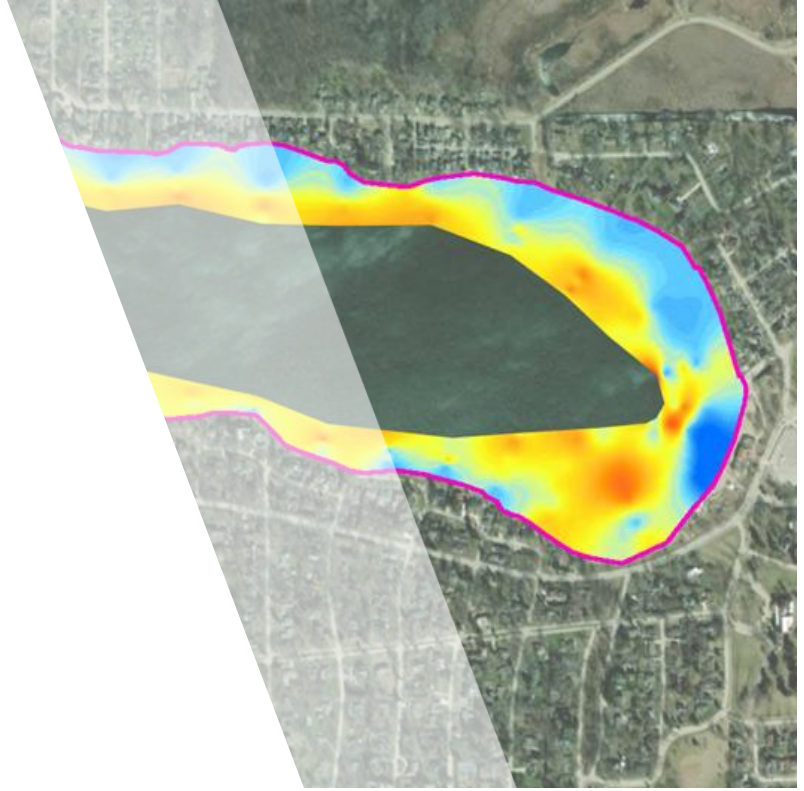
State of the Lake
2023-2024

May 1, 2025



Jeremy Husnik

Leonard Dane

Vince Mosca

Hey and Associates, Inc.
Engineering, Ecology and Landscape Architecture

CRYSTAL LAKE PARK DISTRICT

PROJECT PARTNERS

CRYSTAL LAKE PARK DISTRICT

CCAPOA

CITY OF CRYSTAL LAKE, ILLINOIS · INCORPORATED SEPTEMBER, 1914 ·

MCDH
MCHENRY COUNTY DEPARTMENT OF HEALTH
Promoting Better Health Since 1968

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

ISGS
Illinois State Geological Survey

CRYSTAL LAKE SPOA
SHORELINE PROPERTY OWNERS ASSOCIATION OF CRYSTAL LAKE

Illinois Environmental Protection Agency

The Village of Lakewood
Quality Living in a Natural Setting

Hey and Associates, Inc.

Report Overview

- Year(s) in Review (Monitoring and Management Activities)
- Physical Conditions
- Chemical Conditions
- Biological Conditions
- Trophic State Index

Year in Review (2023-2024)

Monitoring and Management

- Water Column Monitoring Activities
  - On-Lake Water Quality Sampling (Monthly May-Oct)
  - Aquatic Plant Surveys (Spring and Fall)
  - Recording Lake Levels and Water Temperatures

Year in Review (2023-2024)

Monitoring and **Management**

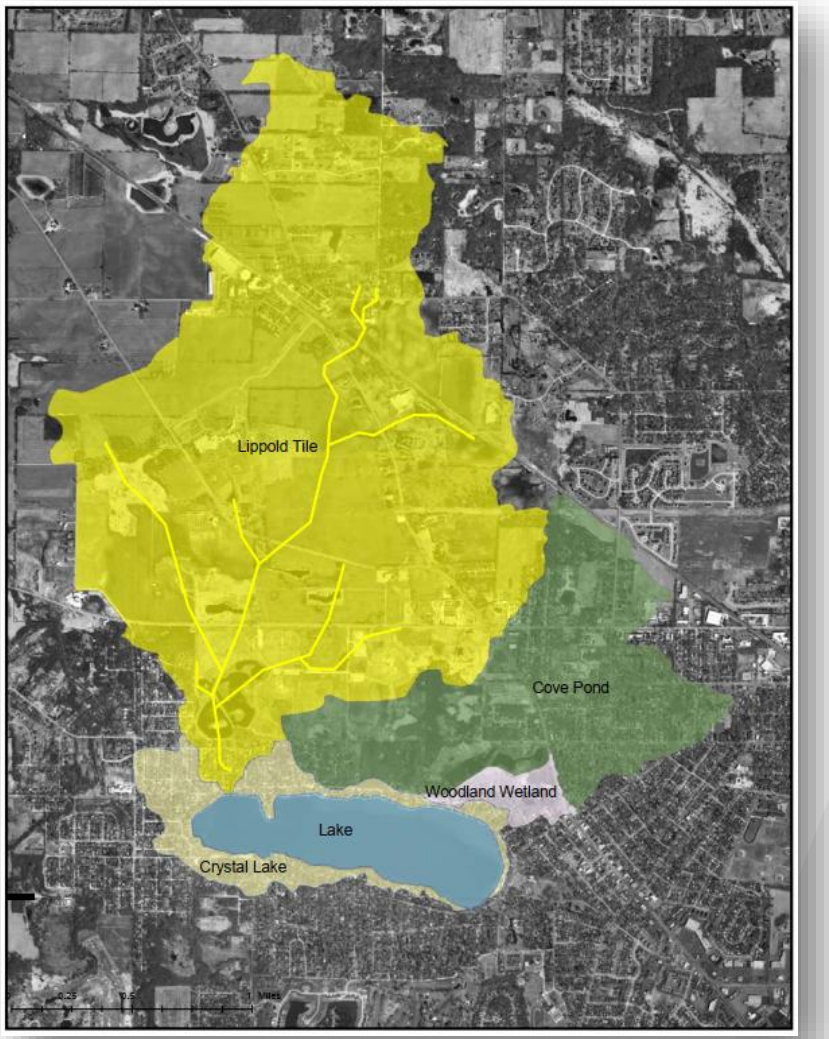
- On-Lake Management Activities
  - Spring Beach Treatments
  - Non-Native Species Treatments (Chemical)
  - Harvesting Activities (Mechanical)

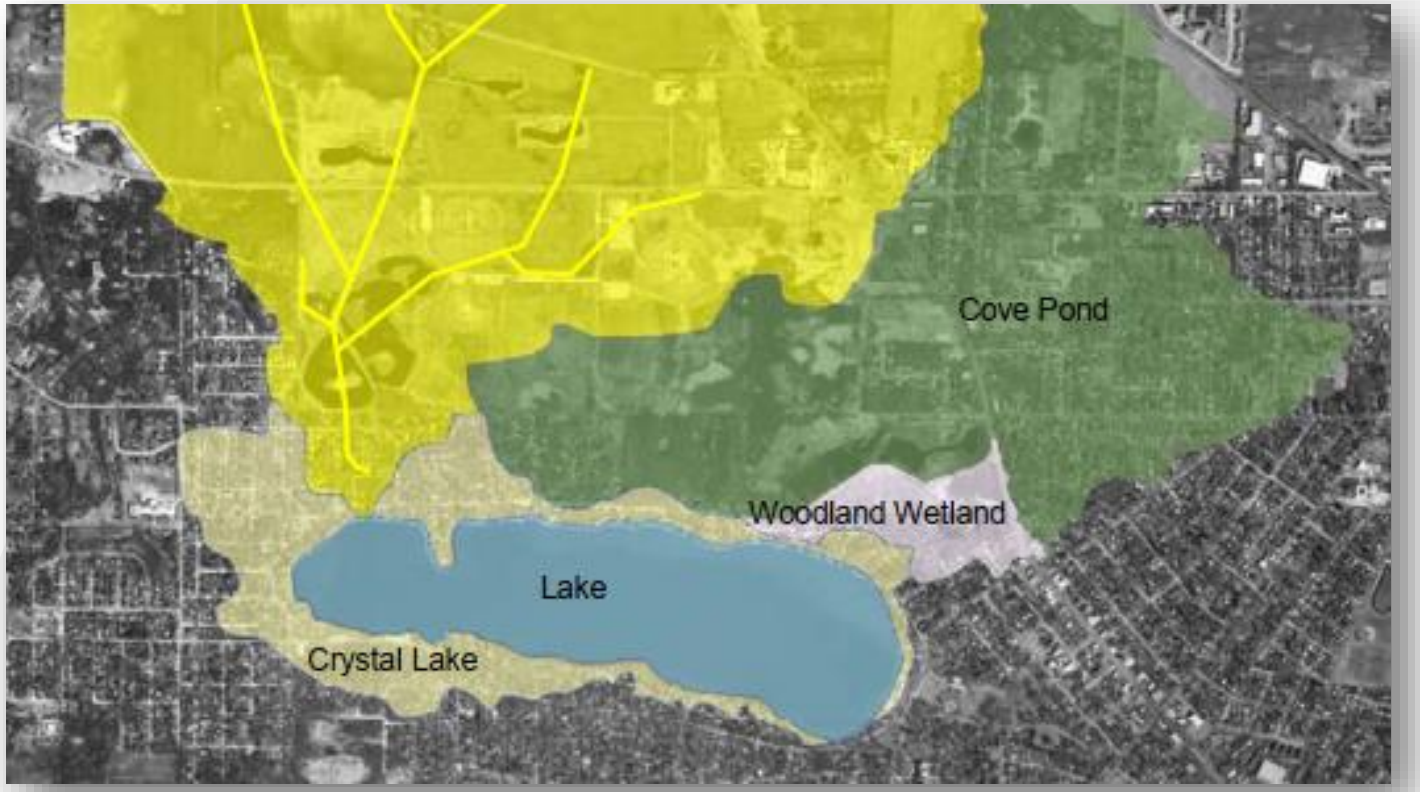
PHYSICAL CONDITIONS

Crystal Lake, and all lakes, are products of the physical variables of the environment that make up, contribute to, and influence the state of the lake. This section assesses and describes the physical characteristics of Crystal Lake to help inform stakeholders and managers with the goals of maintaining the critical environmental and recreation resource that is Crystal Lake.

PHYSICAL CONDITIONS

WATERSHED





3,227 ACRES IN TOTAL SIZE

PHYSICAL CONDITIONS

LAKE BATHYMETRY

(5-FOOT CONTOURS)

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PHYSICAL CONDITIONS

SAMPLING LOCATIONS

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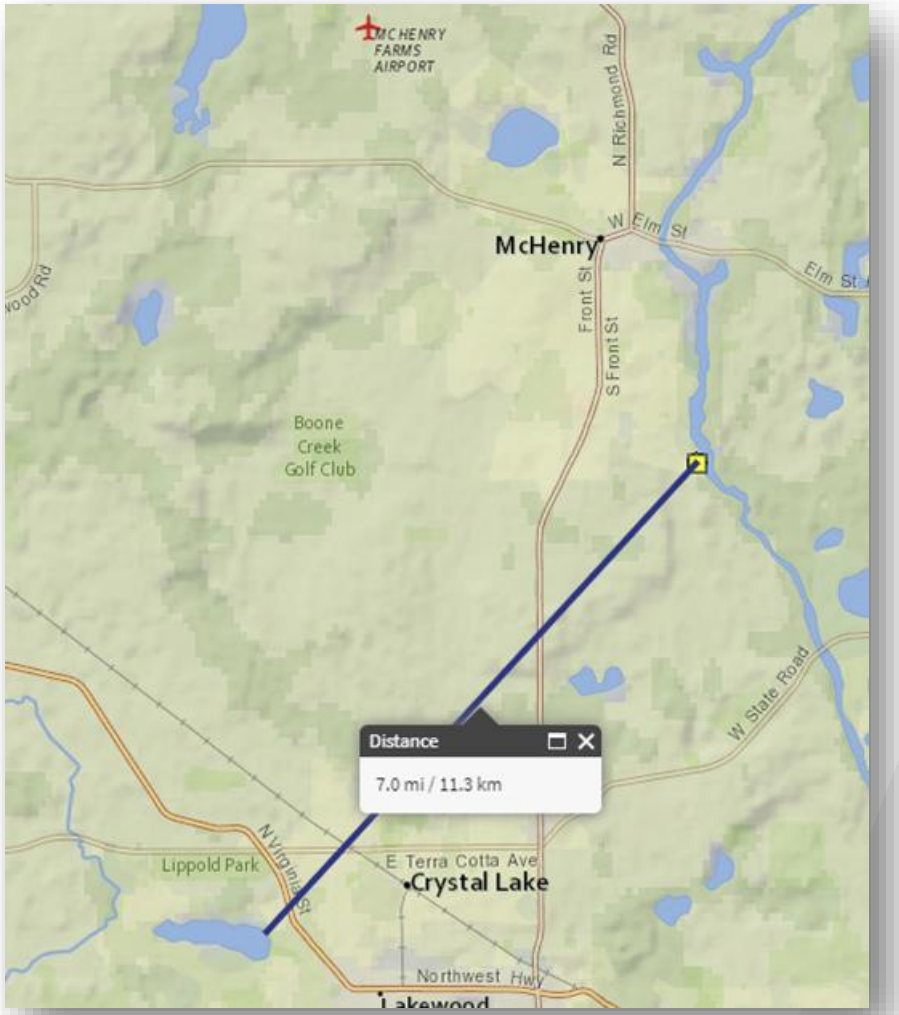
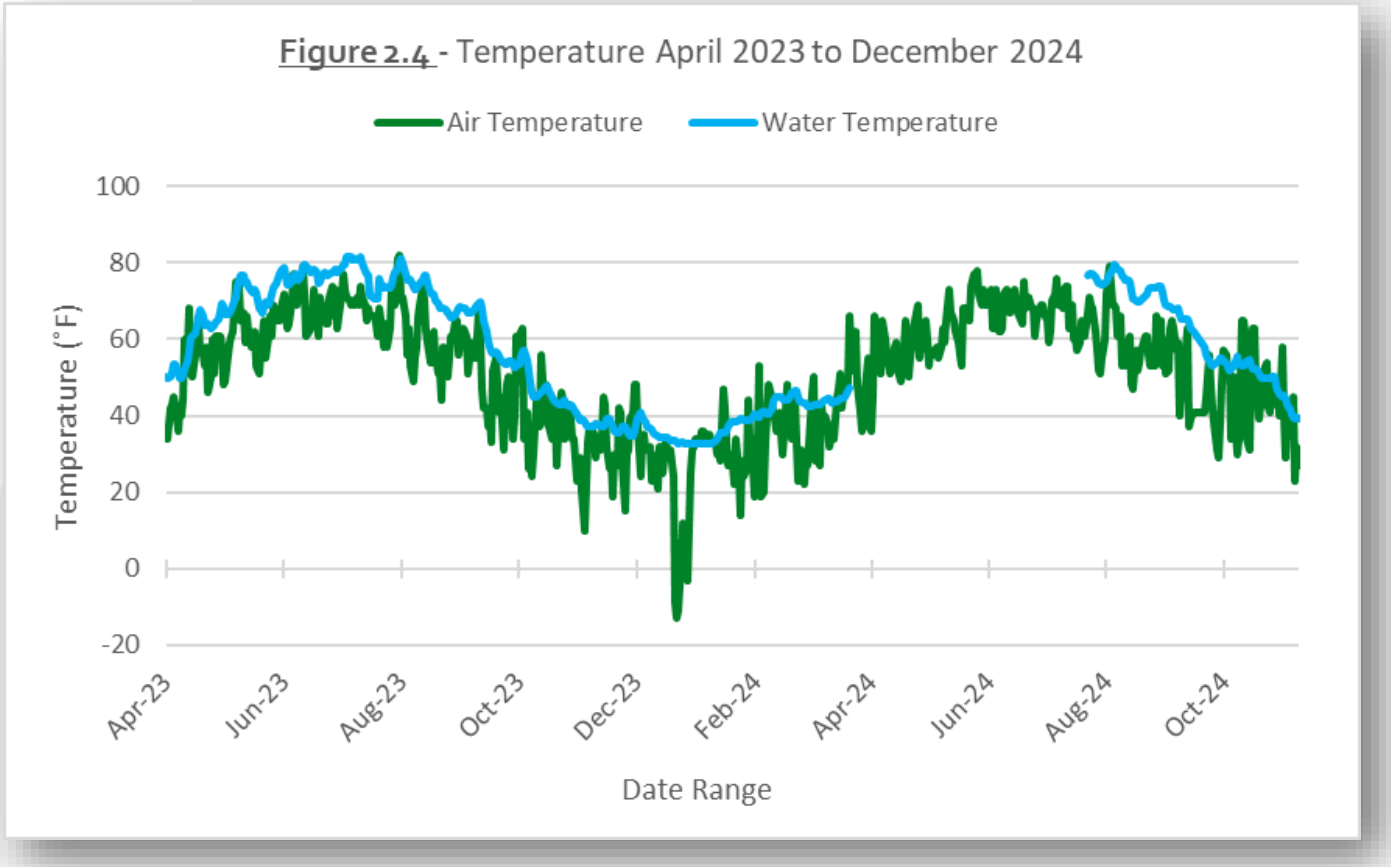
PHYSICAL CONDITIONS

