

METHODS FOR DETERMINING VEGETATION & FISH HEALTH

Overview

Biodiversity is important in maintaining a healthy lake ecosystem. Biodiversity is considered to be a principle driver of ecosystem function and critical to ecosystem resilience and stability. A diverse ecosystem provides a number of services such as nutrient recycling, improved water quality, and increased recreational opportunities. Human disturbances often lead to a decrease in species diversity resulting in a weakening and/or loss of support to the ecosystem services provided by healthy biotic community.

The development of health assessment indices have provided a means in which natural resources managers can evaluate and monitor the health of a lake's biological community to help focus restoration and preservation efforts. The species that make up a community vary in their tolerance to human disturbances, therefore, as the episodic and cumulative disturbances occur to a system a decrease in species richness and a shift to species that are very tolerant to disturbance. Assessment tools developed by the MnDNR use these tolerance differences to relate the relative health of a given lake. Specifically, different sets of tools have been developed to relate the health of the fish community (Fish IBI) and another set of tools for the vegetation community (FQI).

Floristic Quality Index

The Floristic Quality Index (FQI) is a vegetation health assessment tool that is based on a metric of species richness and a Coefficient of Conservatism (C), which is a score (0 -10) that relates a species site fidelity and tolerance to disturbance. Thus, species that have narrow habitat ranges and/or low tolerance to stress have high C-values. Therefore, the more species observed in a lake and the greater the C-values the greater the system health.

FQI assessment was designed to allow for health assessment from various community sampling techniques. Three different survey methods can be used: Minnesota Biological Survey methods, MnDNR transects or point intercept surveys (most common). All three methods have limitations yet all are relatively good at capturing and evaluating the health of the vegetation community.

Due to natural differences in species composition between deep and shallow lakes and ecoregions, two unique sets of thresholds were developed for FQI scoring for the North Central Hardwoods ecoregion (Table 1). The MnDNR has performed at least one survey and FQI assessment on all of the CRWD lakes presented in this appendix. Each lake report card shows the most recent FQI score for each lake and how it relates to the impairment thresholds presented in Table 1. It should be pointed out that the report cards only show FQI assessments conducted by the MnDNR, and therefore do not include any FQI assessments based on surveys performed by CRWD or other parties.

Table 1: Minnesota Department of Natural Resources North Central Hardwoods ecoregion point intercept and transect sampling FQI impairment thresholds for deep and shallow lakes.

Classification	Deep	Shallow
Exceptional	32.4	26.0
Impaired	18.6	17.7

Fish Index of Biotic Integrity

The Fish IBI is comprised of multiple metrics that integrate aspects of species richness, community assemblage, and trophic composition. The combining of all individual metrics results in a single score that relates the relative health of the fish community with healthier systems having greater overall scores. Low scores are typically associated to imbalanced communities filled with tolerant species and high scores are typically received when communities are balanced and filled with intolerant species.

Fish IBI sampling includes trap and gill net surveys along with nearshore backpack electrofishing and beach seining. Together these various sampling gears are able to capture information from various habitats throughout a lake and also target all fish species.

Minnesota lakes that fall within lake classes 20 - 43 (Schupp lake classification) have been partitioned into four distinct Fish IBIs. Lake class groups are clustered together using eight lake attributes that account for the expected variability of a fish community due natural phenomenon (Table 2).

Table 2: Minnesota Department of Natural Resources fish IBI tool classification.

IBI Tool	Schupp's Lake Class	Lake Classification Group Description
2	22, 23, 24, 25, 27	Generally, deep lakes with high shoreline complexity (SDI) that are typically less than 80% littoral.
4	28, 29, 30, 31, 32	Compared to LCG 2 these lakes on average are smaller, have intermediate littoral area, have less shoreline complexity (typically rounder basins). They also typically have a low trophic status, low phosphorus levels, and clearer water compared to LCG2.
5	33, 34, 35, 36, 37, 39	Central and Northern MN lakes of shallow to moderate depths (mostly littoral). Generally, naturally eutrophic lakes with lots of vegetation and soft sediment.
7	38, 41, 42, 43	Shallowest lakes typically consisting of > 80% littoral area. Primarily in the southern half of the state. Excludes winterkill lakes (w/in 10 years) and riverine lakes

Table 3: Minnesota Department of Natural Resources impairment thresholds for fish IBI tools.

Classification	Tool 2	Tool 4	Tool 5	Tool 7
Exceptional	64	59	61	NA
Impaired	44	38	24	36

The MnDNR has performed Fish IBI assessments on six lakes throughout the CRWD: Cedar, Betsy, Louisa, Clearwater, School Section, and Bass. The lake report cards for each of these lakes present the Fish IBI score and how it relates to the impairment thresholds presented in Table 3.

More information on Fish IBI methodology can be found on the MnDNR's website:

