



Cyanobacteria Predictions and Mitigation

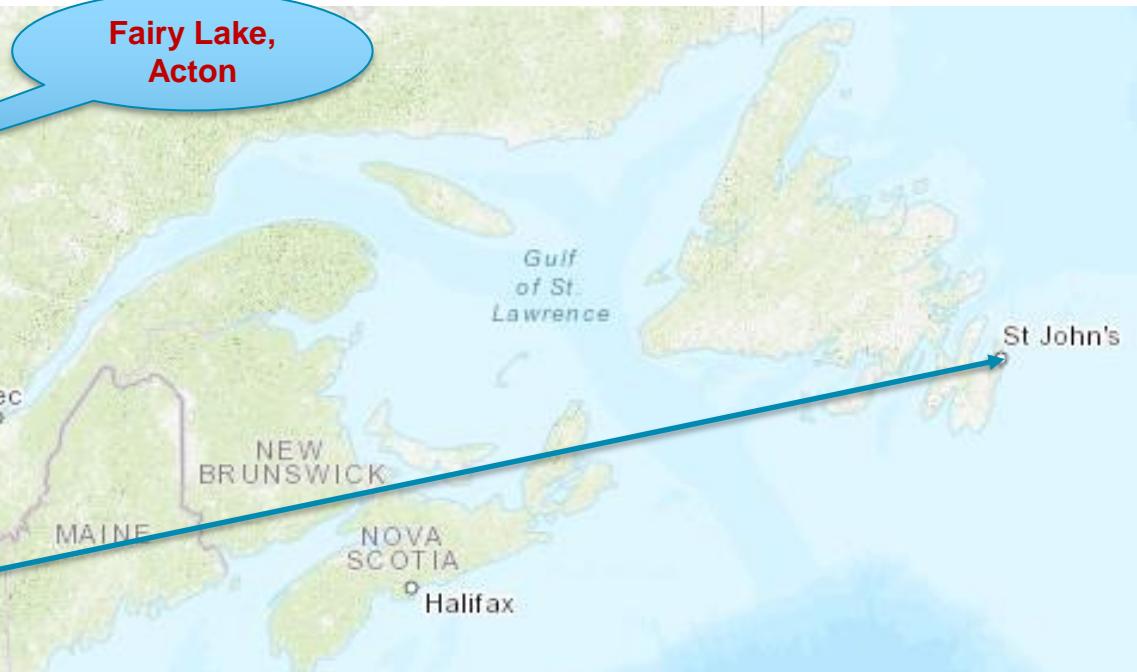
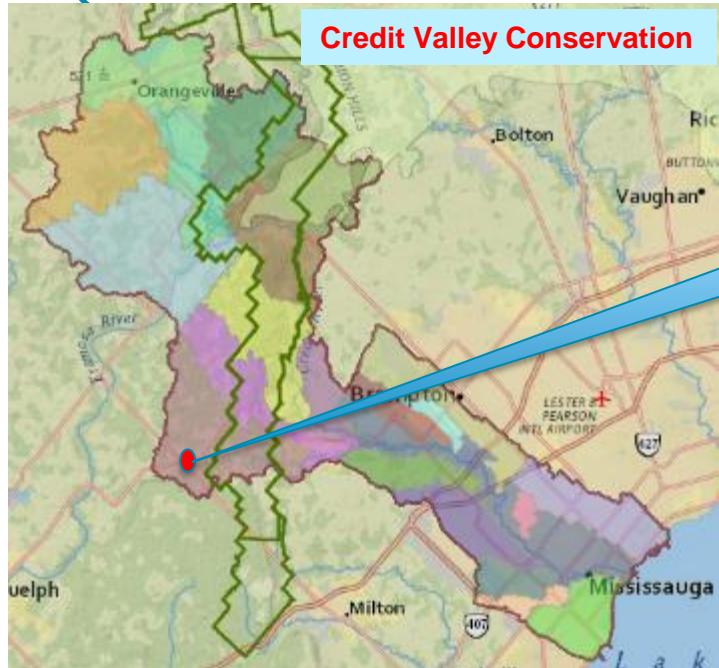
Fairy Lake Case Study

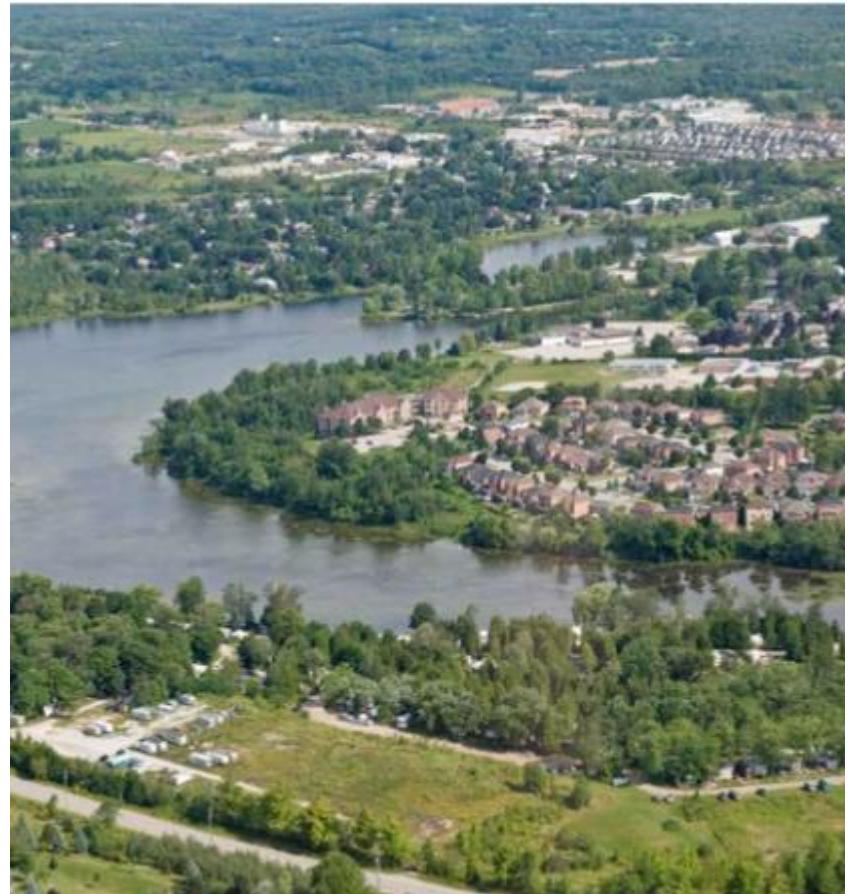
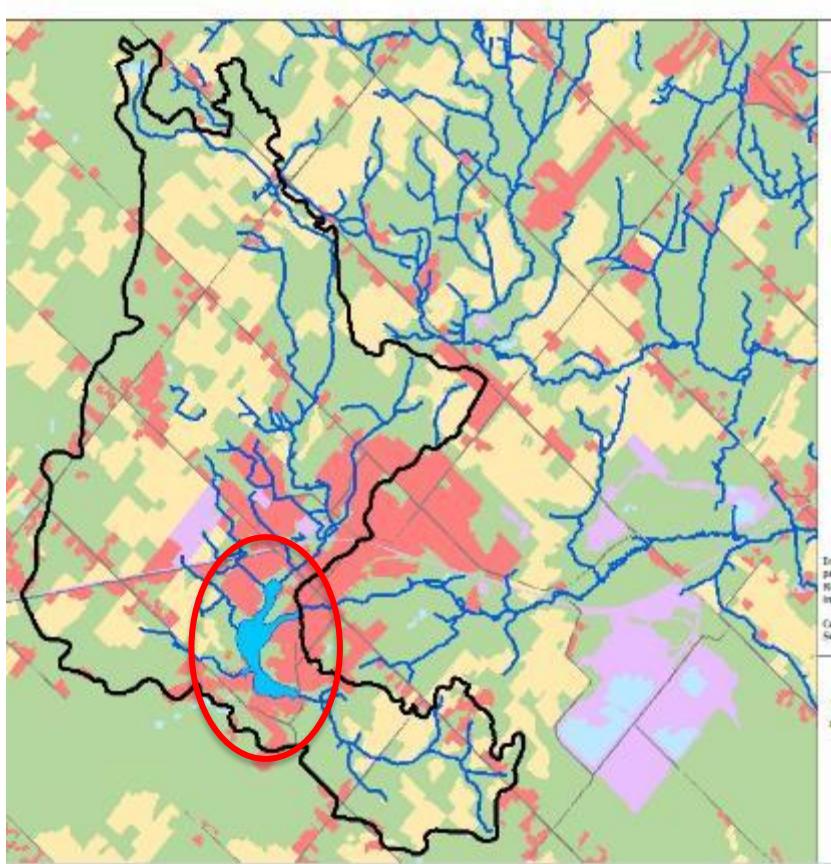
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Sr. Engineer, Water Quality