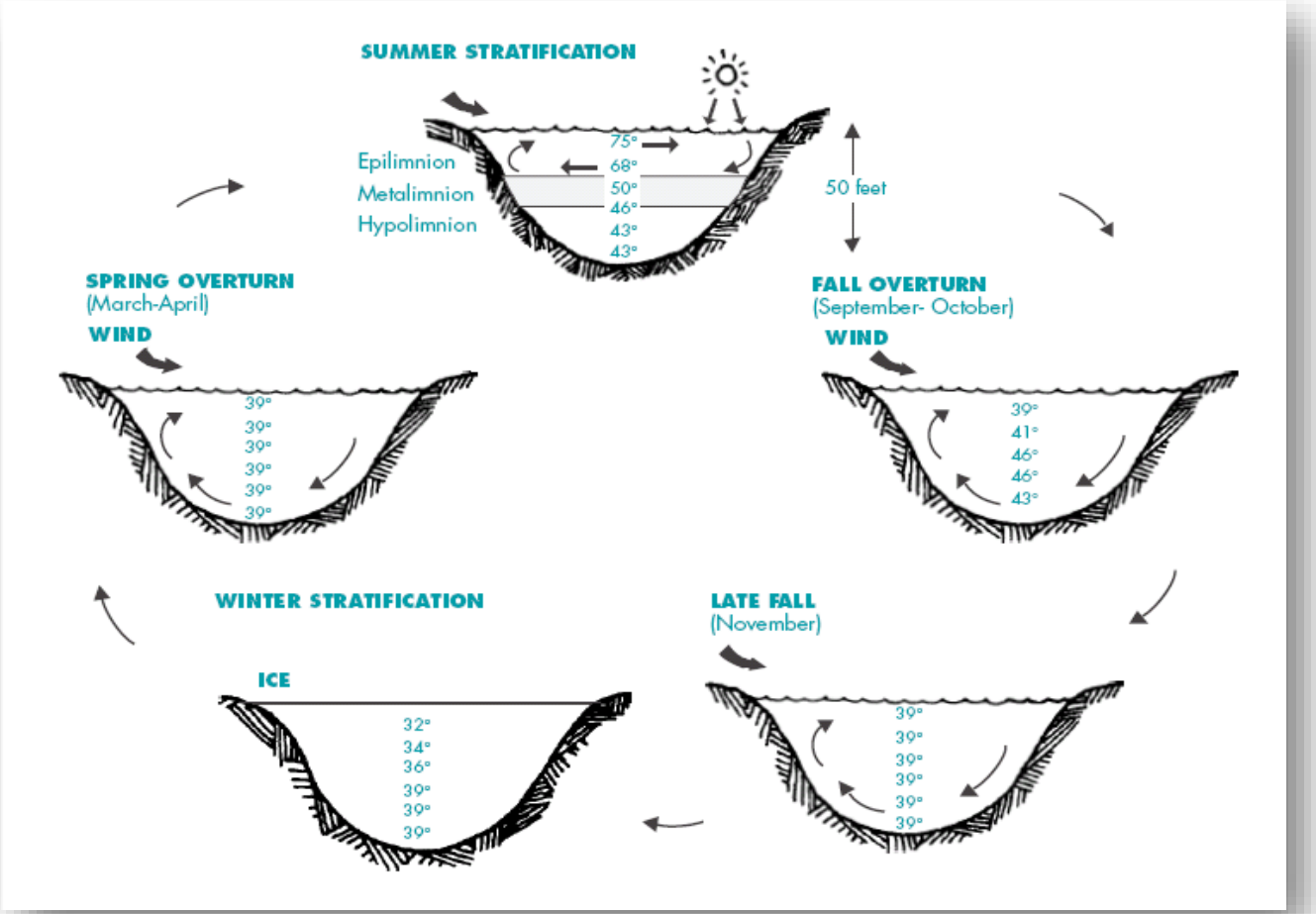
TEMPERATURES





PHYSICAL CONDITIONS

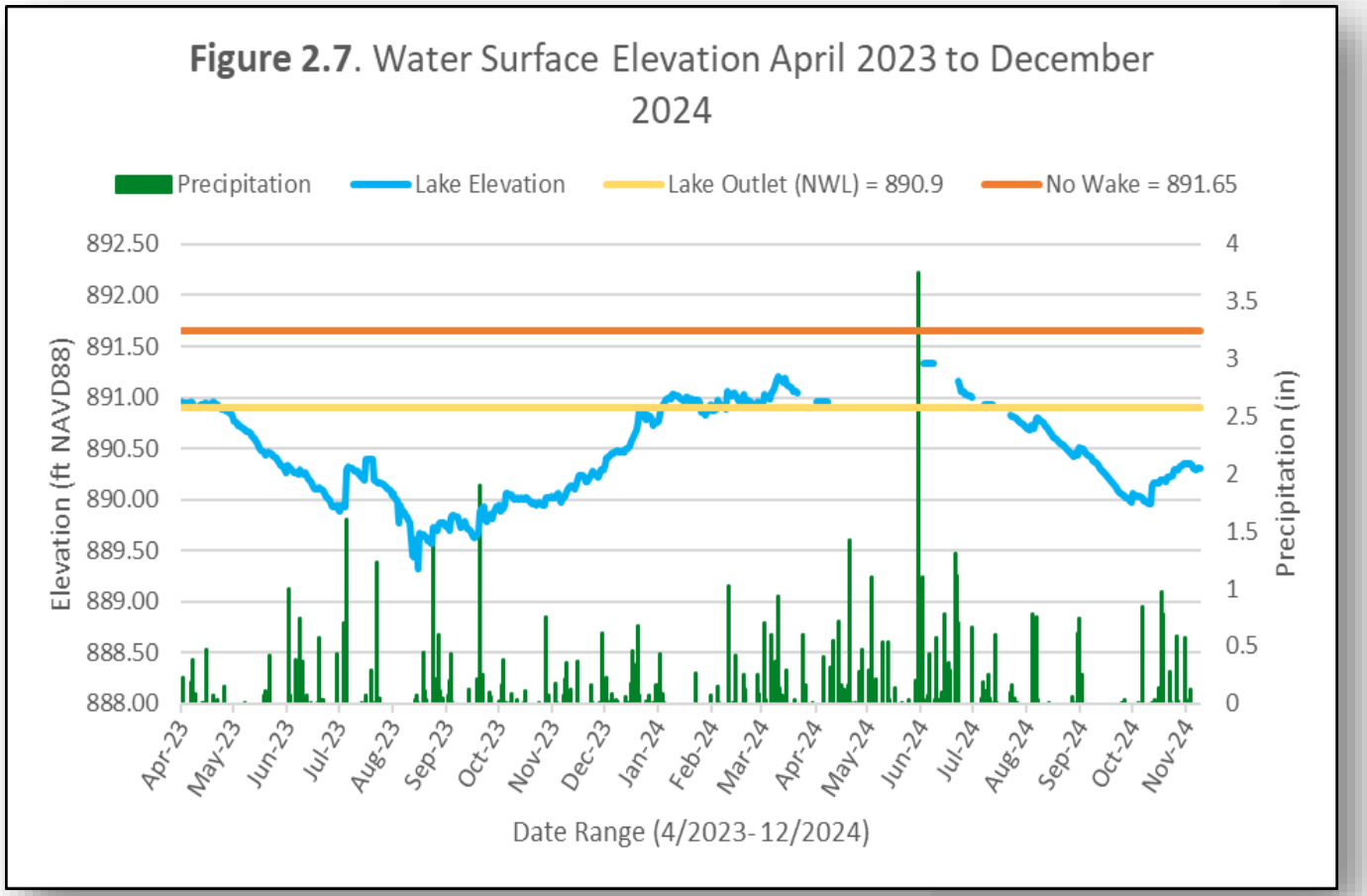
THERMAL STRATIFICATION

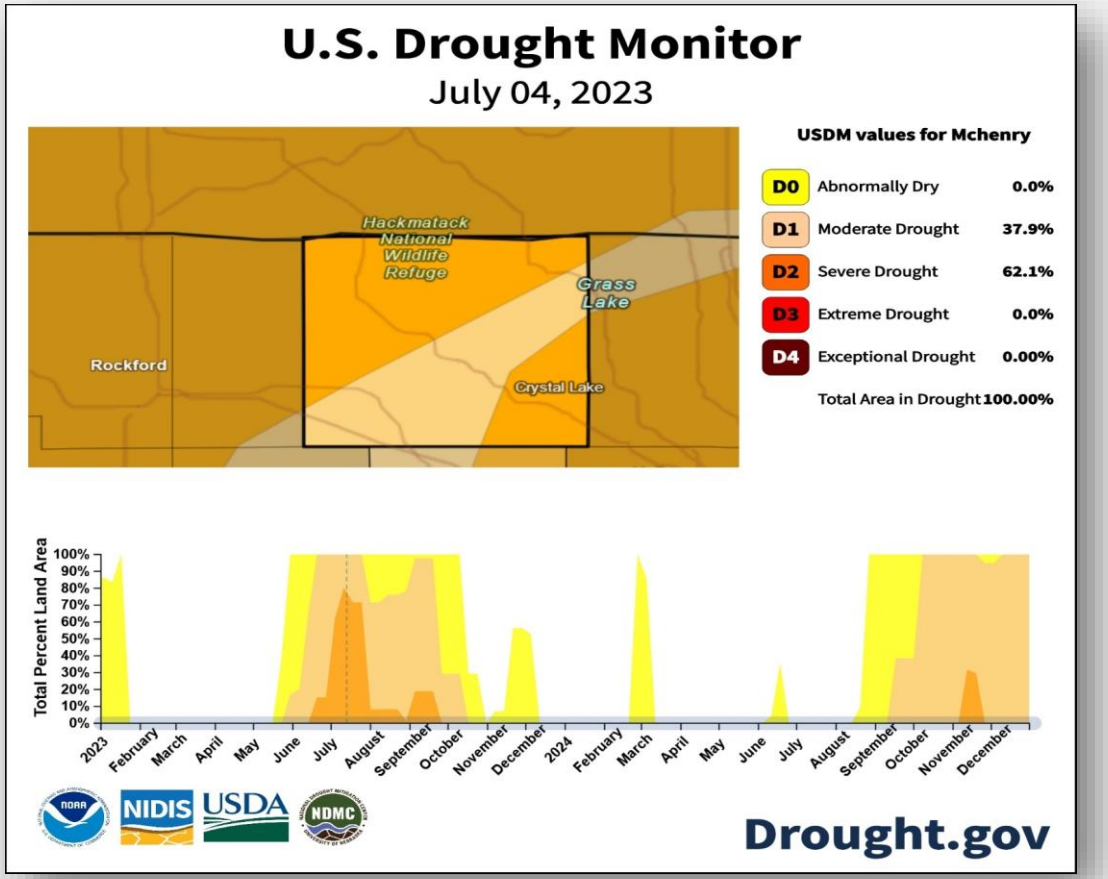


- SUMMER STRATIFICATION
  (WARMER TO COLDER VERTICALLY)
- FALL TURNOVER (MIXING)
- LATE FALL (MIXED – NO VARIABILITY)
- WINTER STRATIFICATION
  (COLDER TO WARMER VERTICALLY)
- SPRING TURNOVER (MIXING)