http://www.dnr.state.mn.us/waters/surfacewater_section/lake_ibi/index.html

ALBION LAKE

QUICK FACTS

Littoral Area: 251 acres

Residence Time: 1477 days

Surface Area: 251 acres

Subwatershed Area: 1,094 acres

Maximum Depth: 9 feet

Upstream Waters: None

Common Fish

Common carp,
black bullhead

Dominant Vegetation

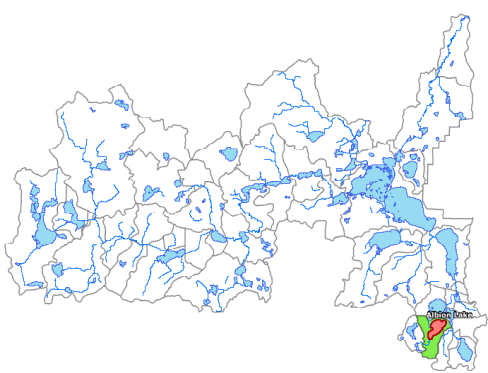
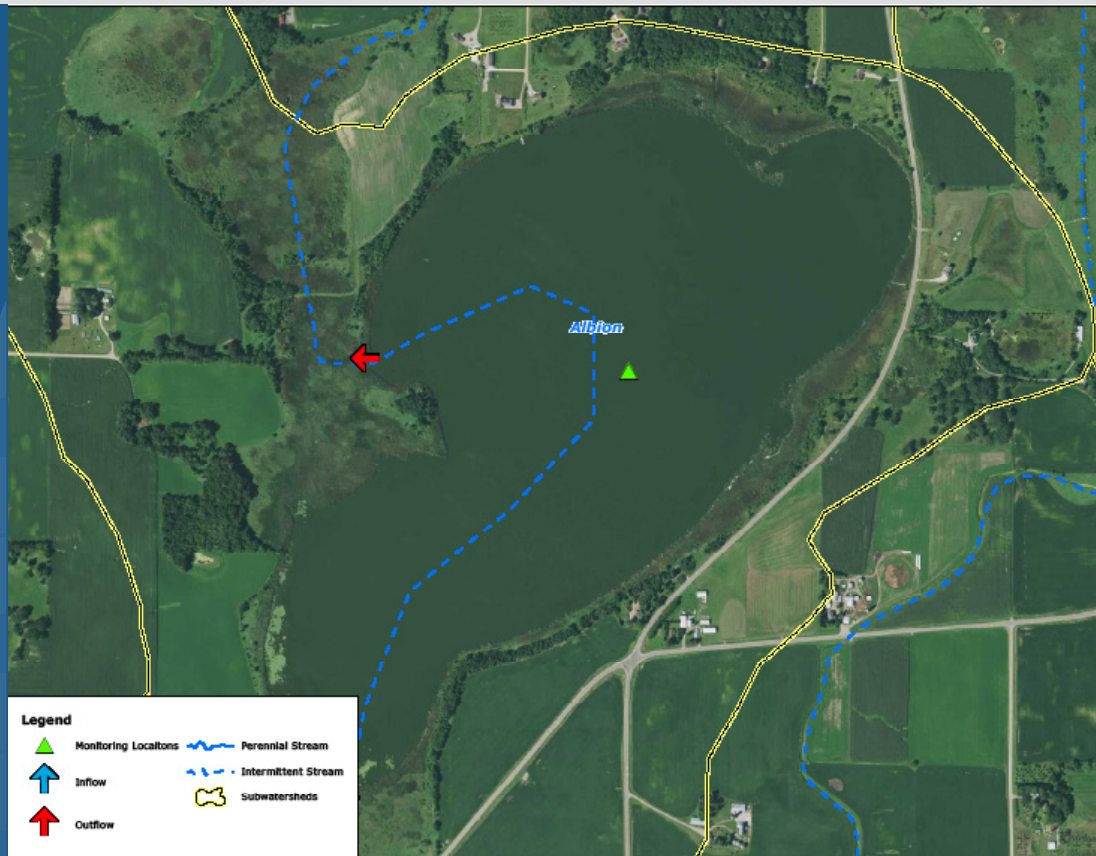
Sago pondweed

Invasive Species

Curly-leaf
pondweed

Status

Impaired; TMDL
Completed 2010



TO DO LIST

- ▲ Rough fish management
- ▲ AIS management
- ▲ Manage upstream loads

Fish Health
(IBI)

Impaired

Supporting

0

36

100

*Fish IBI has not been assessed

12.7

Vegetation Health
(FQI)

Impaired

Supporting

Exceptional

0

17.8

26

*Sample date: 8/14/2015

Sediment P Release
(mg/m²/day)

Low

Moderate

High

0

3.3

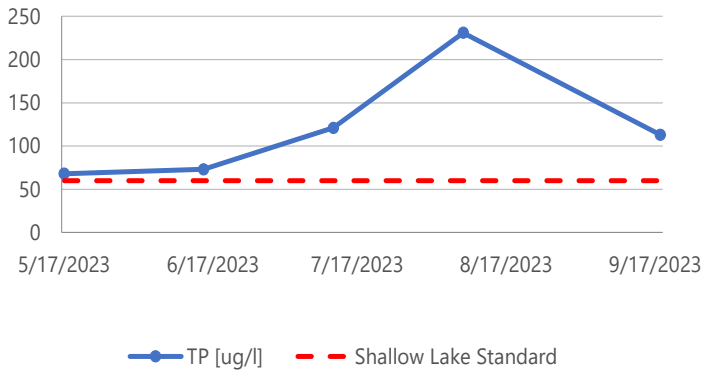
7.5

*Sediment release rate has not been assessed

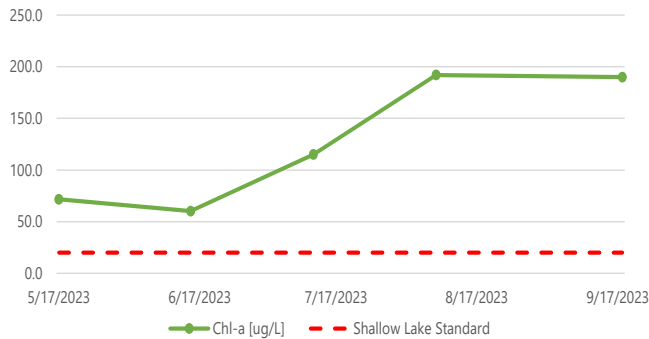
ALBION LAKE

2023 Water Quality

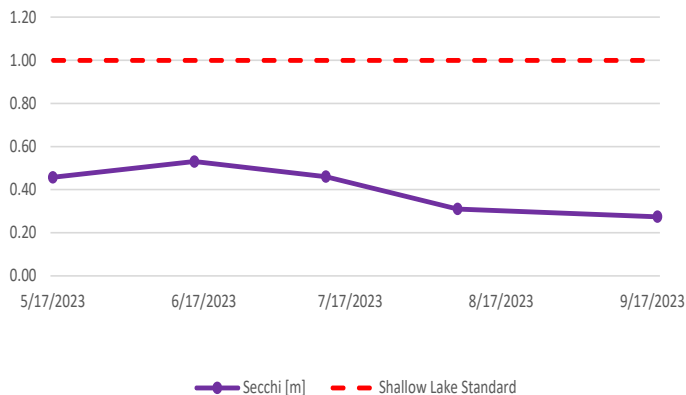
Albion - 2023 TP [ug/l]



Albion - 2023 Chl-a [ug/L]

