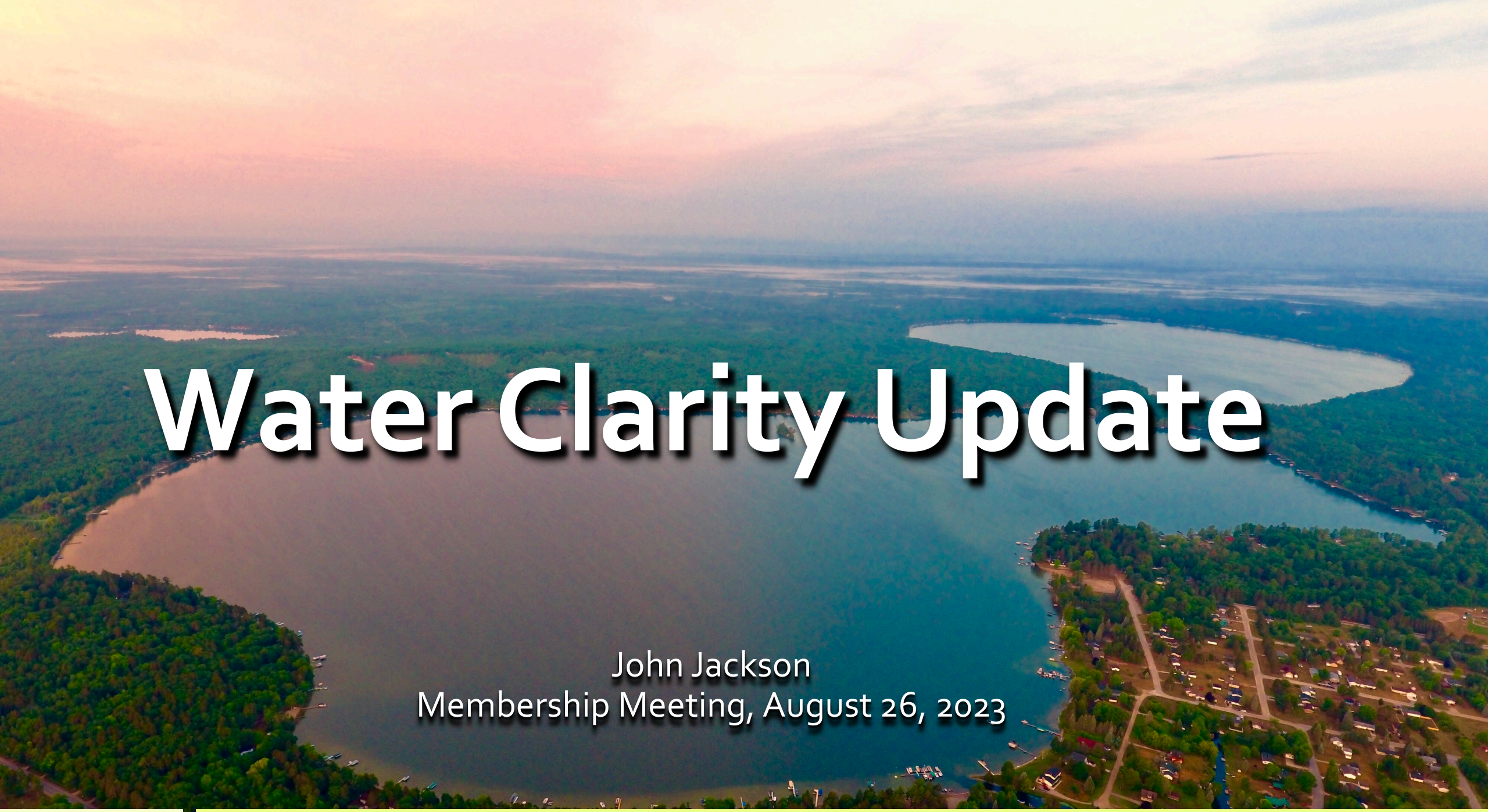


Water Clarity Update

John Jackson
Membership Meeting, August 26, 2023

What is the Cooperative Lakes Monitoring Program (CLMP)?

