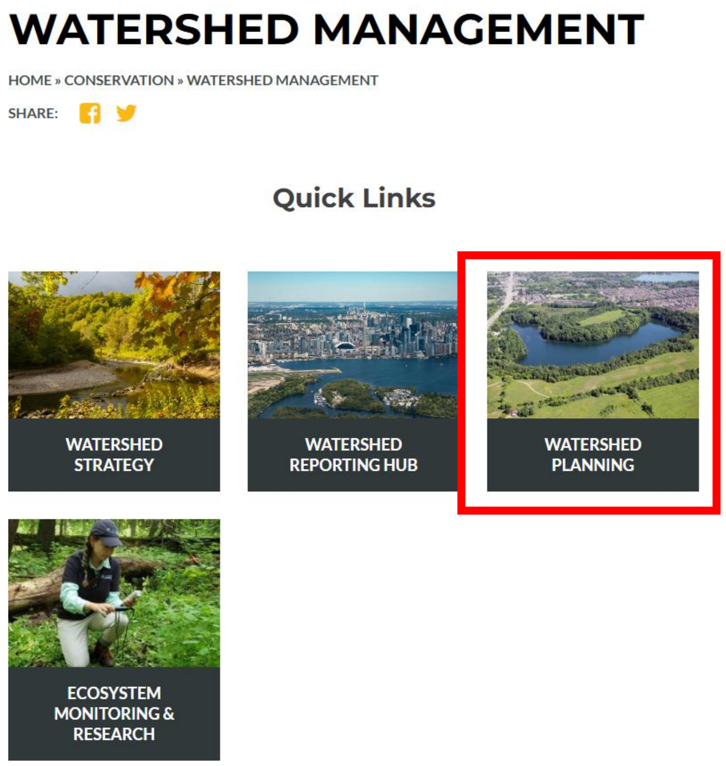


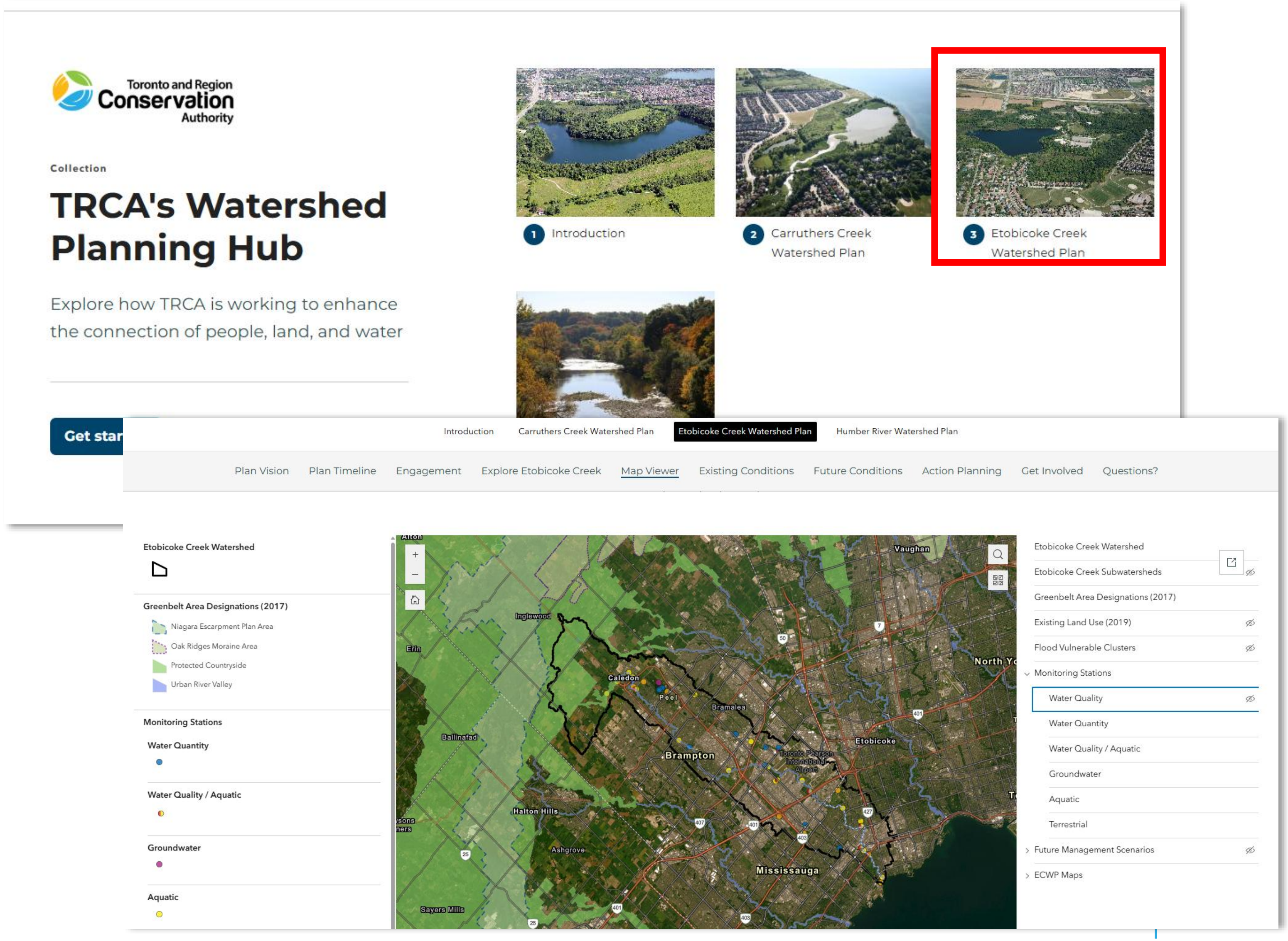
- A key component to measure watershed and ecosystem health requiring timely updates
- Data is updated on an annual basis
- Multiple technical leads spanning from the raw data to final dashboards/content





Watershed Planning Hub





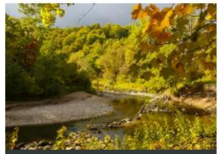
Watershed Planning Hub

WATERSHED MANAGEMENT

HOME » CONSERVATION » WATERSHED MANAGEMENT

SHARE:

Quick Links



WATERSHED STRATEGY

WATERSHED REPORTING HUB

WATERSHED PLANNING

ECOSYSTEM MONITORING & RESEARCH

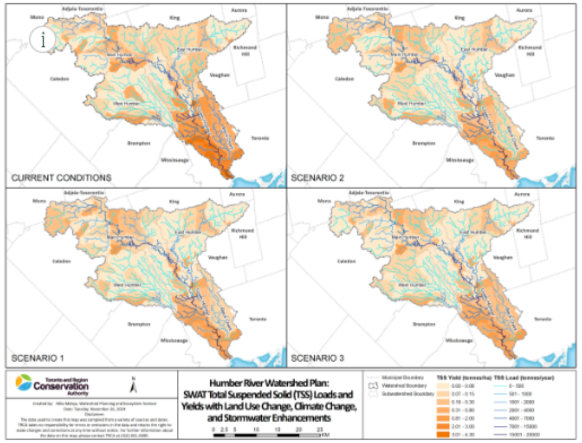
Toronto and Region Conservation Authority — TRCA's Watershed Planning Hub

Introduction | Carruthers Creek Watershed Plan | Etobicoke Creek Watershed Plan | Humber River Watershed Plan

Plan Vision | Plan Timeline | Explore the Humber | Map Viewer | Existing Conditions | Future Conditions | Action Planning | Get Involved | Questions?

The Future of our Surface Water Quality

Water quality conditions within the Humber River watershed vary under the different scenarios, with notable differences between rural/agricultural and urban areas. In rural/agricultural areas, higher Total Suspended Solids and Total Phosphorus are found, mainly due to fertilizer application and erosion. In urban areas, these water quality parameters are elevated as well, primarily due to increased runoff from paved surfaces.



Map: SWAT Total Suspended Solid (TSS) Loads and Yields with Land Use Change, Climate Change, and Stormwater Enhancements

e ... rmwater ... Total ... , especially

...anagement improvements and increasing ...ality in the watershed, benefiting both the

Water Quality Indicators	Scenario 1	Scenario 2	Scenario 3
Total Suspended Solids yield at Humber mouth with climate change	improve	improve	improve
Total Phosphorus yield at Humber mouth with climate change	improve	improve	improve

TRCA Open Data

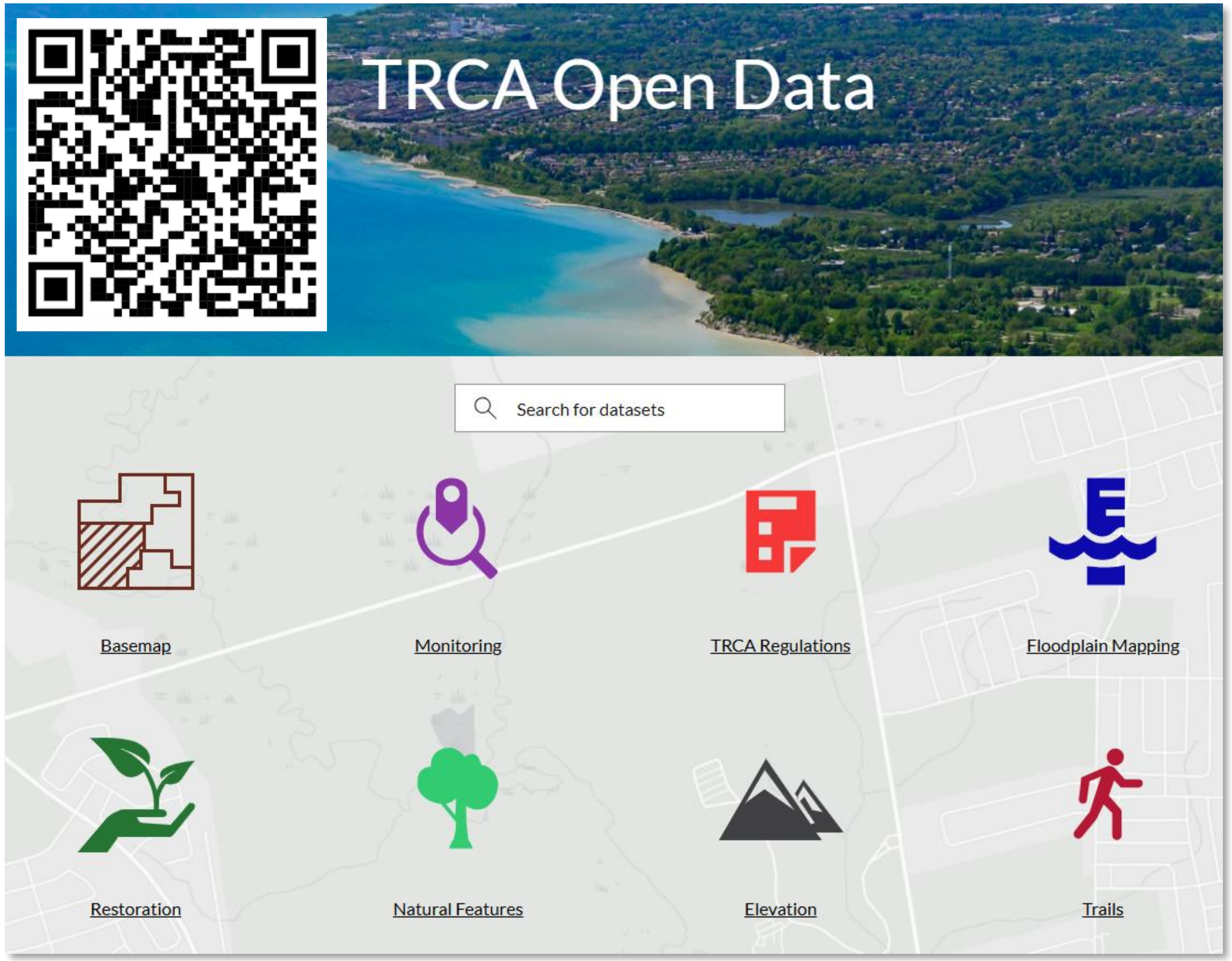
- Provides public access to TRCA's geospatial and environmental datasets

- Geospatial datasets:

trca-camaps.opendata.arcgis.com

- Environmental datasets:

data.trca.ca/organization/development-and-engineering-services



The Impact:
How is RHUB being used?

Stats

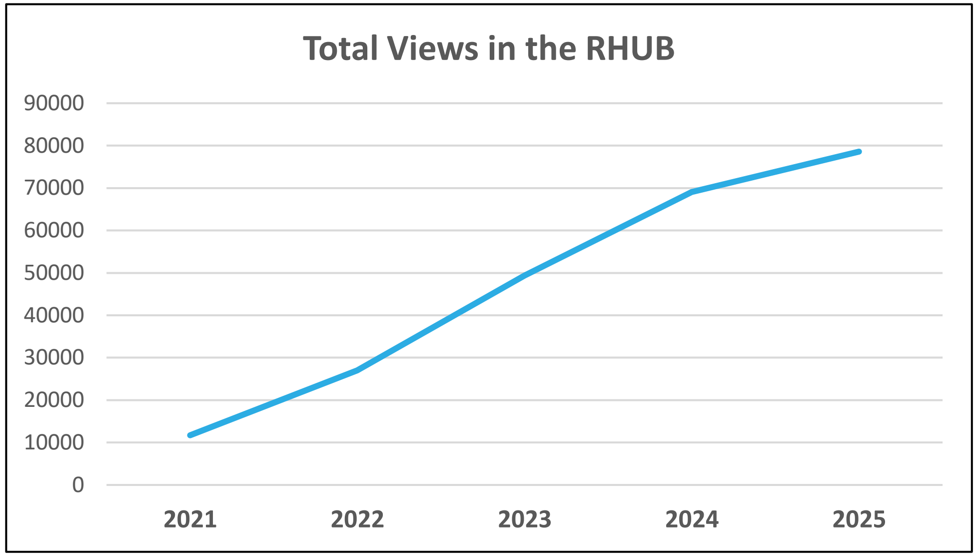
27,178 hits to the Collections landing (as of July 2025)

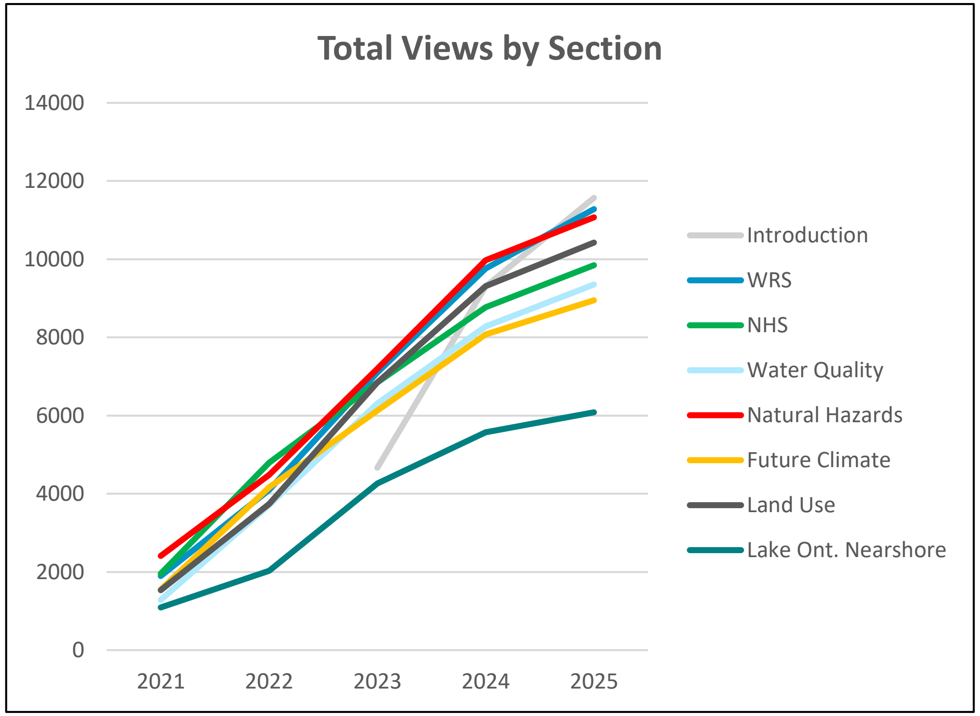
Most Popular Sections:

1. Water Resource System (11,282 views)
2. Natural Hazards (11,072 views)
3. Land Use (10,426 views)
4. Water Quality (9,353 views)

Least Viewed:

- Lake Ontario Nearshore (6,024 views)





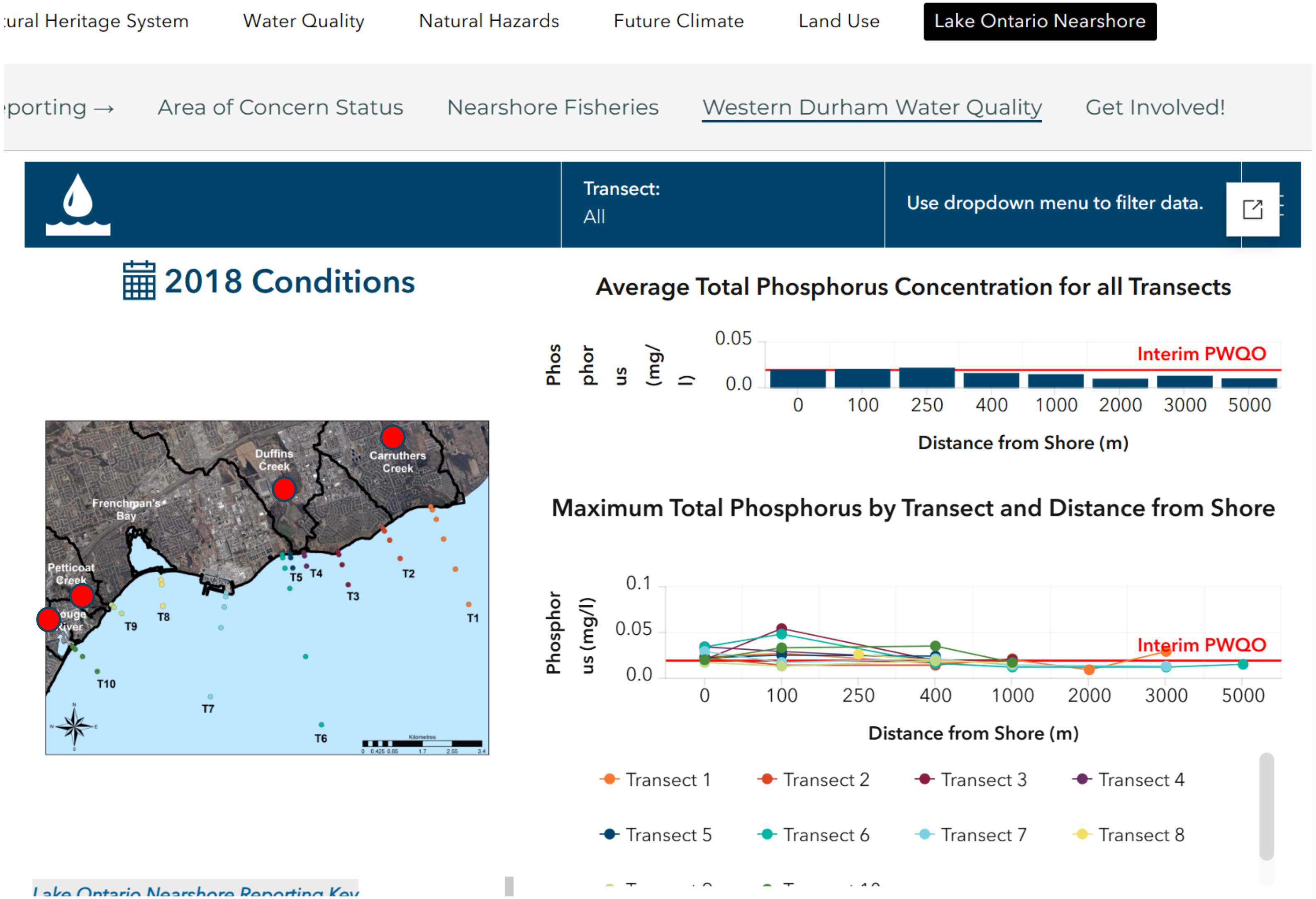
Data Memos

- **Catalogue for Data Requesters**
  - Includes links to Open Data page and data that require a Data Sharing Agreement
- Significantly reduces staff time to handle data requests
- Targeted data memos to municipalities / consultants who have used the data for various land use and infrastructure projects

Theme	Data Name	Data Description & Potential Application	Data Availability
	Mayfield West Comprehensive Management Plan (CAMP) – Fish Data	Fish data collected in the Mayfield West Comprehensive Adaptive Management Plan (CAMP). Monitoring activities identified in the CAMP commenced in early 2012 and continued to 2023 for a period of 12 years.	Data Request and Data Sharing Agreement
	Stream Thermal Regime	To complete thermal classification, the stream reaches were classified based on field and modelled temperature data. Thermal regimes from field data were assessed based on July 1-21 maximum weekly average temperatures collected from loggers between 2019 and 2020 in 14 Reach Contributing Areas.	Data Request and Data Sharing Agreement
Water Quality	ECWP Current Water Quality Conditions Stations	Provides the locations of current water quality conditions that were assessed at eight stations using data collected through TRCA's Regional Watershed Monitoring Program (RWMP) between 2015 and 2019 to support the water quality characterization for the ECWP (2021 update). The RWMP collects water samples monthly at these sites.	TRCA Open Data
	ECWP LD Water Quality Station	Two water quality stations were added in the headwaters of Etobicoke Creek (LDEC-1 and LDEC-2) to support the water quality characterization for the ECWP (2021 update). These stations were monitored monthly between December 2019 and February 2020, and after a short interruption due to the COVID-19 pandemic, sampling resumed in May 2020. Sampling continued until November 2020; however, data were only included until September 2020 to meet reporting deadlines. These stations were selected to identify differences in water quality in the upper portion of the watershed based on the location of three previously unmonitored fourth order streams (west, central, east). Central could not be accessed so these stations represent west and east tributaries.	TRCA Open Data
	Regional Watershed Monitoring Program Water Quality Data	A process-based watershed model is needed to account for hydrologic inputs (i.e. groundwater) and future climate to investigate how stream water quality responds to changes in land use and management.	TRCA Open Data
	Mayfield West Comprehensive Management Plan (CAMP) – Water Quality Data	Water quality data collected in the Mayfield West Comprehensive Adaptive Management Plan (CAMP). Monitoring activities identified in the CAMP commenced in early 2012 and continued to 2023 for a period of 12 years.	Data Request and Data Sharing Agreement

Scaling and Replication

- Structured data flow ensures long-term, replicable, annual update
- Streamlined by multiple leads cut staff time and provide a replicable framework
- Blueprint for how conservation authorities and similar organizations can move toward efficient, data-driven, and publicly transparent watershed management.