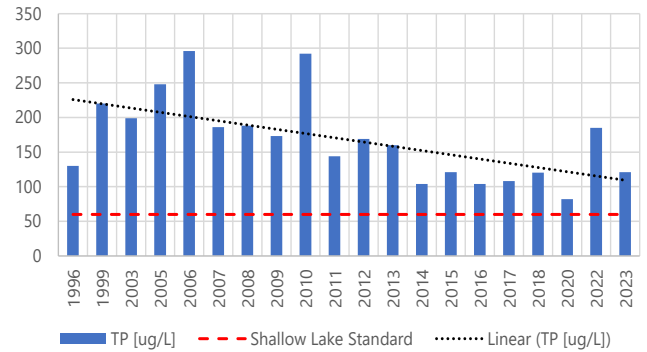


Albion - 2023 Secchi [m]

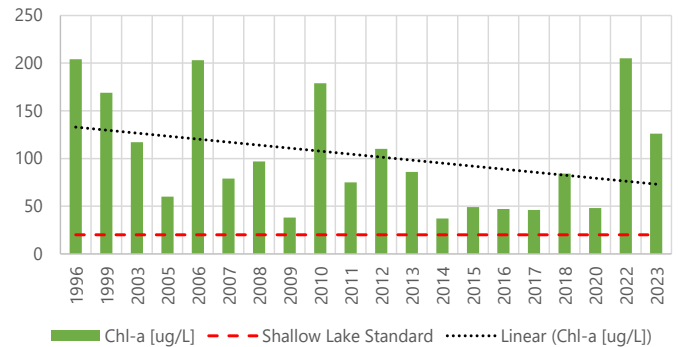


Historic Water Quality

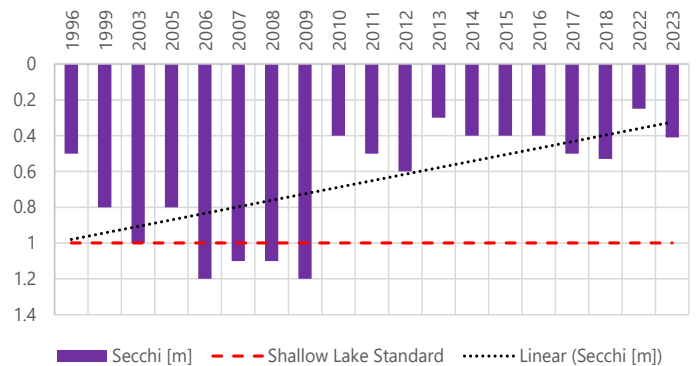
Albion - Historical TP [ug/L]



Albion - Historical Chl-a [ug/L]



Albion - Historical Secchi [m]



BASS LAKE

QUICK FACTS

Littoral Area: 96 acres

Surface Area: 222 acres

Subwatershed Area: 796 acres

Maximum Depth: 34 feet

Upstream Waters: None

Common Fish

Bluegill, Northern Pike, Yellow Bull-head, Largemouth Bass

Dominant Vegetation

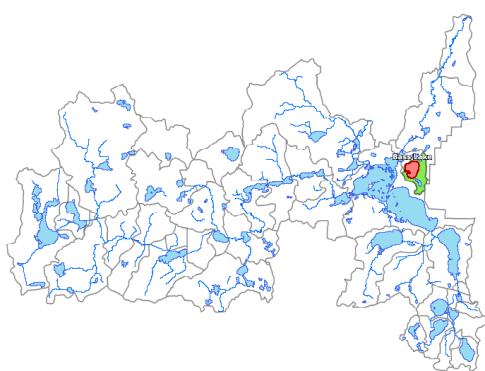
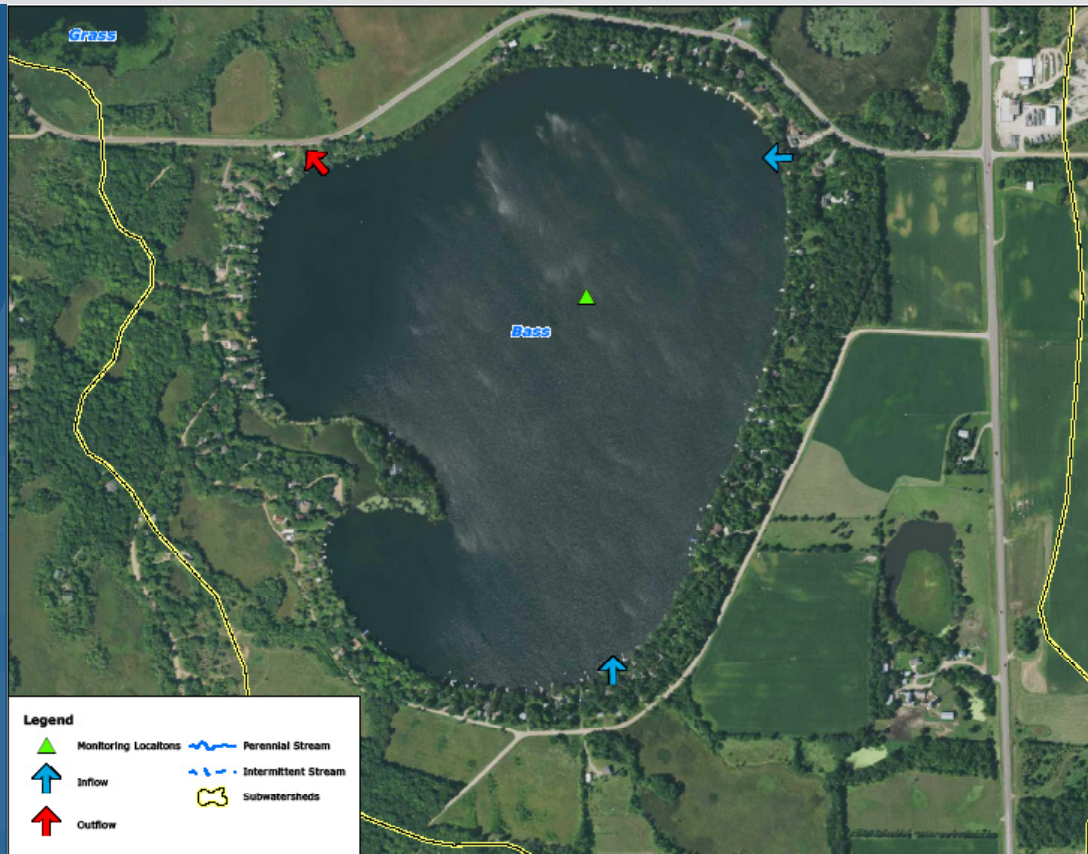
Currently obtaining vegetation info from DNR