Real-Time Water Monitoring Workshop, NL
November 7th – 8th, 2023



About Credit Valley Conservation (www.CVC.ca)





Fairy Lake, Acton

A Provincially Significant Wetland



Inland Lakes A Popular Recreational Venue

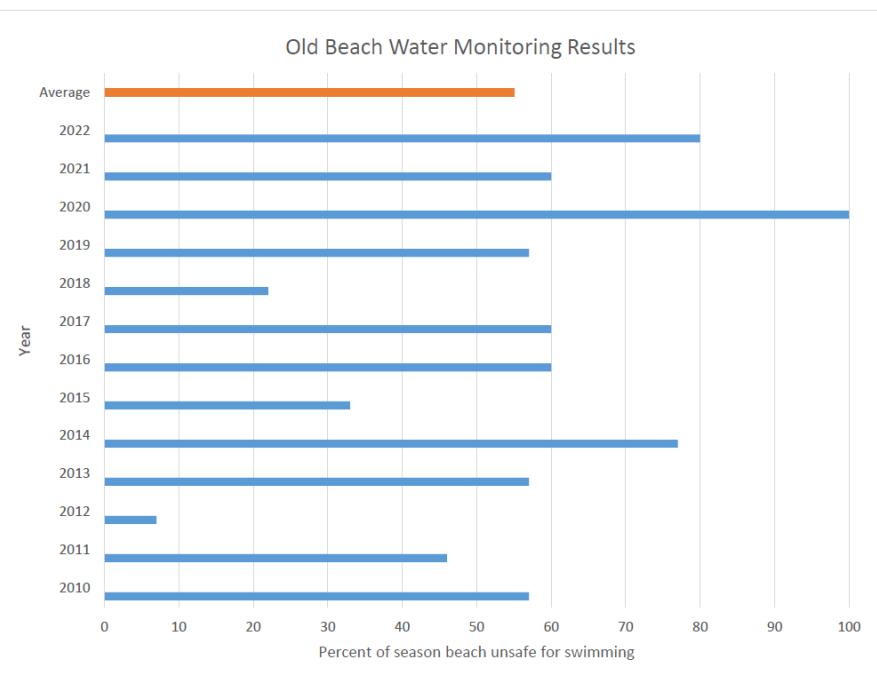
“Beach closures” E. coli and Cyanobacteria



Concern of the Local Authorities - Prediction and Mitigation -



Stats of Beach Closures



Cyanobacteria and Microcystin				
Date	Time of Sampling	Cyanobacteria Oberserved (Y/N)	Microcystin Levels (µg/L)	Anatoxin-A (µg/L)
9/6/2018	18:35	Y	0.73	0.05
10/25/2018	11:01	N	0.1	0
5/29/2019	13:03	Y	0.15	0.2
8/6/2019	10:15	N	0.1	0.2
8/20/2020	17:35	N	0.1	0.2
9/24/2020	14:54	Y	0.11	0.2
8/24/2021	16:15	Y	1.08	0.2
8/24/2021	16:30	N	0.16	0.2
08/29/2023	13:08	Y		
10/18/2023	19:30	Y	1.72	0.2

Study Partners



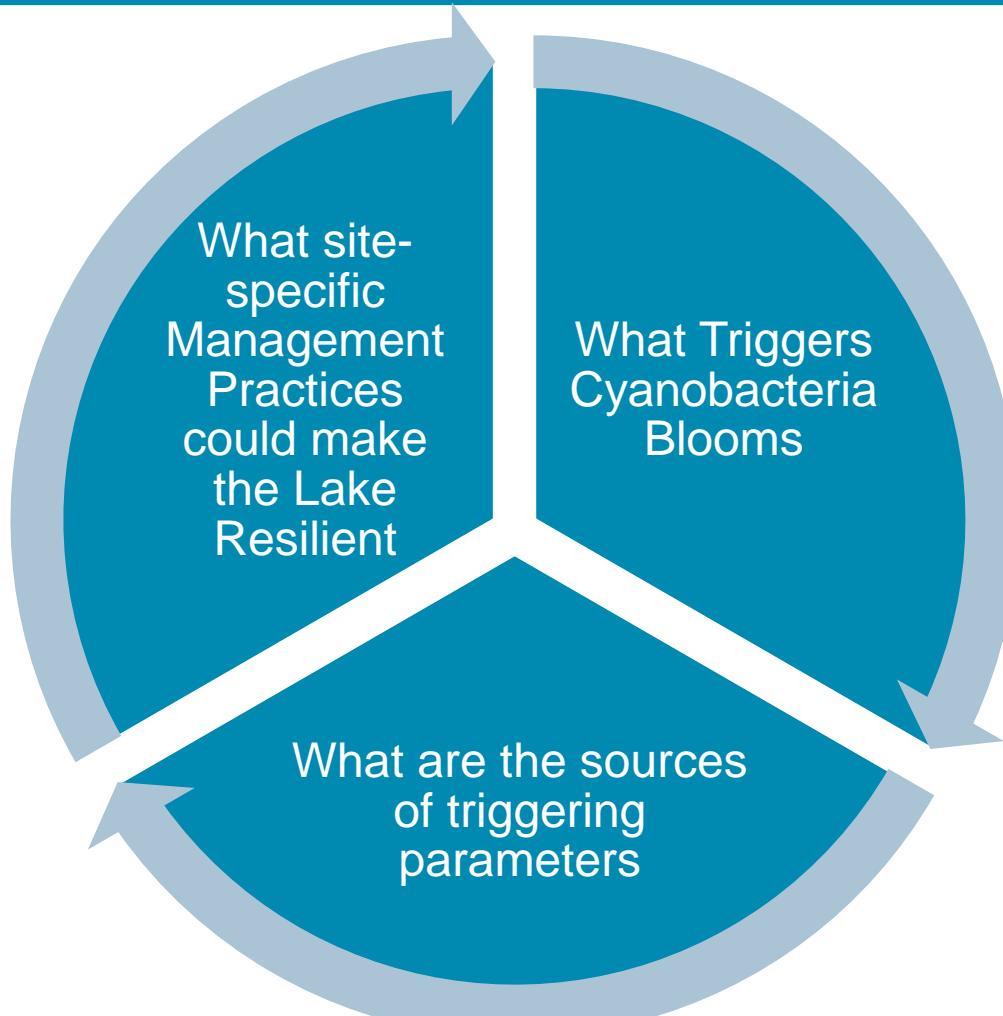
Credit Valley
Conservation
inspired by nature