- ✓ It responsible for collecting all lake water quality data in Michigan
- ✓ It includes local volunteers, EGLE, MSU Extension, Huron River Watershed Council and Michigan Lakes and Streams staff
- ✓ Myself (East Twin) and Jerry Beattie (West Twin) are the current TLPOA volunteers
- ✓ Erick Elgin (MSU) is the staff scientist who mentors the statewide lake volunteers
- ✓ TLPOA has participated in the CLMP for 30 years (1993)
- ✓ CLMP has actively monitored lakes in Michigan for 49 years (1974)
- ✓ We currently monitor 3 critical lake parameters
  1. Secchi Disk
  2. Phosphorous (spring and summer)
  3. Chlorophyll A
- ✓ These are the parameters that determine the lake Trophic Status

Canal PhosLock Application

Phosphorous Readings

- ✓ June 12 before Phoslock
- ✓ Aug 2, 51 days after Phoslock

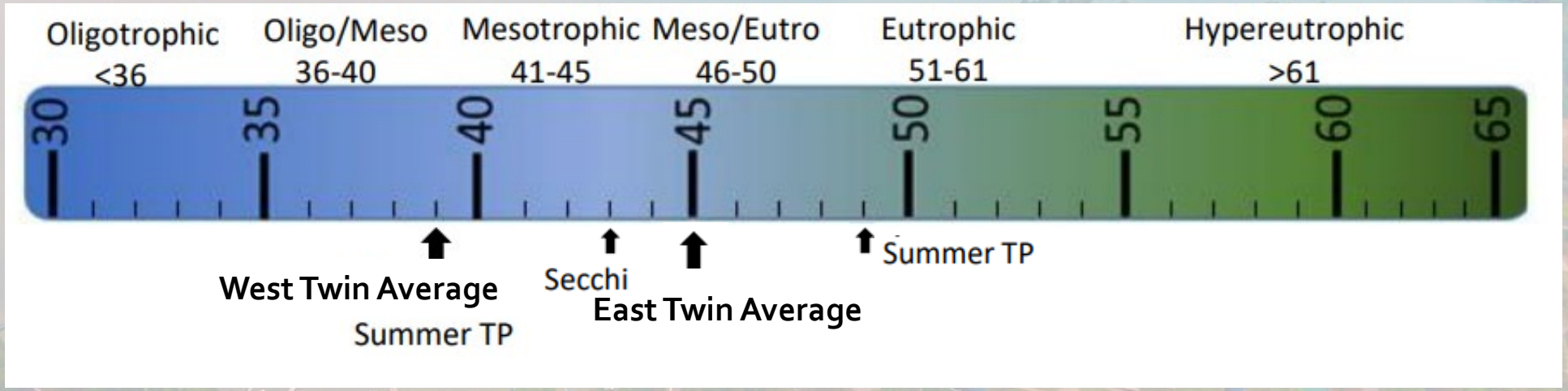
East Twin Secchi Disk Archive

Date 2023	CLMP Week	1939	1993	1995	1998	2000	2002	2004	2007	2009	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Ave	Feet	Trophic Classification
30-Apr	-1		21			15.5										11			14		15.4	22	Oligotrophic
7-May	0		19							10.5					10.5	10.5		13.5	14.5	12	13.6	21	Oligotrophic
14-May	1						12.5	14	17.5			10	10.5	9.5	9.5	10	13	14	14	11.5	13.3	20	Oligotrophic
21-May	2		21	18	16.5	14.5	11			10	11.5	9.5	10	9	9.5	10	12.5	15	16.5	12	12.9	19	Oligotrophic
28-May	3				14.5	12.5	10	14	14		11	9.5	9	8.5	9.5	9.5	13.5	13.5	13.5	14	12.2	18	Oligotrophic
4-Jun	4			18	15.5	10.5	12			11		9.5	7.5	8.5	8.5	10	11.5	15.5	12.5	11	12.1	17	Oligotrophic
11-Jun	5			18	15.5	11.5	15.5		12		10	7.5	7	8	8.5	9.5	11.5	21.5	13	13	11.9	16	Oligotrophic
18-Jun	6		21	16.5	12		11.5			9.5	9.5	7.5	6.5	7	7.5	10.5	10	17.5	11.5	12	11.9	15	Oligotrophic
25-Jun	7				10.5	12	11	15	10		12		6.5	6.5	7	9.5	9	12	10	11.5	10.2	14	Oligotrophic