Invasive Species

Currently obtaining vegetation info from DNR

Status

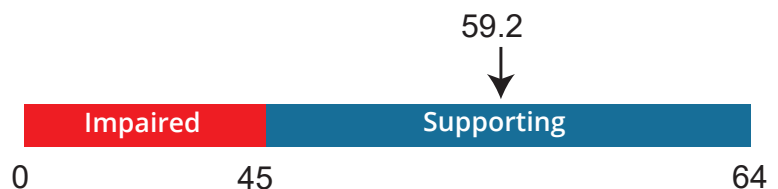
Not impaired



TO DO LIST

- Protect water quality
- Manage upstream loads
- AIS management and prevention

Fish Health (IBI)



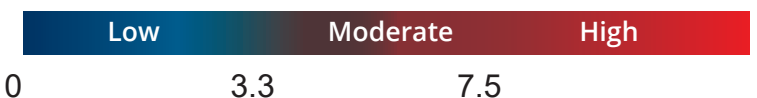
*Sample date: 8/09/2017

Vegetation Health (FQI)



*Sample date: 8/10/2015

Sediment P Release (mg/m²/day)



*Sediment release rate has not been assessed

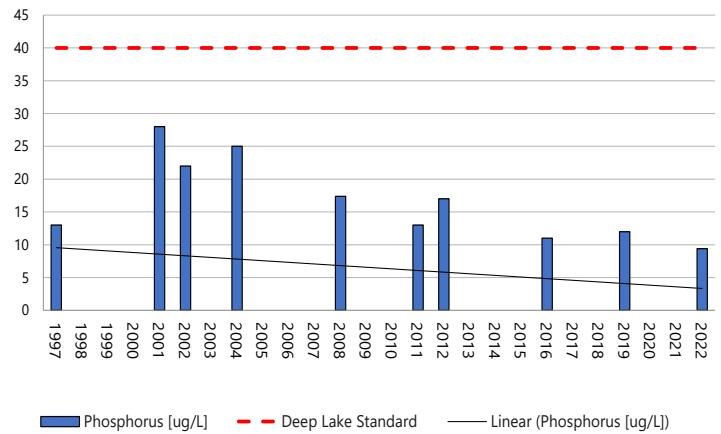
BASS LAKE

2023 Water Quality

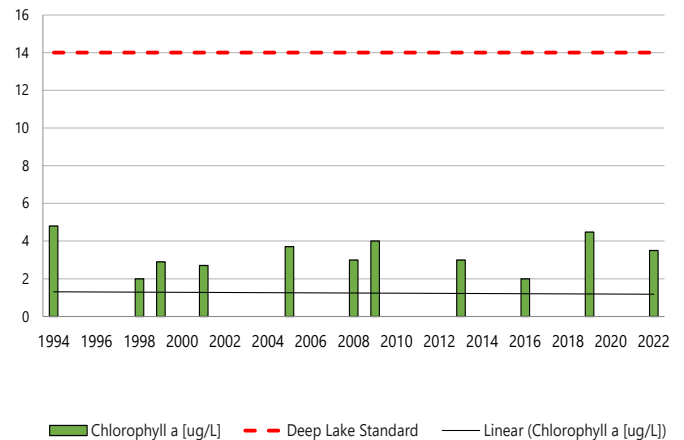
Lake not sampled

Historic Water Quality

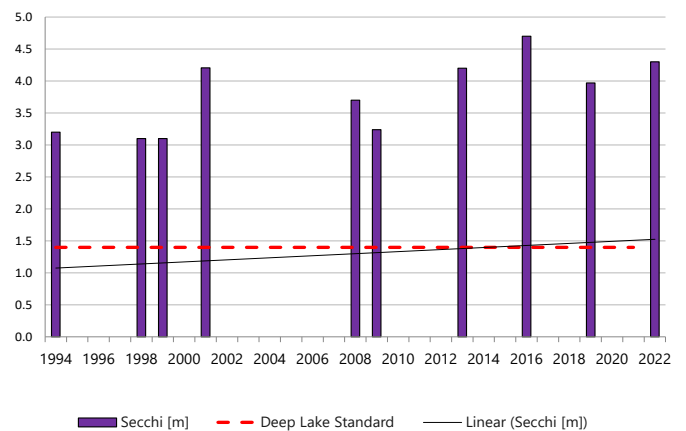
Bass - Historical TP [ug/l]



Bass - Historical Chl-a [ug/l]



Bass - Historical Secchi [m]