NSERC
CRSNG

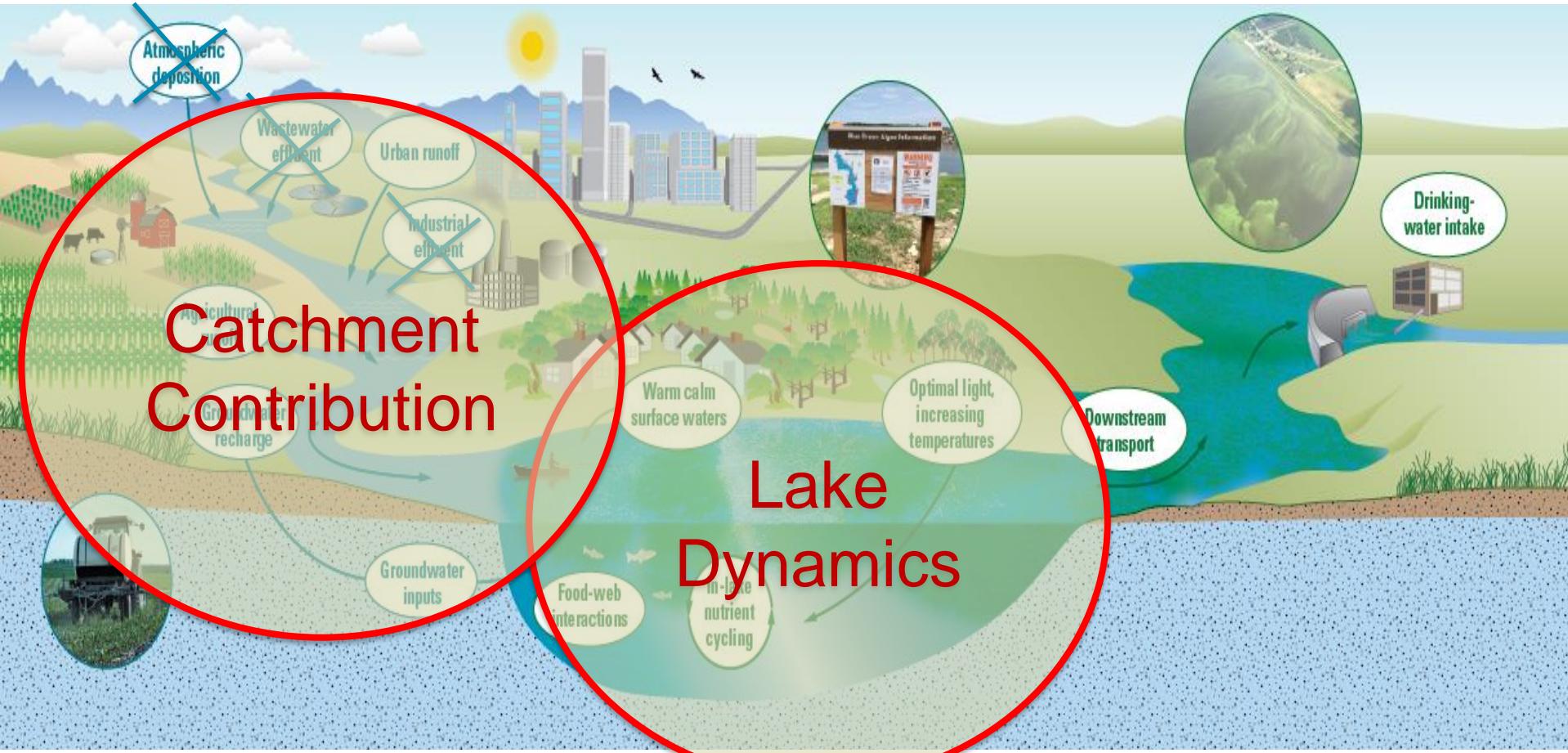


Study Objective



Focus only on Plankton Cyanobacteria

Modeling and Monitoring



Monitoring: Traditional and Non-traditional

Water Chemistry



Water Temperature



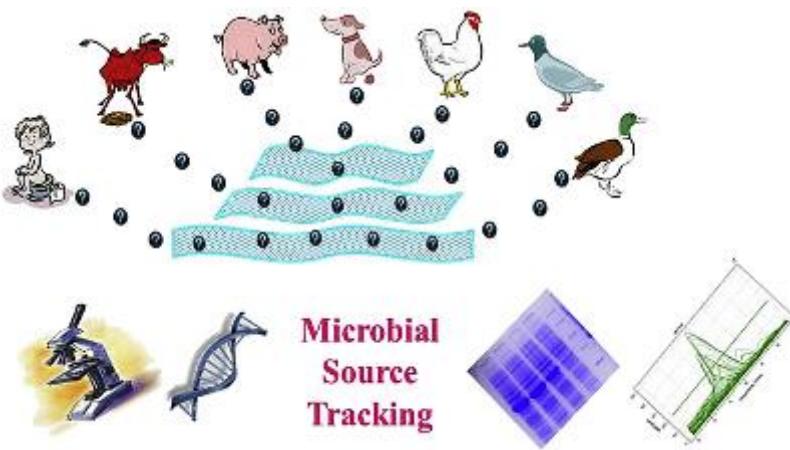
Camera



e-DNA



Microbial
Source
Tracking



What Did The Camera Capture



STEALTHCAM 10:55AM 09/07/22 28C BEACH CAM

Staff and Students Enjoy Monitoring



**Monitoring kicked off with something unique
– Drone based lake sampling-**



Escherichia Coli (cfu/100ml)



Wet Weather

Dry Weather

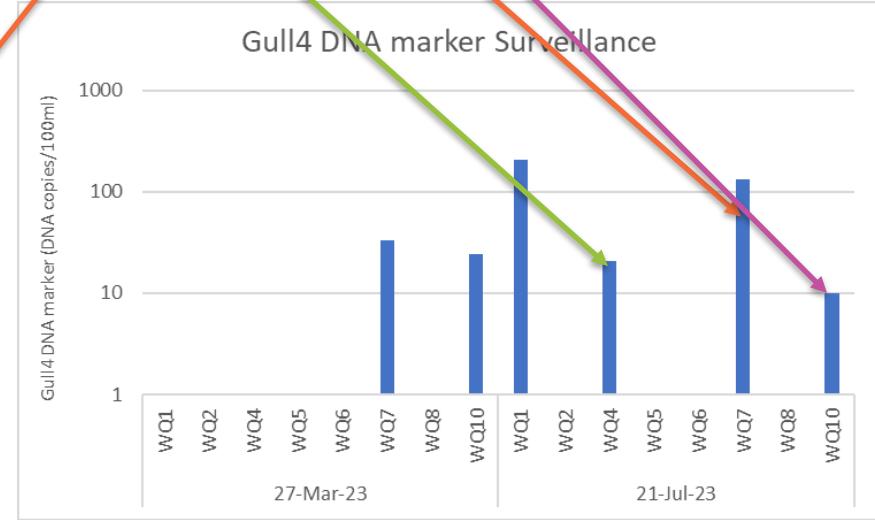
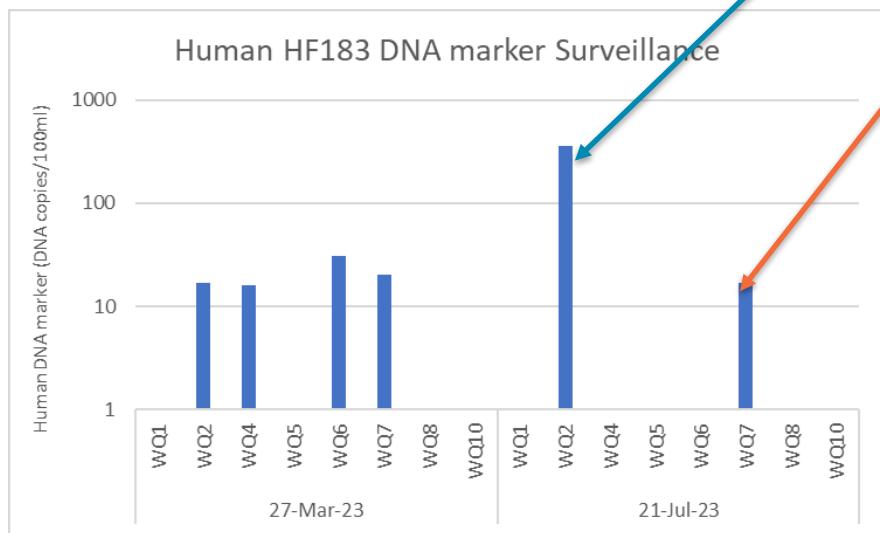
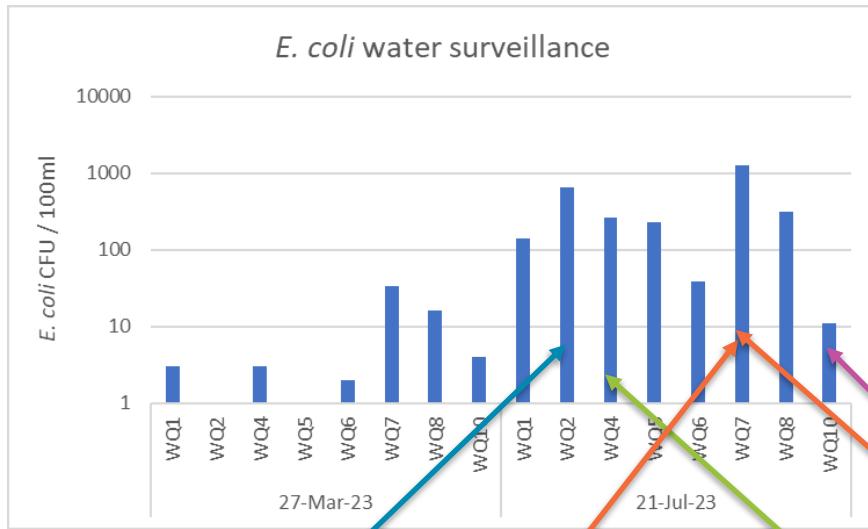
Total Phosphorus (mg/L)