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GREATER TORONTO'S TOP 2025 EMPLOYERS

2025 CANADA'S GREENEST EMPLOYERS

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Thank you

Krista Chomicki,
Research Scientist,
Toronto and Region Conservation Authority
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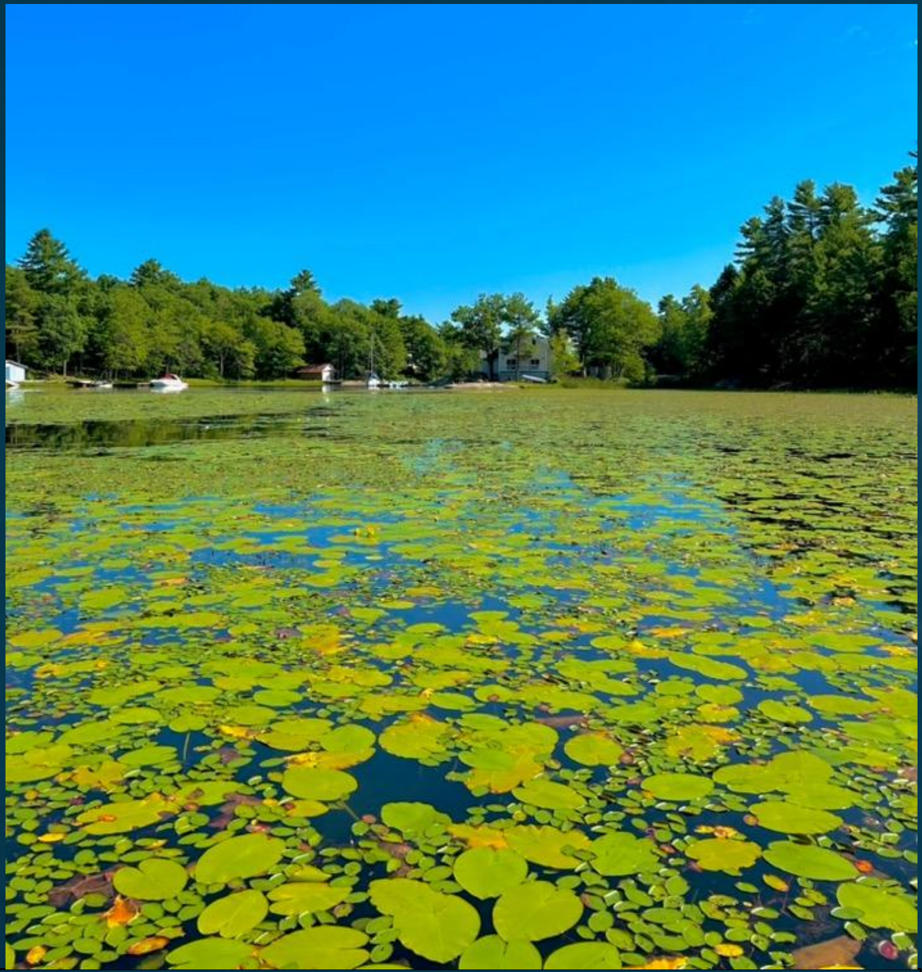
Toronto and Region Conservation Authority

Use of the Resilience Index to classify ecological resilience of coastal marshes in Georgian Bay to climate-induced extremes in water-level fluctuations

Pat Chow-Fraser
Jess Stevens
McMaster University
Department of Biology




Coastal Marshes



Provide critical spawning and nursery habitat for many species of Great Lakes fishes

Nursery Habitat for important species

Northern Pike

Pumpkinseed

Rock Bass

Largemouth Bass

Yellow Perch

Longnose Gar

Brown Bullhead

Bluegill

Georgian Bay, eastern arm of Lake Huron

- Minimal recreational development
- No other human impacts other than climate change

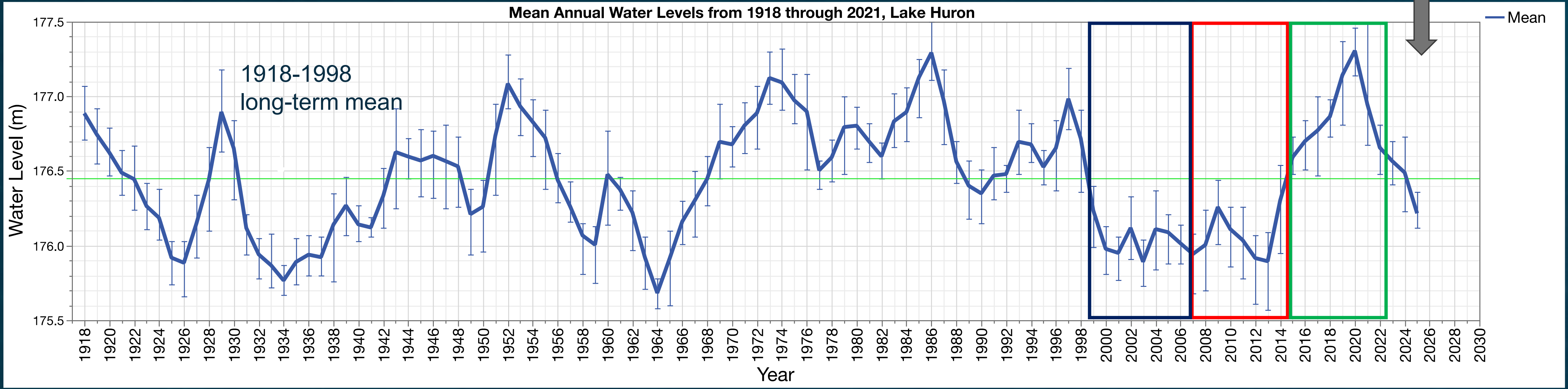
Climate-Induced disruptions in WL Fluctuations

Initial Low Water Period 1

Sustained Low Water Period 2

High Water Period 3

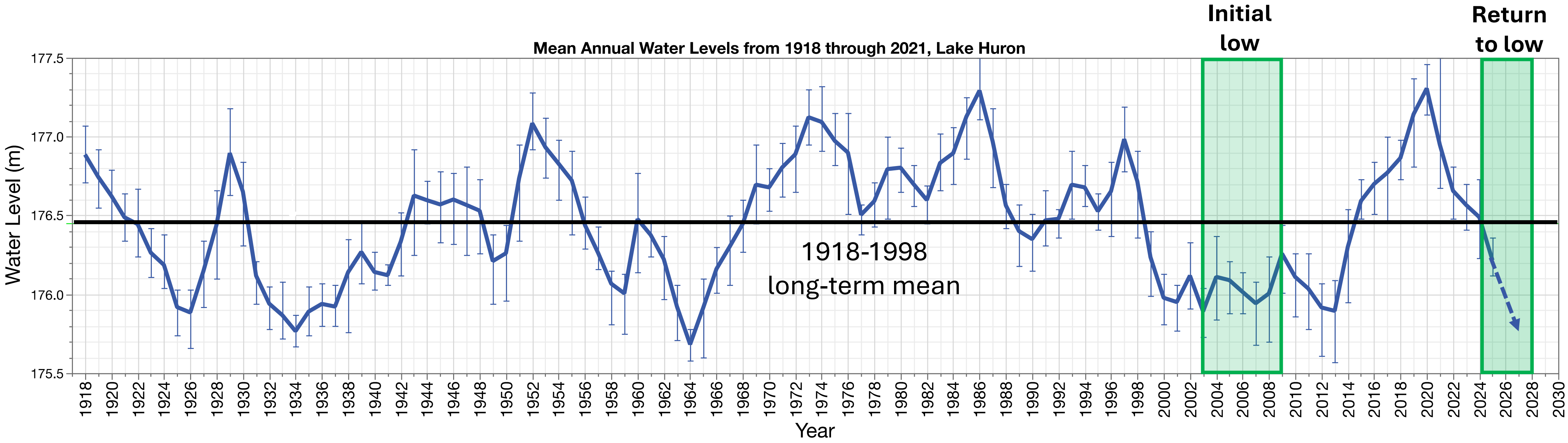
Present Low Water Period 4



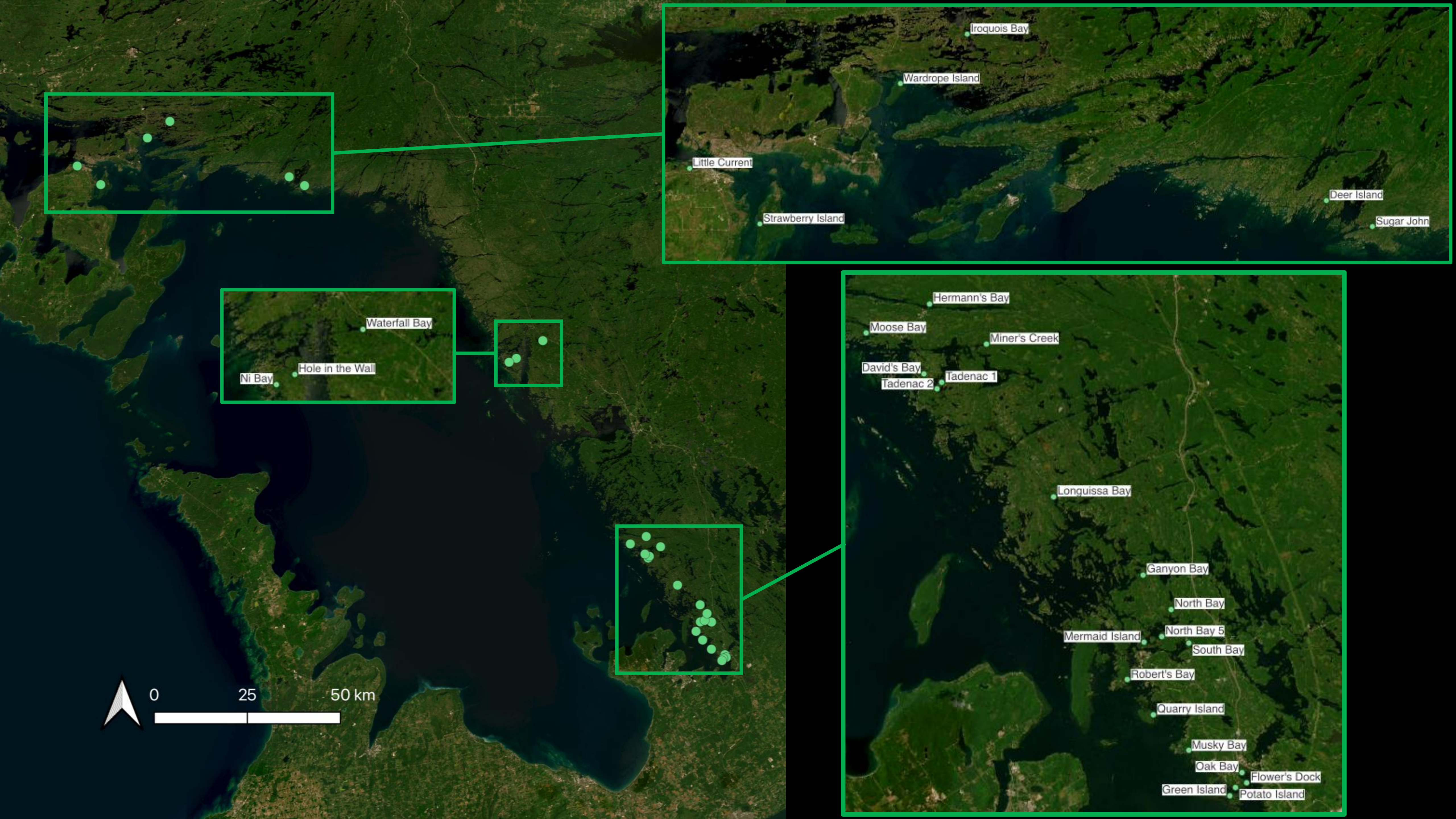
Period 1

Period 2

Period 3



- Beginning in 1999, there were 14 years of sustained low WL below the long-term mean (1918-1998)
- Our lab surveyed wetlands in Georgian Bay between 2003 and 2009; we are re-sampling the same wetlands ~20 years later, when water levels are returning to levels below long-term mean
- Can we use the fish community data to assess ecosystem resilience to the unprecedented water-level fluctuations experienced over the past 2 decades
- **Hypothesis:** degree of resilience will vary according to Weller and Chow-Fraser's (2019) Resilience Index (RI) score
- **Prediction:** similarity index score of fish communities for the two periods of low water levels (separated by ~20 years) will increase with RI score


Iroquois Bay
Wardrope Island
Little Current
Strawberry Island
Deer Island
Sugar John
Waterfall Bay
Hole in the Wall
Ni Bay
Hermann's Bay
Moose Bay
Miner's Creek
David's Bay
Tadenac 1
Tadenac 2
Longuissa Bay
Ganyon Bay
North Bay
North Bay 5
Mermaid Island
South Bay
Robert's Bay
Quarry Island
Musky Bay
Oak Bay
Flower's Dock
Green Island
Potato Island
0
25
50 km

Wetland	RI score	VI score	Below long-term mean (1999-2009)	Above long-term mean (2014-2017)	Below long-term mean (2024-2027)	1 vs 3
Ganyon Bay	0.925	0.432	05-08-2005 18-06-2009	16-08-2016	24-06-2025 08-2026	Yes
Mermaid Island	0.906	0.432		19-07-2021	13-08-2024	
South Bay	0.829	0.440			20-08-2024	
North Bay 1	0.726	0.432	15-06-2005 16-08-2009 11-08-2009	16-08-2016 13-06-2017	08-08-2024 18-06-2025	Yes
North Bay 5	0.547	0.440		14-06-2017	08-09-2024	
Garden Channel	0.546	0.289	23-06-2004	05-07-2017	06-2026	Yes
Longuissa Bay	0.536		29-06-2004		23-06-2025	Yes
Wardrope Island	0.522		05-08-2004 09-08-2005 31-07-2011		02-08-2025	Yes
Hermann's Bay	0.502	0.475	31-08-2005 07-08-2009	22-06-2016 26-08-2017 15-08-2019	08-07-2025	Yes
Key River 3	0.455	0.572	20-07-2006	21-08-2014 10-08-2016 28-06-2019	07-2026	Yes
West Bay	0.406	0.577	12-08-2003	04-07-2016	08-2026	Yes
Green Island	0.399	0.753	09-07-2003 03-06-2004 03-06-2008 18-08-2009	12-06-2014 29-08-2016 20-06-2017	23-07-2024 12-08-2025	Yes
Francis Point	0.331	0.577	22-06-2006	05-07-2016	07-2026	Yes
Beaverstone	0.327	0.534	10-08-2006	05-08-2016	08-2026	Yes
Key River	0.320	0.572	14-08-2003	21-08-2014 10-08-2016 26-06-2019	08-2026	Yes
Roberts Bay	0.315	0.657	02-06-2004 11-06-2008 17-06-2009	25-06-2014 22-08-2016	18-07-2024 16-06-2025	Yes
Oak Bay	0.279	0.753	08-07-2003 09-06-2004 03-06-2008 04-06-2008 09-06-2009 20-08-2009	10-06-2014 20-06-2017	26-07-2024 11-08-2025	Yes
Ojibway Bay	0.221	0.432	15-06-2005 24-06-2009	31-08-2015 15-08-2016	06-2026	Yes
Quarry Island	0.216	0.657	10-07-2003 25-06-2009	22-08-2016	17-07-2024	Yes
Potato Island	0.207	0.753	04-07-2008	12-06-2014 21-06-2017	25-07-2024	Yes
Strawberry Island	0.206		12-08-2006 01-08-2011		05-08-2025	Yes
Iroquois Bay	0.205	0.507	06-08-2004 08-08-2007 29-07-2011	03-08-2017 02-08-2019	29-05-2025	Yes
Corbman Bay	0.191	0.577	20-06-2006	05-07-2016	07-2026	Yes
Moose Bay	0.179		15-06-2004		08-07-2025	Yes
Lake St. Patrick	0.155	0.567	24-08-2006	24-06-2016	08-2026	Yes
Musky Bay 1	0.101	0.753	09-07-2003 03-06-2008 12-08-2009	24-06-2014 23-08-2016	24-07-2024 13-08-2025	Yes
David's Bay	0.052	0.475	26-07-2006	18-06-2015 30-08-2016 13-08-2019	07-07-2025	Yes
Roseborough	0.447		23-08-2006		08-2026	Yes
Ingersoll Bay	0.062		24-08-2005		08-2026	Yes
French River Main	0.813		26-07-2005		07-2026	Yes
Hockey Stick	0.916		04-08-2005		08-2026	Yes
Dead Horse Bay	0.731		10-08-2005		08-2026	Yes
Sturgeon Bay South	0.095		27-07-2004	08-07-2015	07-2026	Yes
Hog Bay	0.316		08-06-2004	08-07-2015	07-2026	Yes
Vincent's Buni	0.247		07-08-2004		07-2026	Yes
Prisque Bay South		0.962	11-07-2007	19-07-2017		
Kendrick Bay		0.962	10-07-2007	18-07-2017		
Treasure Bay		0.657	14-06-2005 09-06-2008 23-06-2009	09-07-2015 15-08-2016	06-2026	Yes
Cormican Bay		0.577	12-08-2003 21-06-2006	04-07-2016	07-2026	Yes
Moreau Bay		0.567	17-06-2004 05-08-2009	02-09-2015 29-08-2016 20-08-2019	07-2026	Yes
Sugar John		0.534	09-08-2006 25-07-2011	07-08-2016 31-07-2019	30-07-2025 08-2026	Yes
Tadenac Bay 1		0.475	20-07-2005 16-07-2009	15-07-2014 19-08-2015	20-08-2025	Yes
Tadenac Bay 2		0.475	19-07-2005 15-07-2009		20-08-2025	Yes
Black Rock		0.475		14-08-2019	n/a	
Miner's Creek Bay		0.475	25-07-2006	18-08-2015	18-08-2025	Yes
Dogfish		0.456	13-08-2005	06-08-2017	08-2026	Yes
Ni (Mud) Bay		0.441	01-06-2005	23-07-2014	16-07-2025	Yes
Hole in the Wall		0.441	01-08-2007	23-07-2014 20-07-2015	16-07-2025	Yes
Inukshuk Bay		0.441		21-07-2015	07-2026	Yes
Shawanaga River		0.441	05-07-2006	21-07-2015	07-2026	Yes
Sturgeon Bay Central		0.441	13-08-2003	04-08-2015	08-2026	Yes
Lost Channel		0.435		12-07-2016	n/a	
Charles Inlet		0.435	07-07-2004	12-07-2016	07-2026	Yes
Deer Island		0.357	09-08-2006 26-07-2011	04-08-2016	29-07-2025	Yes
Gooseneck		0.289	26-06-2003	06-07-2017	06-2026	Yes
Waterfall Bay				05-08-2015	15-07-2025	
Shadow Bay			19-07-2006	19-08-2014 23-07-2019	n/a	
Jumbo Bay			09-08-2004 12-08-2005 14-08-2006 02-08-2011	06-08-2017	08-2026	Yes
La Cloche (Inner)			15-08-2006 03-08-2011	07-08-2017	08-2026	Yes
Little Current			13-08-2006	08-08-2017	05-08-2025	Yes