5-Jul	8		16	15	9	12	11.5			9		6.5	6.5	6	6.5	8.5	9	11.5	9	10	10.1	13	Mesotrophic
12-Jul	9			9	9	12.5	11	12	10			7	6.5	5.5	6	6	8	9	8	12	9.1	12	Mesotrophic
16-Jul	10		11		10.5	12.5	10.5			10.5	10		7	6		6	6.5	11	8	11	9.6	11	Mesotrophic
24-Jul	11			9.5	10.5	15	10	11	6.5		11.5	6	7.5	5.5	6.5	6.5	7	11	7	9.5	9.1	10	Mesotrophic
31-Jul	12		15		10	11	11.5			10.5	10	5.5	8.5	6	6.5	6.5	7.5	10	8	11.5	9.4	9	Mesotrophic
10-Aug	13				9.5		11	7	8		9.5	5.5	9.5	6.5	6.5	7	8	9	8	11	8.6	8	Mesotrophic
14-Aug	14		13	9	9.5	10	10.5			9.5		5.5	10	6.5	6.5	7	8	9	8	10.5	8.8	7	Mesotrophic
21-Aug	15			9	12	9.5	7	7.5	7.5		10	6.5	9.5	6.5	7	7	8	9	8.5	10	8.5	6	Eutrophic
27-Aug	16		11.5	9	13	9	9.5			9	9.5	6.5	9.5	6.5	6.5	7	8.5	11	8		8.9	5	Eutrophic
3-Sep	17	14.5	11.5	10.5		9	10	7	8		10	6.5	10	6	8	7	9	10	9		9.3	4	Eutrophic
10-Sep	18		12	10.5	10	10.5	10.5			10		6.5		9	9	7.5	9.5	9	9		9.7	3	Hypereutrophic
17-Sep	19			12.5		11	11	8.5	8.5		10		11	7.5	9.5	8.5	10	10	10		10.3	2	Hypereutrophic
24-Sep	20				13					9.5	12										11.4	1	Hypereutrophic
	Ave	14.5	14.7	12.7	11.8	11.4	10.9	10.7	10.2	9.9	10.5	7.2	8.5	7.1	7.7	8.1	9.5	12.1	10.5	11.4	10.4		

West Twin Lake 13.3 13.4

2022 Twin Lakes CLMP Results Analysis

- ✓ West Twin: With a TSI score of 39 based on summer total phosphorus, this lake is rated between the oligotrophic and mesotrophic lake classification. The lake leans slightly more mesotrophic than oligotrophic.
- ✓ East Twin: Long term monitoring shows slight upward slopes on all the parameters and an increase in average TSI score over time. These results indicate a slow movement toward higher nutrient levels in this lake.



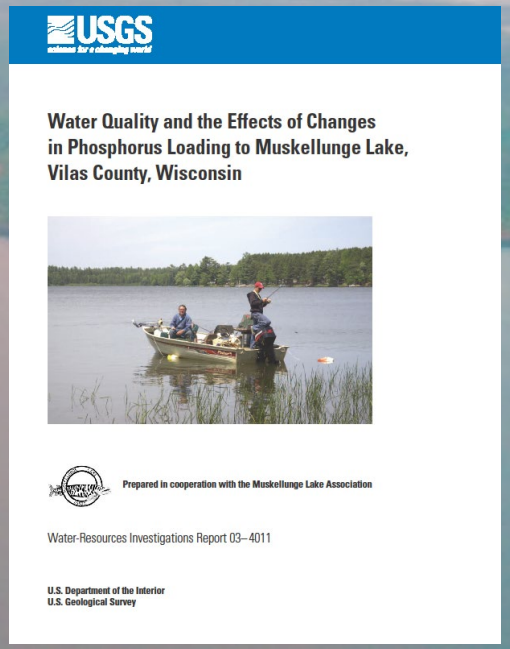
East Twin Lake Nutrient Increase & Septic System Survey Update

John Jackson

Membership Meeting, August 26, 2023

How do we determine the nutrient increases in ETL?