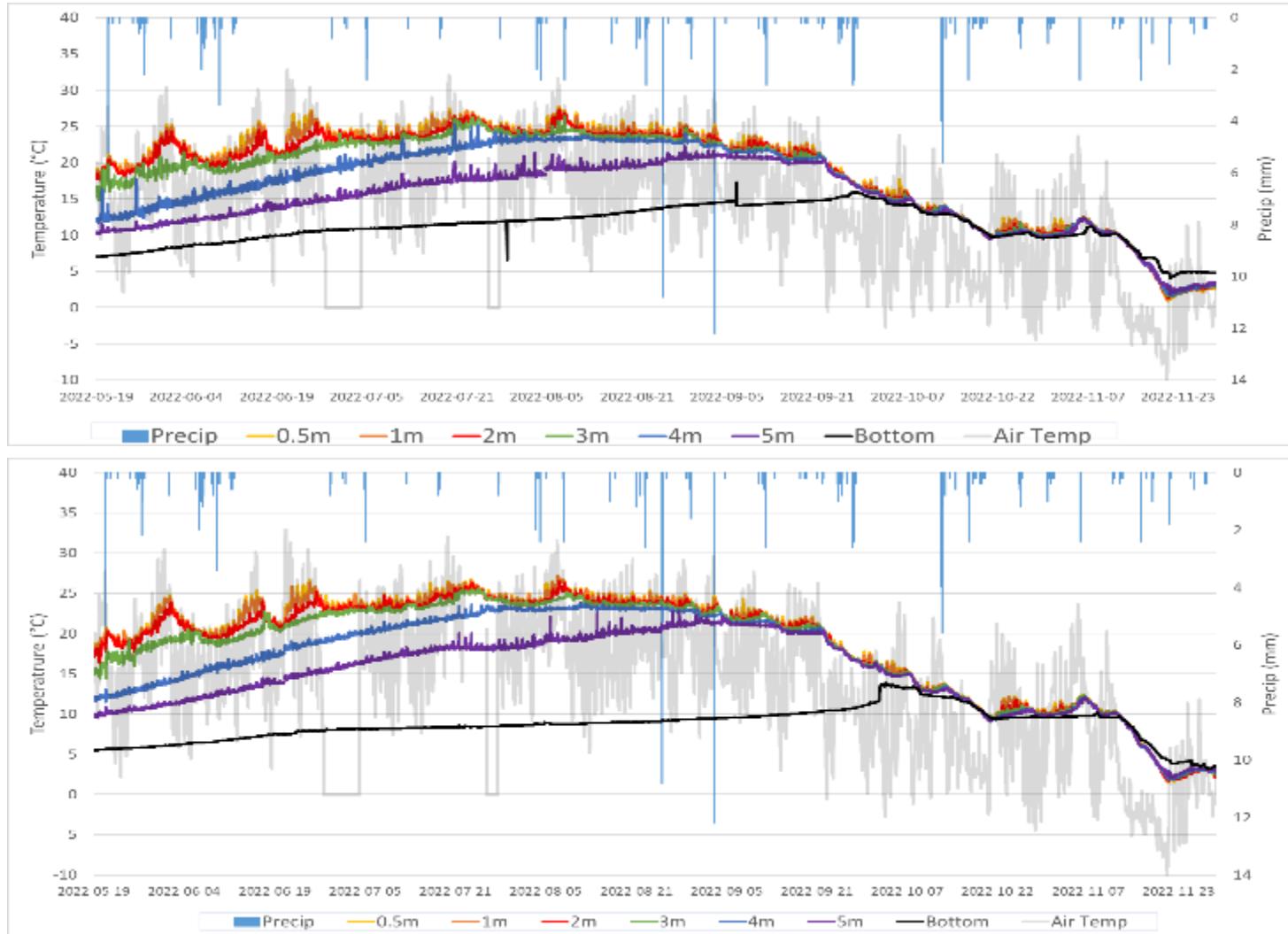
Wet Weather

Dry Weather

What did Microbial Source Tracking (MST) tell us

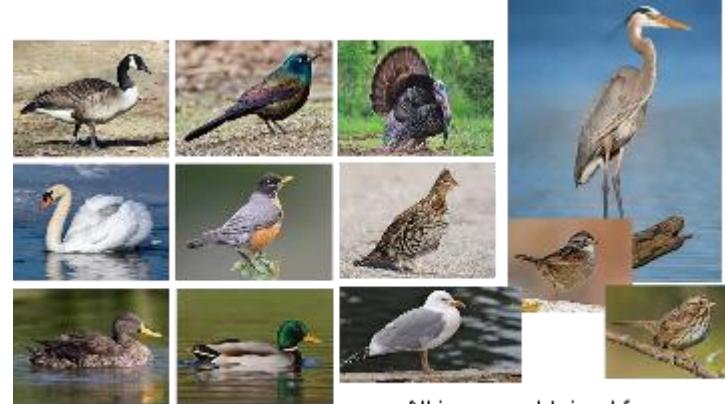


Temperature mooring data

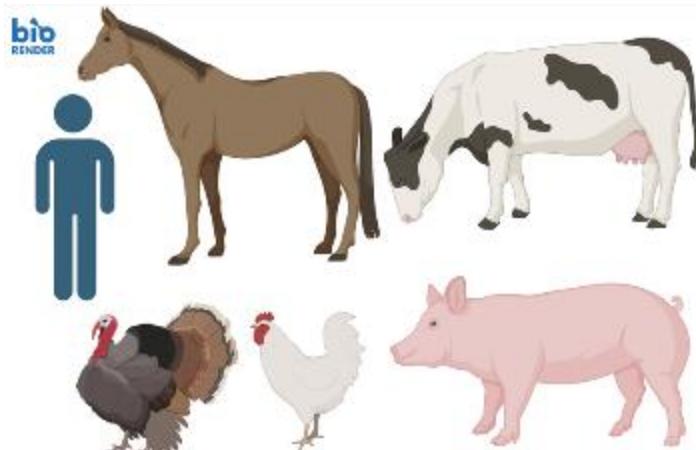


Fairy Lake: eDNA Confirmation

Species	Last Record	Comments	Detected with 12S?	Detected with COI?
Banded Killifish	2012	Likely still present	No	Yes (sl <1%)
Black Crappie	2022	Report from local naturalist of seeing an angler catching them	Yes	Yes
Brown Bullhead	2011	Likely still present	Yes	No
Common Carp	- 2010	Report from angler; likely still present	Yes	No
Golden Shiner	2011	Current status unknown	Yes	Yes
Largemouth Bass	2011	Likely still present	Yes	Yes
Northern Pike	2011	Likely still present	Yes	Yes
Pumpkinseed	2011	Likely still present	Yes	Yes
Rock Bass	2011	Likely still present	Yes	Yes
Yellow Perch	- 2010	Caught by an angler (LGL staff person) ice fishing; current status unk	Yes	Yes