PHYSICAL CONDITIONS

LAKE STAGE (ELEVATION)

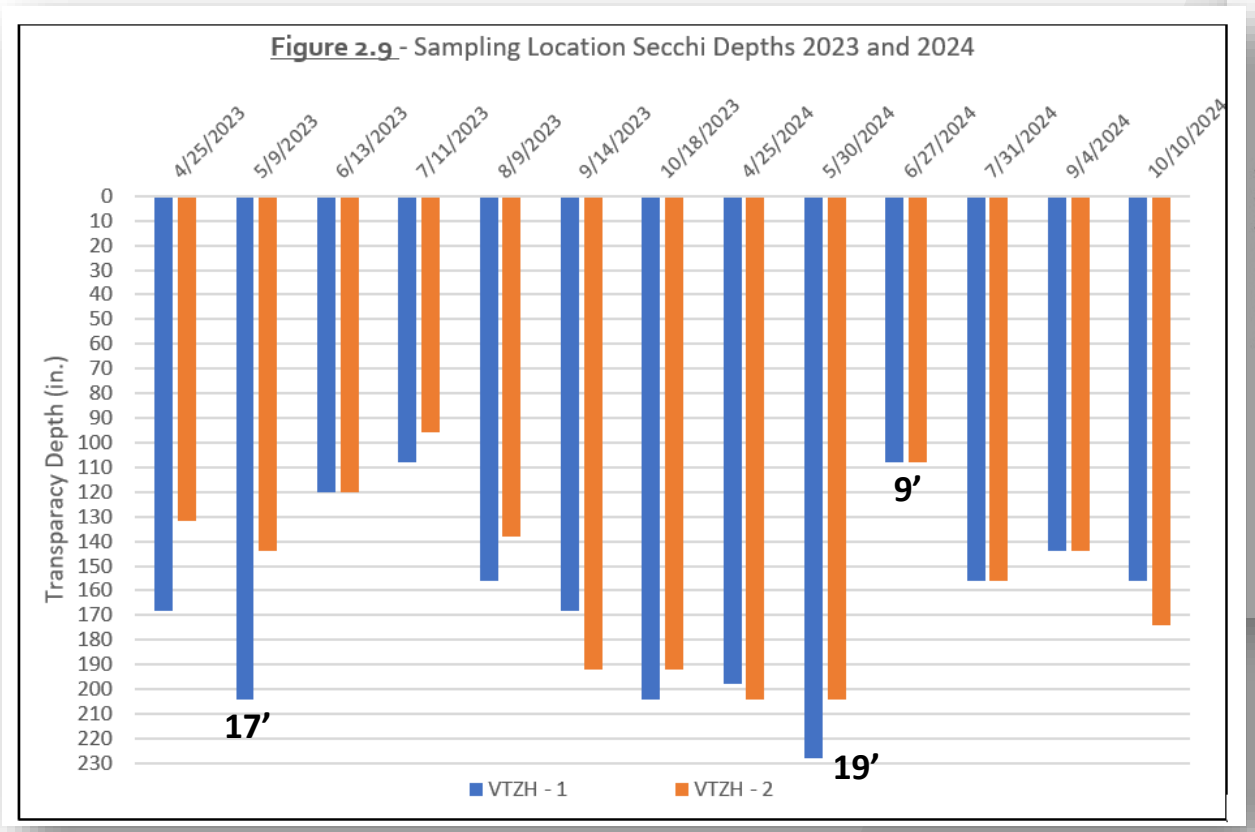


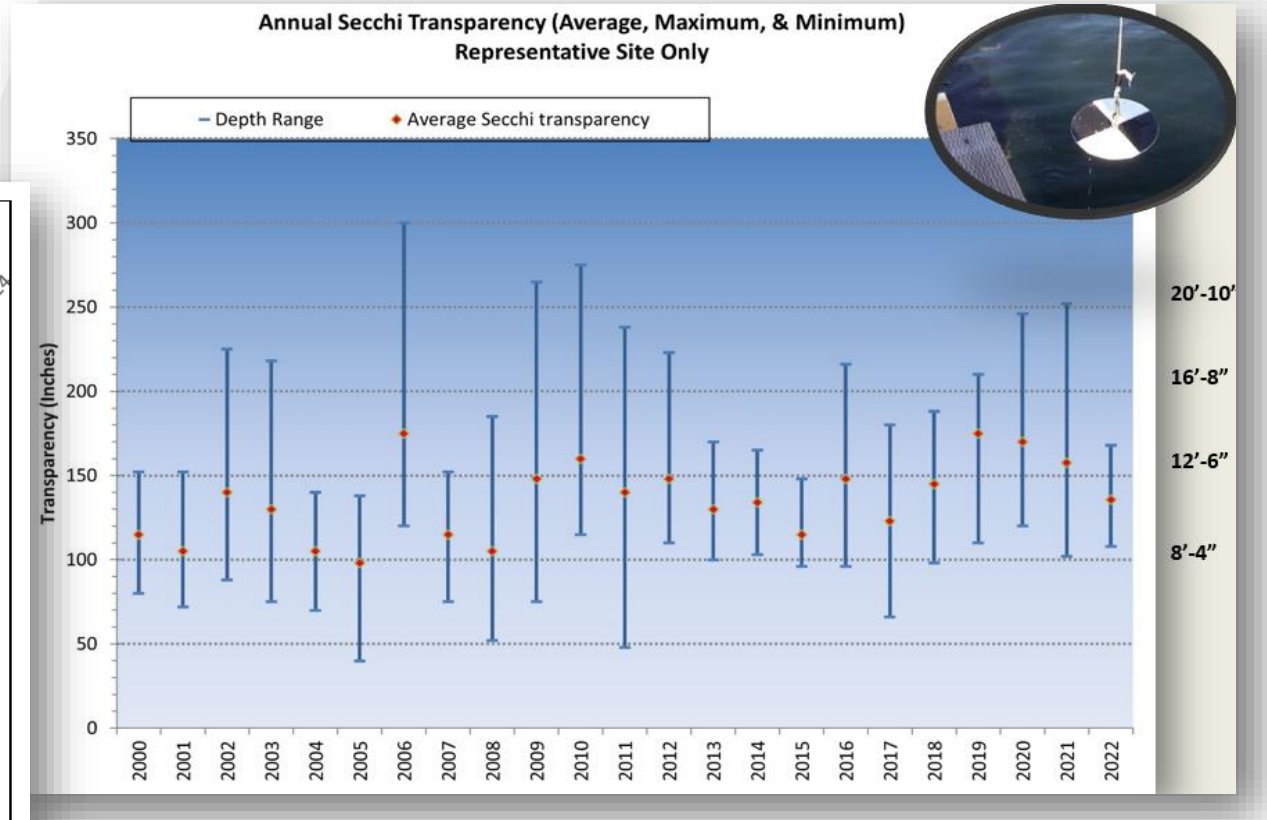


PHYSICAL CONDITIONS

SECCHI DISC READINGS (WATER CLARITY)

2023-2024





HISTORICAL

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Physical Conditions

Secchi Disc Readings (Water Clarity) Local Comparison

Crystal Lake 2023-2024 Average: 13.17’ (158” or 4.0 meters)

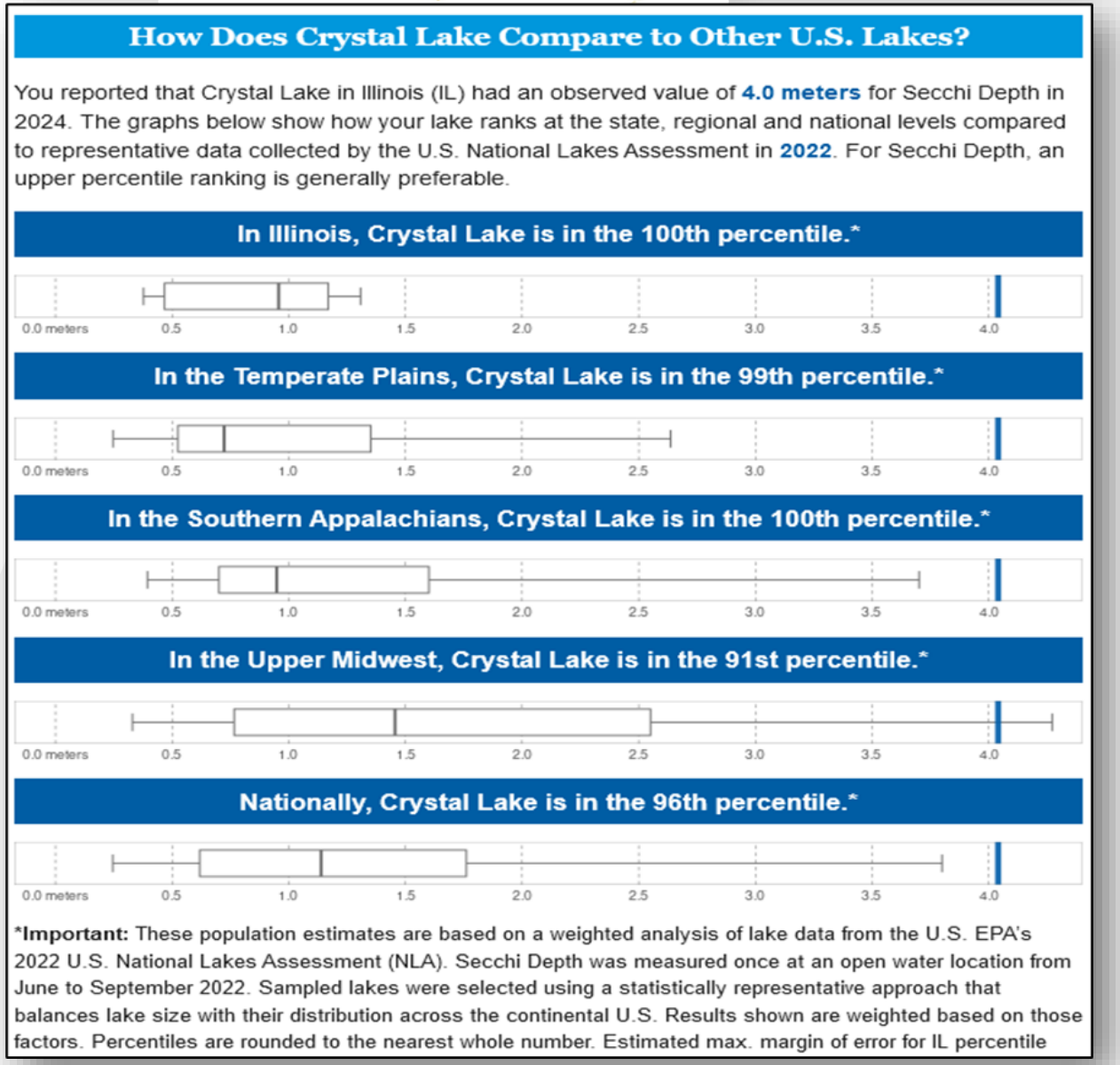
Wonder Lake Average: 1.5’ (17” or 0.5 meters)

Bangs Lake Average: 8.21’ (99” or 2.5 meters)

Lake Zurich Average: 7.1’ (85” or 2.2 meters)

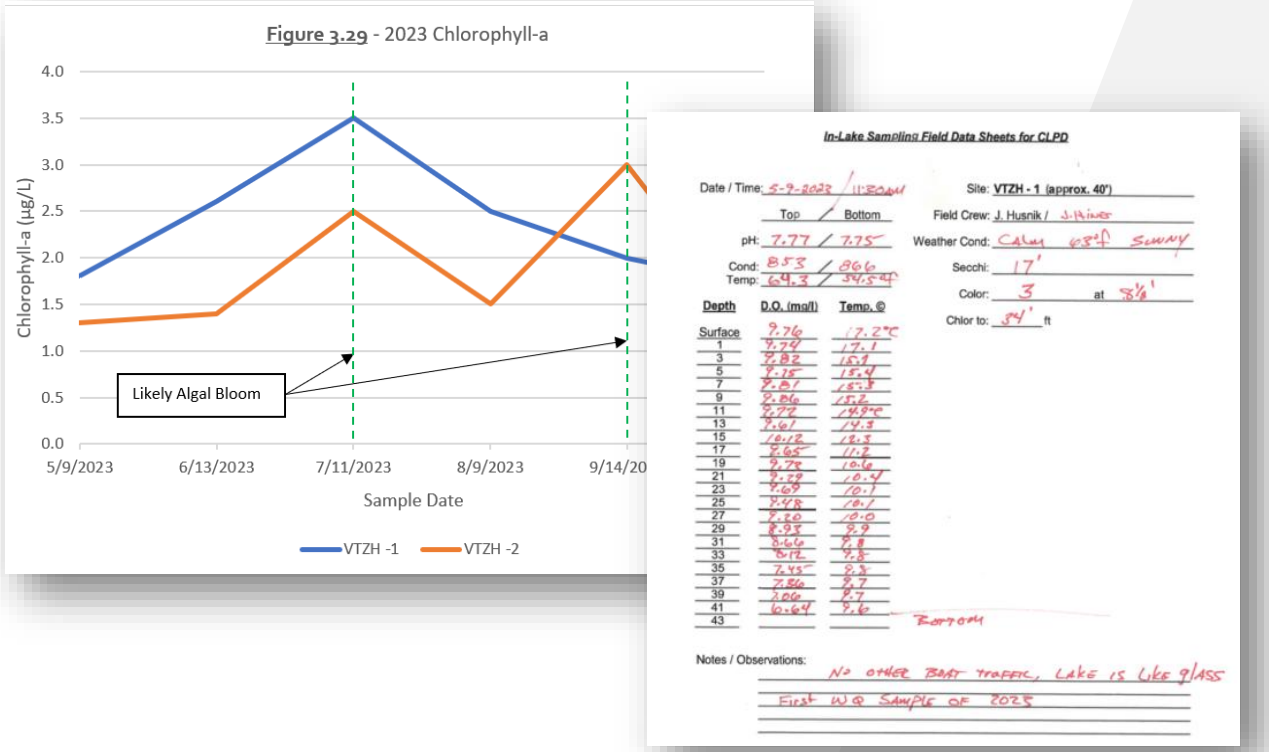
PHYSICAL CONDITIONS

USEPA LAKE COMPARISON



CHEMICAL CONDITIONS

The chemical conditions within Crystal Lake are important indicators to its health, but this chemical health is not necessarily assessable or apparent to a physical observer. Hey, along with the support of its project partners, monitor many key aspects of water quality within the lake and its contributing water sources.