- ✓Identify and Quantify the nutrient increase sources
- ✓Use Water Flow and Phosphorous (P) Loading analysis technique from a similar inland lake (Muskellunge Lake WI)


USGS

Water Quality and the Effects of Changes in Phosphorus Loading to Muskellunge Lake, Vilas County, Wisconsin

Prepared in cooperation with the Muskellunge Lake Association

Water-Resources Investigations Report 03–4011

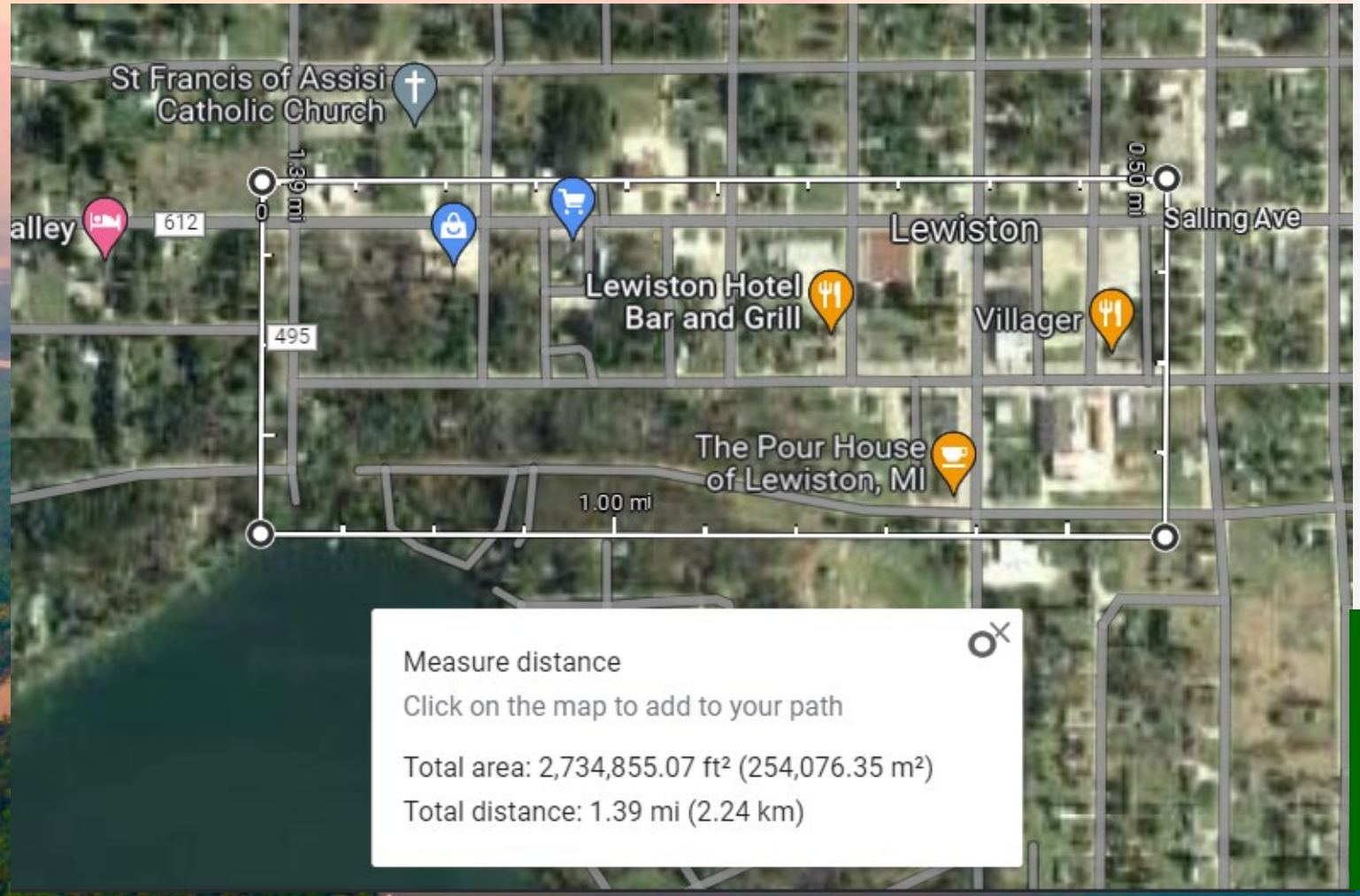
U.S. Department of the Interior
U.S. Geological Survey