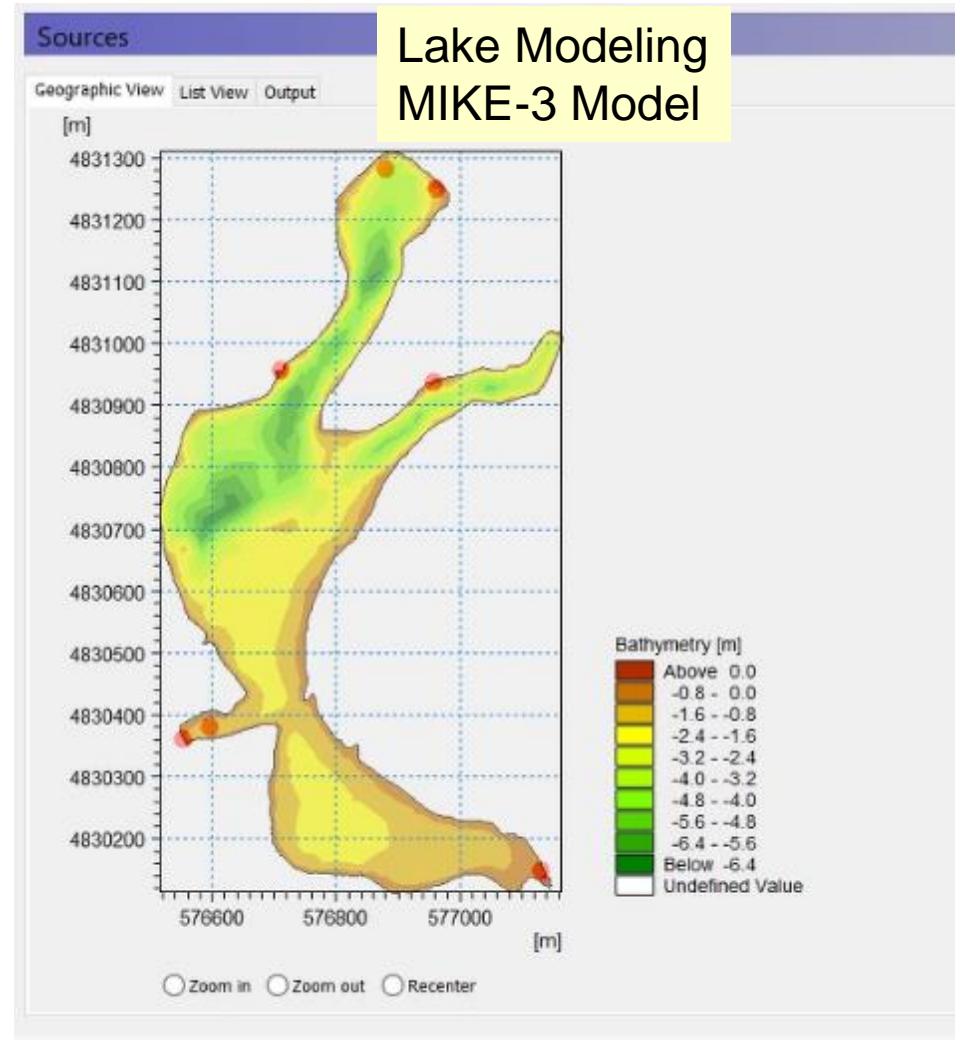
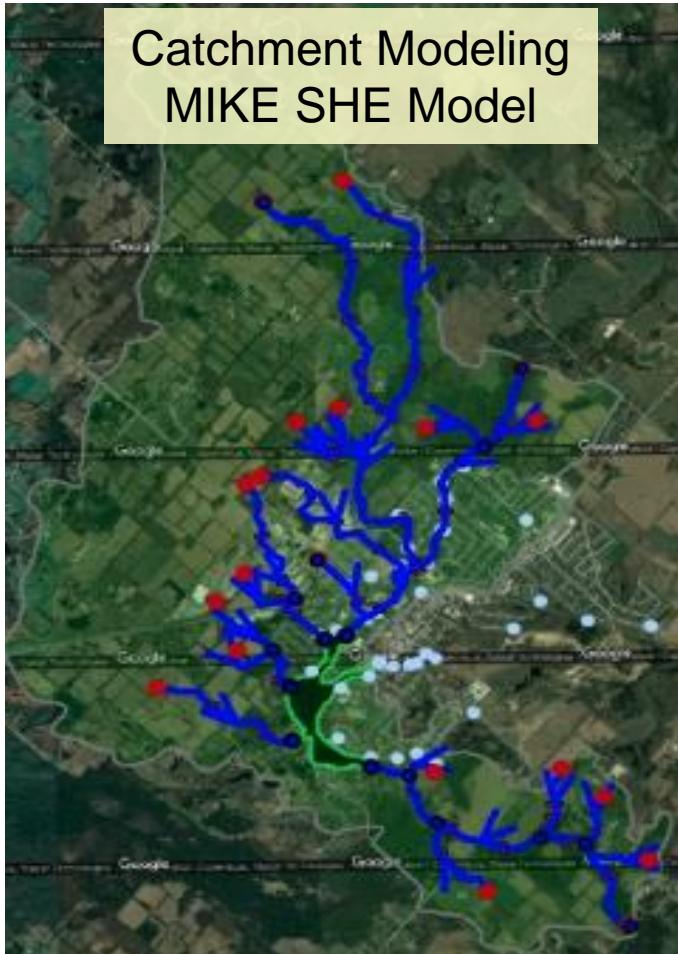
All images obtained from:
[All About Birds](#)



Modeling

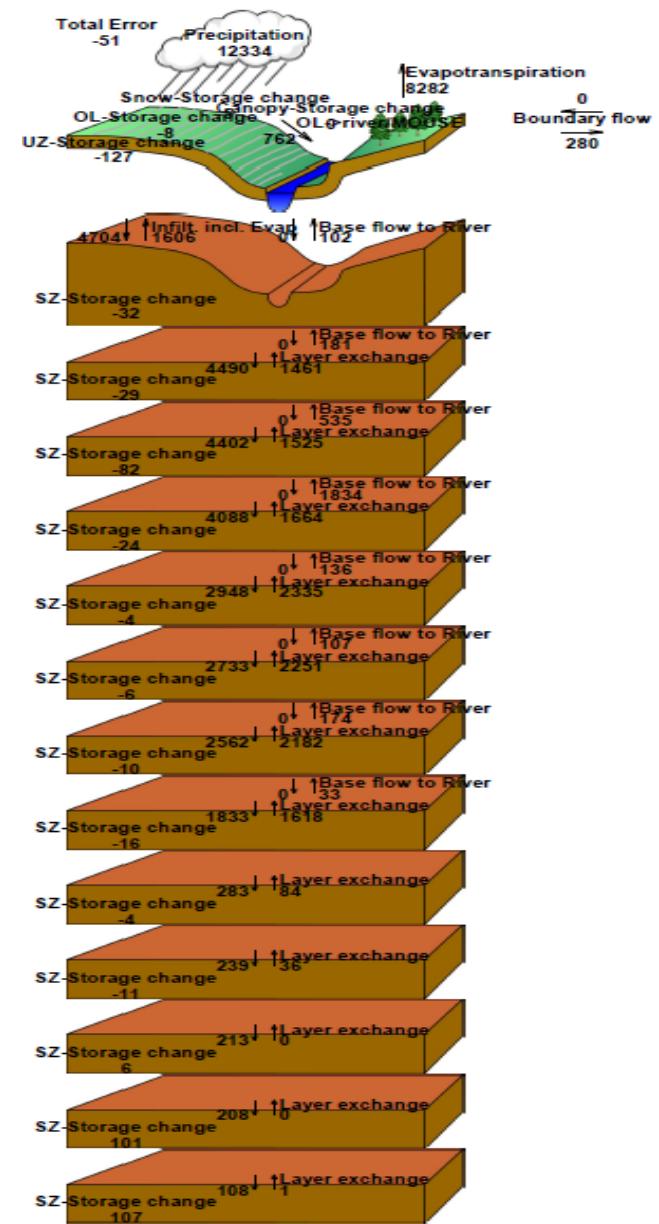
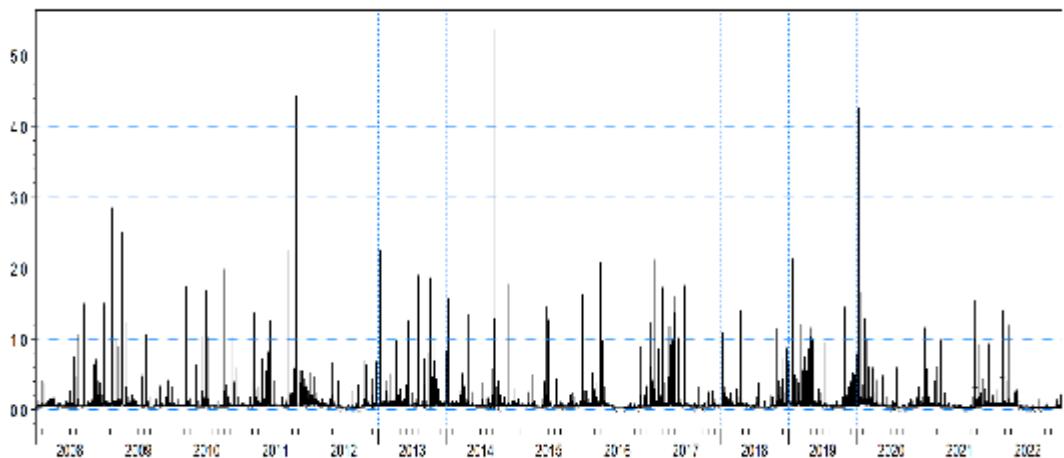