Progress to date:

Between **2024-2025**, 27 wetlands were sampled at least once

Planned for 2026:

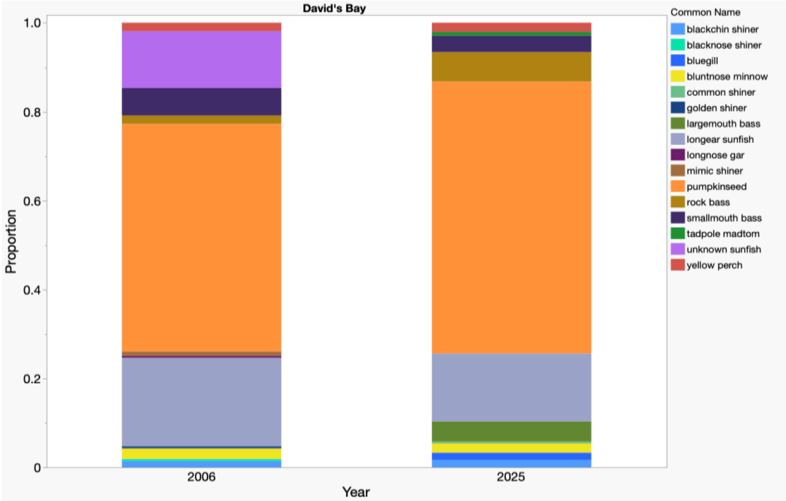
By **2026,** 35 sites will have been sampled at least once during 2024-2026 with RI scores, of which 31 can be used to compare similarity scores between the two low WL periods, separated by 2 decades (hypothesis testing)

Analyses planned:

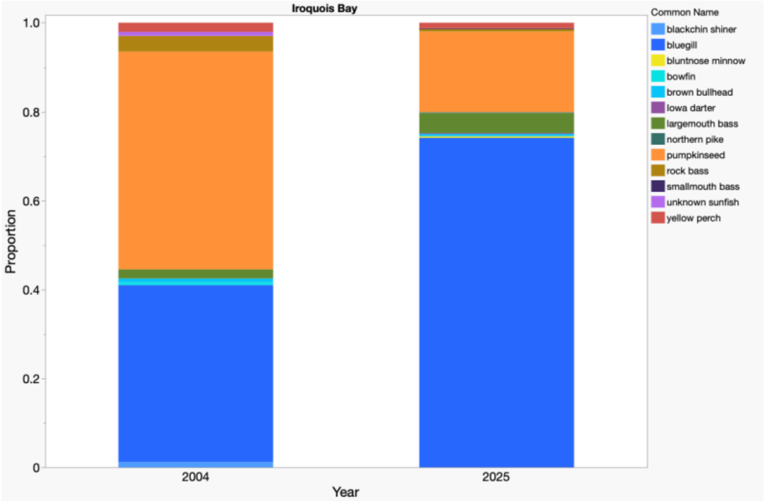
By **2027**

- At least 41 sites will have been sampled during the two low WL years and can be used to determine if similarity index scores are influenced by other metrics

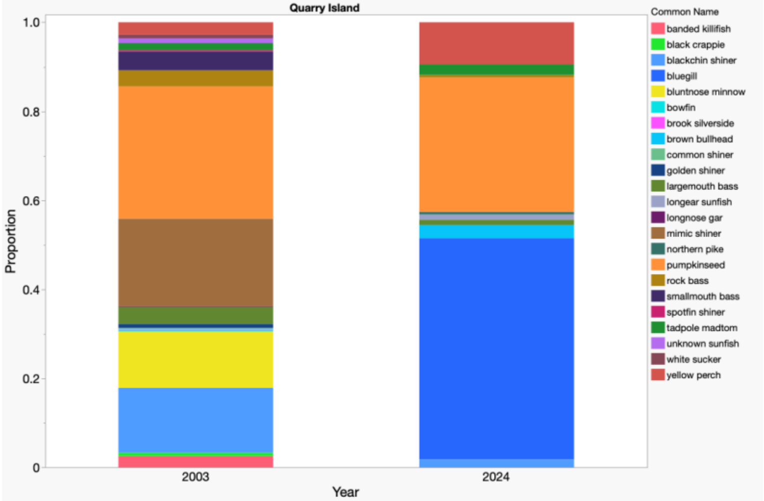
Wetlands presented according to RI score



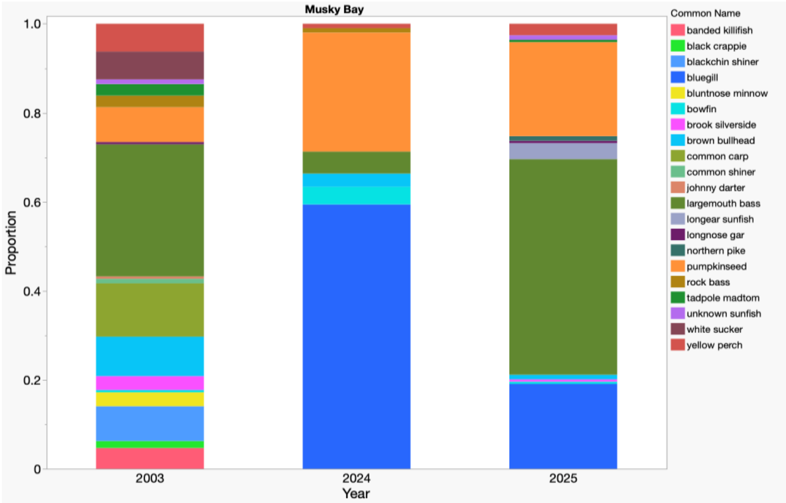
David's Bay RI 0.052



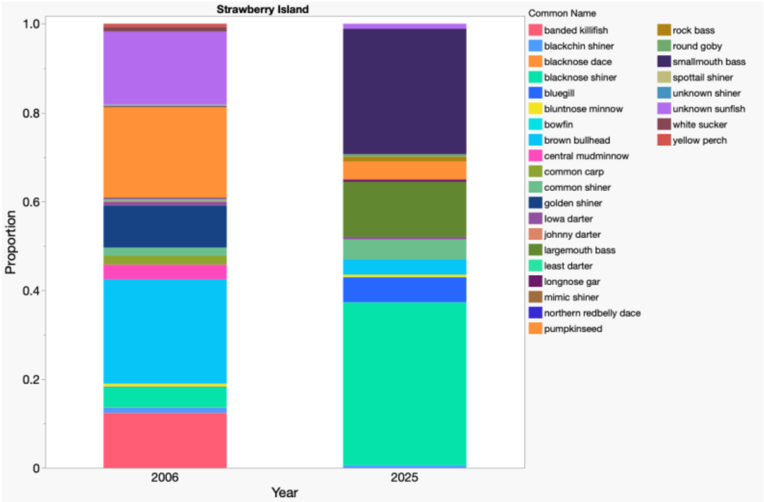
Iroquois Bay RI 0.205



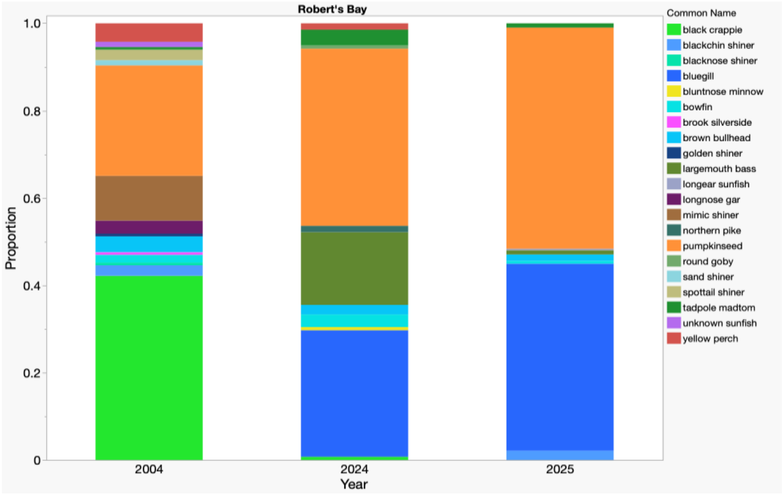
Quarry Island RI 0.216



Musky Bay RI 0.101

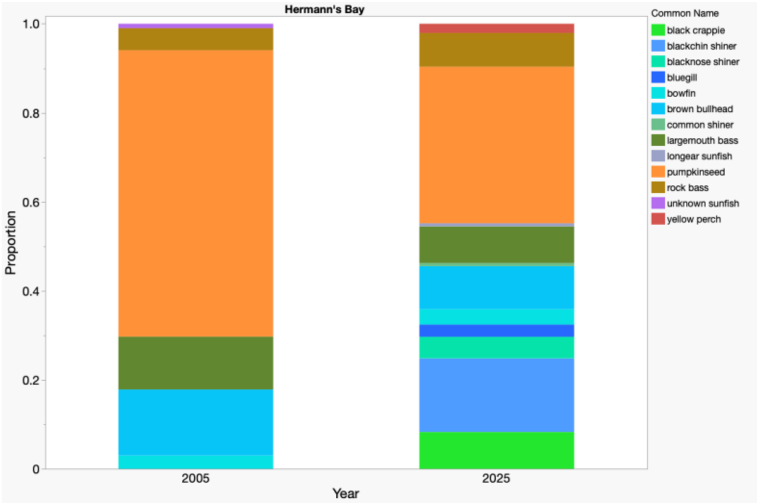


Strawberry Island RI 0.206

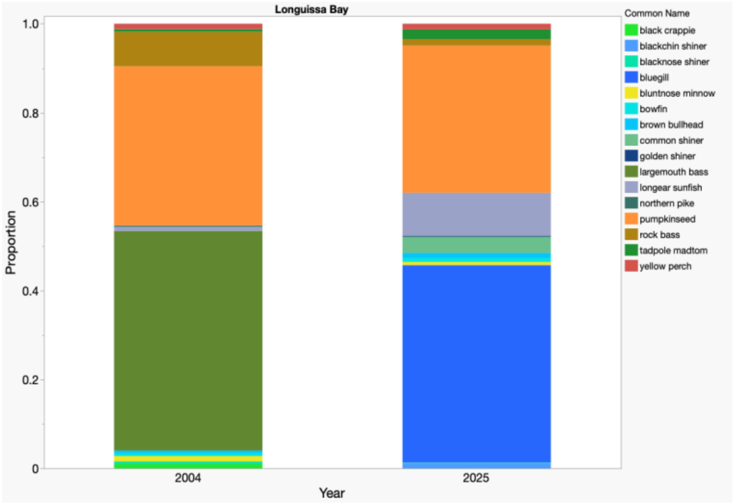


Robert's Bay RI 0.315

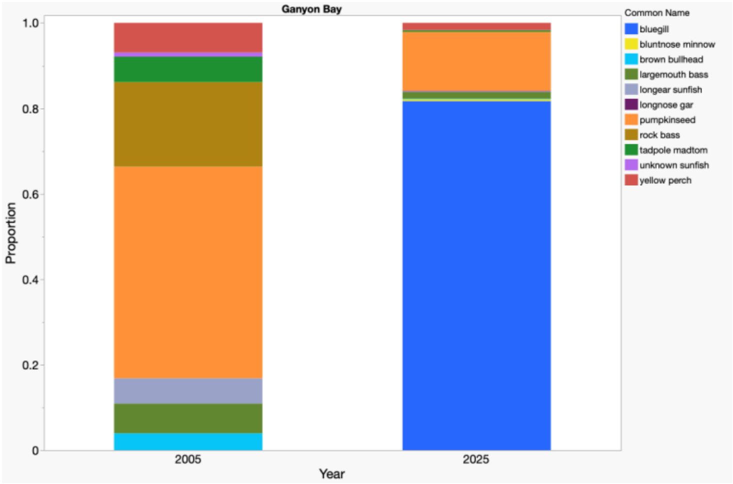
Wetlands presented according to RI score



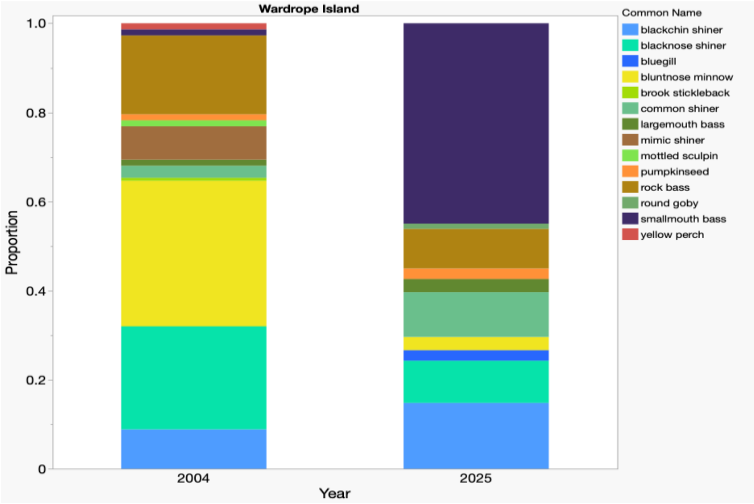
Hermann's Bay RI 0.502



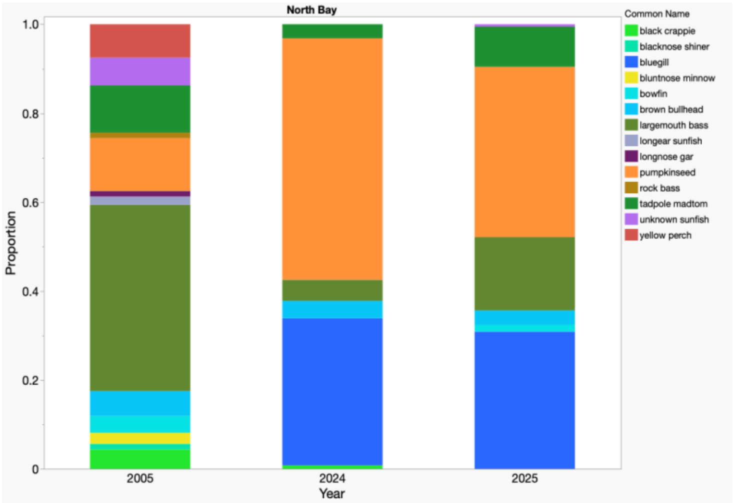
Longuissa Bay RI 0.536



Ganyon Bay RI 0.925



Wardrope Island RI 0.522



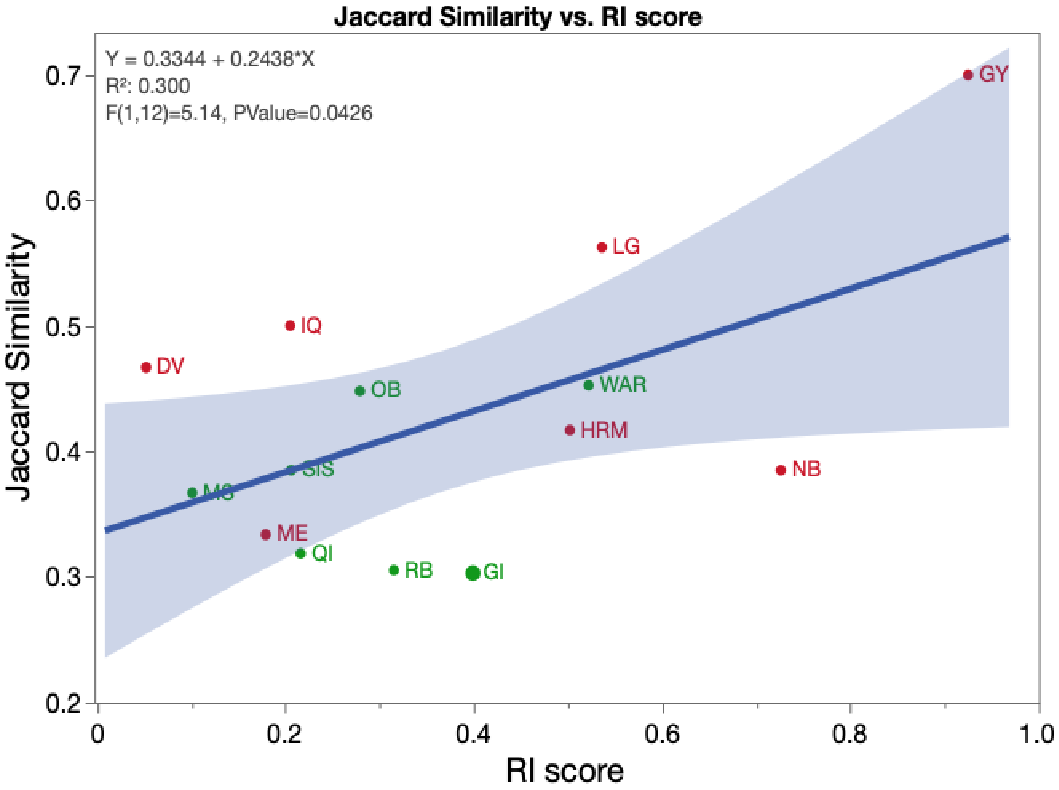
North Bay RI 0.726

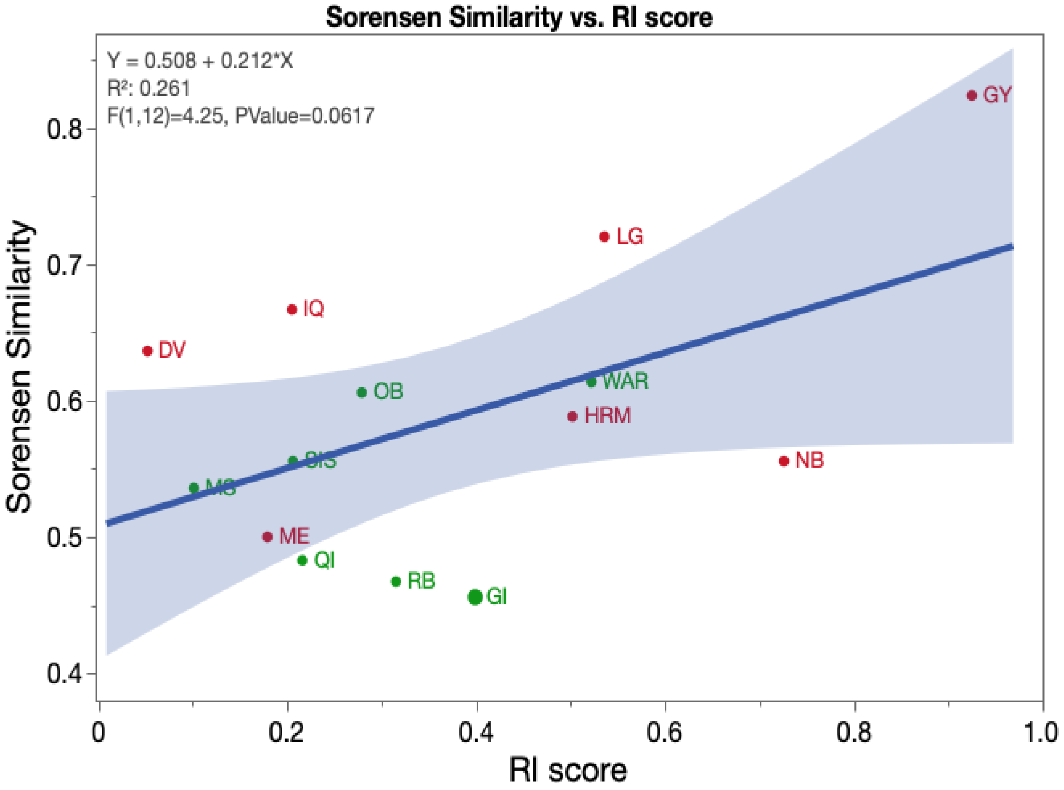
- Generally, there have been a decline in species richness across time periods and a shift from dominance by pumpkinseed to dominance by bluegill sunfish, and a decrease in bass species
- What do similarity indices show regarding change in species composition?