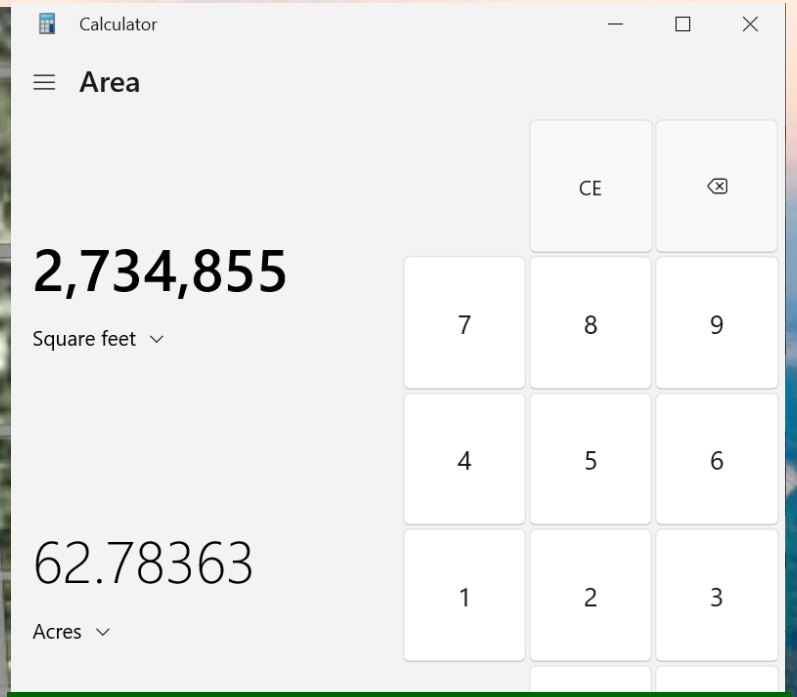
- ✓ Determine the relative contribution of each source

How do we calculate annual Water Flow and P budgets?

- ✓Let's assume East Twin returns to a consistent level each spring
- ✓ Hence, annual Water Inputs = annual Water Losses
- ✓What are the Water Input Sources
  - + Precipitation
  - + Storm Water Input from the Lewiston Storm Sewer System
  - + Runoff from Near Shore area
  - + Groundwater
- ✓What are the Water Loss Sources
  - - Evaporation
  - - Flow through Culvert to West Twin
- ✓What is the Total P = P Concentration * Volume of ETL water
  - .012 mg/L*5076 Acre-Ft*2.719= **165.6 Lbs P**

How do much stormwater enters ETL from Lewiston?





Annual Rainfall (30 Yr Ave)
37.35 in/yr*62.78 acres/834 acres= 2.8 in/year

How do you determine Septic System Input (ChatGPT AI)?

1) Conduct a survey of Lake residents using septic fields
2) Estimate septic usage for each field
   - ✓Number of people using the field
   - ✓Number of months each year the field is used
3) Calculate Phosphorous load for each field
   - ✓Estimate distance of field from lake
   - ✓Estimate age of field
4) Compare Septic Input to Lake Total Phosphorous
5) Consider other factors; age of system, changes in usage, Geese and other Waterfowl

What are the Survey Results?

1) 245 ETL properties,
   - ✓ 162 w/email addresses
   - ✓ 57 responded (34% of emails, 23% overall)

2) Estimate septic usage & location for each field
   - ✓ Survey Ave 2.73 people, 2 for nonresp; **Net 2.15**
   - ✓ Survey Ave 8.2 months, 3 for nonresp; **Net 4.21**
   - ✓ Survey Ave 249 ft from lake; 200 ft for nonresp; **Net 211**
   - ✓ Survey Ave Age 30 yrs; 20 yrs for nonresp; **Net 22.46**

3) Calculate Phosphorous load for each field
   - ✓ Phos=E_s*(number of capita years)*(1-S_R)

   E_s= Export coefficient, 1.5 same as Musky Lake
   S_R= Soil Retention coefficient, f of septic field distance and age

4) Sum of Phosphorous input from all septic fields
   - ✓ 90.6 lbs of Phosphorous

Relative Contribution Analysis

Data Used in Analysis					
Actual Measured Data					
Use Musky Lake Data					
Surveyed Data					
Calculated Data					