Catchment and Lake Models Setup

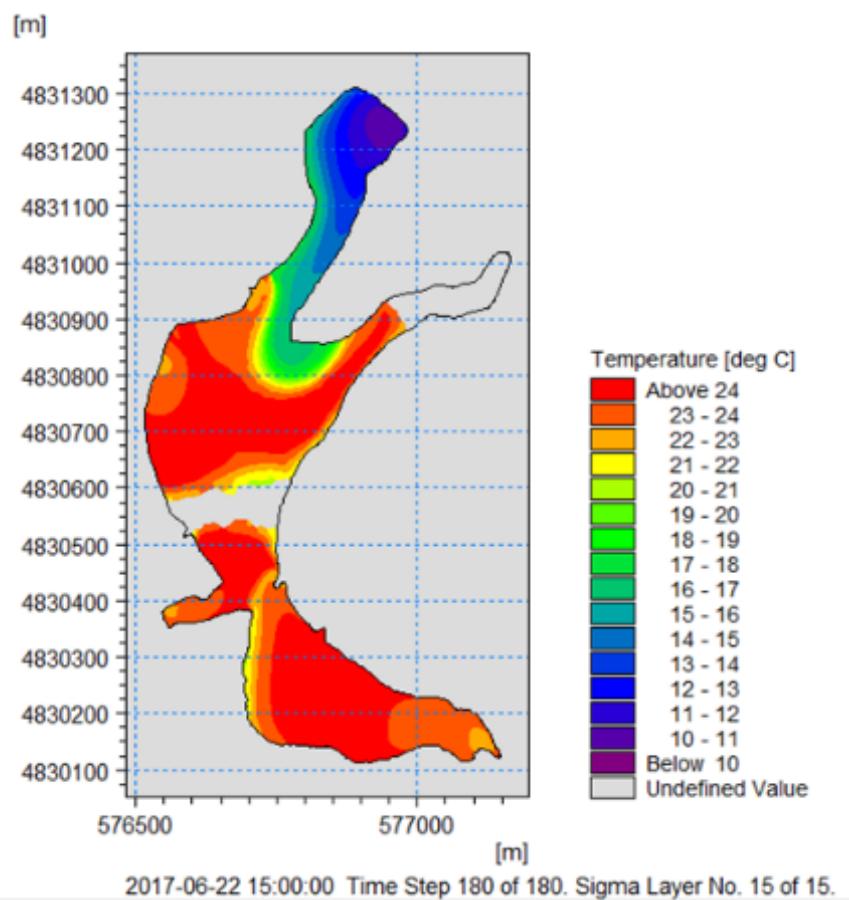
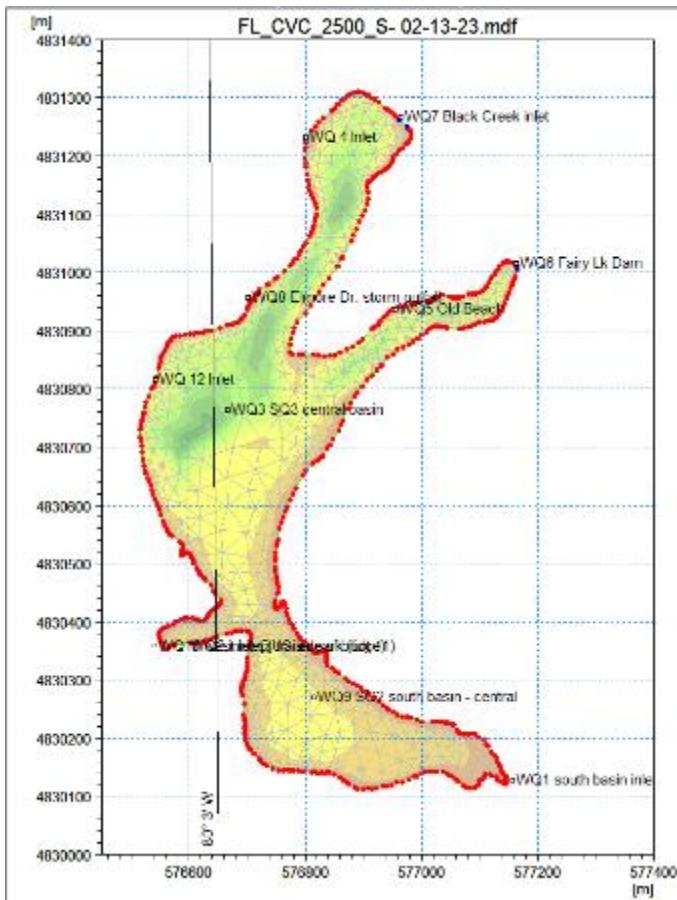


Catchment Modeling: Flow Calibration and Water Balance

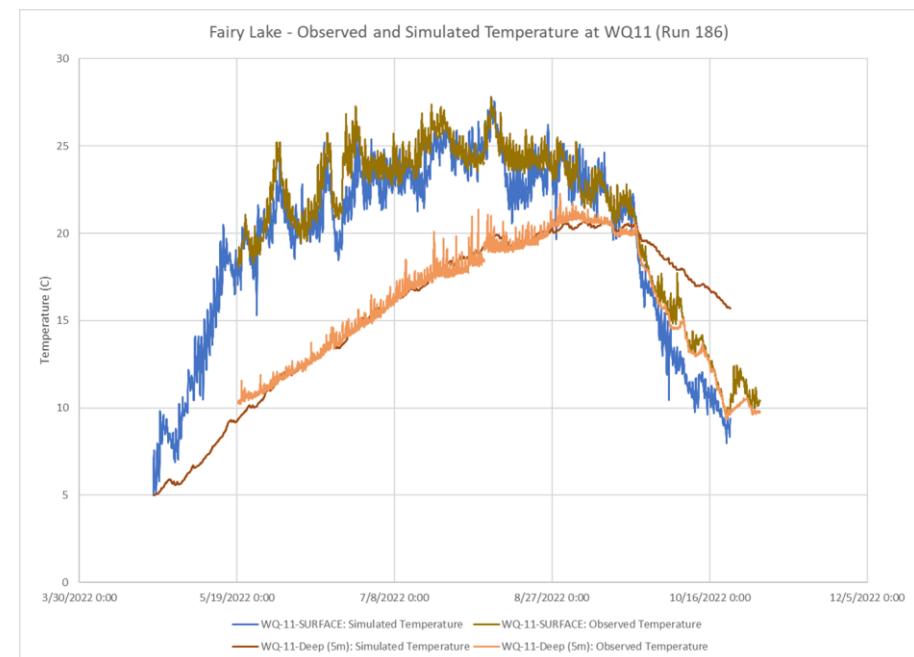
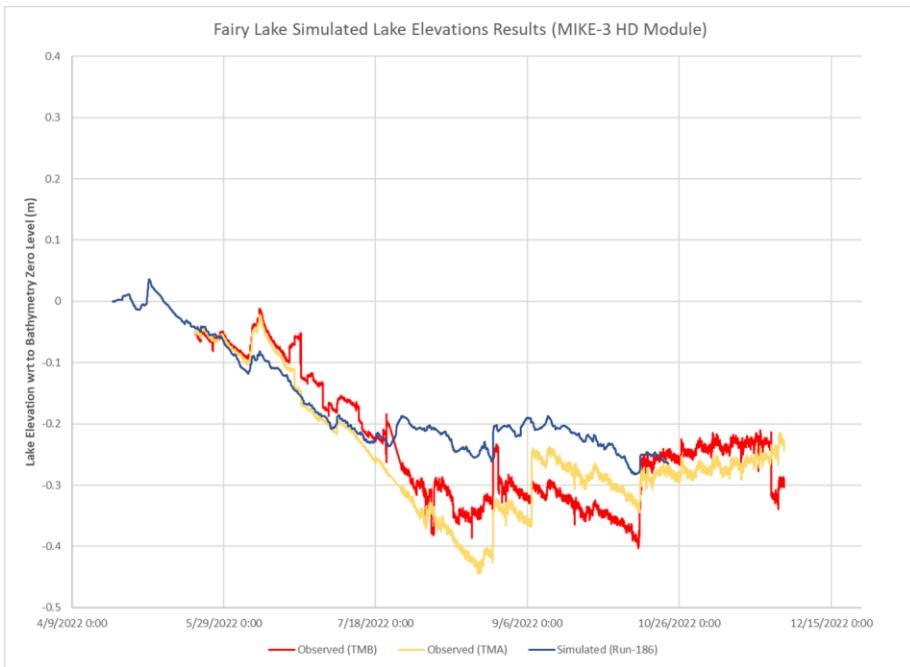
SWD (mm) | m³/s
TWI (TWI) | m³/s