Preliminary test results: Includes the 14 sites sampled during 2024 and 2025; consistent with prediction, Jaccard similarity index score increases significantly with RI score; Sorensen similarity index score not significant but P-value is 0.06

Exposed sites

Protected sites





NOTE: The exposed sites appear to be less influenced by RI score.

New sites proposed to be sampled in 2026 (perhaps some of 2027)

Jessica Stevens will be transferring to PhD in 2026

- In 2026, projected water levels will be as low as in 2013.
- We will aim to sample as many of the sites as possible during 2026 and 2027 (depending on accessibility)
- That would give us overall 40+ sites to determine if similarity index between current and past low WL periods are influenced by simple to measure metrics (i.e. not Resilience Index)
    - simplified slope that Jess is developing
    - site exposure
    - cottage and dock development
    - presence of exotic species
    - proximity to other wetlands (as source populations)

Available Tools and Appropriate Scope for Coastal Restoration Projects

GLFEI Annual Coastal Symposium

Session 2: Using Science and modelling to Inform Protection and Restoration

Seth Logan, P.Eng.

SJL Engineering

December 12, 2025

INCREASING RESILIENCE THROUGH COASTAL RESTORATION & CLIMATE ADAPTATION:

Hillman Marsh Restoration

Port Hope Sediment Bypassing

Lynde Shores

Sculthorpe Marsh

Goderich Feeder Beach

Pelee Rock Shoals

Scientific Investigations vs. Engineering Design

Scientific Investigations:

- Problem statement
- Regional ... scale
- **D...**
- ...
- Hi... ns
- Future metocean conditions
- **Numerical modelling**
- Public engagement

What's going on here?

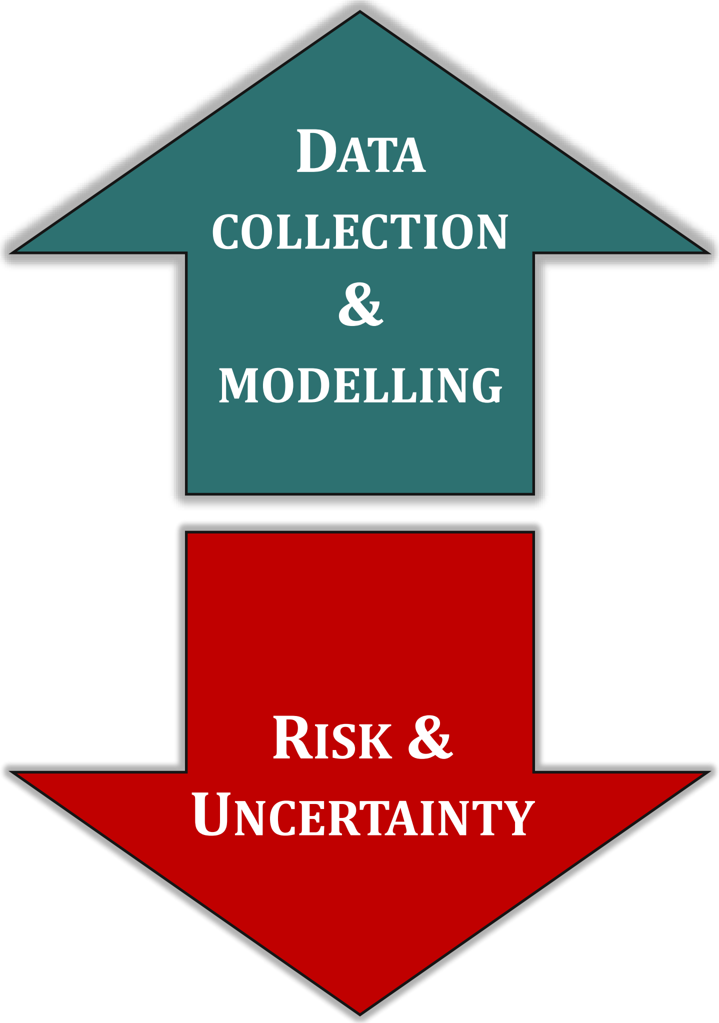
Coastal Engineering Design:

- Objectives & KPIs
- Engageme...
- D...
- ...
- **...ing**
- Selection ... (s)
- Detailed engineering design
- Implementation

What can we do about it?

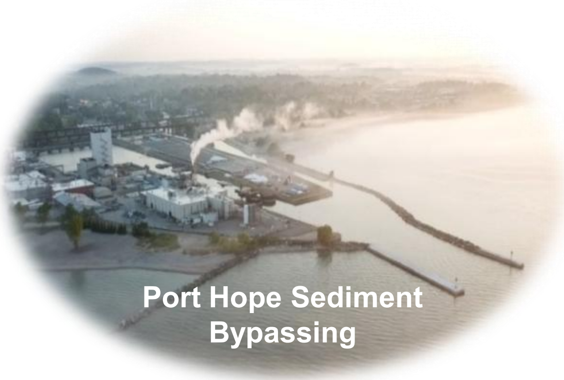
Pre-Project Considerations

- Matching the technical scope to the needs of a project and available funding is the first challenge
- Scalable project elements include **data collection and modelling**
- Open communication regarding how scope influences expected project outcomes is critical to project 'success'



Small

Medium



Large

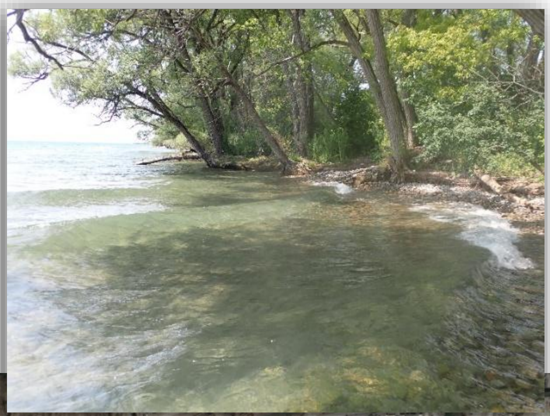
Small Scope: Sculthorpe Marsh

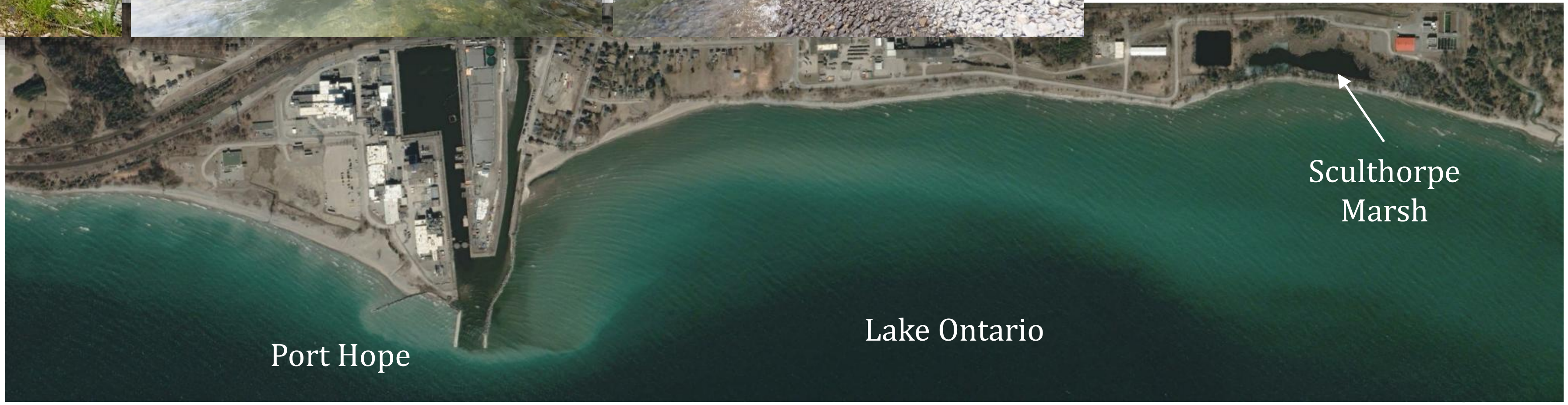
Small

Medium

Large

- Limited data collection & NO NUMERICAL MODELLING
- Primarily desktop engineering analyses
- Strategies focussed on easily implementable, low cost, low risk



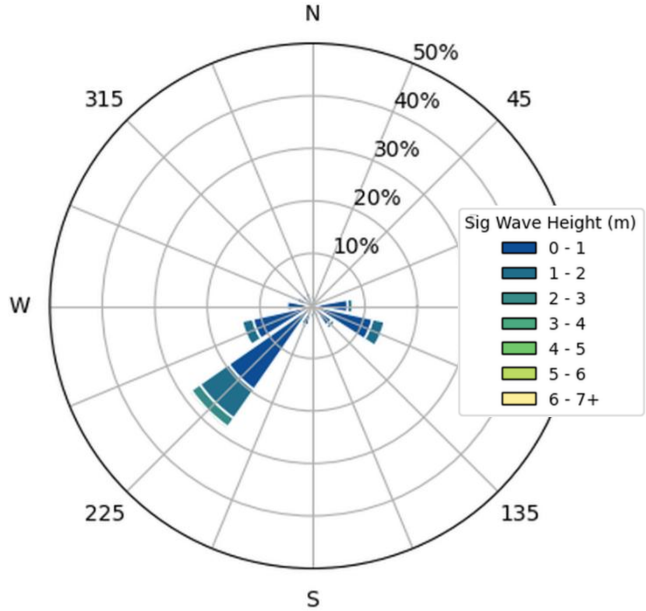


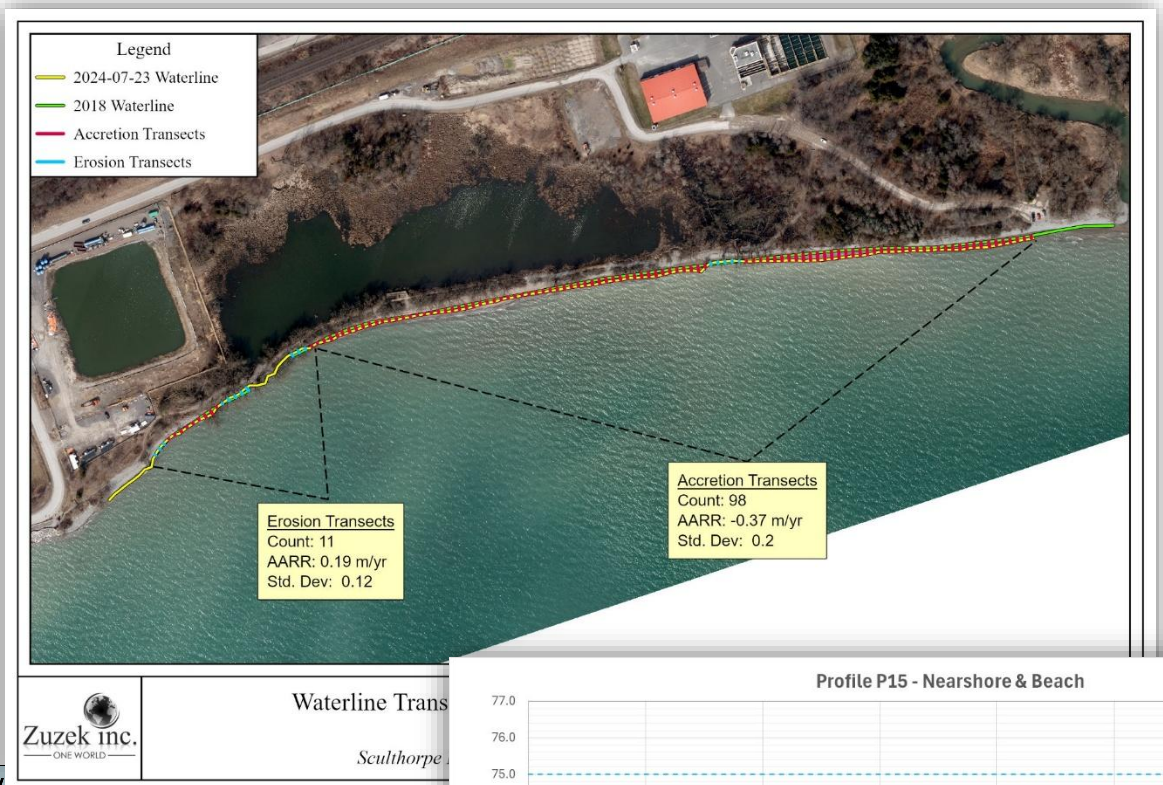
SMALL SCOPE: SCULTHORPE MARSH

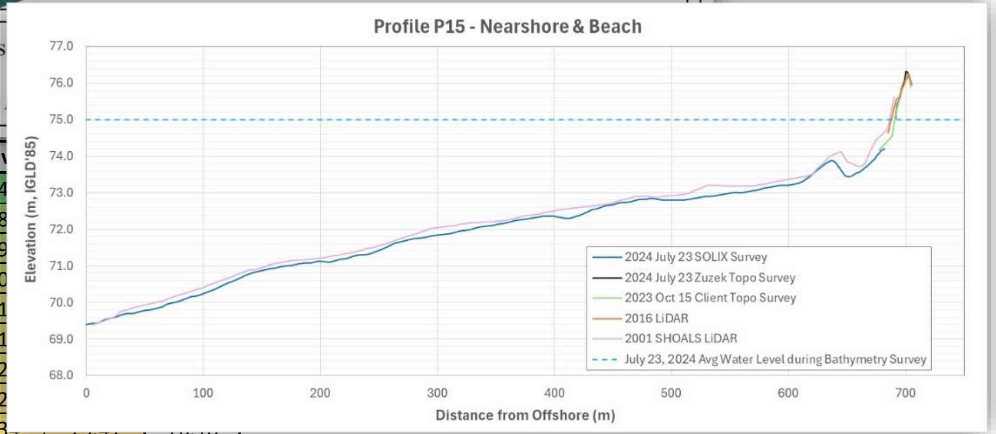
Small

Medium

Large

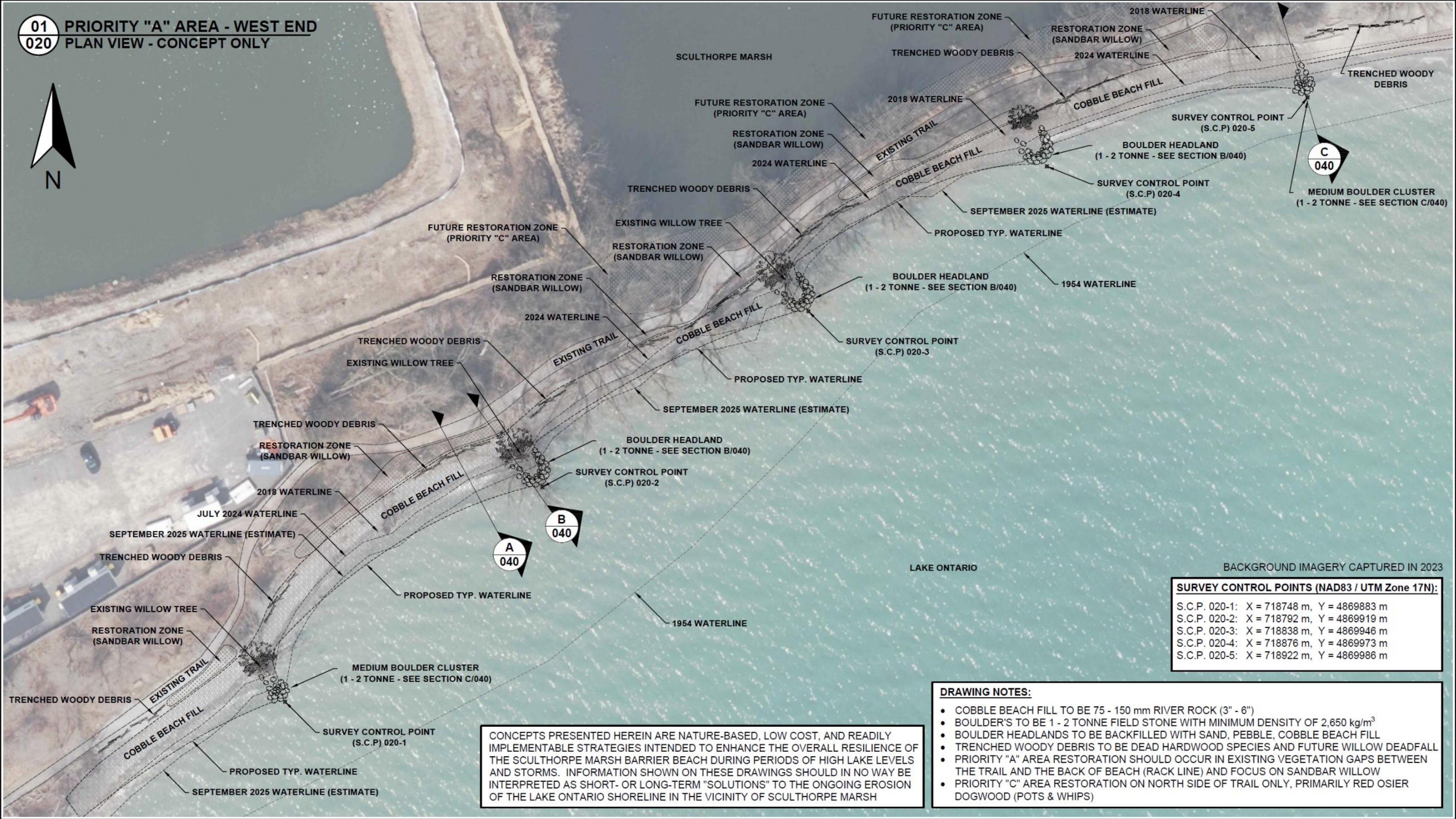






	Monthly Combined Flood Lev												
Tr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	[illegible]	[illegible]
1.5	74.41	74.37	74.46	74.72	74.83	74.86	74.85	74.79	74.66	74.56	[illegible]	[illegible]	[illegible]
2	74.80	74.82	74.91	75.11	75.21	75.20	75.16	75.09	74.99	74.88	[illegible]	[illegible]	[illegible]
5	75.06	75.08	75.15	75.38	75.48	75.47	75.41	75.31	75.17	75.04	[illegible]	[illegible]	[illegible]
10	75.19	75.21	75.27	75.52	75.64	75.62	75.55	75.42	75.25	75.12	[illegible]	[illegible]	[illegible]
20	75.30	75.31	75.37	75.64	75.76	75.75	75.66	75.52	75.32	75.18	[illegible]	[illegible]	[illegible]
25	75.33	75.35	75.39	75.67	75.80	75.79	75.70	75.55	75.34	75.20	[illegible]	[illegible]	[illegible]
50	75.42	75.43	75.47	75.77	75.92	75.92	75.80	75.63	75.40	75.26	[illegible]	[illegible]	[illegible]
100	75.51	75.51	75.54	75.87	76.03	76.04	75.91	75.72	75.46	75.31	[illegible]	[illegible]	[illegible]
200	75.64	75.59	75.61	76.00	76.18	76.18	76.04	75.83	75.50	75.38	[illegible]	[illegible]	[illegible]
MAX Obs.	75.31	75.30	75.48	75.78	75.96	75.93	75.86	75.68	75.43	75.27	75.20	75.17	75.96
Date	1978-01-26	1993-02-21	1973-03-17	1973-04-10	2019-05-29	2019-06-02	2019-07-11	2019-08-06	2019-09-03	1986-10-04	1986-11-09	1986-12-09	