CEDAR LAKE

QUICK FACTS

Littoral Area: 315 acres

Surface Area: 790 acres

Subwatershed Area: 9,715 acres

Maximum Depth: 108 feet

Upstream Waters: Swartout, Albion, Henshaw

Common Fish

Bluegill, Northern Pike, Walleye, Largemouth Bass

Dominant Vegetation

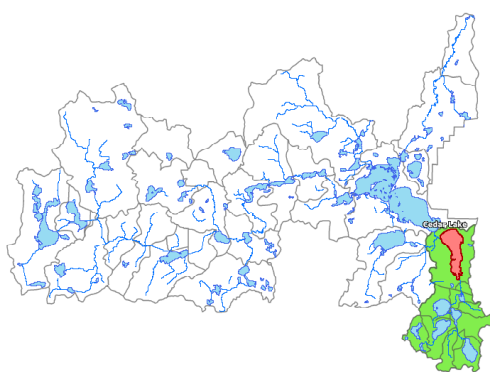
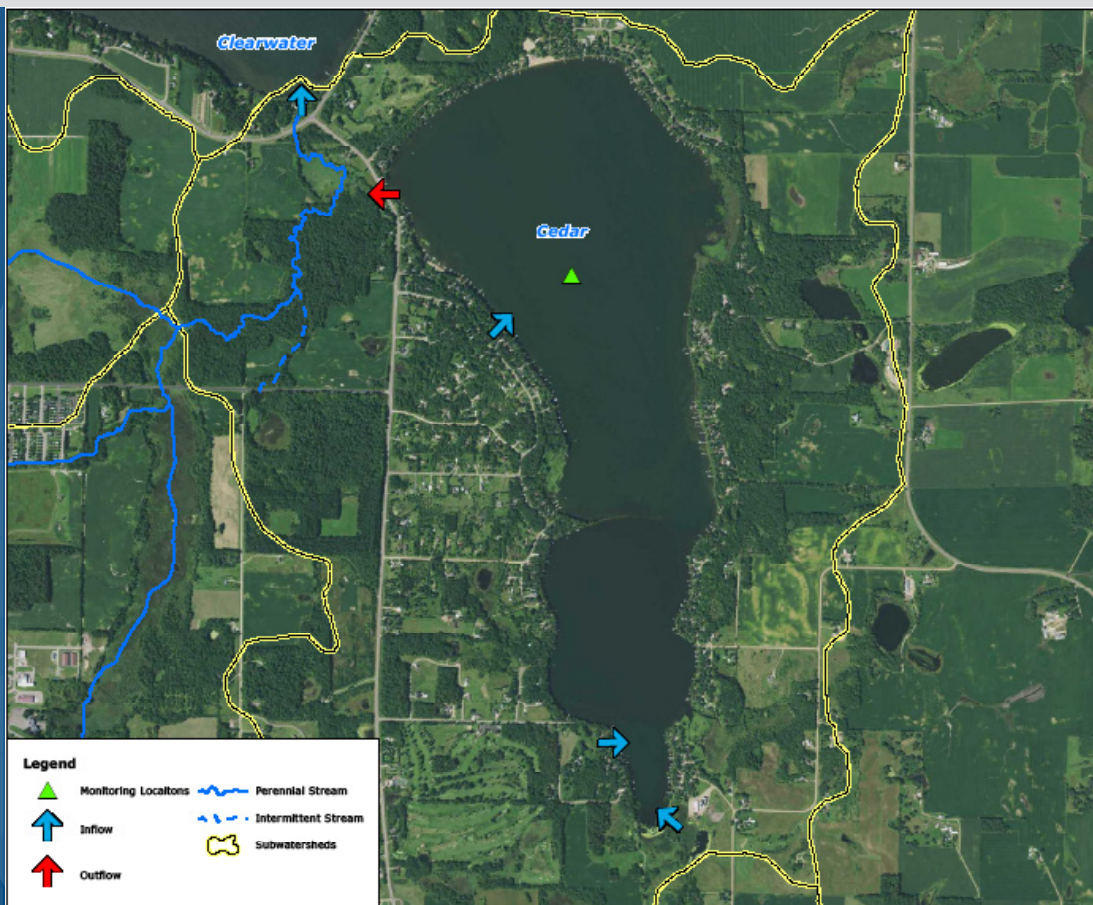
Coontail, northern water milfoil, chara