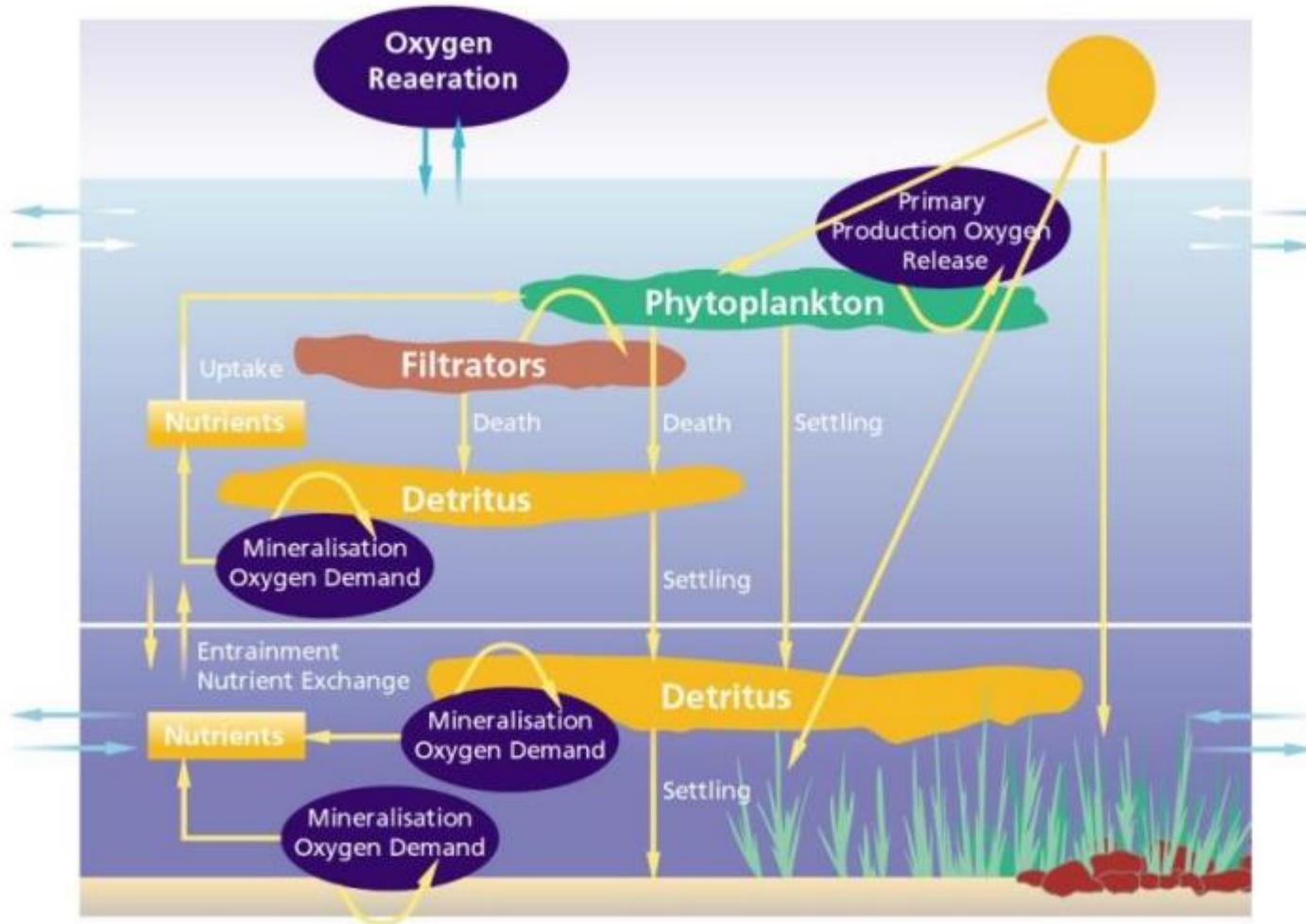
Lake Modeling: Model Setup and Temperature Simulation