01/020 PRIORITY "A" AREA - WEST END
PLAN VIEW - CONCEPT ONLY



SURVEY CONTROL POINTS (NAD83 / UTM Zone 17N):

S.C.P. 020-1: X = 718748 m, Y = 4869883 m
S.C.P. 020-2: X = 718792 m, Y = 4869919 m
S.C.P. 020-3: X = 718838 m, Y = 4869946 m
S.C.P. 020-4: X = 718876 m, Y = 4869973 m
S.C.P. 020-5: X = 718922 m, Y = 4869986 m

CONCEPTS PRESENTED HEREIN ARE NATURE-BASED, LOW COST, AND READILY IMPLEMENTABLE STRATEGIES INTENDED TO ENHANCE THE OVERALL RESILIENCE OF THE SCULTHORPE MARSH BARRIER BEACH DURING PERIODS OF HIGH LAKE LEVELS AND STORMS. INFORMATION SHOWN ON THESE DRAWINGS SHOULD IN NO WAY BE INTERPRETED AS SHORT- OR LONG-TERM "SOLUTIONS" TO THE ONGOING EROSION OF THE LAKE ONTARIO SHORELINE IN THE VICINITY OF SCULTHORPE MARSH

DRAWING NOTES:

- COBBLE BEACH FILL TO BE 75 - 150 mm RIVER ROCK (3" - 6")
- BOULDER'S TO BE 1 - 2 TONNE FIELD STONE WITH MINIMUM DENSITY OF 2,650 kg/m^3
- BOULDER HEADLANDS TO BE BACKFILLED WITH SAND, PEBBLE, COBBLE BEACH FILL
- TRENCHED WOODY DEBRIS TO BE DEAD HARDWOOD SPECIES AND FUTURE WILLOW DEADFALL
- PRIORITY "A" AREA RESTORATION SHOULD OCCUR IN EXISTING VEGETATION GAPS BETWEEN THE TRAIL AND THE BACK OF BEACH (RACK LINE) AND FOCUS ON SANDBAR WILLOW
- PRIORITY "C" AREA RESTORATION ON NORTH SIDE OF TRAIL ONLY, PRIMARILY RED OSIER DOGWOOD (POTS & WHIPS)

PREPARED BY:
SJL ENGINEERING INC.
SETH LOGAN, M.A.Sc., P.Eng.

PREPARED FOR:
MUNICIPALITY OF PORT HOPE
284 VICTORIA STREET N.
PORT HOPE, ON
L1A 3V8

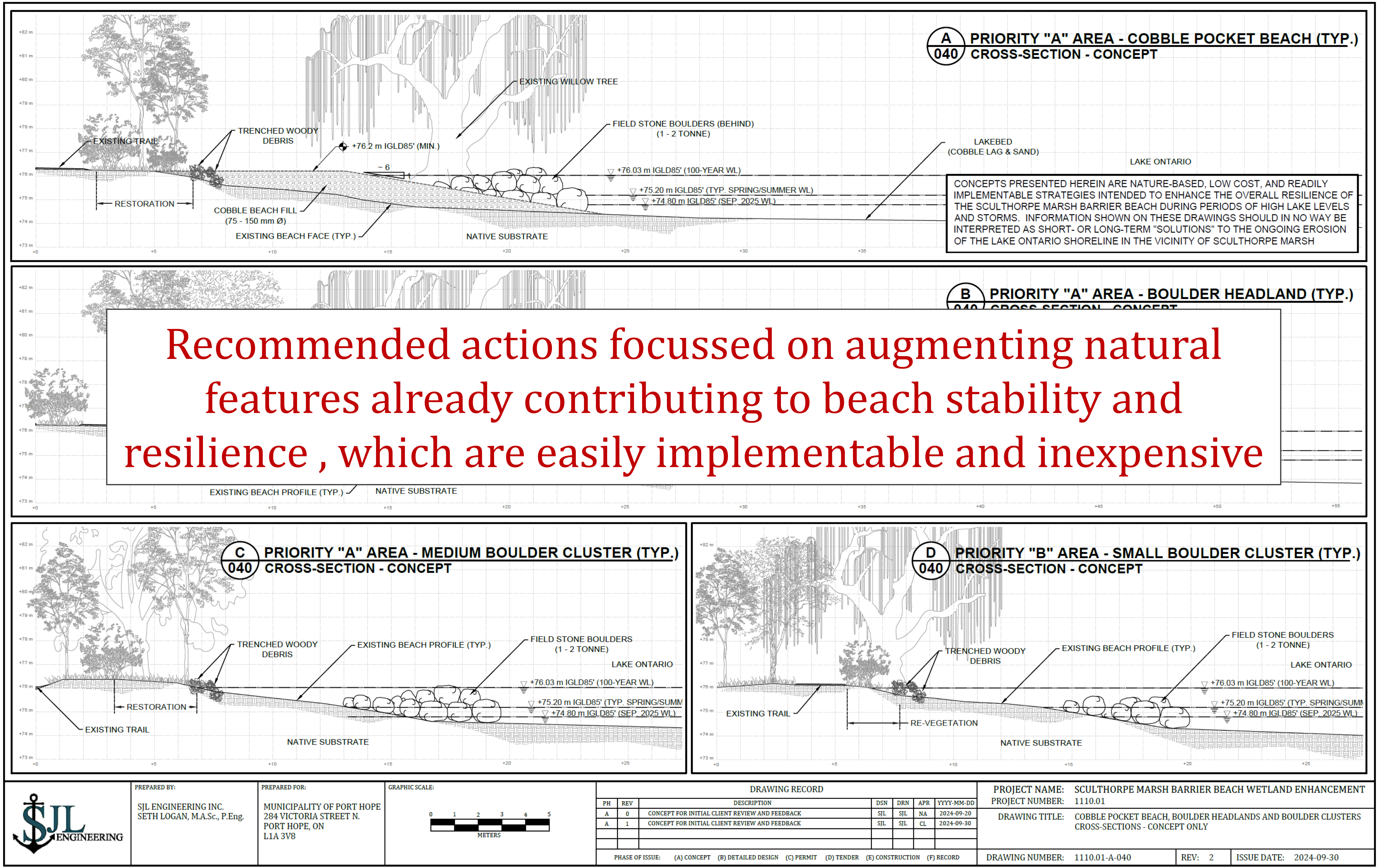
GRAPHIC SCALE: 0 5 10 15 20 30 METERS

DRAWING RECORD

PH	REV	DESCRIPTION	DSN	DRN	APR	YYYY-MM-DD
A	0	CONCEPT FOR INITIAL CLIENT REVIEW AND FEEDBACK	SJL	SJL	NA	2024-09-20
A	1	CONCEPT FOR INITIAL CLIENT REVIEW AND FEEDBACK	SJL	SJL	CL	2024-09-30

PHASE OF ISSUE: (A) CONCEPT (B) DETAILED DESIGN (C) PERMIT (D) TENDER (E) CONSTRUCTION (F) RECORD

PROJECT NAME: SCULTHORPE MARSH BARRIER BEACH WETLAND ENHANCEMENT
PROJECT NUMBER: 1110.01
DRAWING TITLE: PRIORITY "A" AREA - WEST END PLAN VIEW - CONCEPT ONLY
DRAWING NUMBER: 1110.01-A-020 REV: 2 ISSUE DATE: 2024-09-30



Recommended actions focussed on augmenting natural features already contributing to beach stability and resilience , which are easily implementable and inexpensive

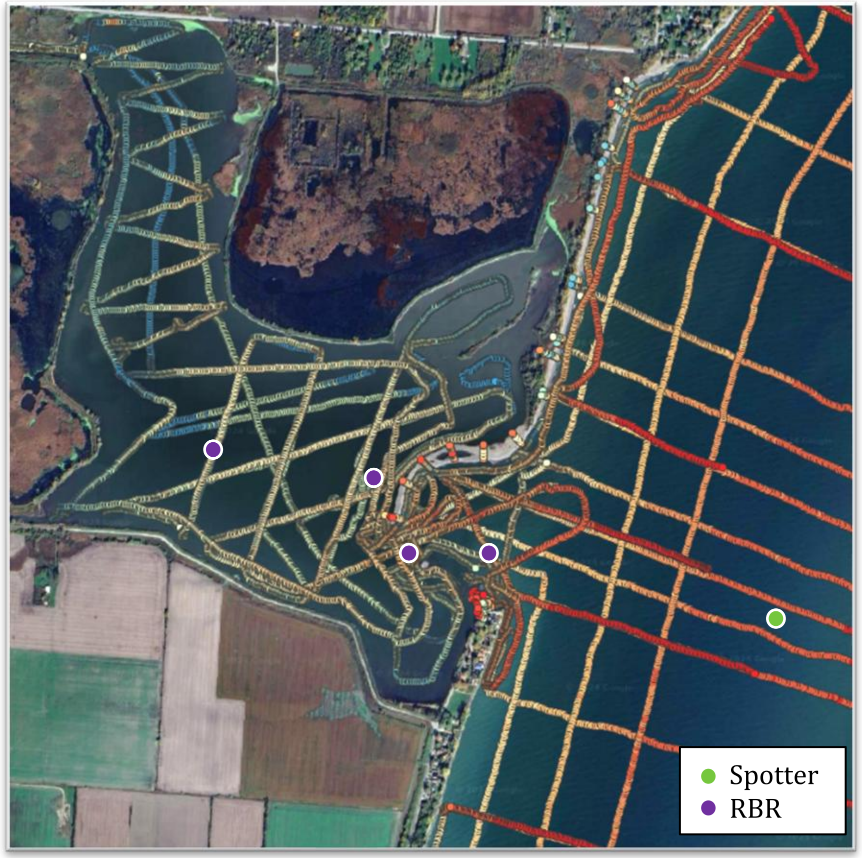
LARGE SCOPE: HILLMAN MARSH

Small
Medium
Large

- Significant data acquisition
- **Numerical modelling:**
  - Waves, uprush, overwash, ponding
  - Currents, flushing, seiche
  - Sediment transport & beach morphology (1D & 2D)
- Wide range of concepts considered & evaluation with numerical models
- **Physical modelling**

Large Scope: Hillman Marsh

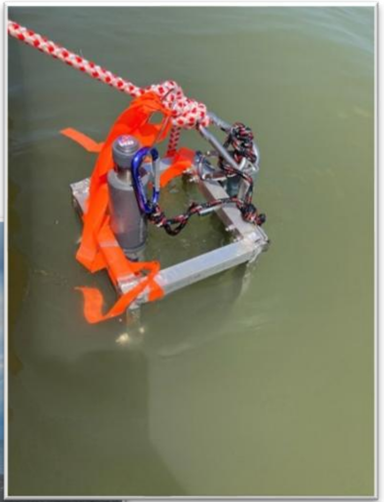
Small
Medium
Large



Data Collection (Summer 2024)

Spotter Buoy deployment

Surficial sediment sampling (Dec 2024)



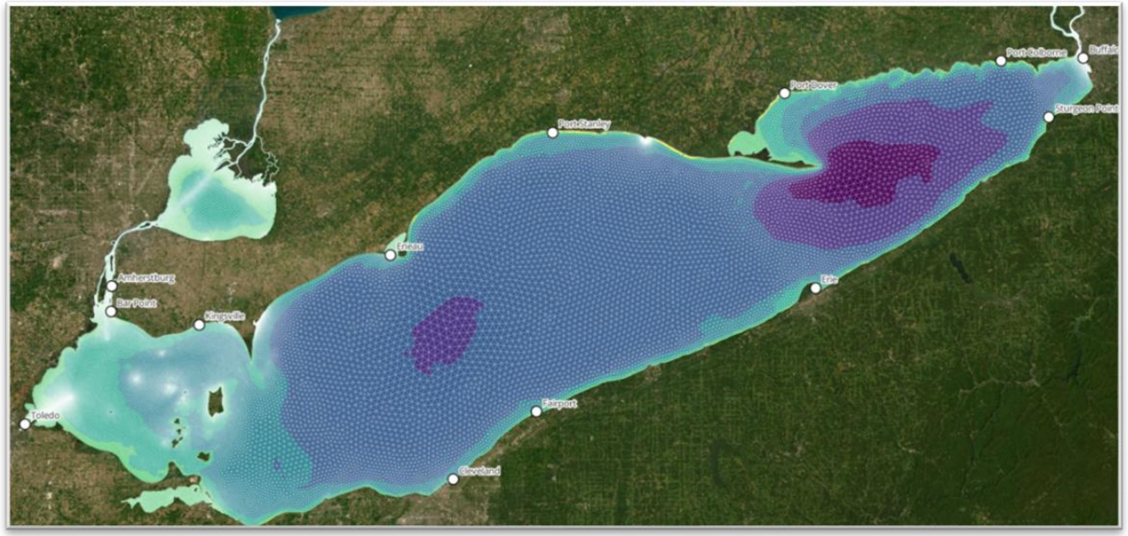
Turbidity sensor deployment (2023)

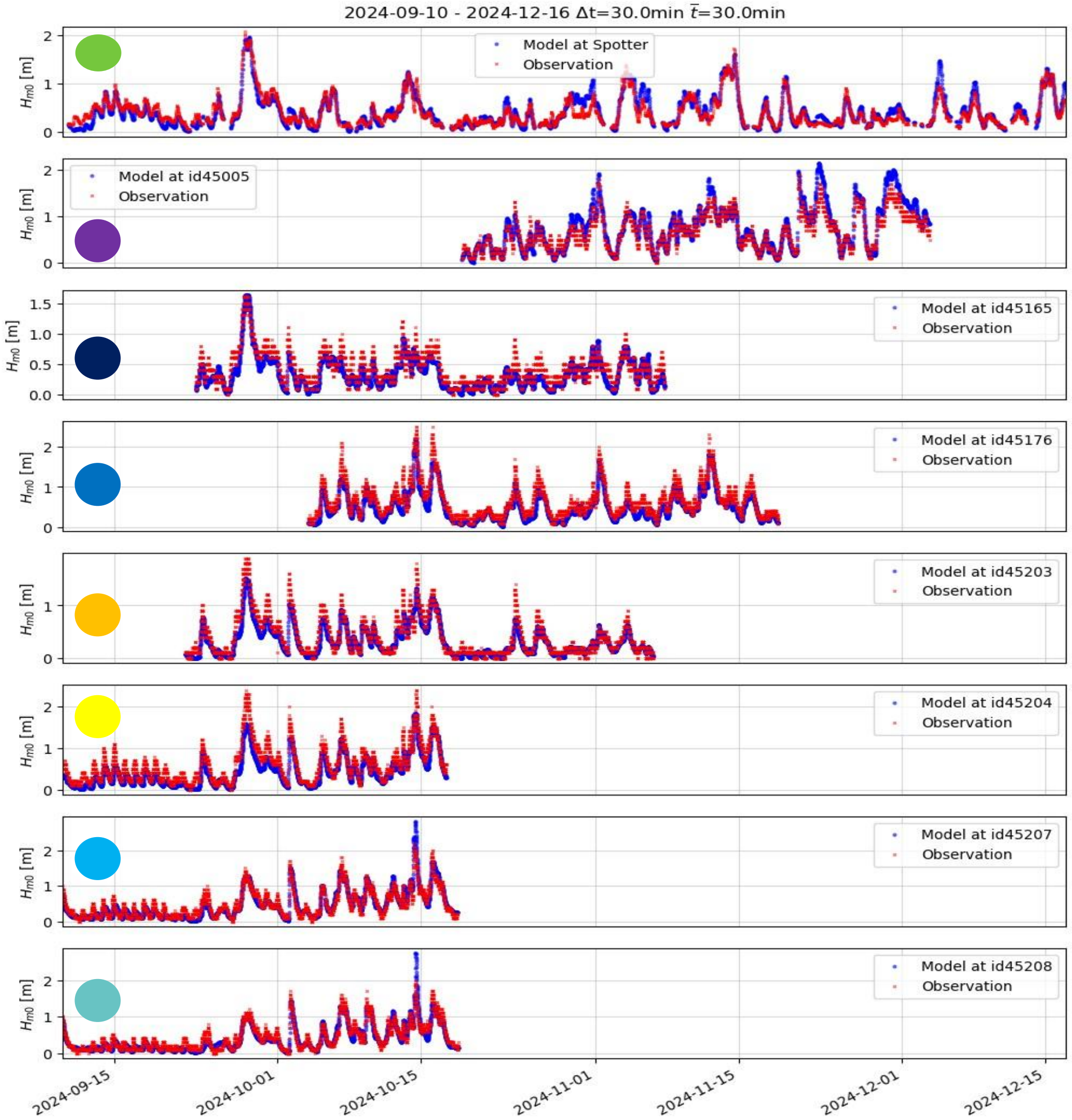
RBR's (4) and Spotter Buoy after retrieval

Geotechnical field work (courtesy of BGC - Dec 2024)

Large Scope: Hillman Marsh

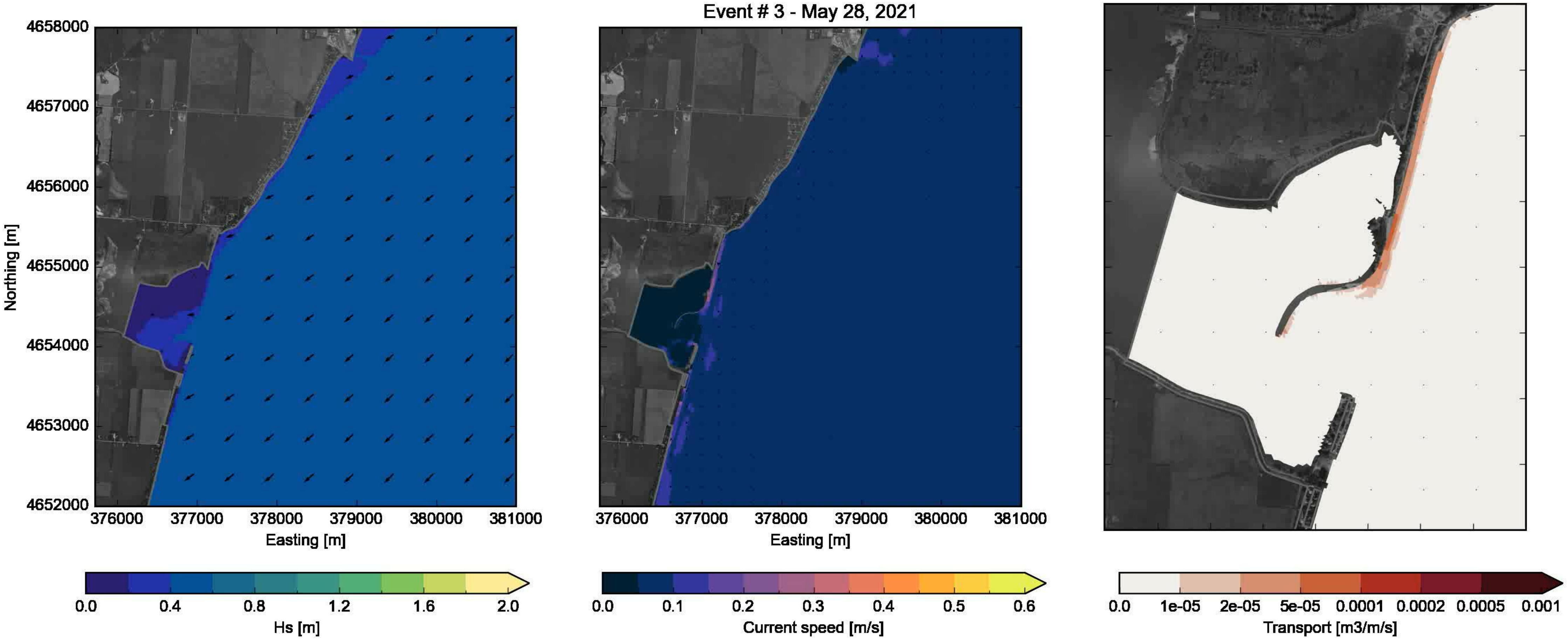
Lake-Wide Wave & Hydrodynamic Models (MIKE21 SW/HD)