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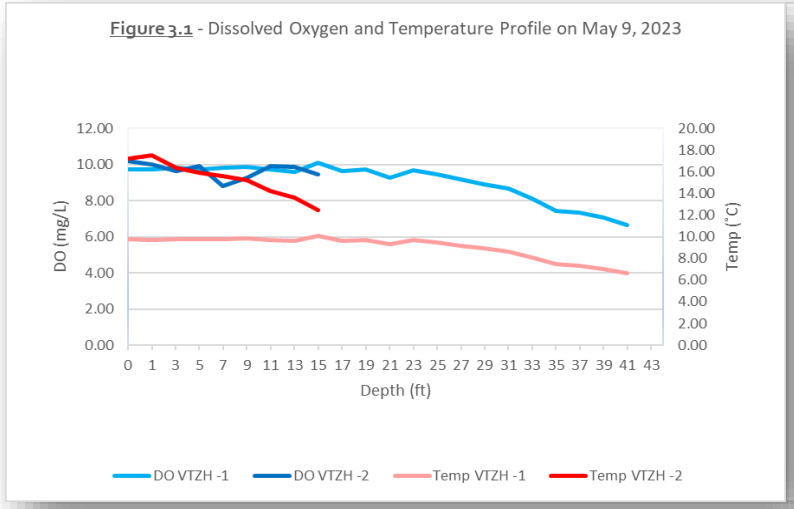
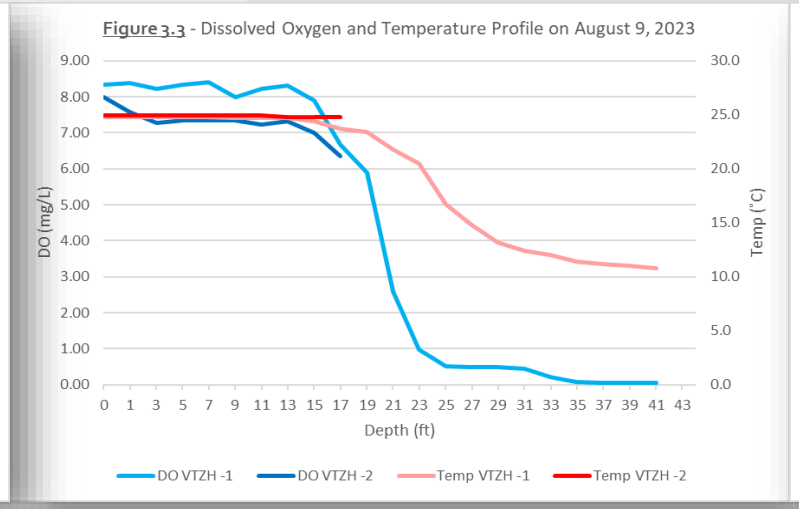
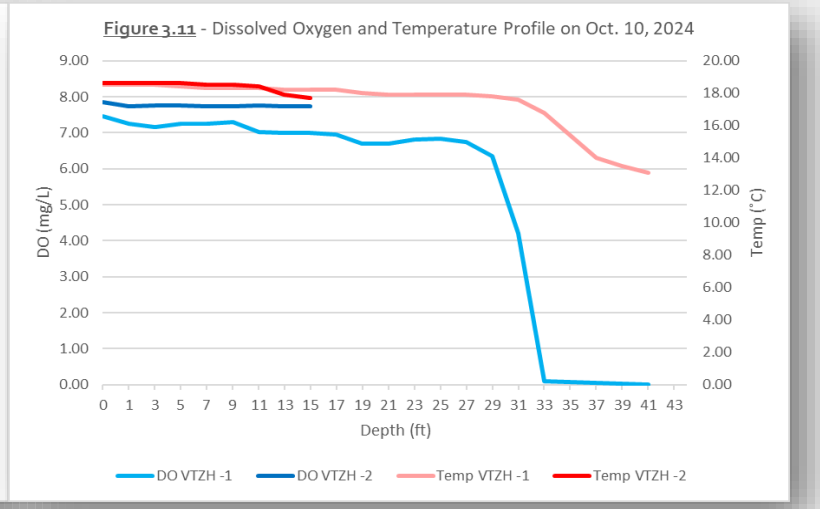
CHEMICAL CONDITIONS

DISSOLVED OXYGEN

- One of the most important factors affecting aquatic life
- Most fish require levels greater than 3.0 mg/L
- Monthly depth profiles of water temperature and dissolved oxygen were taken at 2-foot intervals (surface, 1’, 3’, 5’…13’) from the lake surface to the lake bottom
- VTZH-2 was greater than 3.0 mg/L during all sampling
- VTZH-1 dropped below 3.0 mg/L June through October in 2023 and 2024







CHEMICAL CONDITIONS

ALKALINITY AND PH

ALKALINITY = buffering capacity of a lake

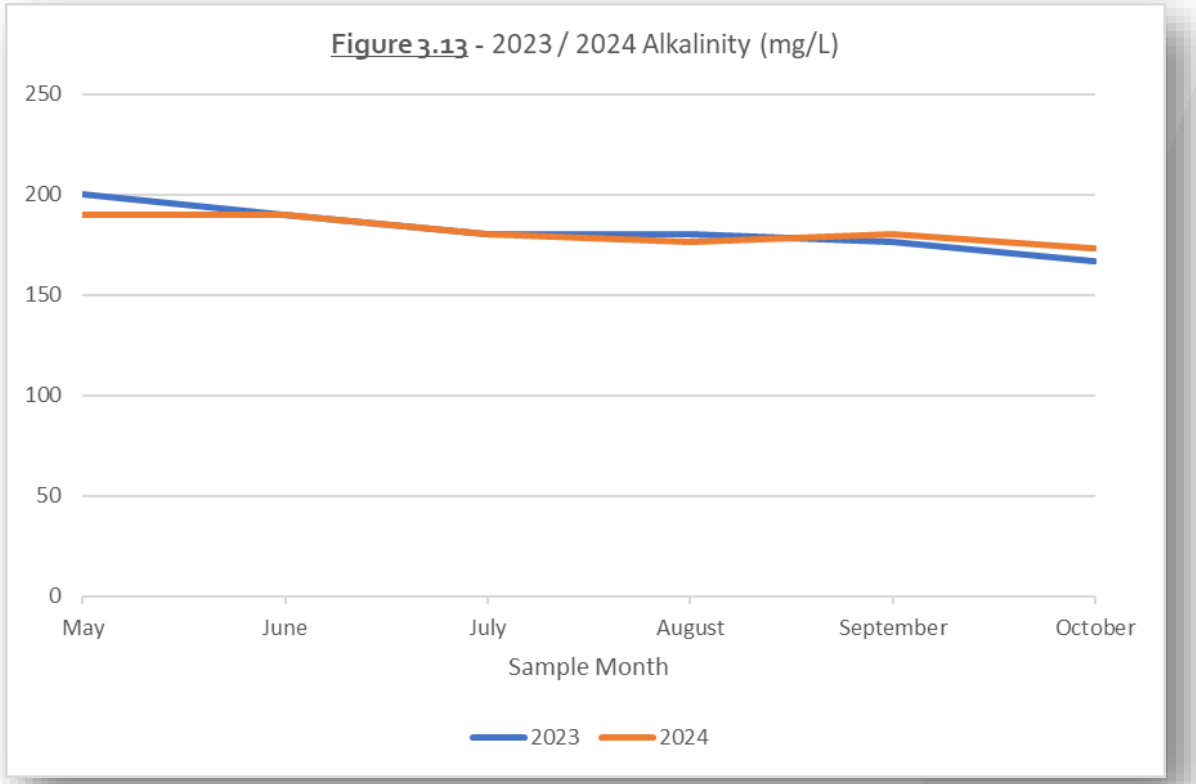
- absorb/neutralize acid-minimizing pH shifts
- Ranged 167 mg/L to 200 mg/L ranking moderately to very hard

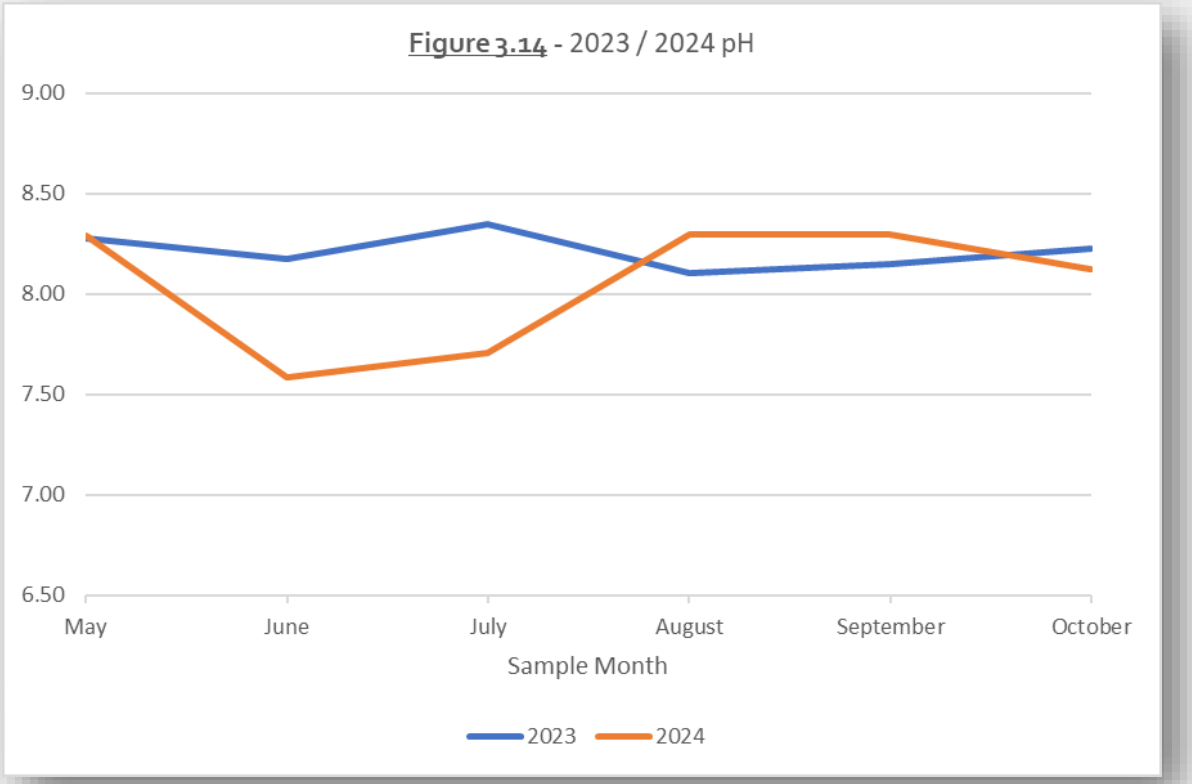
PH = hydrogen ion concentration on a scale from 0 to 14

- IEPA pH standard is greater than 6.5 and less than 9.0
- Most aquatic life requires 6.5 to 9.0
- The pH at Crystal Lake ranged 7.58 to 8.35 in 2023 and 2024