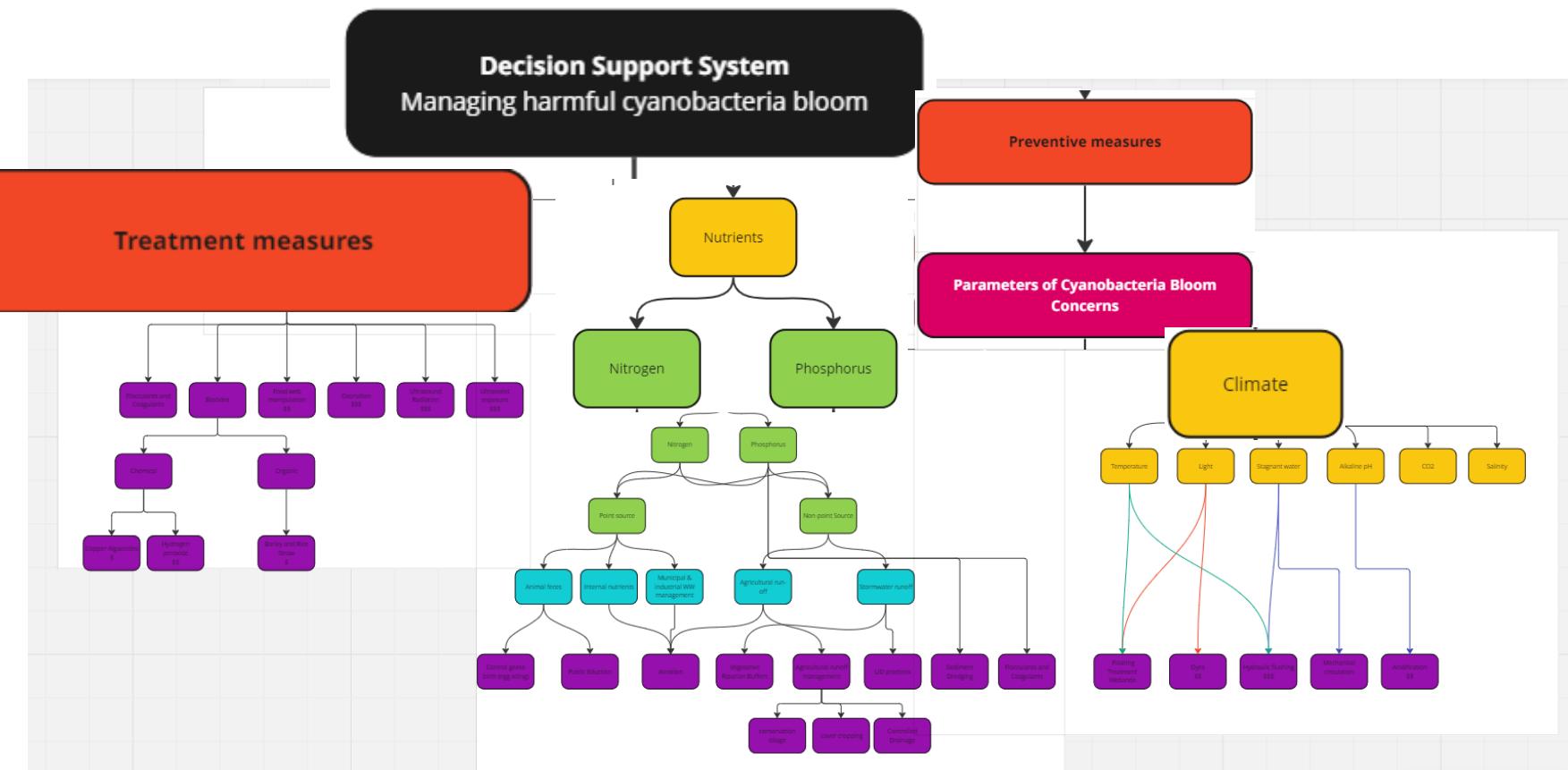
Lake Level and Temperature Simulations



Cyanobacteria Modeling- MIKE-3 + Ecolab



Final Product: Decision Support System



Simulation Complexities leading to Mitigation Challenges

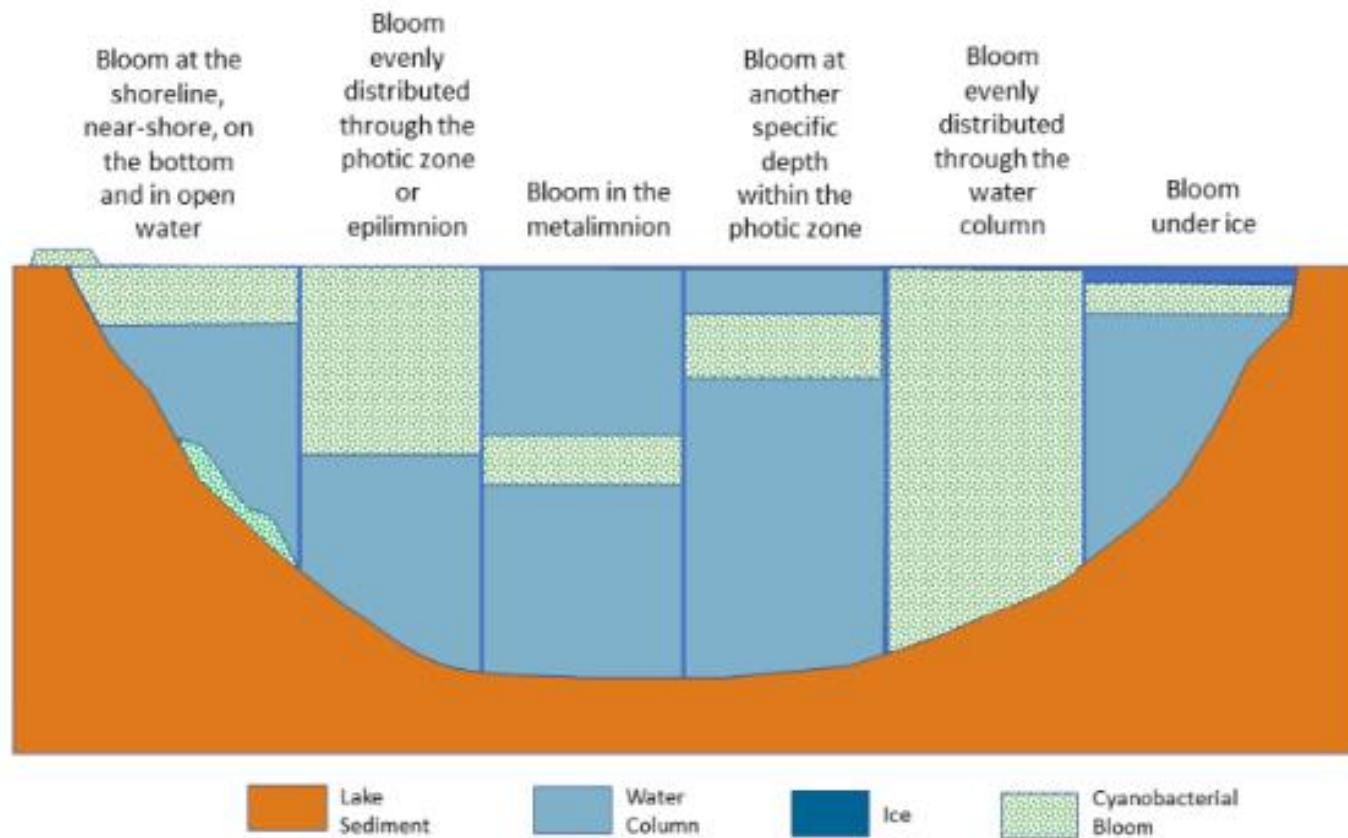


Simulation Challenges leading to Mitigation Efforts

- Combinations \propto list of parameters of concern
 - Two nutrients, water temperature = 6
 - + clarity = 24
 - + rain and drought = 720
 - + dissolved oxygen = 5040
 - 10 parameters = 3628800

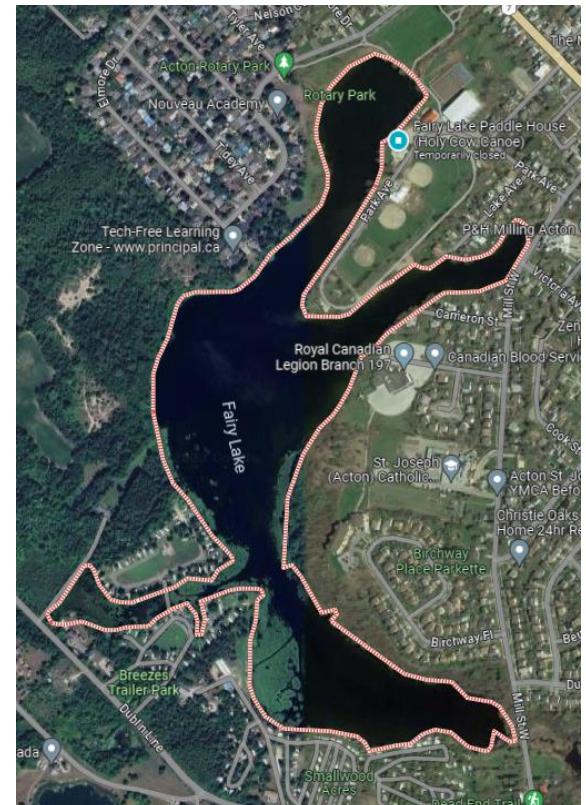


Cyanobacteria: Where, When, and Howmuch



Lake modeling Challenges

- Hydrodynamics: Lake shape
- Water temperature: Stratification
- Water quality (inflow and in-lake nutrients dynamics)
- Competition with other forms of algae and other aquatic life



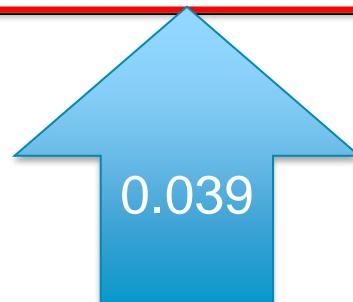
What is being monitored and what can be modelled and what is the correlation?

- Cyanobacteria vs Microcystins vs Chlorophyll-a



This will shock you, but it is reality

	UNITS	WQ1 SOUTH BASIN	MU	RDL
Inorganics				
Total Kjeldahl Nitrogen (TKN)	mg/L	0.75	+/- 0.12	0.10
Dissolved Phosphorus	mg/L	0.022	+/- <RDL	0.004
Total Phosphorus	mg/L	0.019	+/- <RDL	0.004



**We need data across Canada that is
consistently collected**



ARE YOU IN?

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questions?