Invasive Species

Eurasian water milfoil, curly-leaf pondweed

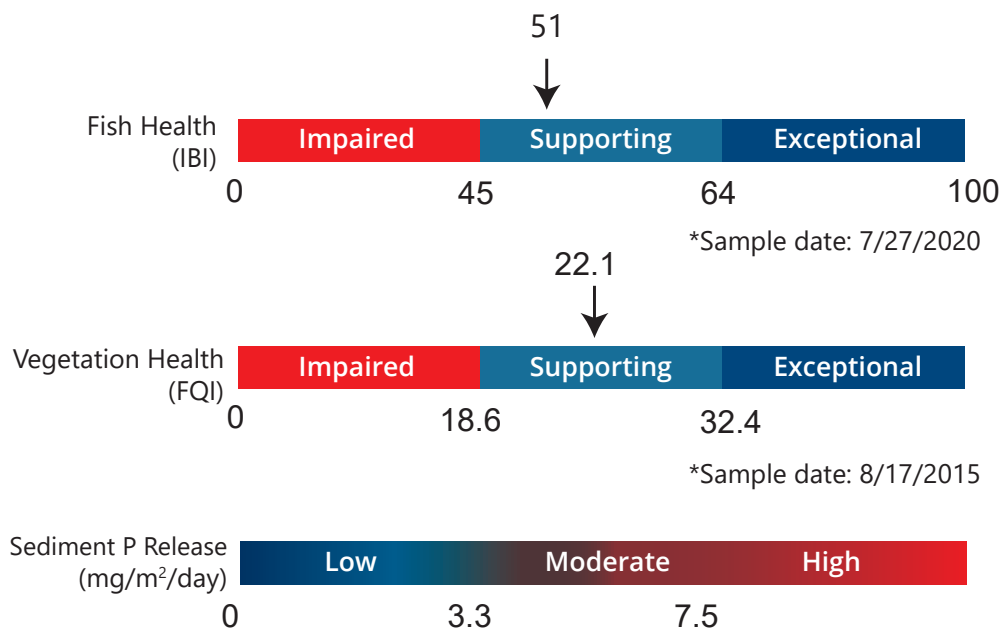
Status

Not Impaired



TO DO LIST

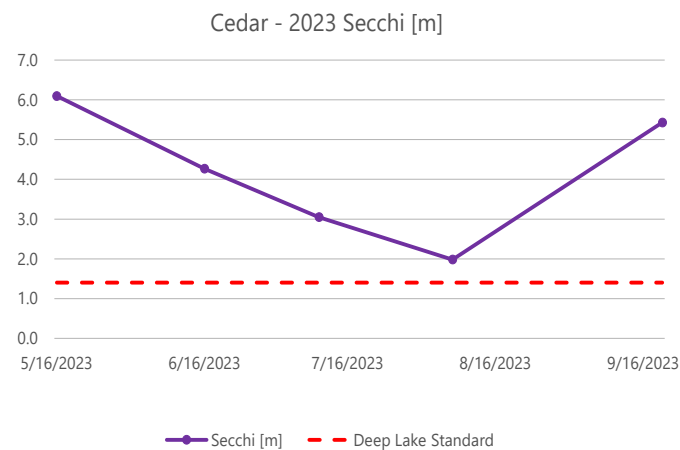
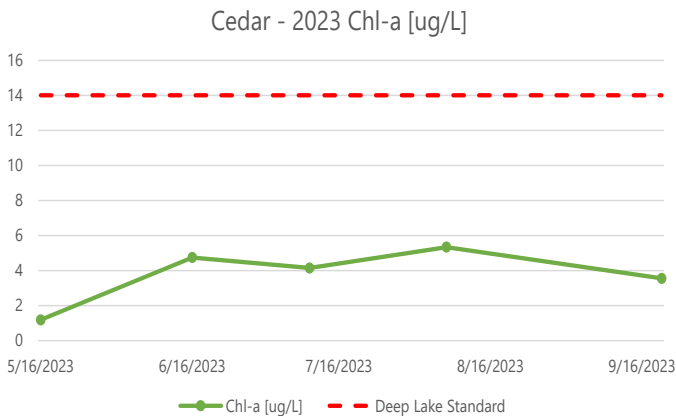
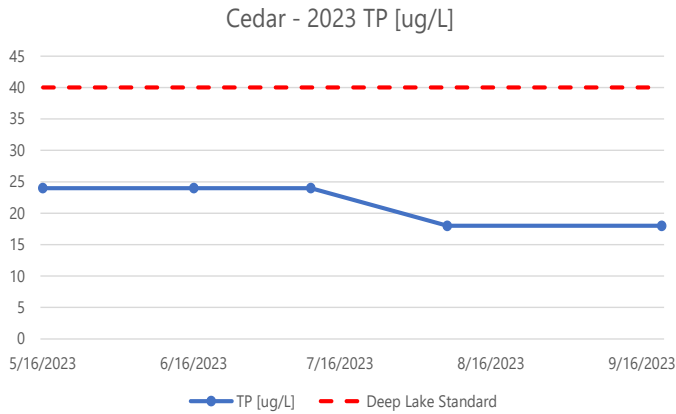
- ▲ AIS management
- ▲ Rough fish management in upstream lakes
- ▲ Manage upstream soluble P loads



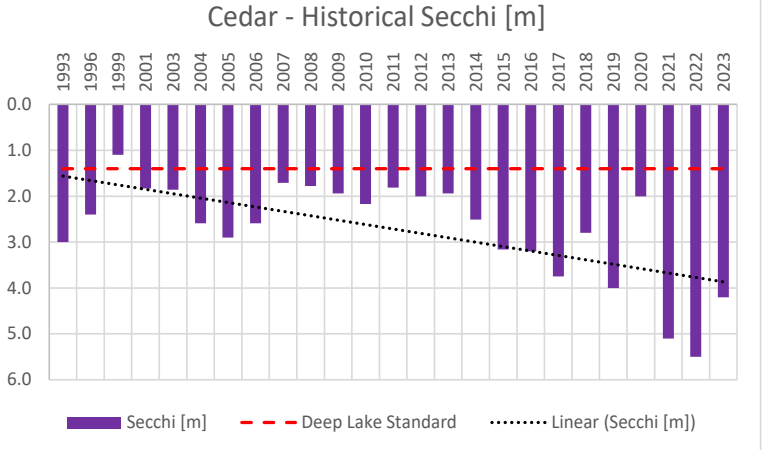
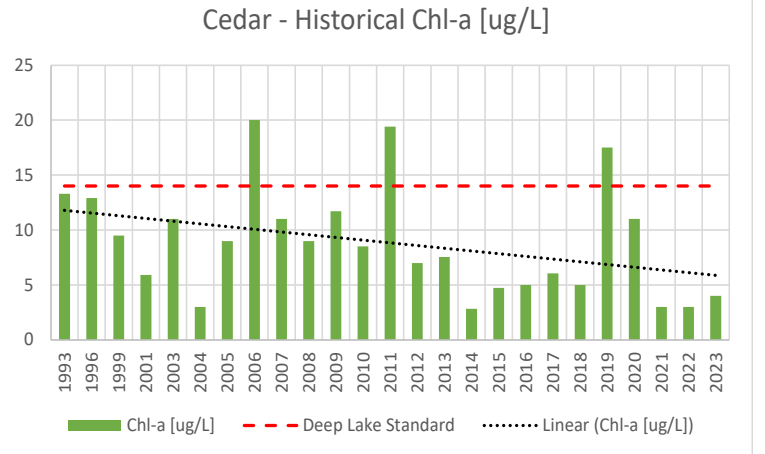
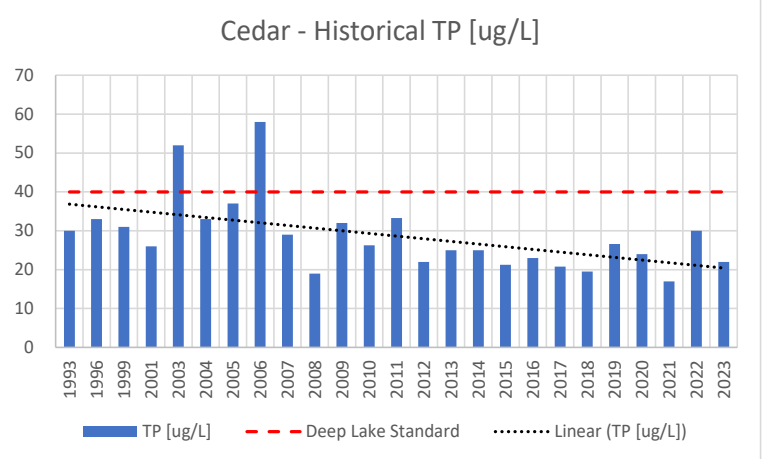
*Sediment release rate has not been assessed