CHEMICAL CONDITIONS

ALKALINITY AND PH



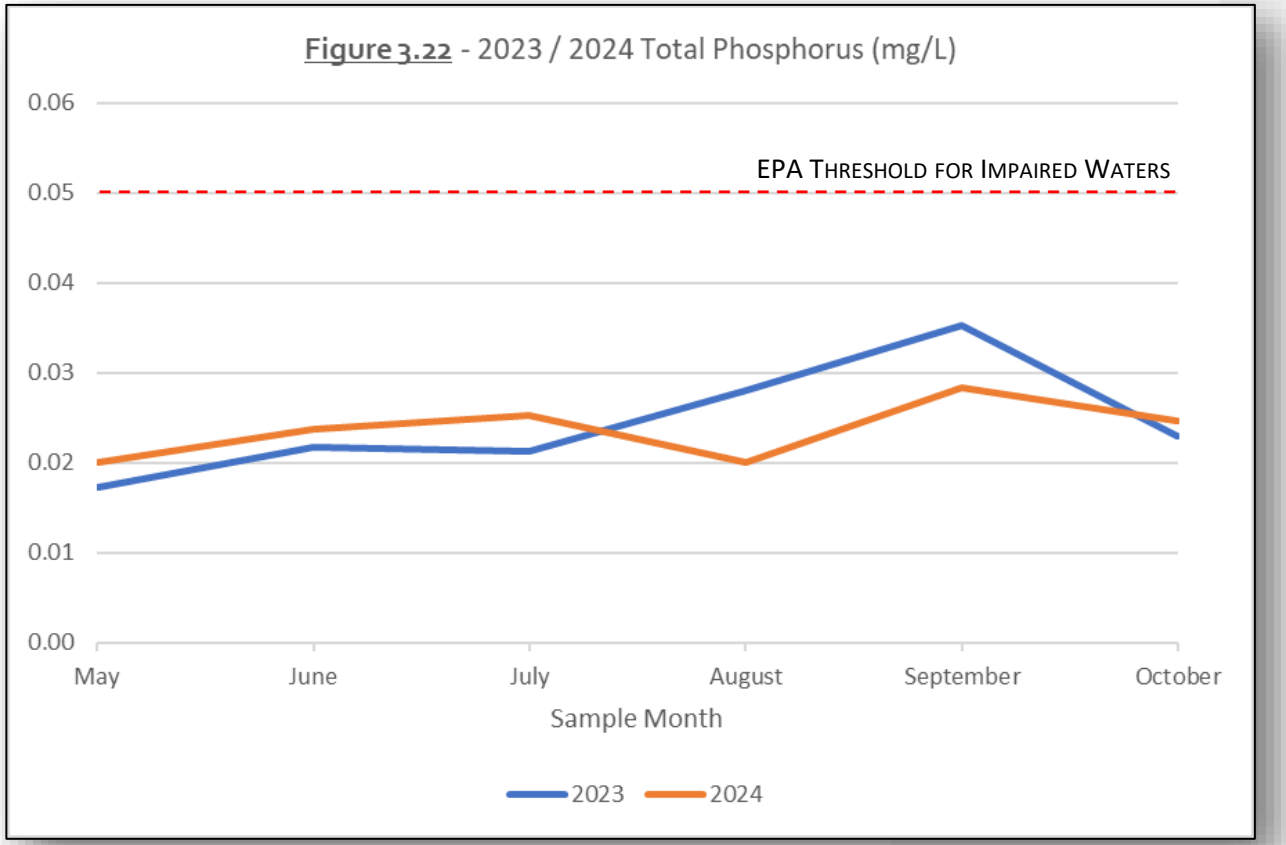


CHEMICAL CONDITIONS

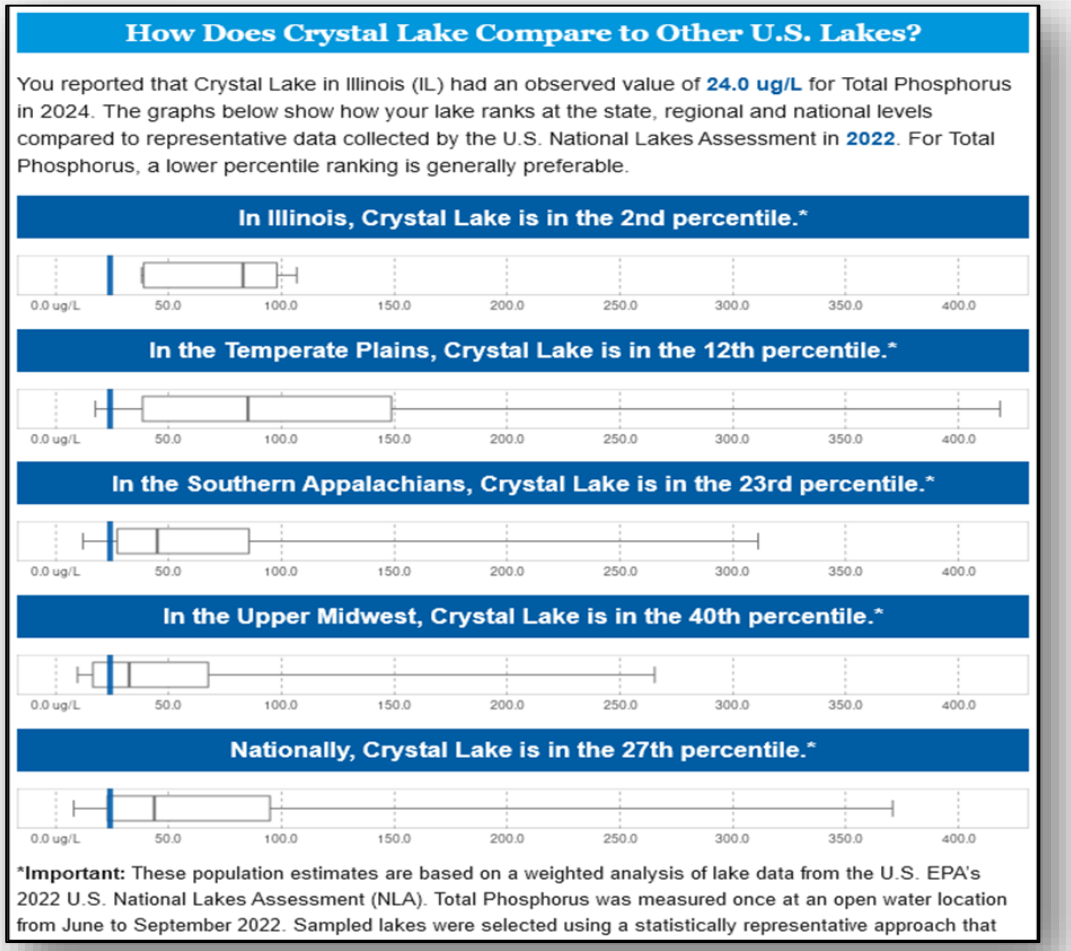
NUTRIENTS (TOTAL PHOSPHOROUS)

- Limiting nutrient affecting plant growth
- Added phosphorus in the system can trigger plant and algae growth
- IEPA standard is 0.05 mg/L
- The average value of total phosphorus at Crystal was 0.024 mg/L
- Crystal Lake is in the 2nd percentile statewide, 12th percentile in the EPA Ecoregion Temperate Plains, and 27th percentile in the nation regarding total phosphorus levels

CHEMICAL CONDITIONS



NUTRIENTS (TOTAL PHOSPHOROUS)



USEPA LAKE COMPARISON

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Chemical Conditions

Nutrients (Total Phosphorous) Local Comparison

Crystal Lake 2023-2024 Average: 0.024 mg/L

Wonder Lake Average: 0.152 mg/L (6 x CL)

Bangs Lake Average: 0.023 mg/L

Lake Zurich Average: 0.024 mg/L

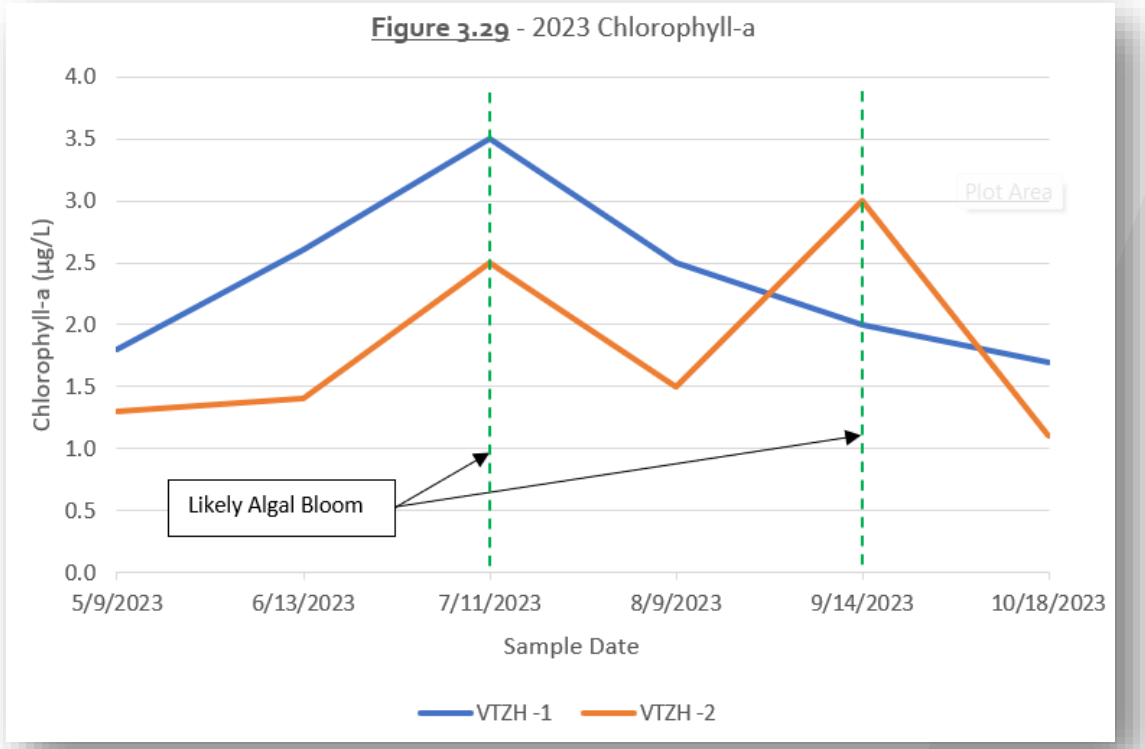
CHEMICAL CONDITIONS

CHLOROPHYLL-a

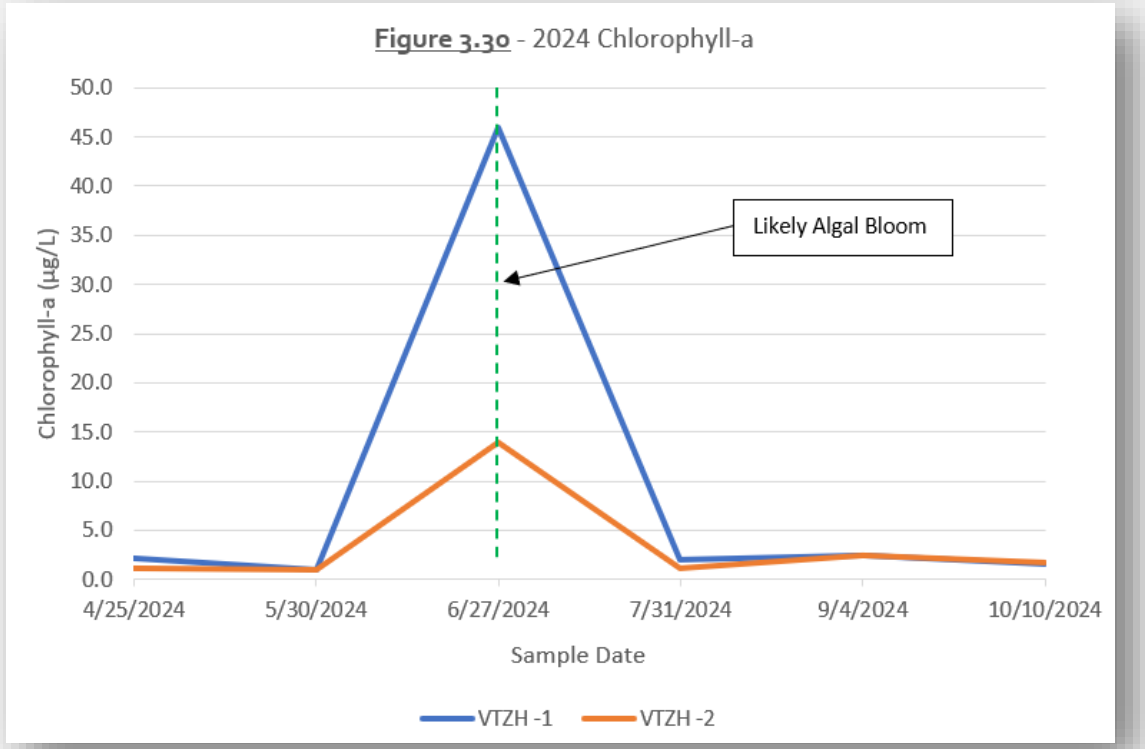
- Photosynthetic pigment in algae that gives algae its characteristic green color
- Amount of chlorophyll-a is an indicator of the amount of algal biomass in water
- The average value of chlorophyll-a in Crystal Lake for 2023 was 2.1 µg/L and in 2024 the average was 6.4 µg/L with an elevated value in June indicating an algal bloom

CHEMICAL CONDITIONS

CHLOROPHYLL-a



RAIN EVENTS TOTALING GREATER THAN 1 ½" EACH

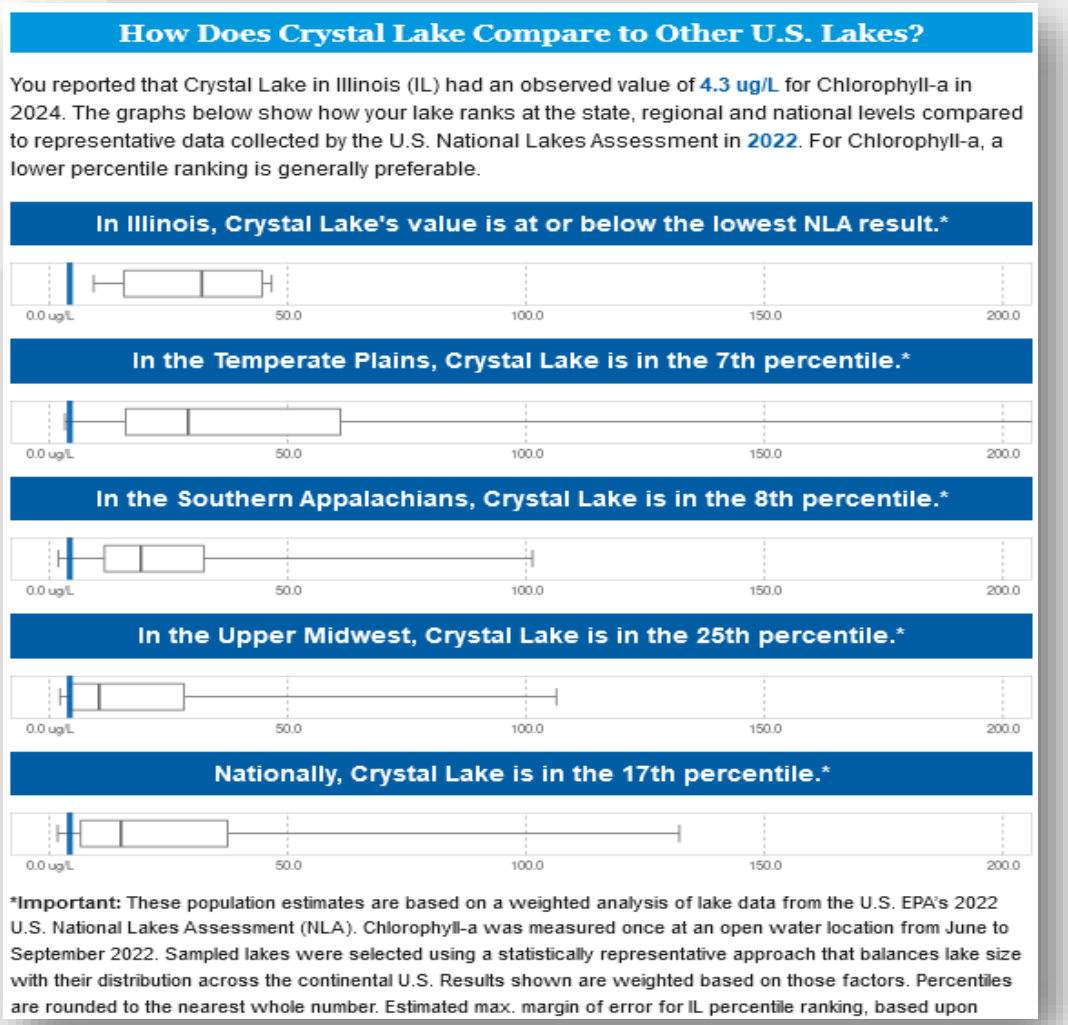


RAIN EVENT TOTALING GREATER THAN 3 ½"