LARGE SCOPE: HILLMAN MARSH

REGIONAL WAVE & HYDRODYNAMIC MODELS (MIKE21 SW/HD/ST)

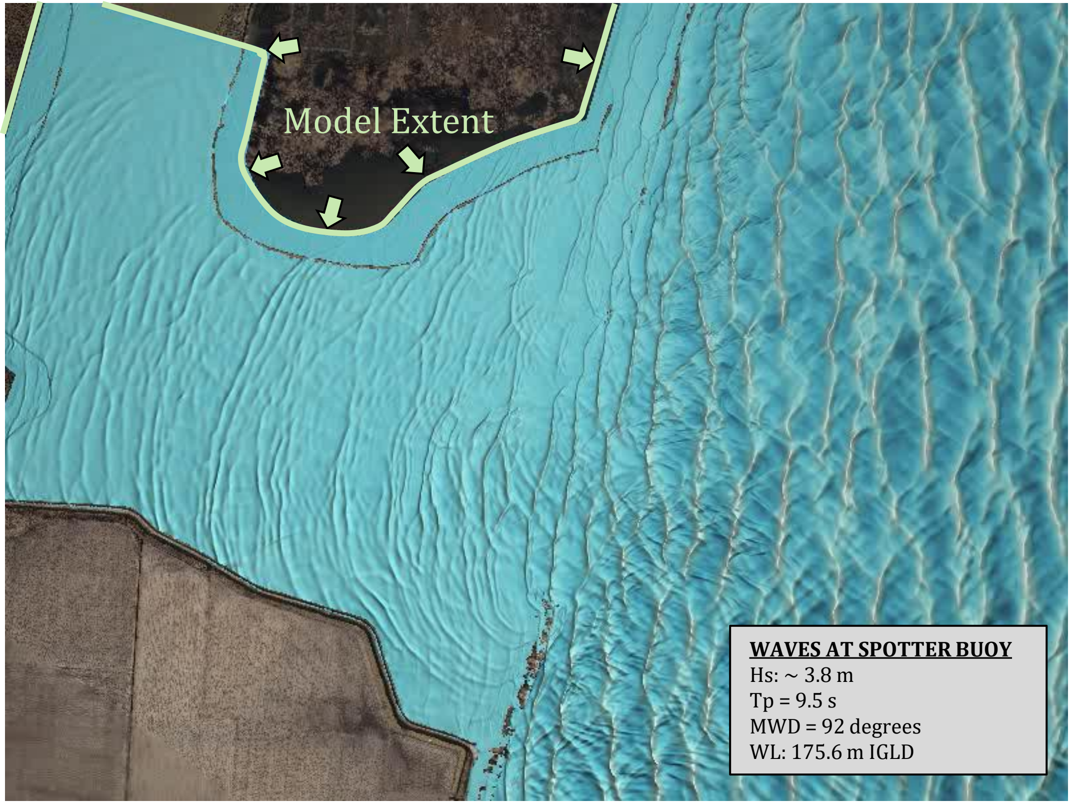


LARGE SCOPE: HILLMAN MARSH

LOCAL HIGH-FIDELITY MODELLING (MIKE3 WAVE FM)

Calibration Event, September 28th, 2024:

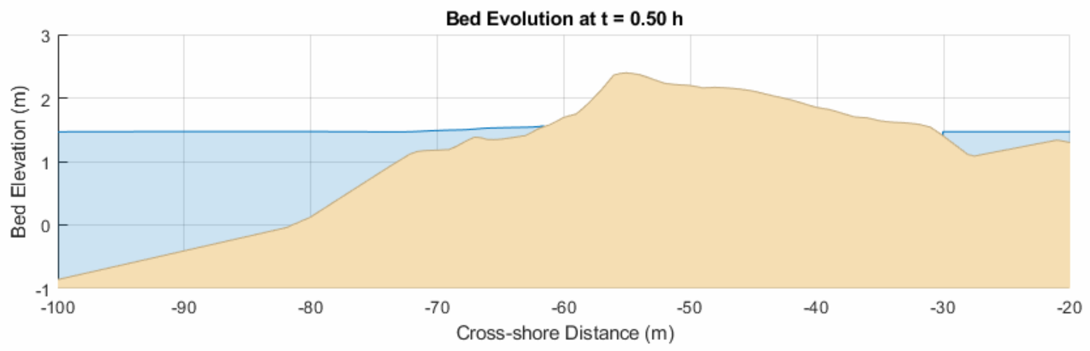
100-year Return Period Event (post-breach):

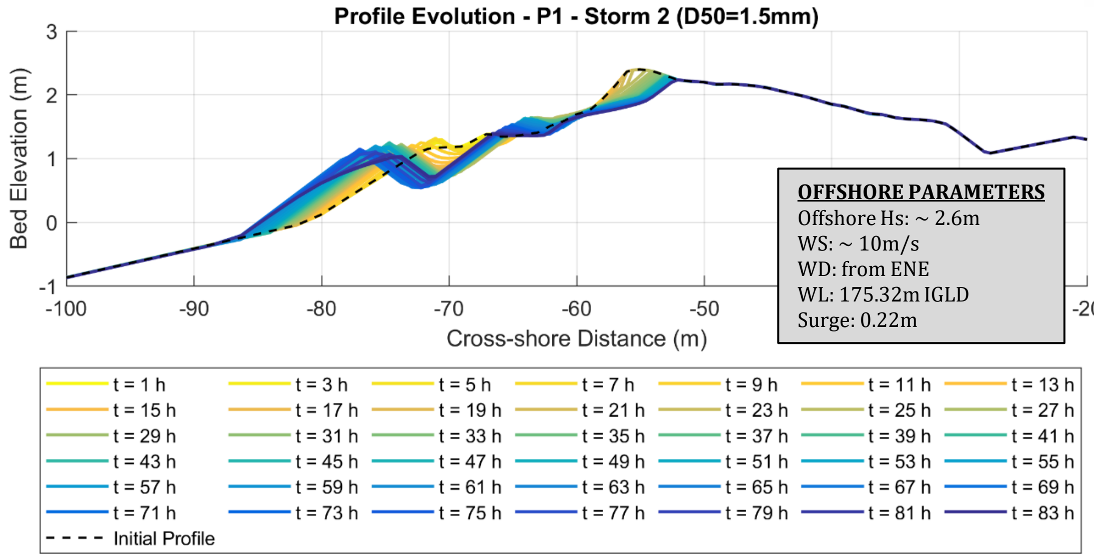


Large Scope: Hillman Marsh

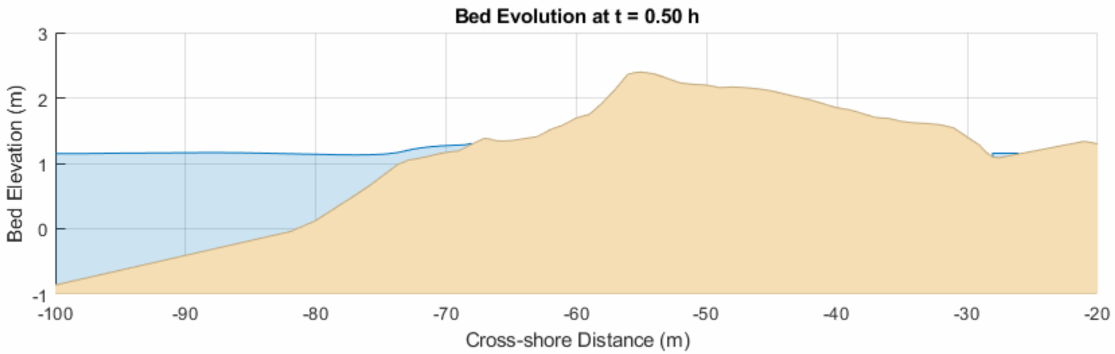
1D Modelling of Barrier Evolution 2019 – 2021 (XBeach)

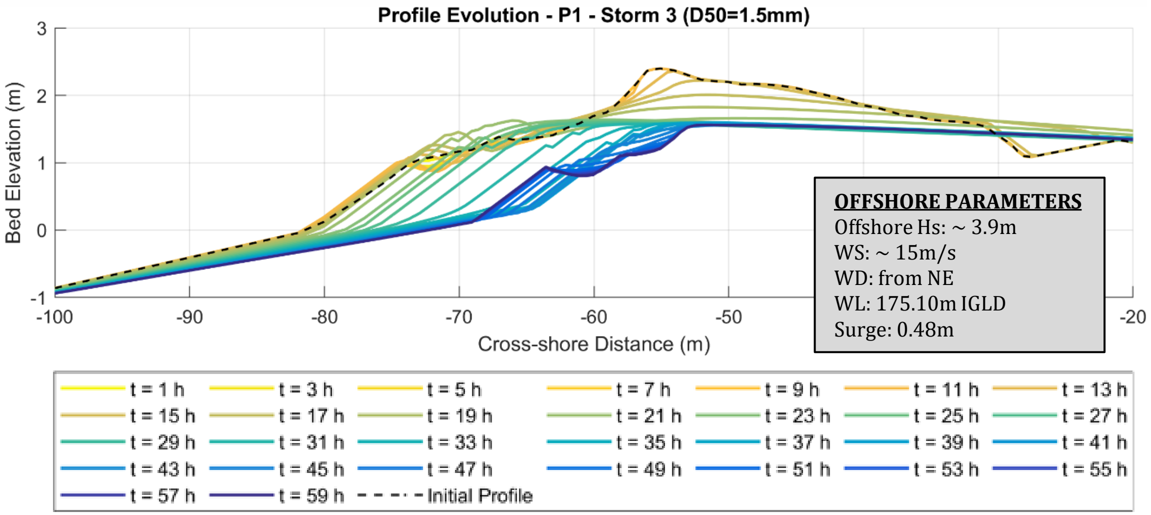
Event # 2 - May 19, 2020
Barrier Bar response for d50=1.5mm





Event # 3 - May 28, 2021
Barrier Bar response for d50=1.5mm



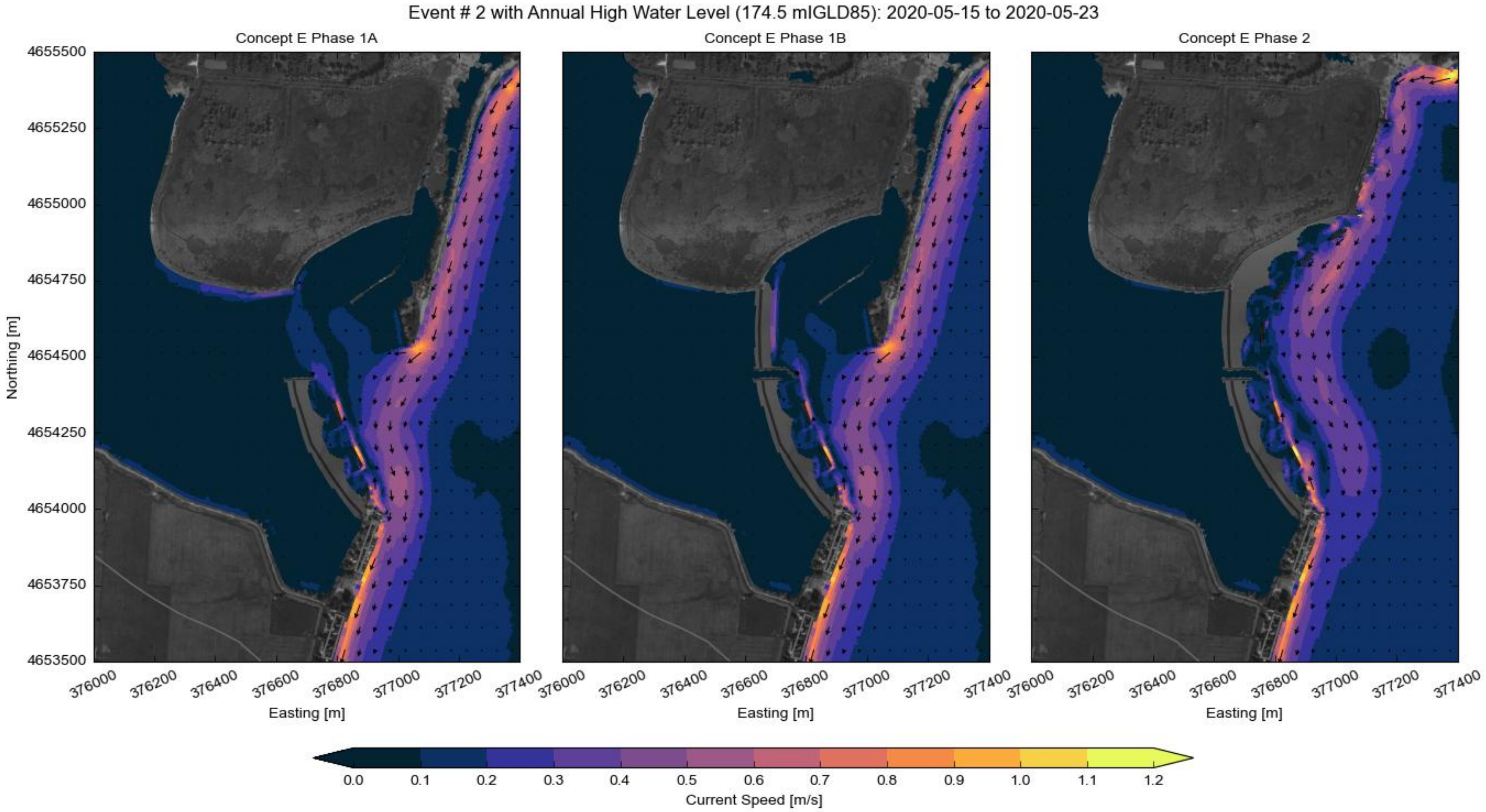


LARGE SCOPE: HILLMAN MARSH

MODELLING OF CONCEPTS (MIKE21 SW/HD)

WAVES AT SPOTTER BUOY
Hs: ~ 2.6 m
Tp = 8.5 s
MWD = ~80 degrees
WL: ~175.1 m IGLD

MIKE21 SW-HD modelling of currents during annual storm event at typical high WL:

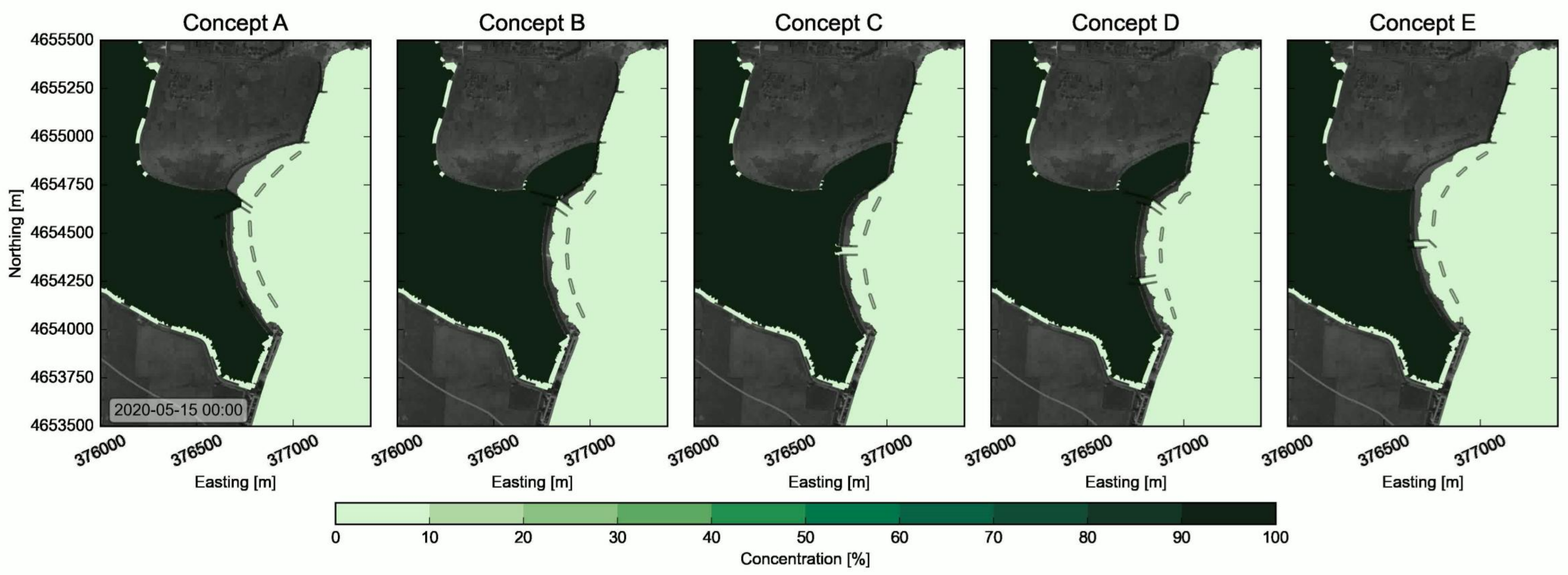


LARGE SCOPE: HILLMAN MARSH

MODELLING OF CONCEPTS (MIKE21 SW/HD)