CEDAR LAKE

2023 Water Quality



Historic Water Quality



CLEAR LAKE

QUICK FACTS

Littoral Area: 441 acres

Residence Time: 686 days

Surface Area: 529 acres

Subwatershed Area: 6,801 acres

Maximum Depth: 18 feet

Upstream Waters: None

Common Fish

Northern Pike,
Black Crappie,
Walleye, Bluegill

Dominant Vegetation

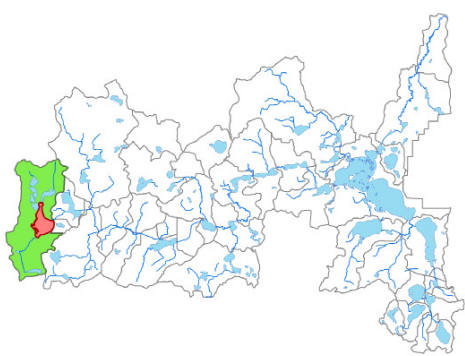
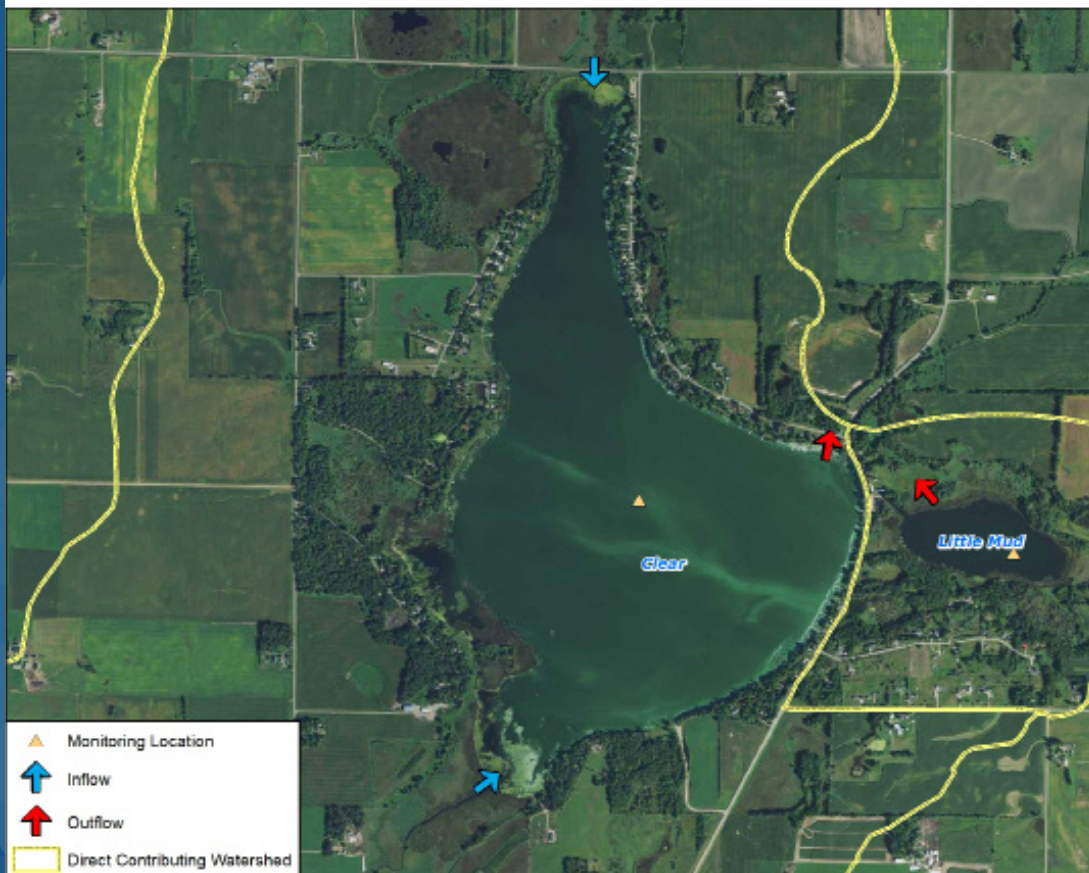
Coontail