CHEMICAL CONDITIONS

- Crystal Lake at or below the lowest results in Illinois
- 7th percentile in the EPA Temperate Plains Ecoregion
- 17th percentile in the nation concerning chlorophyll-a levels
- Lower percentile ranking is generally preferable

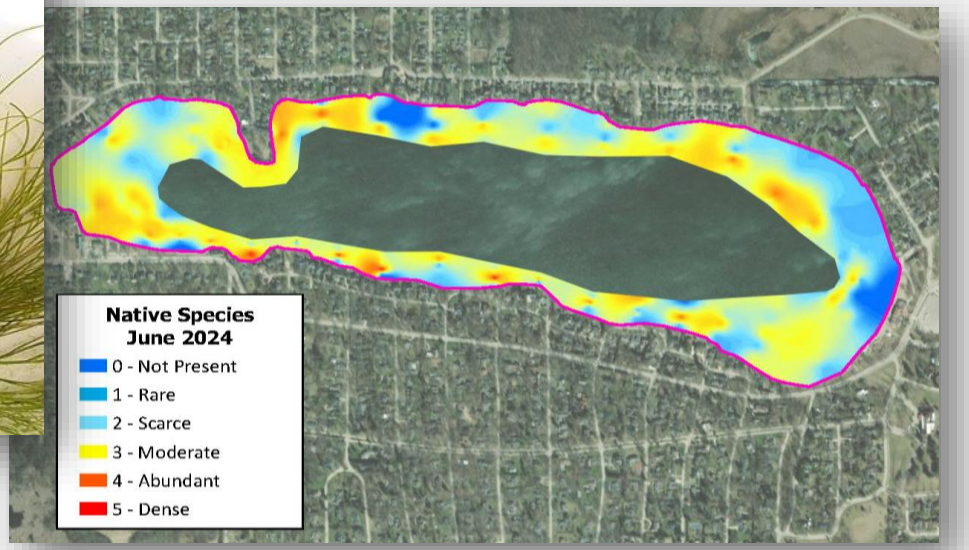
CHLOROPHYLL-a



USEPA LAKE COMPARISON

BIOLOGICAL CONDITIONS

The biological features of Crystal Lake include all the living organisms that interact with the lake. These conditions are generally dictated by the physical and chemical characteristics of the lake, which are related and affect one another. Algae blooms, fish populations, invasive species management, and aquatic plants are examples of biological conditions that are actively measured and managed at Crystal Lake in accordance with the lake management goals.



BIOLOGICAL CONDITIONS

FISH

- The most recent fish survey was on May 7th, 2021, by the Illinois Department of Natural Resources
- Crystal Lake has been stocked annually with Walleye, Smallmouth Bass, and Yellow Perch
- Other species that have been stocked in the past include Tiger Musky, Largemouth Bass, Channel Catfish, Black Crappie, and Northern Pike
- Detailed stocking records are available on the Crystal Lake Park District website
- A fish survey is recommended every 3 to 5 years to determine the status of the fish community and to assess the stocking program and if any regulations need to be adjusted

Biological Conditions

Aquatic Macrophytes (Plants)

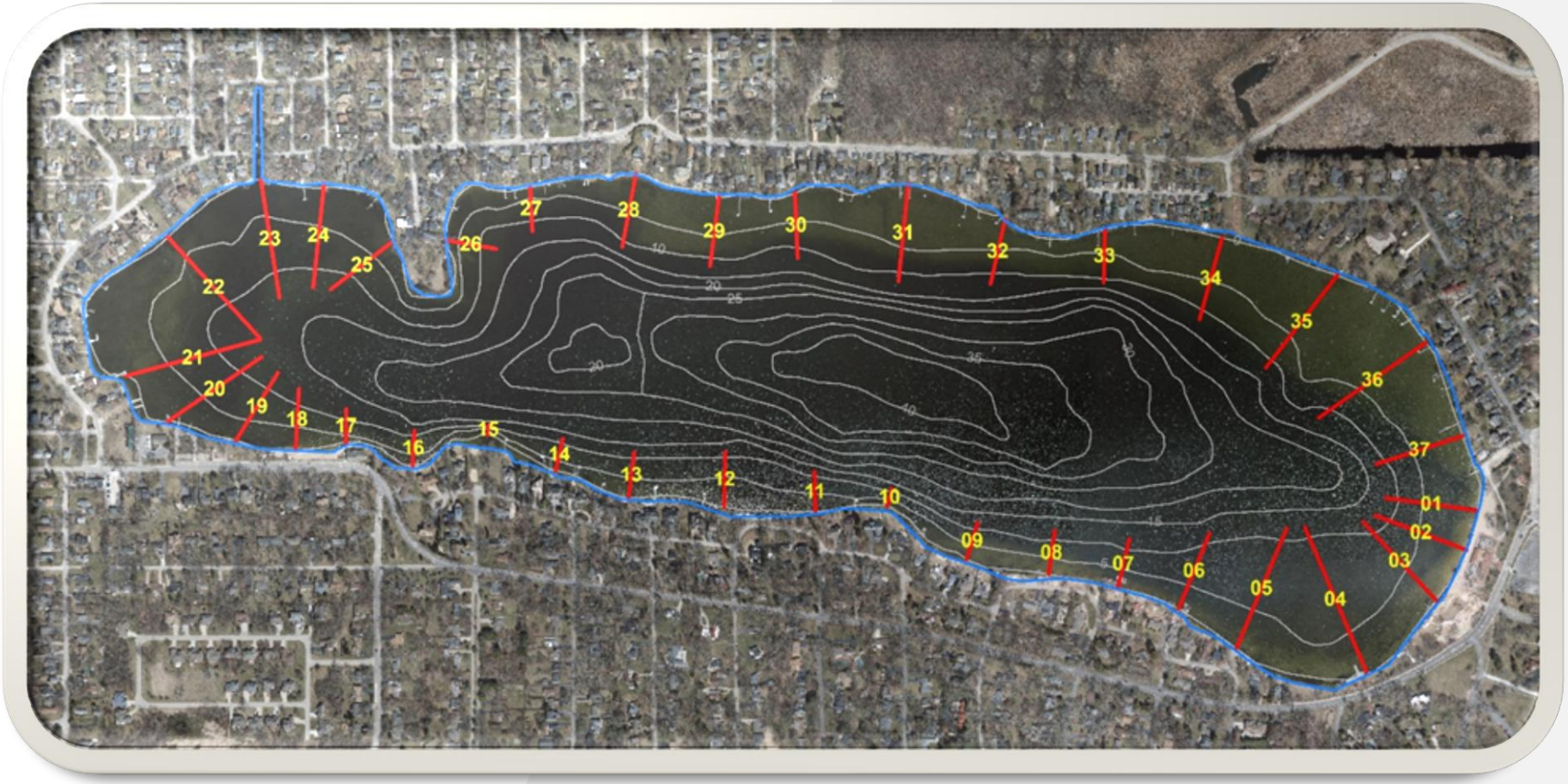
Aquatic macrophytes, or aquatic plants, are a vital component of the lake ecosystem. They are a major primary producer responsible for converting sunlight and inorganic nutrients in the water column and lake sediment into biologically available compounds for consumption by other aquatic life. As a result, plants are an important component of healthy and diverse aquatic ecosystems.

Specific roles of aquatic plants include:

- Habitat and food for fish, invertebrates, amphibians, wildlife, and waterfowl
- Spawning areas for many fish, invertebrates, and amphibians
- Oxygen production
- Protection of lake sediments and shorelines
- Regulation of temperature and light
- Reducing the effects of exotic species invasions

Biological Conditions

Aquatic Macrophytes (Plants)



Typical Plant Survey

37 Transects; 222 Total Sites

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BIOLOGICAL CONDITIONS

AQUATIC MACROPHYTES (PLANTS)

Table 1 - Aquatic Plant Survey Results 2023

Species	Found at Sites (#)	Frequency of Occurrence	Average Density when present	Relative Dominance
Ceratophillum demersun - Coontail	6	1.40%	1.17	0.53%
Chara sp. - Muskgrass	329	76.87%	2.38	39.77%
Elodea canadensis - Elodea	1	0.23%	1.00	0.08%
Najas marina– Spiny Naiad*	14	3.27%	2.07	1.58%
Potamogeton crispus – Curly-Leaf Pondweed*	21	4.91%	1.43	2.01%
Potamogeton illinoensis – Illinois Pondweed	54	12.62%	1.48	5.25%
Stuckenia pectinatus – Sago Pondweed	191	44.63%	2.02	21.30%
Nymphaea tuberosa – White Water Lily	2	0.47%	1.00	0.17%
Vallisneria americana – Eel Grass	237	55.37%	2.42	28.95%
Utricularia sp. – Bladderwort	3	0.70%	2.33	0.36%

*Indicates non-native species

2023 *(8 NATIVE, 2 NON-NATIVE)*

BIOLOGICAL CONDITIONS

AQUATIC MACROPHYTES (PLANTS)

Table 2 - Aquatic Plant Survey Results 2024

Species	Found at Sites (#)	Frequency of Occurrence	Average Density when present	Relative Dominance
Ceratophillum demersun - Coontail	25	5.81%	2.08	2.82%
Chara sp. - Muskgrass	362	84.19%	2.63	45.84%
Elodea canadensis - Elodea	6	1.40%	3.00	0.81%
Myriophillum spicatum– Eurasian Watermilfoil*	9	2.09%	2.44	1.10%
Najas marina– Spiny Naiad*	18	4.19%	2.17	2.07%
Potamogeton crispus – Curly-Leaf Pondweed*	5	1.16%	1.2	0.45%
Potamogeton illinoensis – Illinois Pondweed	9	2.09%	1.56	0.90%
Stuckenia pectinatus – Sago Pondweed	155	36.05%	1.97	17.05%
Ranunculus aquatilis – White Water Crowfoot	2	0.47%	1.00	0.17%
Vallisneria americana – Eel Grass	209	48.60%	2.60	26.28%
Utricularia sp. – Bladderwort	24	5.58%	1.75	2.51%

*Indicates non-native species

2024 *(8 NATIVE, 3 NON-NATIVE)*

Biological Conditions

Aquatic Macrophytes (Non-Natives)

2023

2024

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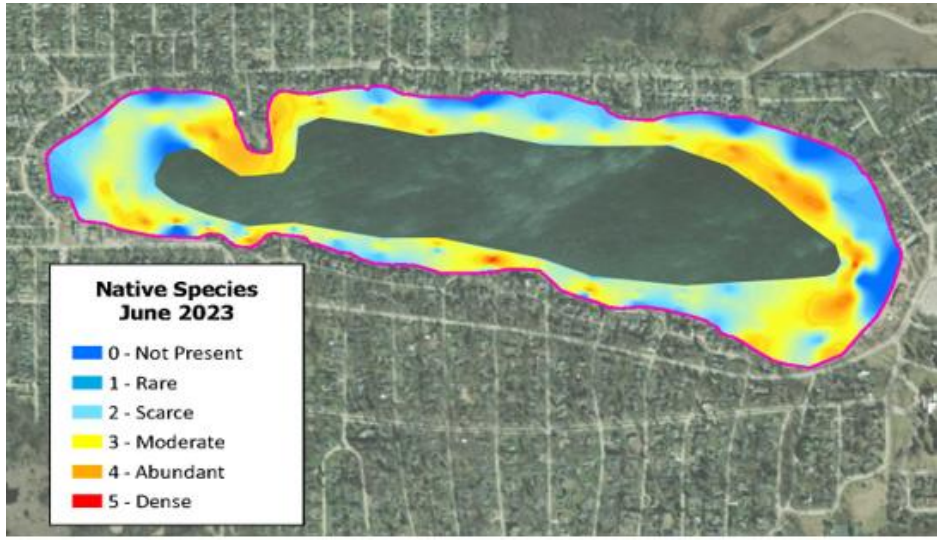
BIOLOGICAL CONDITIONS

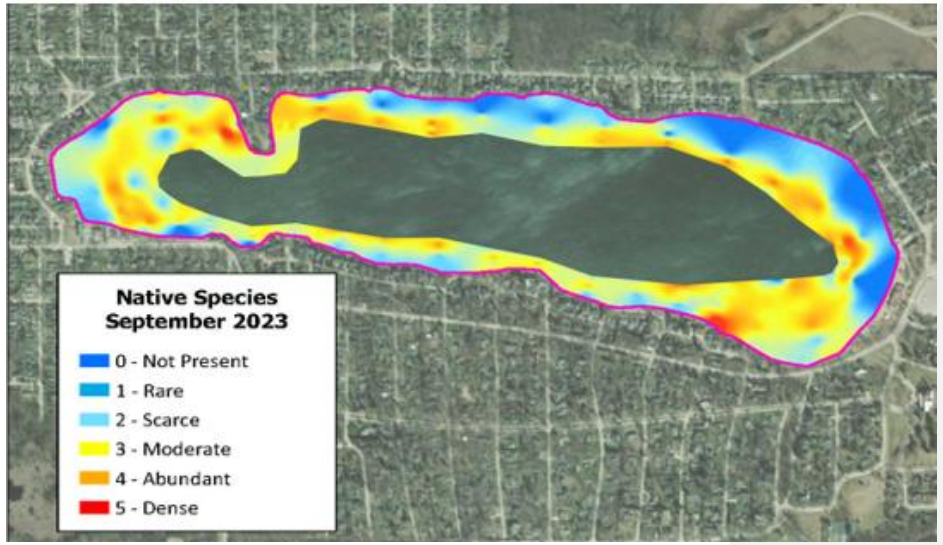
AQUATIC MACROPHYTES (NON-NATIVES)