WAVES AT SPOTTER BUOY
Hs: ~ 2.6 m
Tp = 8.5 s
MWD = ~80 degrees
WL: ~175.1 m IGLD

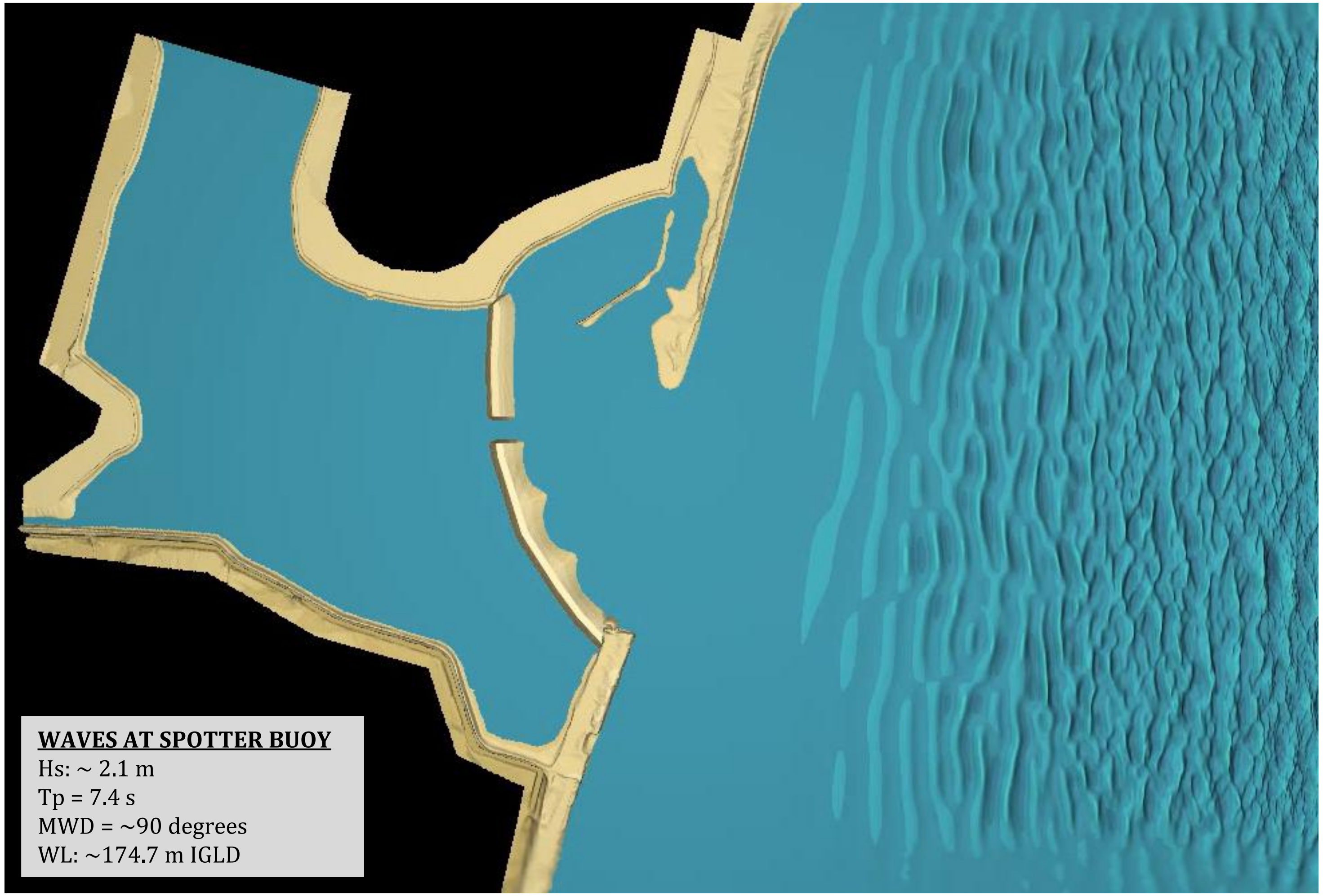
MIKE21 SW-HD modelling of flushing (residence time) during ~annual high-water event:



LARGE SCOPE: HILLMAN MARSH

MODELLING OF CONCEPTS (MIKE3 WAVE FM)

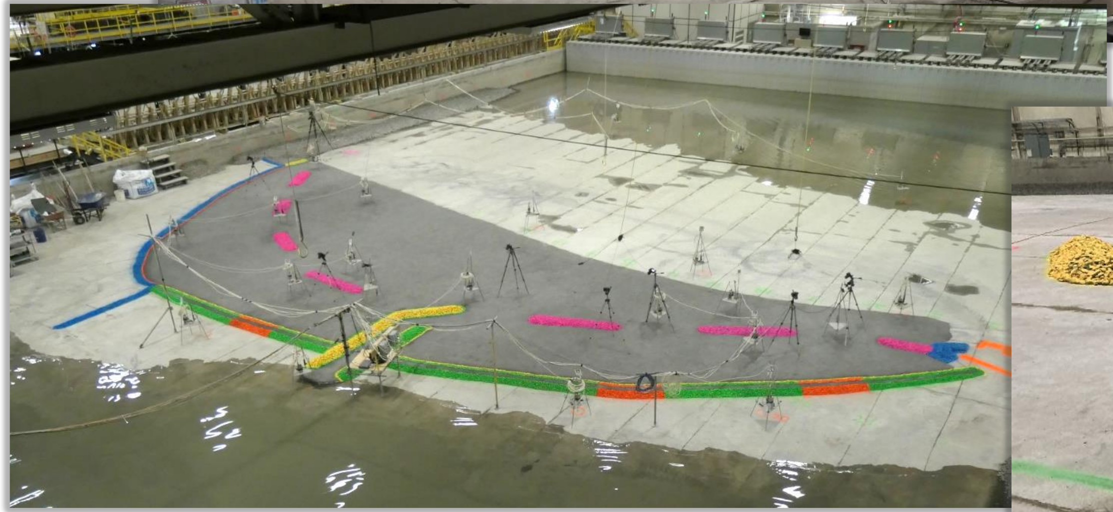
MIKE3 Wave FM modelling of concept for September 2024 calibration event:

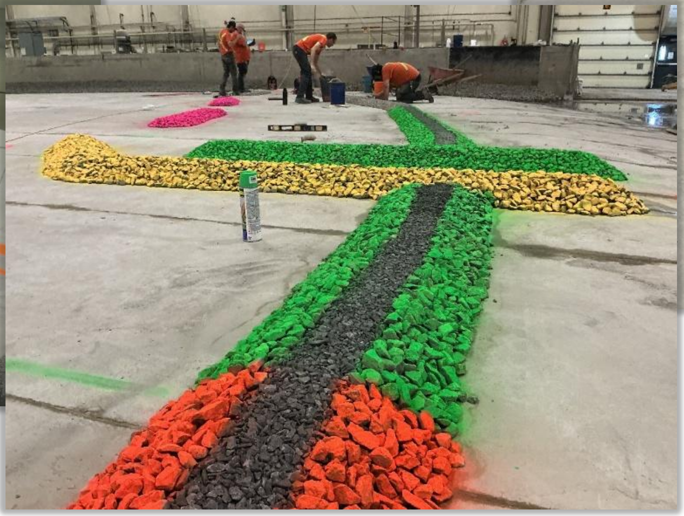


National Research Council Canada
Conseil national de recherches Canada

Large Scope: Hillman Marsh

Initial Construction of Concept

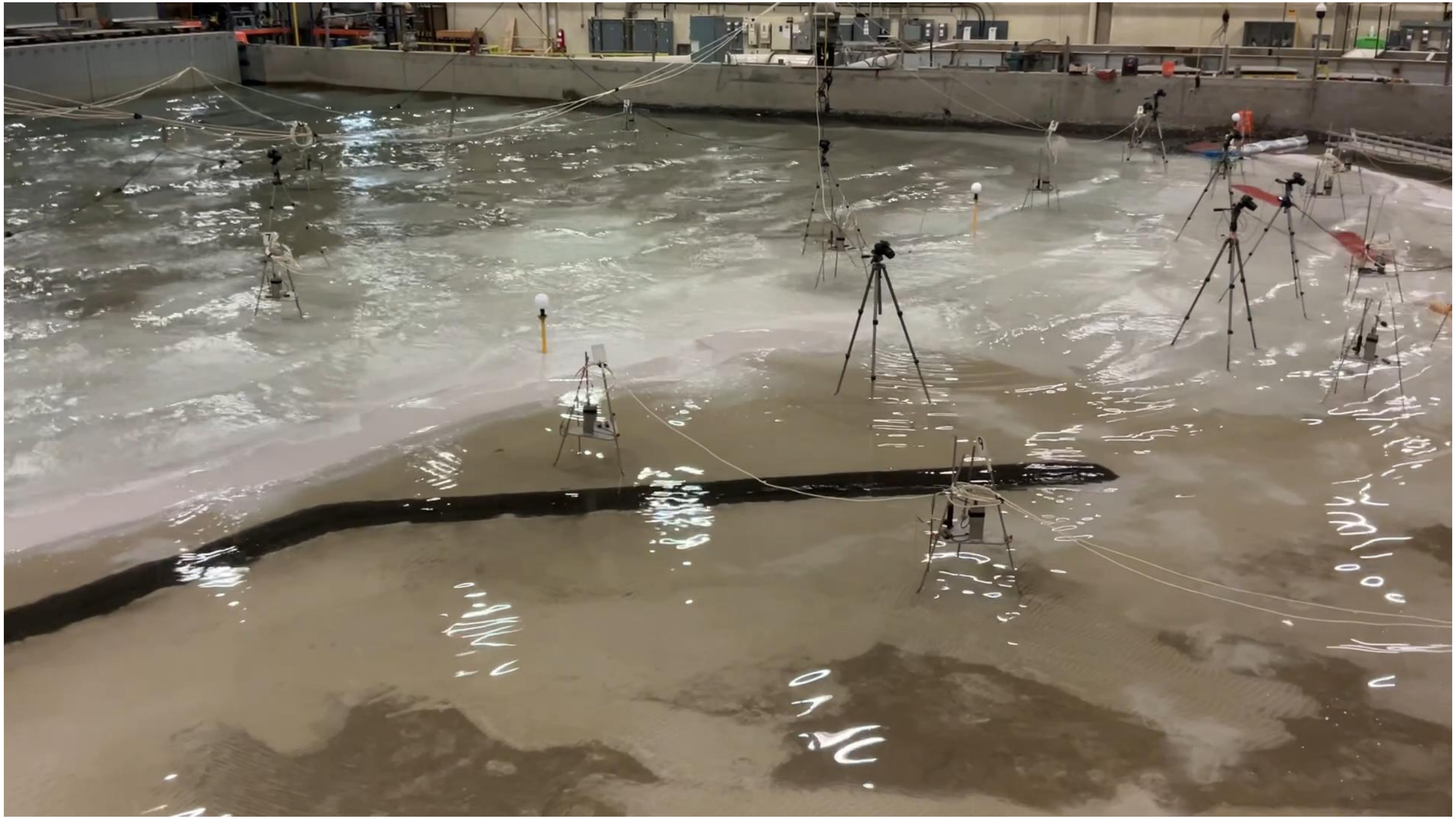




Large Scope: Hillman Marsh

National Research Council Canada
Conseil national de recherches Canada

100-yr Waves at 100-yr WL – Placed Beach and Existing Barrier



Implementation Phase 1B

Final Thoughts

- We have many tools available to help us understand coastal processes, and how restoration & adaptation strategies may impact those processes

- Need to use the right tools for the job based on project needs, scale, complexity and available funding

- **Data collection and modelling** are often two of the most readily scalable components of a project scope

- The more quality data we collect, the more confidence we can put in our models

- The greater the modelling scope, the more we can reduce risk and uncertainty

Thank You!

slogan@sjleng.ca

SJL Engineering

DHI

Zuzek inc. ONE WORLD

Resolution Studio

BGC

Session 2:

Using Science and Modelling to Inform Protection and Restoration – Q&A discussion

Credit: National Hydrological Service, ECCC

Afternoon break and networking

Session 3:

Strengthening Partnerships for Great Lakes Coastal Resilience

Albion Falls | Hamilton, Ontario | Credit: Joe deSousa

Canada Water Agency
Agence de l'eau du Canada

Fostering Nature-Based Coastal Management :

Applying behavioural insights to support sustainable shoreline practices

Stephanie Otto

Great Lakes Freshwater Ecosystem Initiative Coastal Symposium 2025

Introduction

- Fostering nature-based coastal management

- Applying behavioural insights to support sustainable shoreline practices

Understanding Mindsets

Cognitive biases and predictable patterns shape judgement

Social norms heavily impact decisions

Contextual design and information framing influence choices

Behavioural Insights in Wasaga Beach

Insights from Wasaga Beach

- ✓Limited awareness of nature-based options
- ✓Timing and stress
- ✓Conflicting messages across authorities
- ✓Placed-based attachment

Enablers and Opportunities

- ✓Strong environmental stewardship values
- ✓Trusted community networks
- ✓Easy access to tools and guidance
- ✓Simplified pathways to implementation

Photo credit:
Lake Huron Coastal Centre

Strengthening Partnerships

- ✓Multijurisdictional coordination
- ✓Clarity and consistency in messaging
- ✓Transparency and repeated collaboration

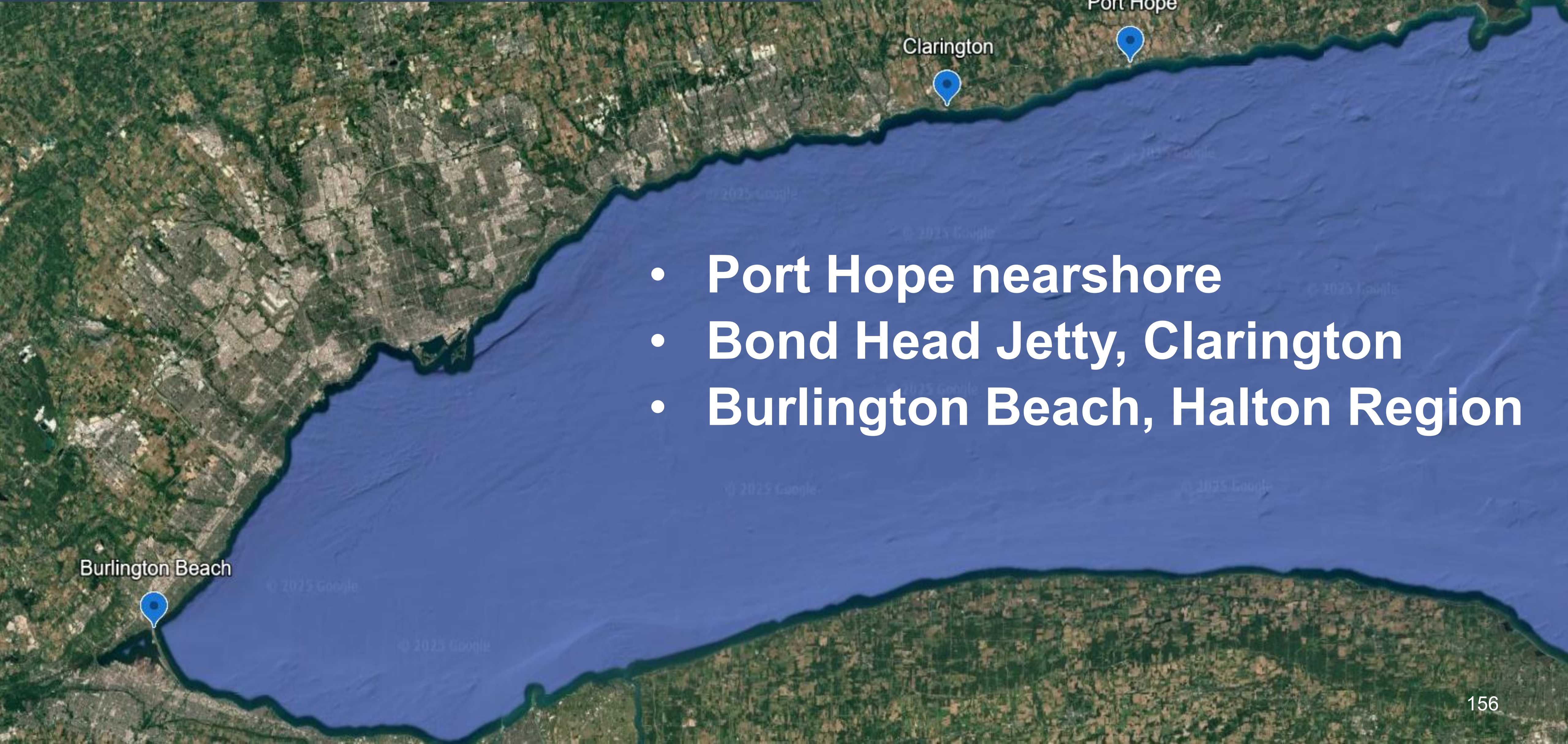
Canada Water Agency | Agence de l'eau du Canada

Thank you!

Stephanie Otto
Canada Water Agency
Stephanie.Otto@cwa-aec.gc.ca

Jody McKenna
Canada Water Agency
Jody.McKenna@cwa-aec.gc.ca

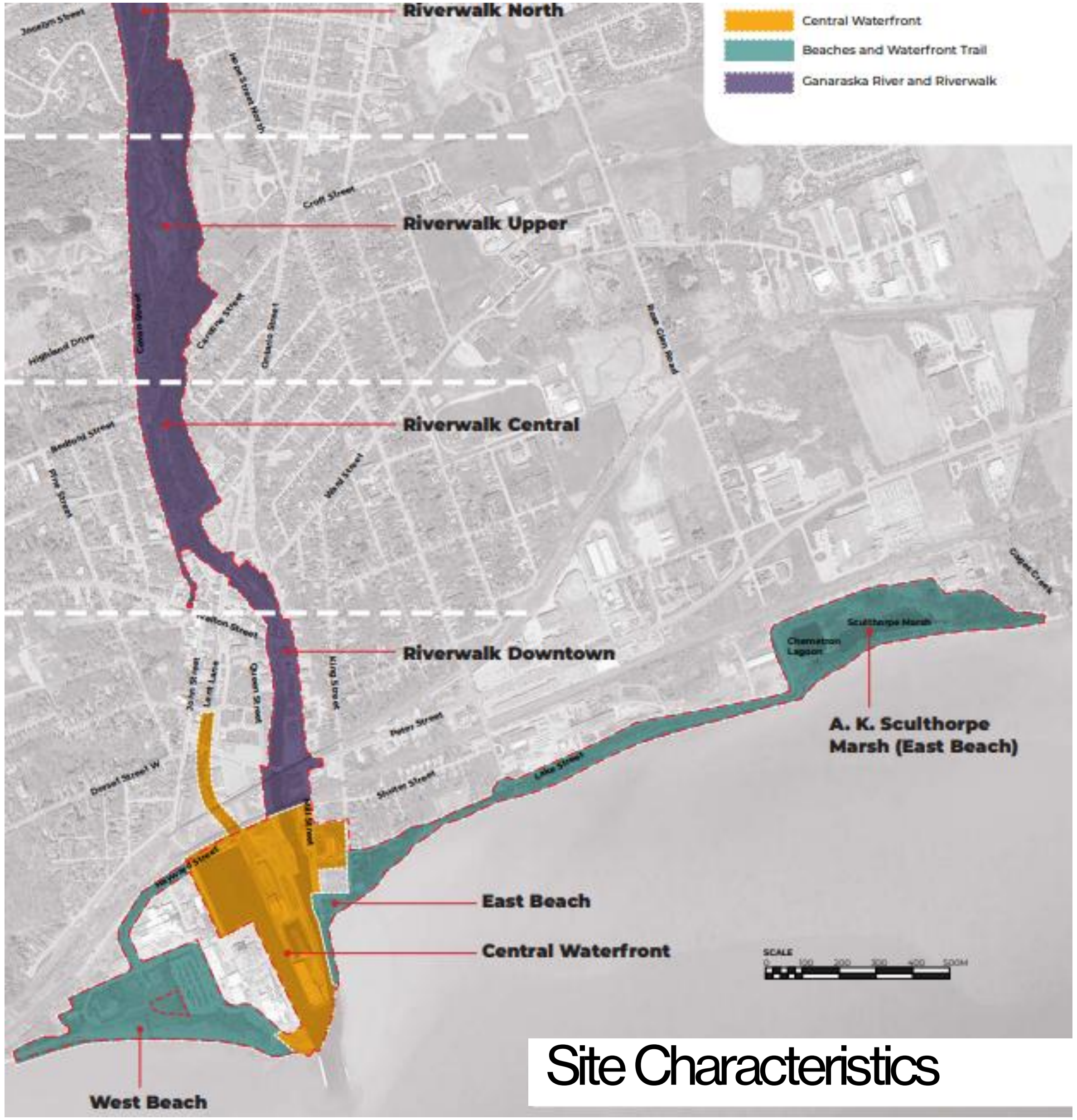
Municipal Spotlights



- Port Hope nearshore
- Bond Head Jetty, Clarington
- Burlington Beach, Halton Region

Environmental restoration fostering sustainable nearshore ecosystems

Restoring Balance: Port Hope Nearshore Revitalization Project



Site Characteristics

Port Hope Waterfront and River

Central Waterfront (Inner Harbour, Centre Pier, and Jetties)

- Examine marina opportunity, public access, and recreational opportunities.
- Improve connectivity and safety while preserving heritage and natural features.

Ganaraska River Corridor

- Extends from Lake Ontario passing through the downtown core
- Includes significant landmarks like Corbett's Dam and Port Hope's historic downtown
- Emphasize ecological protection, public art, Indigenous education, and improved trail connectivity.

West Beach

- Identified as a dynamic beach hazard area
- Address safety, erosion control, and sustainable recreational use while balancing natural preservation with public enjoyment.

East Beach

- Supports passive recreation and environmental education.