Source	Water Volume ("/Yr)	Concentration Phos (mg/L)	Phos (Lbs)	Relative Contribution %	Description
Precipitation	37.4	0.007	49.4	21%	37.4" Annual Rainfall (Gaylord 30 yr ave)
NearShore	3.1	0.022	12.9	6%	Ratioed ML to ETL (Shoreline)
Storm Sewer Water	2.5	0.082	38.7	17%	2.5" Annual @ .082 mg/L Phos (RLS 2020)
GroundWater	20.0	0.012	45.4	20%	Ratioed ML to ETL (Acreage)
Geese (150)			74.4	32%	Full Season Apr 15-Oct 15 = 183 days (RLS 2018)
Septic			90.6	39%	Calculated per survey
Evaporation	-22.0	0.000	0.0		Assume same rate of Evaporation as ML
Flow to West Twin	-41.0	0.010	-80.1	-35%	Average Phos .010 mg/L in water leaving ETL
Ice Out			-71.4		Annual Phos Deactivation (30 yr CLMP)
Total	0.00			100%	East Twin remains at Normal Depth
		0.0168	231.3		Predicted 2023 Summer Phos ETL
		0.0116	160.0		Predicted 2024 Spring Phos ETL
Spring Phos		0.010	141.9		CLMP 30 Yr Trendline
Summer Phos		0.015	213.3		CLMP 30 Yr Trendline
Spring Phos		0.012	165.6		2022
Summer Phos		0.022	303.7		2022

Ranking of Potential Corrective Actions (Timing, Impact, Cost)

1) Geese Deterrence

- Immediate and potentially biggest impact
- May not require permits
- Would require "volunteer member's" consent and financial support

2) Lewiston Stormwater Control Improvements

- Least potential improvement, less time than 3
- Requires buy in from Road Commission and Albert Twp
- Requires additional data collection
- Requires additional outside funding

3) Decentralized Wastewater System

- Potentially biggest improvement
- Requires buy in from everyone
- Requires massive financial support
- Very long-term project, similar projects have been rejected in the past

Current TLPOA Board Action Plan

- ✓ Enlisted Spicer Group Inc for technical help
  - ✓ They toured East and West Twin July 17
  - ✓ They suggested a 3-prong attack July 20
    1. Lewiston Retention Pond Enhancements
    2. Storm Sewer System Enhancements
    3. Enhanced water quality measurements
       a. - Total Nitrogen (Nitrate, Nitrite, Total Kjeldahl Nitrogen, Ammonia)
       b. - Soluble Reactive Phosphorus
       c. - Total Phosphorus
       d. - Total Suspended Solids
       e. - Total Chloride
       f. - Chlorophyll-a.
       g. - Critical Flow rates