BIOLOGICAL CONDITIONS

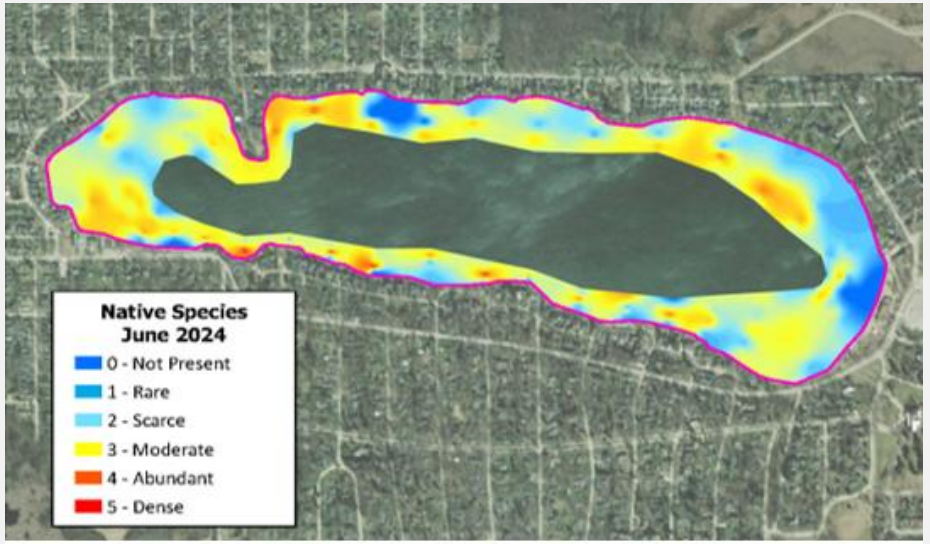
AQUATIC MACROPHYTES (NATIVES)

2023



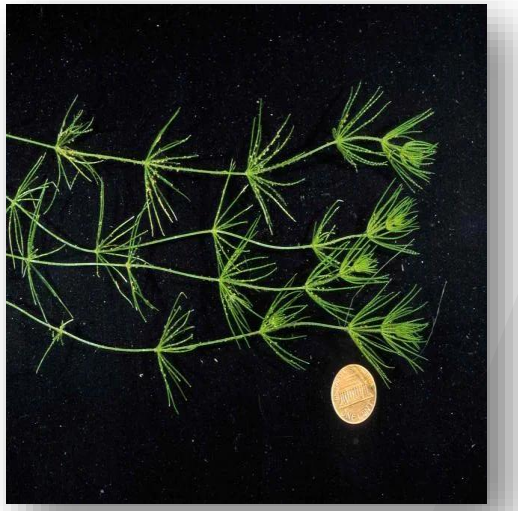


2024



BIOLOGICAL CONDITIONS

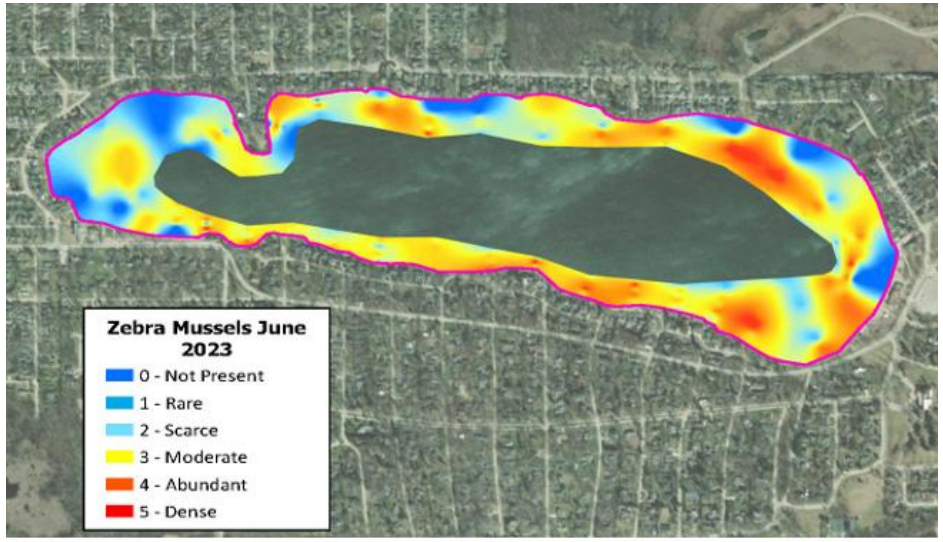
AQUATIC MACROPHYTES (NATIVES)

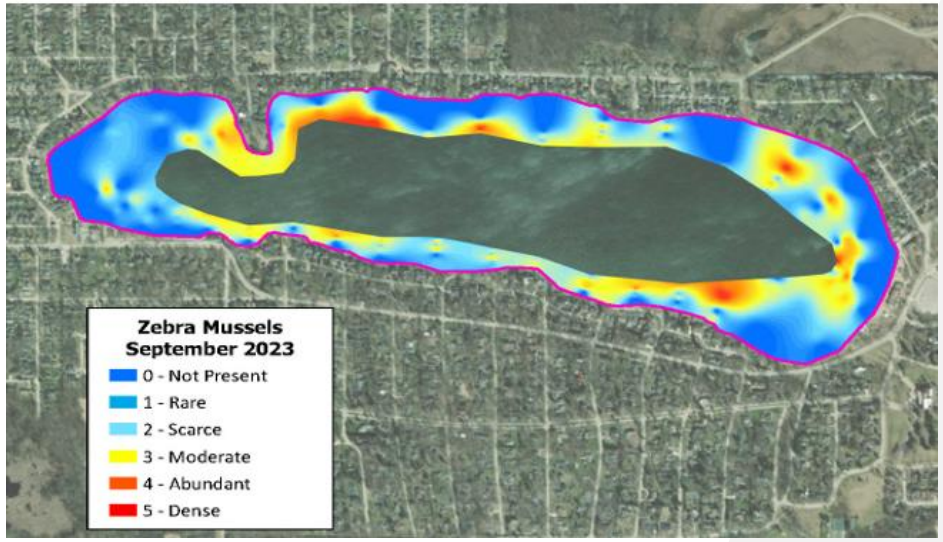


BIOLOGICAL CONDITIONS

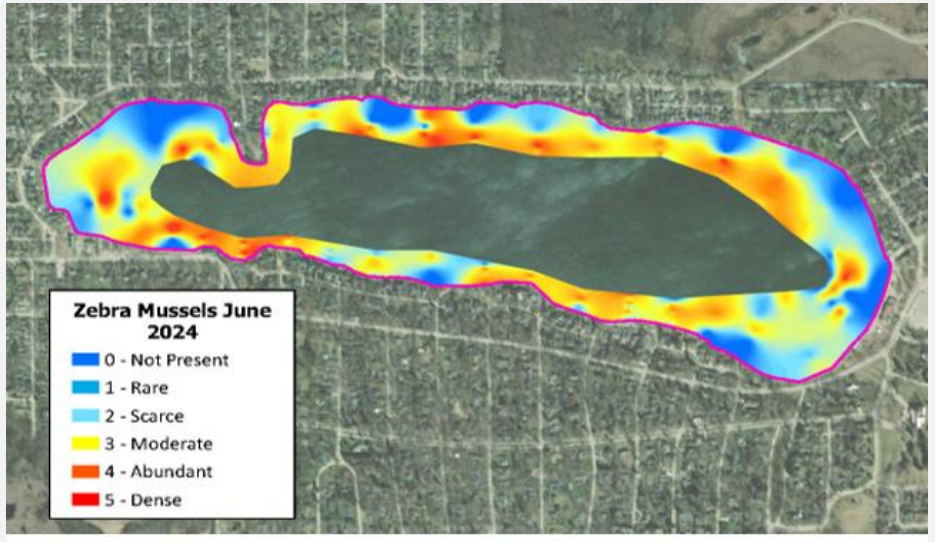
AQUATIC ORGANISMS (ZEBRA MUSSELS)

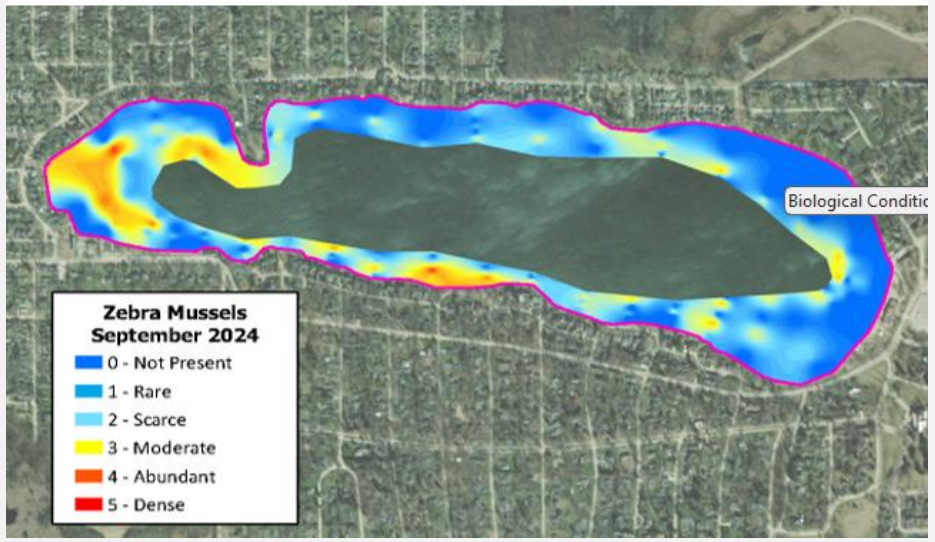
2023





2024





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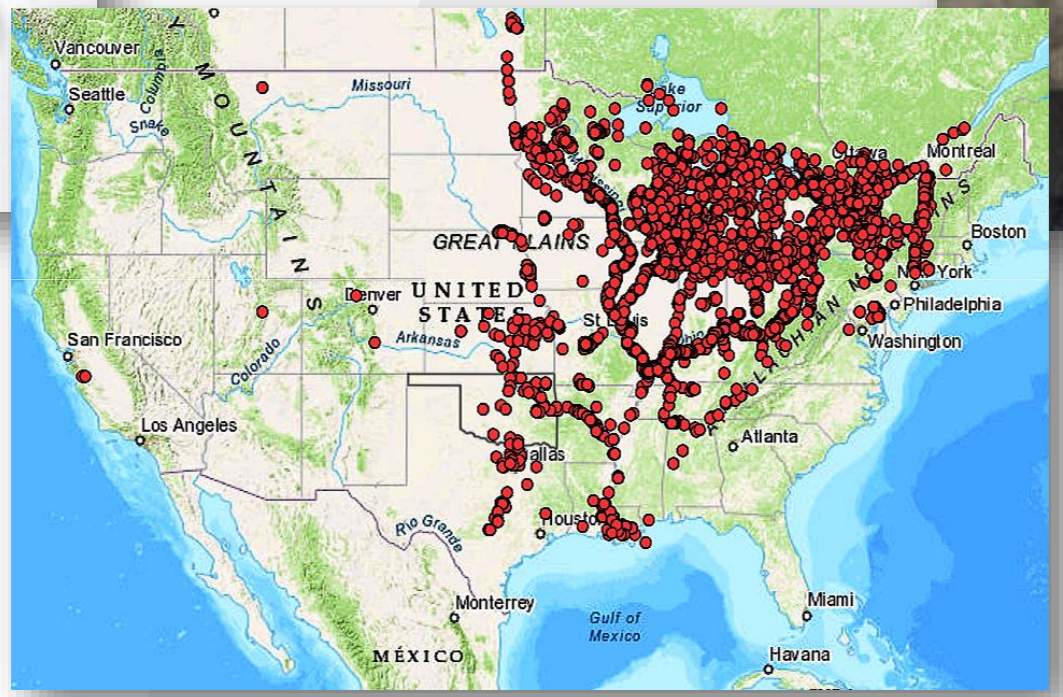
BIOLOGICAL CONDITIONS

AQUATIC ORGANISMS (ZEBRA MUSSELS)



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BIOLOGICAL CONDITIONS

PLANT MANAGEMENT (ON-LAKE ACTIVITY)

2023

Table 3 - Aquatic Plant Treatments 2023 (chemical and mechanical)

Date	Location	Type	Chemical	Target Species
5/17/2023	• Areas in north and northeast West Bay	A. Aquatic Herbicide	A. Spritflo™ (liquid form of the active ingredient Fluoridone)	unwanted, submerged, non-native Curly-leaf
5/25/2023	• Main and West Beach swimming areas (entire roped off area)	A. Aquatic Herbicide B. Algaecide	A. Aquathol Super K™ (granular form of the broad-spectrum active ingredient Mono salt of endothall) B. Copper Sulfate (granular form)	A. unwanted, submerged, native and non-native vegetation B. algae
5/25/2023	• CCAPOA private swimming areas at beaches 7, 13 and 21 (deeper half of the roped off areas)	A. Aquatic Herbicide B. Algaecide	A. Aquathol Super K™ (granular form of the broad-spectrum active ingredient Mono salt of endothall) B. Copper Sulfate (granular form)	A. unwanted, submerged, native and non-native vegetation B. algae
6/30/2023 (A) 7/27/2023 (B)	• Specific, privately funded frontages around entire lake (SPOA effort)	• Aquatic Herbicide • Algaecide	A. Aquathol Super K™ (granular form of the broad-spectrum active ingredient Mono salt of endothall) B. Copper Sulfate (granular form)	A. All vegetation within the pier areas B. Chara within pier areas
7/6/2023 and 8/9/2023	• West Bay, northern areas east and west of the Lippold Channel to Rumsey's Point	• Mechanical Harvesting (three days total)		• Rooted and up-rooted, floating plants
Late 2023	• CLPD takes delivery of new harvesting equipment (training and testing near Main Beach)	• Mechanical Harvesting		• Rooted and up-rooted, floating plants