Wetland and Barrier Beach

- A sensitive ecological zone requiring protection and restoration
- Promote habitat conservation, controlled access, and nature-based experiences.

Project Overview

Project Purpose

The project addresses establishing and understanding of coastal sediment disruptions to restore shoreline and wetland ecological health.

Technical Evaluation

Comprehensive analysis of sediment sources and sinks within the adjacent littoral cell to inform restoration plans.

Nature-Based Solutions

Future jetty and beach modifications use anticipated to use nature-based approaches to restore sediment flow and resilience.

Project Timeline and Impact

A two-year project aiming for sustainable, environment-friendly solutions benefiting the local and regional shoreline.

Objectives and Rationale

Project Planning and Consultation

A detailed workplan and RFP to be developed to establish project milestones, scope, and stakeholder engagement.

Coastal Process Evaluation

A coastal engineering consultant to develop sediment transport models to evaluate shoreline dynamics and jetty impacts.

Fieldwork and Data Collection

Bathymetry, substrate surveys, and hydrodynamic analysis to be conducted to understand nearshore sediment and wave patterns.

Stakeholder Collaboration and Communication

Engagement with partners and the community will be facilitated through communication schedules and joint technical reviews.

Anticipated Outcomes

Environmental Restoration

The project aims to improve sediment flow and shoreline resilience, restoring barrier beaches and coastal wetlands to support biodiversity.

Strategic Coastal Management

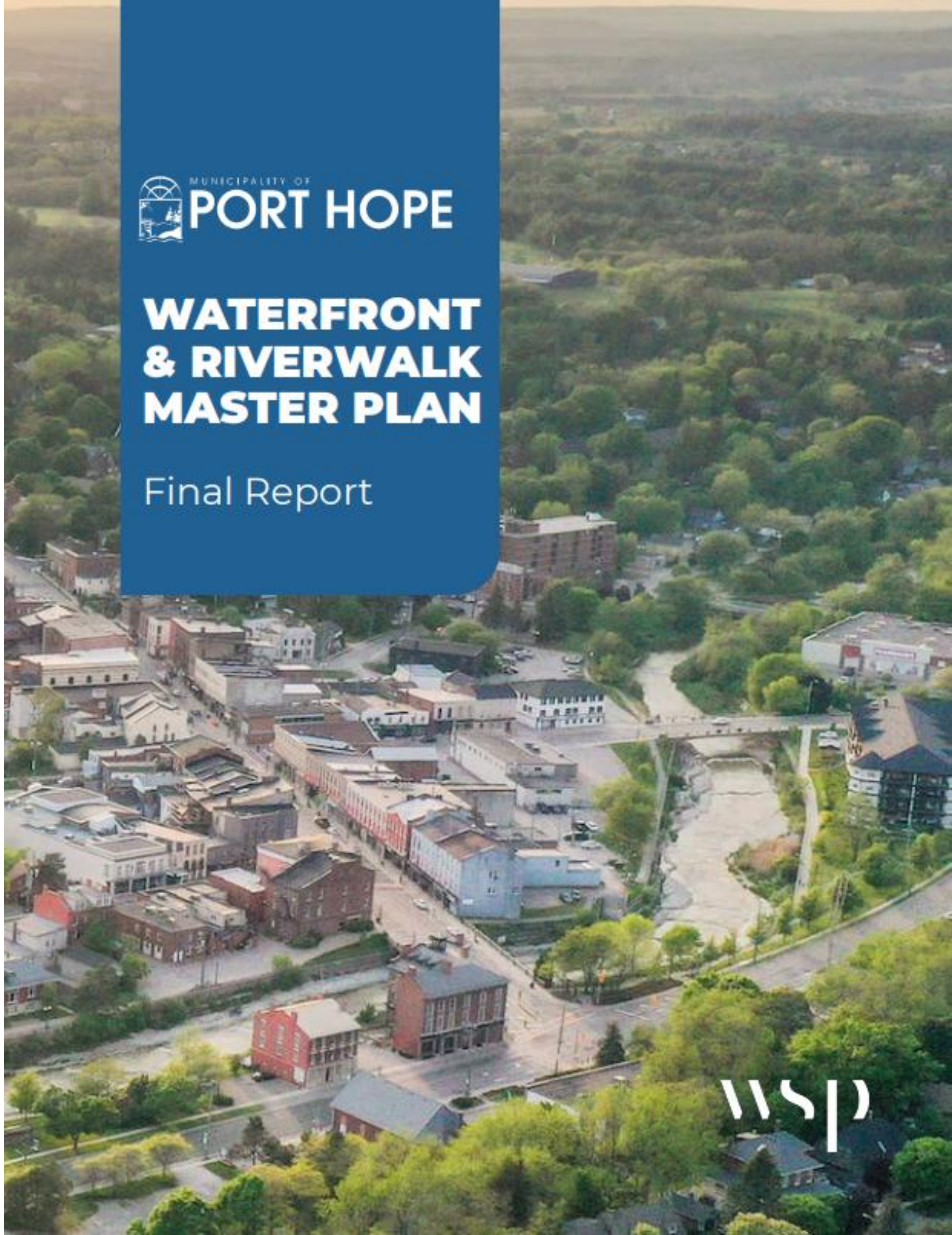
Develops scalable nature-based solutions and shares sediment transport data to aid coastal management across the Great Lakes region.

Knowledge Sharing

Informs approaches for implementation of the Waterfront and RiverWalk Master Plan and other impacts within the reach.

Adaptation

Serves as a model for restoration and adaptation by promoting sustainable sediment management and resilient infrastructure.



Collaboration, Engagement and Future Plans

Collaborative Stakeholder Engagement

The project engages multiple stakeholders for technical reviews, information sharing, and coordinated progress tracking, through support of the funding program.

Community Communication

Communication plans include social media updates, education and awareness.

Advanced Modeling and Design Evaluation

Advanced modeling assesses jetty impacts and potential alterations to improve sediment transport and shoreline resilience. Considerations for how Ganaraska River intersect into the mouth.

Comprehensive Reporting and Knowledge Sharing

Technical reports, presentations, and updates on document findings, lessons, and recommendations for sustainable coastal management.

Project Overview

Bond Head Jetty, Newcastle Marina, Ontario

Objectives

- Understanding the shoreline processes that have caused the erosion of the jetty at Bond Head Park and the adjacent beach.
- Reduce shoreline and jetty erosion
- Enhance the aquatic ecosystem and public use of key waterfront assets
- Include features to improve fish habitat and reduce erosion & drift debris deposition onto the beach
- In-depth review of the existing jetty, including its construction, current level of safety, and potential future impacts if left untreated
- Conceptual design alternatives to repair the jetty and beach area focused on enhancing public utilization and address shoreline and jetty erosion without affecting neighbouring private properties.

Current Members of Technical Team

- Ausenco Engineering – Coastal Engineering Consultant
- Municipality of Clarington
- Ganaraska Region Conservation Authority
- Canada Water Agency

Clarington

Project Team

Ganaraska Region Conservation Authority

- Technical team aiding the Municipality of Clarington with completion of this project
  - Cory Harris – Watershed Services Coordinator
  - Leslie Benson – Water Resources Engineer
- Aided in the review and development of the Request for Proposal for this assignment
- Leslie had previously reviewed and provided comment on the Lakeshore Road Erosion Study prepared by Kilborn Limited on behalf of the Town of Newcastle in 1987
  - Background history on the area
  - Completed Field Inspection of the area in 1987
  - Noted key components to addressing these erosion issues are slope stabilization and toe of slope protection measures based on the fluctuating lake levels for the 2 through 100-year return periods.

KILBORN

Kilborn Limited/2200 Lake Shore Boulevard West, Toronto, Canada M8V 1A4. Telex: 06-967531, Tel: 416, 252-5311

March 13, 1980

File No. 1203-15

Ganaraska Region Conservation Authority
56 Queen Street, P.O. Box 328
Port Hope, Ontario L1A 3W4

Attention: Mr. Jim Rowat
Resources Manager

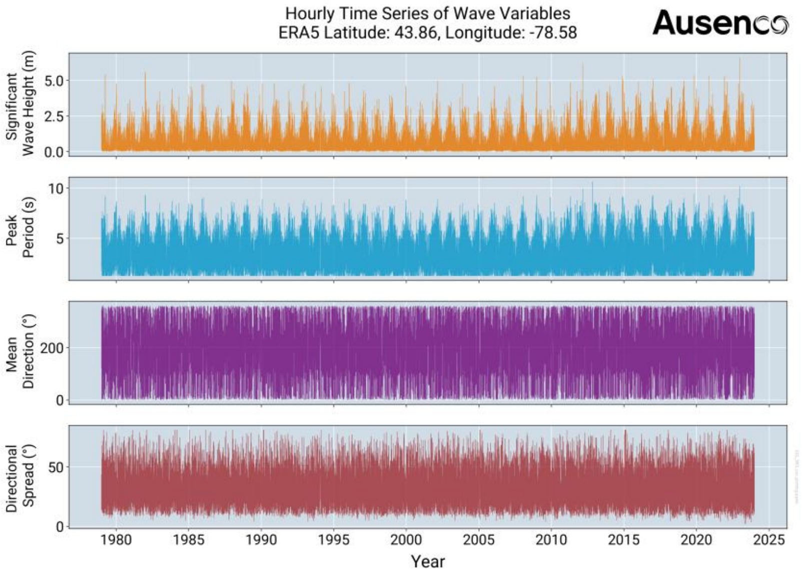
Reference: Lake Shore Road Erosion Study
Town of Newcastle

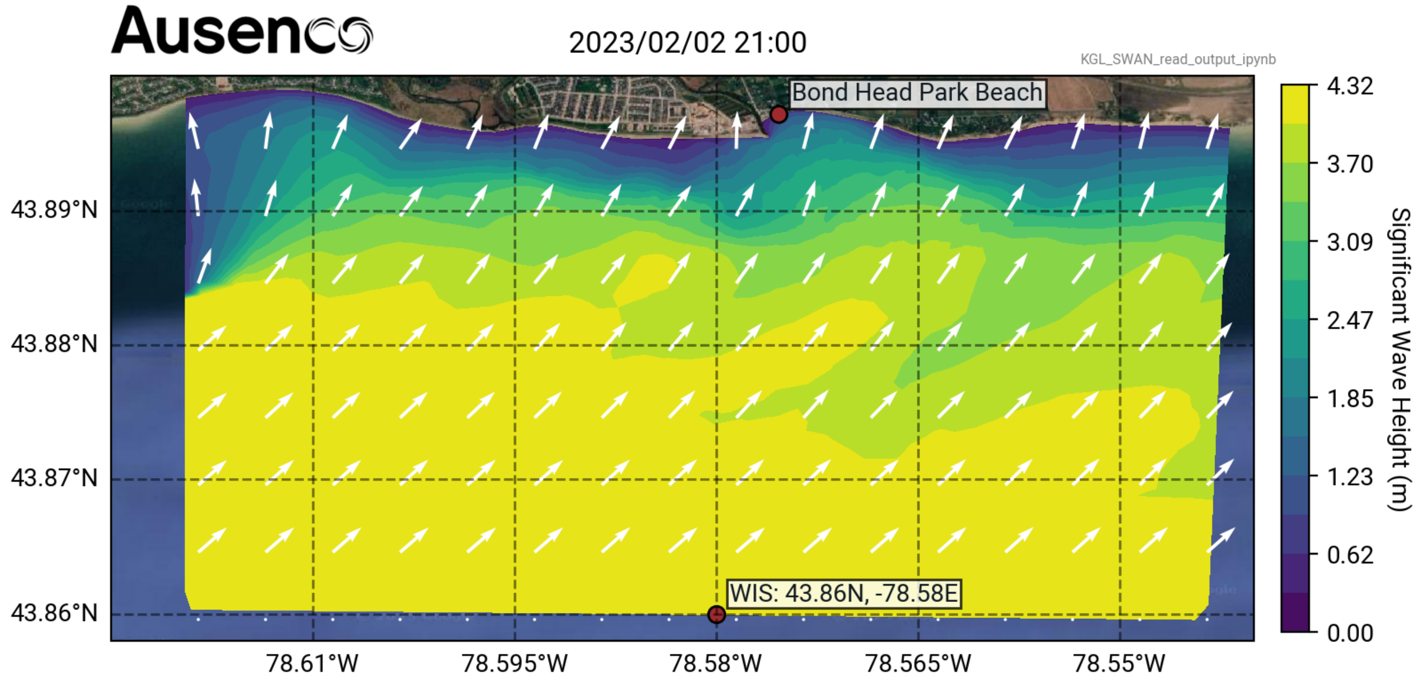
Project Team

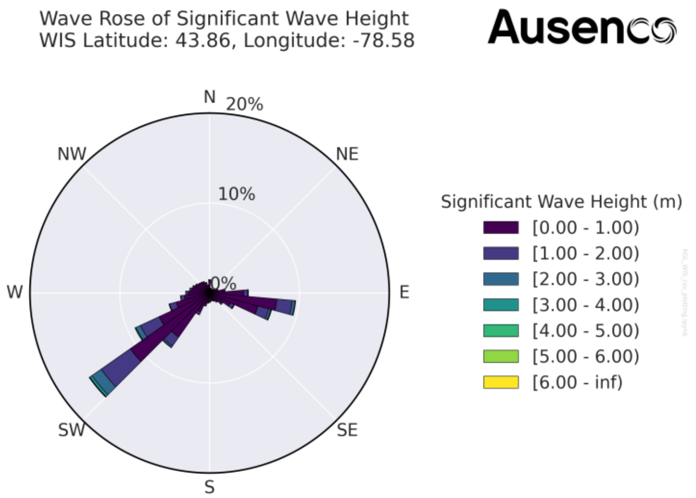
Ausenco Engineering – Coastal Engineering Consultant retained by Clarington

Data Analysis Completed to Date

- Mapped the offshore wave data and how waves change throughout the year including height of the waves & their peak periods
- Mapped offshore wave directions & heights
- Created boundary conditions based on offshore wave data and local bathymetric and topographic surveys
- Modelled operational and extreme case scenarios to ensure any armouring proposed would remain stable during all events







Clarington

Challenges

Main Barriers

- Bathymetric and Topographic Data Survey Delay
  - Consultant received bathymetric and topographic survey data from subconsultant November 7th
- Condensed timeline – Project was awarded July 2025
  - Project was awarded July 2025
  - Issued for Tender Design scheduled for Completion March 2026 in time for Year-End Reporting

Complexity

- Looking into nature-based solutions to reduce the hardened shoreline approach while ensuring the extreme scenarios are addressed

Resources

- Great Lakes Freshwater Ecosystem Initiative

Clarington

Reflection

Lesson Learned

- There is no such thing as too much communication between the project team. The fastest way to end up delaying a project is when not everyone is on the same page.

Next Steps

- Developing the sediment transport model to understand the preferred nature-based solution
- Exploring the reduction of armouring to increase nature-based solutions based on the findings of the sediment transport model
- 30% Concept Design – December 10th, 2025
- 75% Concept Design – February 9th, 2026
- Issued for Tender Drawing Package & Technical Specifications for Shoreline Remediation – March 30th, 2026

Clarington

Burlington Beach Regional Waterfront Park

Great Lakes Freshwater Ecosystem Initiative

Annual Coastal Symposium

Canada

Halton REGION

CITY OF Burlington

Conservation Halton

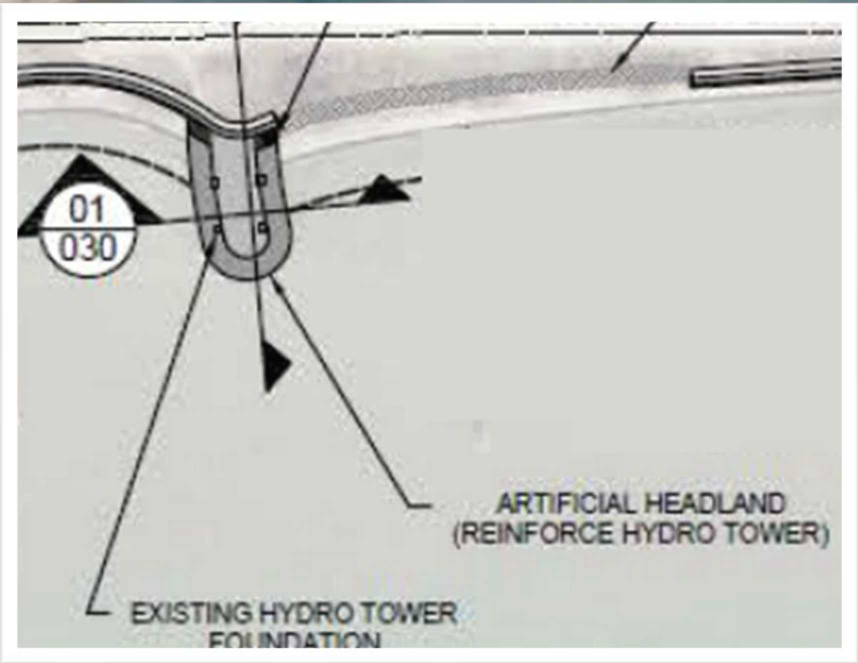
Burlington Beach: Introduction

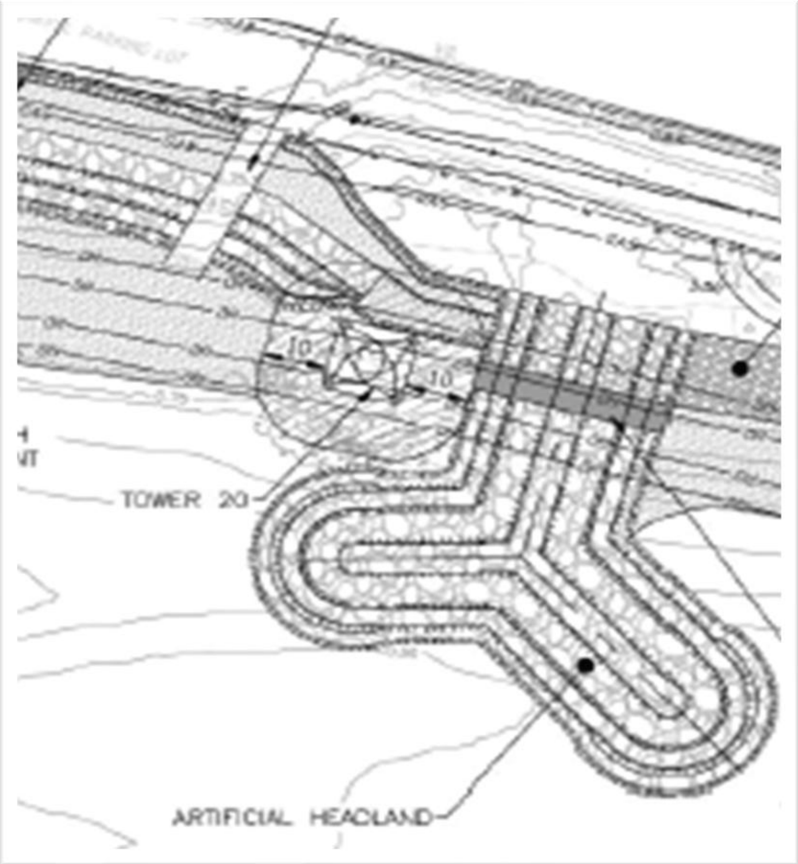
Burlington Beach: Challenges

Burlington Beach: Successes

Strong Partnerships

Burlington Beach: Reflection





Thank You

Session 3 Panel:

Strengthening Partnerships for Great Lakes Coastal Resilience

Evan Skinn,
Lake Huron Coastal Centre

Jamie Davidson,
Central Lake Ontario Conservation Authority

Jody McKenna,
Canada Water Agency

Namrata Shrestha,
Toronto and Region Conservation Authority

Long Point, Ontario | Credit: Declan P

Thank you for attending!

Protecting and Restoring Critically Important Great Lakes Coastal Areas

Great Lakes Freshwater Ecosystem Initiative (GLFEI) Second Annual Symposium

For questions, please contact Dylan.Hrach@cwa-aec.gc.ca or Sharon.Lam@trca.ca