P and Flow Measurements Needed to Improve Analysis Accuracy

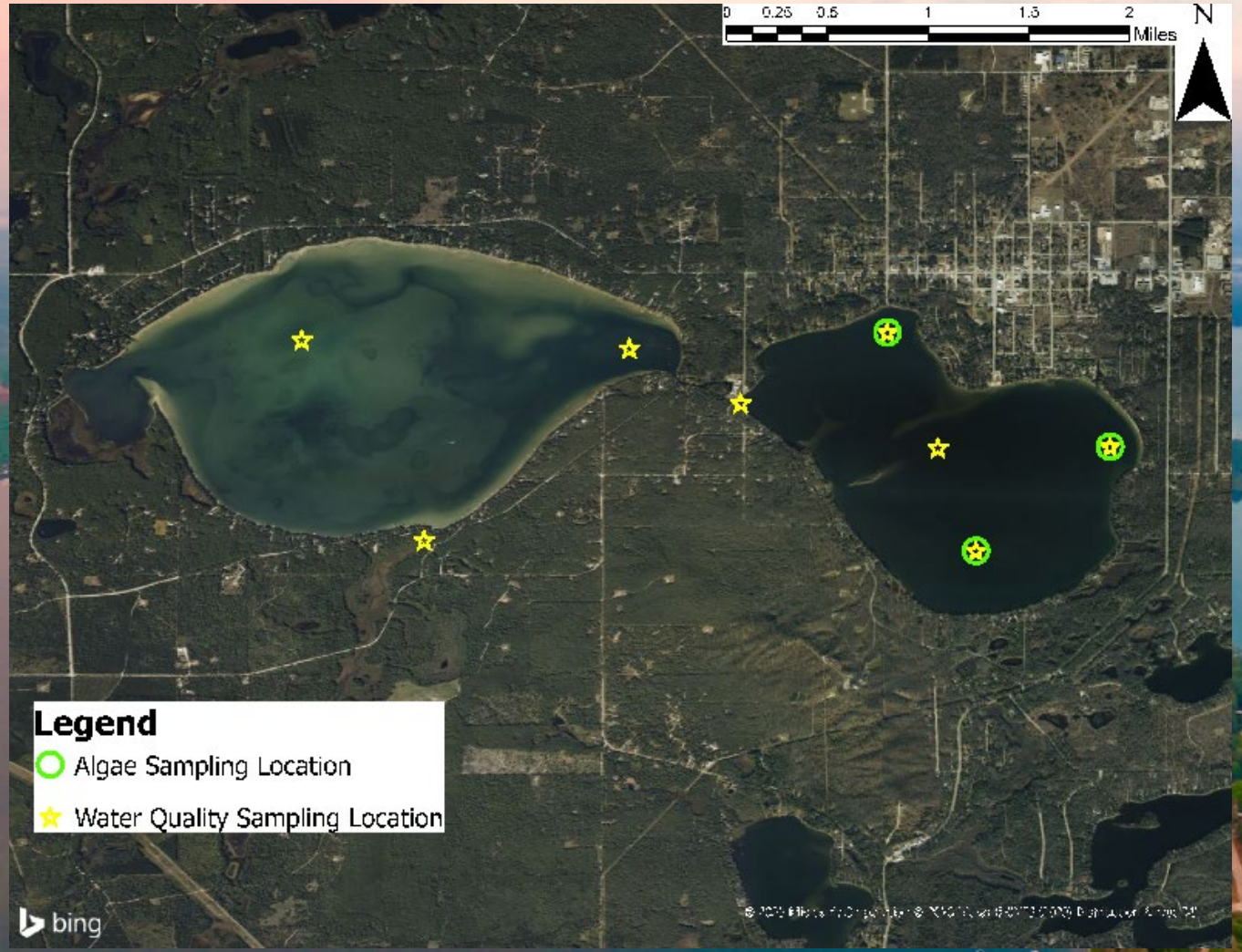
✓Inputs (P Concentration & Flow Rate)

- + Precipitation (NOAA Gaylord)
- ➢Storm Water Input from the Lewiston Storm Sewer System
- + Runoff from Near Shore area
- + Groundwater

✓Outflows (P Concentration & Flow Rate)

- − Evaporation
- ➢Flow through Culvert to West Twin
- ➢Flow from West Twin to Cobb Creek

Spicer Measurement Locations



What are the TLPOA future steps?