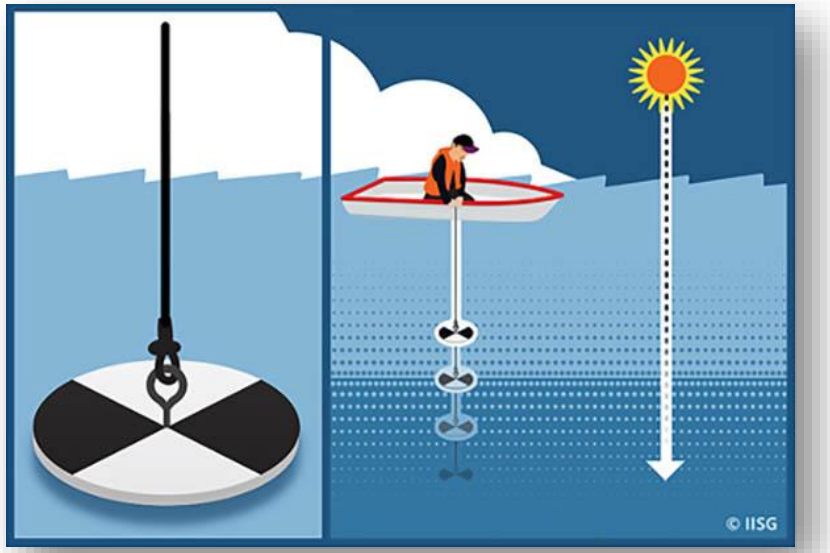
2024

Table 4 - Aquatic Plant Treatments 2024 (chemical and mechanical)

Date	Location	Type	Chemical	Target Species
5/20/2024	• Main and West Beach swimming areas (entire roped off area)	A. Aquatic Herbicide C. Algaecide	A. Aquathol Super K™ (granular form of the broad-spectrum active ingredient Mono salt of endothall) B. Copper Sulfate (granular form)	A. unwanted, submerged, native and non-native vegetation B. algae
5/20/2024	• CCAPOA private swimming areas at beaches 3, 7, 13 and 21 (deeper half of the roped off areas)	A. Aquatic Herbicide B. Algaecide	A. Aquathol Super K™ (granular form of the broad-spectrum active ingredient Mono salt of endothall) B. Copper Sulfate (granular form)	A. unwanted, submerged, native and non-native vegetation B. algae
5/21/2024	• West Bay, northern areas east and west of the Lippold Channel to Rumsey's Point	A. Aquatic Herbicide	A. Aquathol Super K™ (granular form of the broad-spectrum active ingredient Mono salt of endothall)	unwanted, submerged, native and non-native vegetation
9/3/2024	• Specific, privately funded frontages (SPOA effort)	A. Aquatic Herbicide B. Algaecide	A. Hydrothol 191™ (granular form of the broad-spectrum active ingredient Mono salt of endothall) B. Cutrine Plus™ (granular form of elemental copper)	A. All vegetation within the pier areas B. Chara within pier areas
Season-long Harvester Operation	• West Bay, northern areas east and west of the Lippold Channel to Rumsey's Point	• Mechanical Harvesting		• Rooted and up-rooted, floating plants

TROPHIC STATE INDEX

Trophic status is an estimate of a lake's primary productivity and can be used to determine the ecological impacts of nutrient enrichment to a lake. The trophic state impacts the physical, chemical, and biological lake conditions. A trophic state index (TSI) assigns a trophic status based on Secchi disk, total phosphorus, and chlorophyll-a readings.



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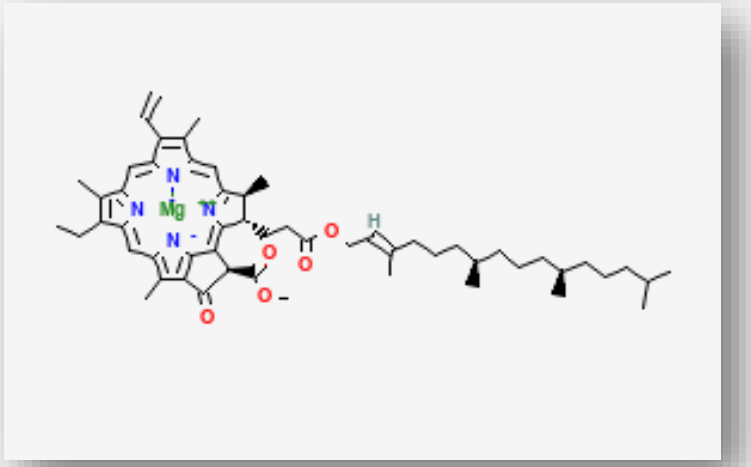
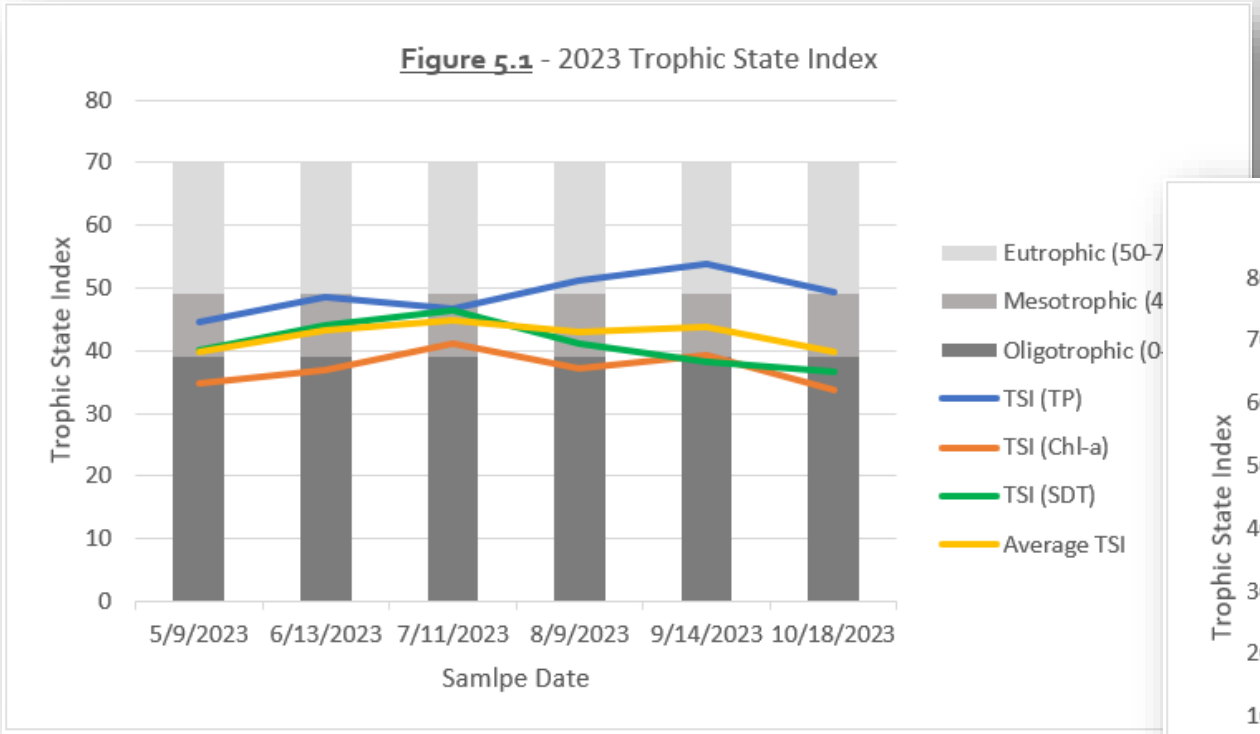
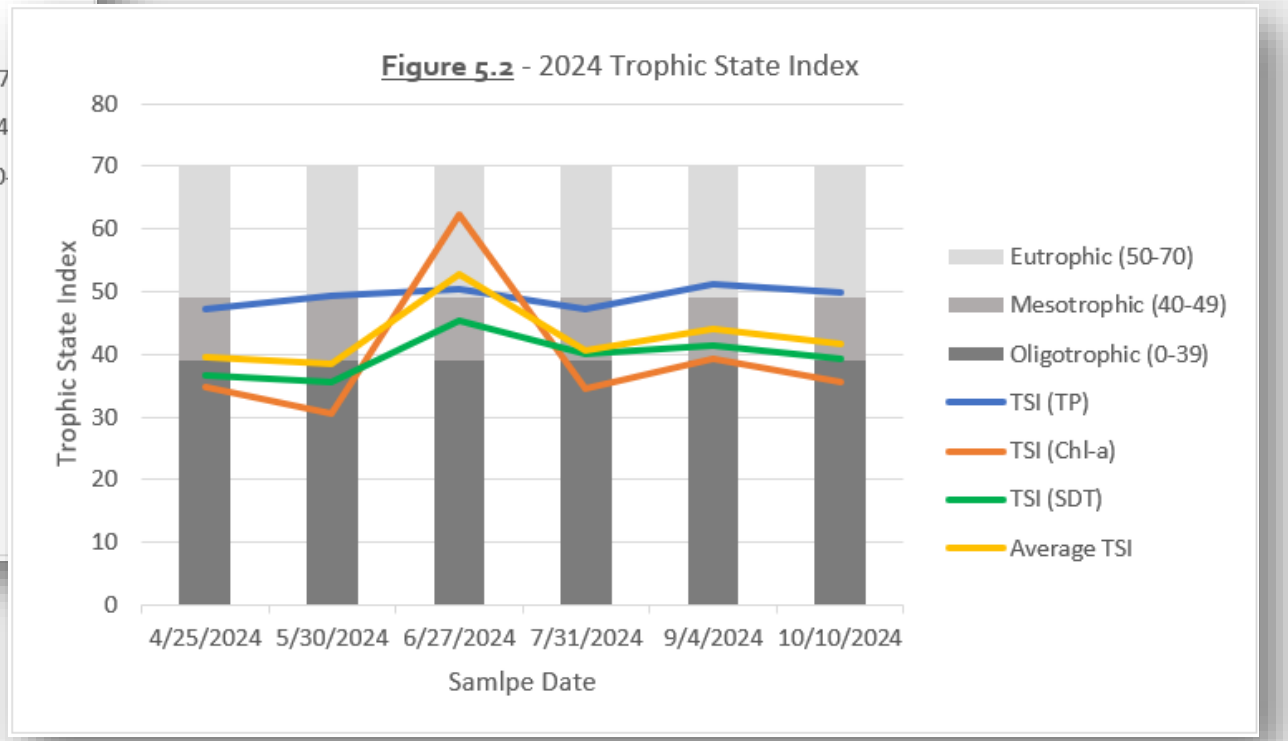


Trophic State Index

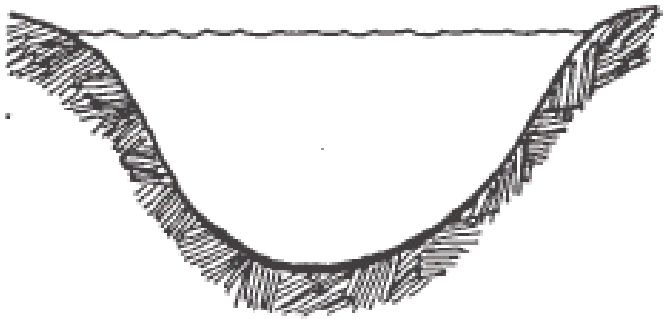


TSI 42 (2023)



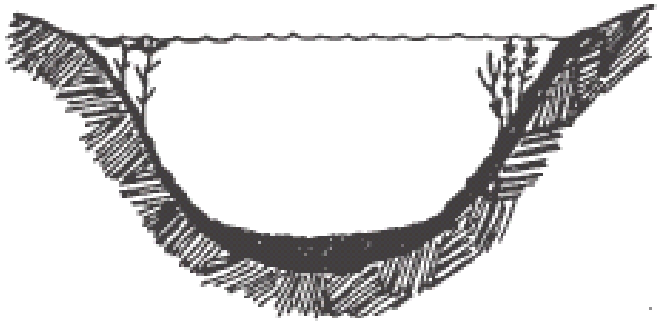
TSI 43 (2024)

TROPHIC STATE INDEX



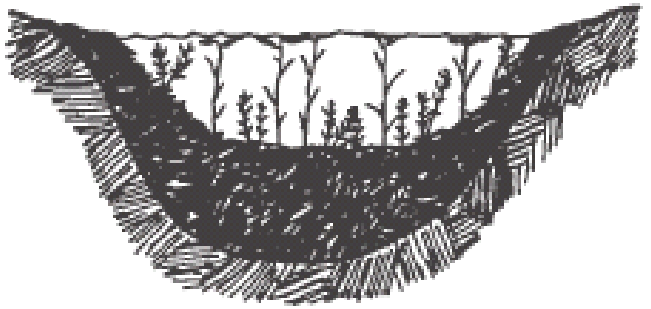
OLIGOTROPHIC

- Clear water, low productivity
- Very desirable fishery of large game fish



MESOTROPHIC

- Increased production
- Accumulated organic matter
- Occasional algal bloom
- Good fishery



EUTROPHIC

- Very productive
- May experience oxygen depletion
- Rough fish common

Summary

- Lake continues to be stable chemically & biologically
- Water quality data is consistent and enviable and ranks higher than other lakes locally and nationally
- Fishery has not been assessed since 2021. It continues to be enhanced through stocking efforts
- 11 plant species in the lake; 2 non-natives species with 3RD re-populating
- Trophic State Index of 42 & 43 indicates lake is Mesotrophic (40-49)
- Watershed protection measures are working

THANK YOU FOR COMING