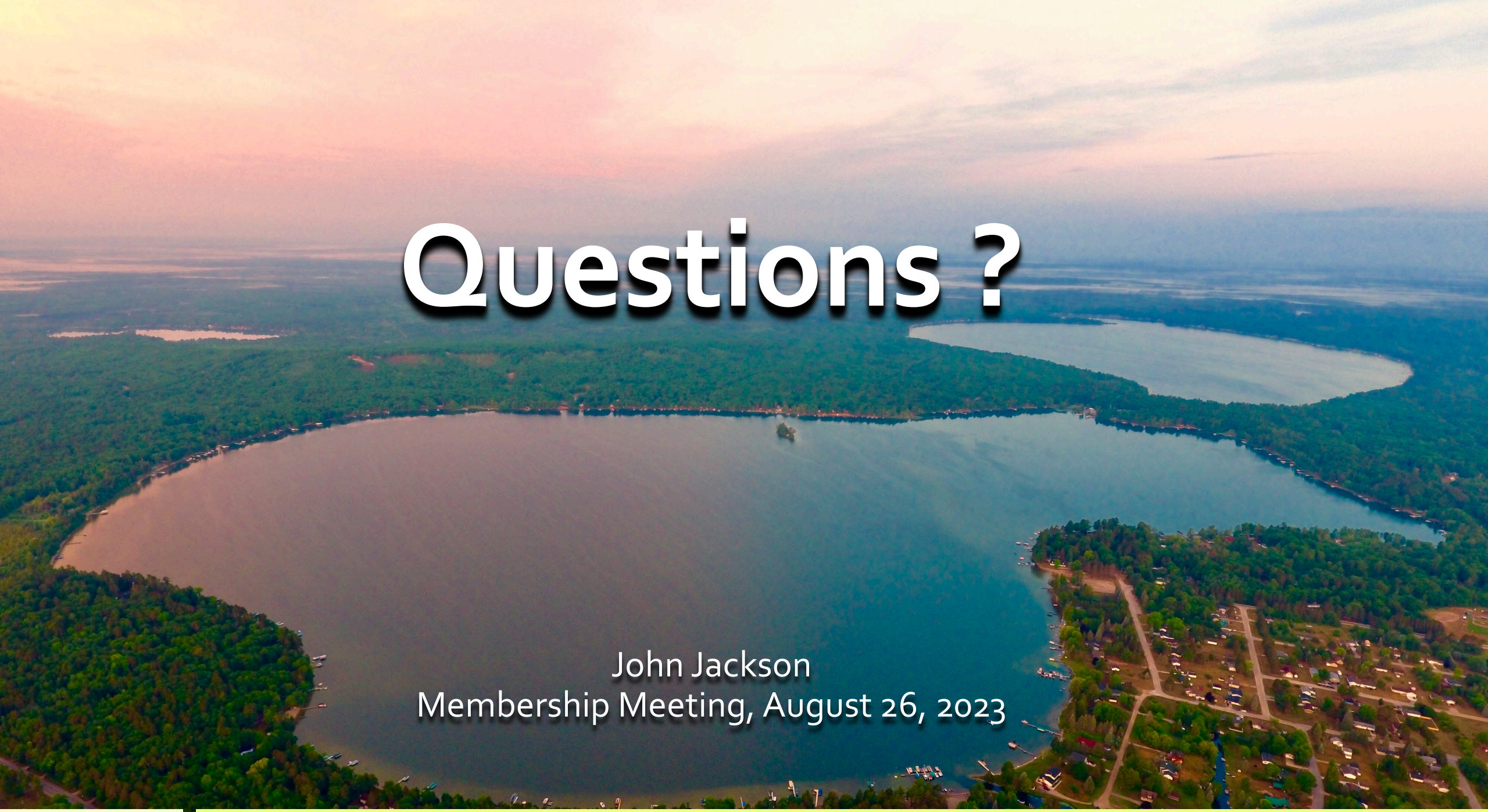
1. Determine if Summer P increase in ETL & WTL repeat
2. If necessary, implement corrective action
3. Get Montmorency Road Commission and Albert Twp to support Lewiston Stormwater System improvements
4. If data is sufficient write a 319 Grant or SOM Budget Supplement

Targeting 319 $ for Protection

- State prioritization approaches often aim to identify healthier waters and watersheds most vulnerable to degradation.
  - E.g., using EPA Recovery Potential Screening Tool
- Priority waters/watersheds can be focus of state RFAs.
- Example factors included in prioritization frameworks →

Category	Subcategory	Example Indicators
Water Quality	Water Quality Assessment Status	• Presence/absence of impaired waters • Percent stream length supporting aquatic life use • Presence of waters supporting aquatic life and primary contact recreation uses
	Water Quality Trend	• Negative water clarity trend • Proximity to numeric water quality criteria
	Biological Condition	• Stream miles with healthy benthic community rating • Mean aquatic habitat condition rating in watershed • Count of monitoring stations in watershed with sensitive organisms
Watershed Condition	Natural Land Cover Extent	• Percent natural land cover in watershed • Percent natural cover in riparian zone • Percent of wetlands remaining in watershed
	Existing Development	• Percent impervious cover in watershed • Percent agricultural cover in watershed • Number road-stream crossings in watershed • Number of combined sewer overflow outfalls
	Hydrology	• Miles of free-flowing streams • Number of dams with fishways
	Development Trend	• Change in the number of housing units over the last X years • High risk for development due to proximity to highway access • Projected increases in wastewater discharges
Social and Programmatic Factors	High Quality Water Designations	• Presence of high quality-designated waters (i.e., Tier 2, 2.5 or 3) • Percent of stream miles within Natural or Scenic Rivers Programs
	Drinking Water Supply	• Presence of surface drinking water supply • Number of drinking water intakes
	Recreation Use	• Number of recreation areas in watershed • Stream miles with trout stocking
	Protected Lands	• Percent of watershed containing protected lands
	Watershed Plans	• Presence of watershed-based plan • Percent of stream miles covered by a TMDL
	Planning Complexity	• Jurisdictional complexity (number of different counties, cities, towns, etc.) in the watershed

Example Vulnerability factors


Questions ?
John Jackson
Membership Meeting, August 26, 2023