Invasive Species

Eurasian water
milfoil, Curly-leaf
pondweed

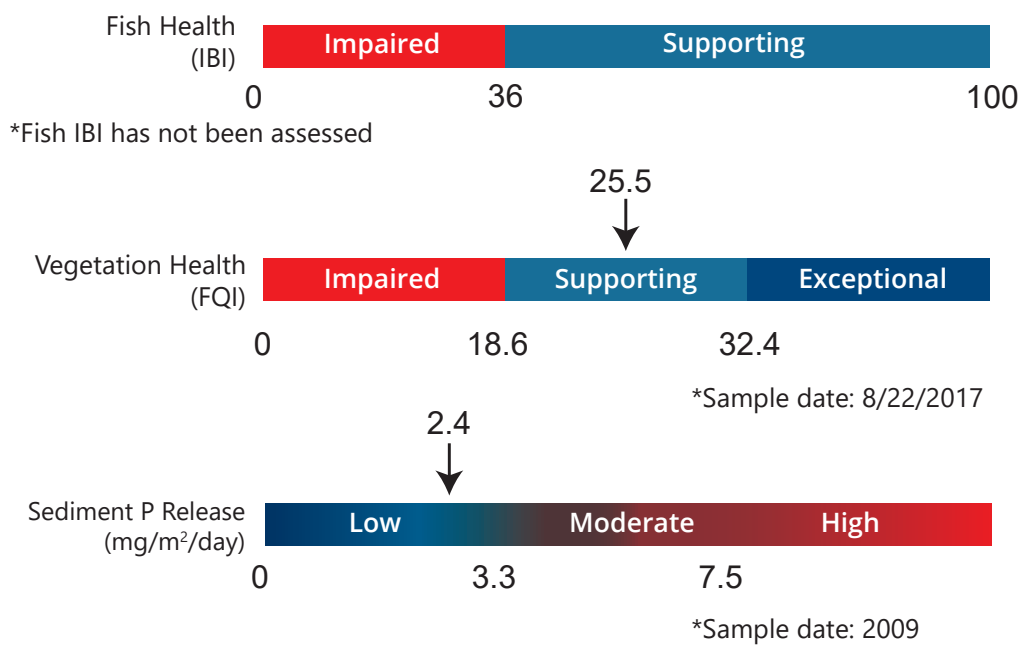
Status

Impaired, TMDL
completed in 2009

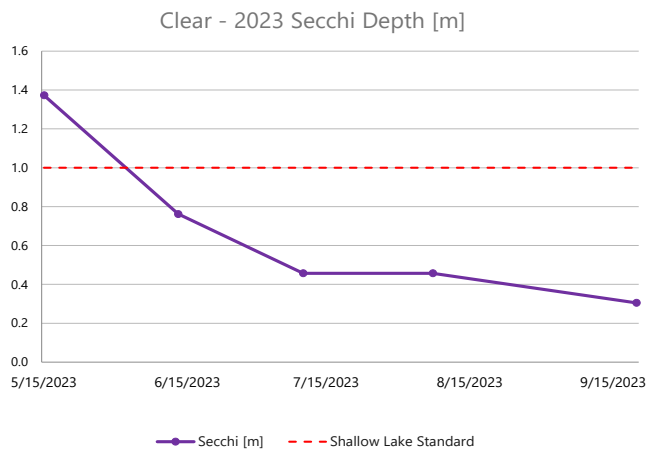
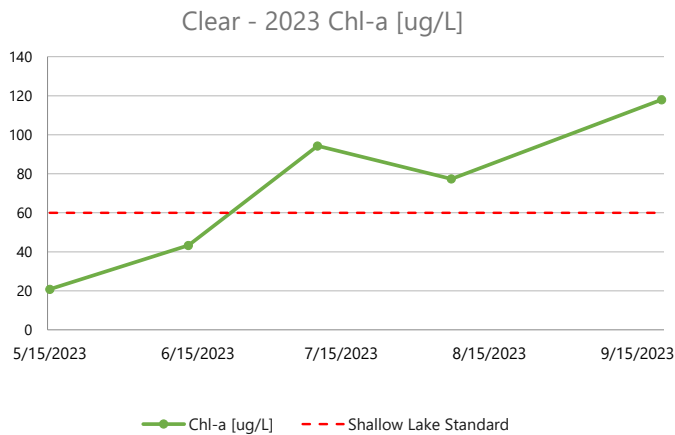
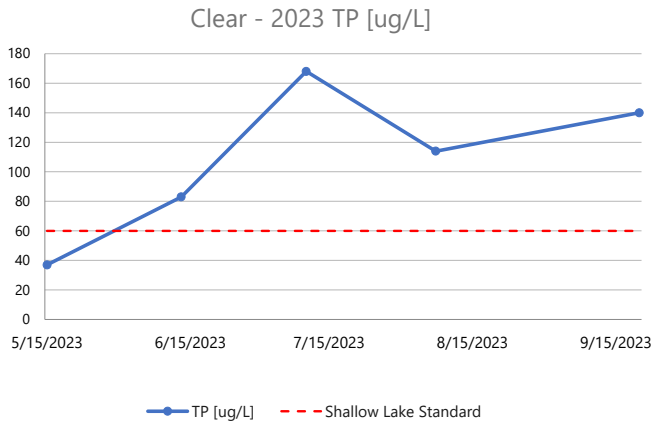


TO DO LIST

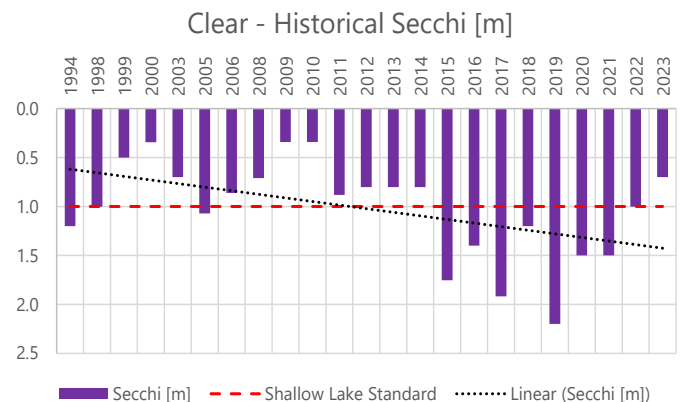
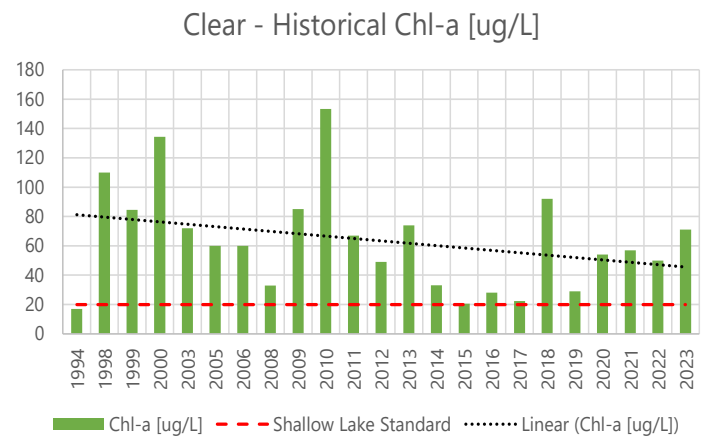
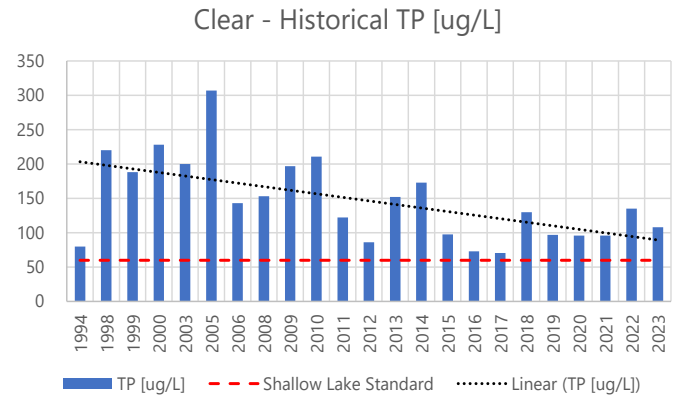
- ▲ AIS Management
- ▲ Manage rough fish
- ▲ Manage upstream soluble P loads



2023 Water Quality



Historic Water Quality



CLEARWATER LAKE

QUICK FACTS

Littoral Area: 1,596 acres

Surface Area: 3,158 acres

Subwatershed Area: 100,232 acres

Maximum Depth: 73 feet

Upstream Waters: Clearwater River, Augusta, Cedar, Otter, and Pleasant Lake

Common Fish

Bluegill, Northern Pike, Walleye, Largemouth Bass, Yellow Bullhead

Dominant Vegetation

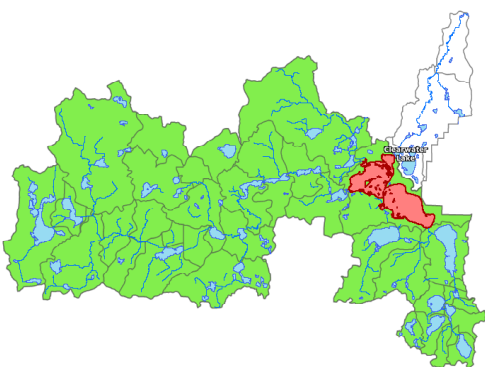
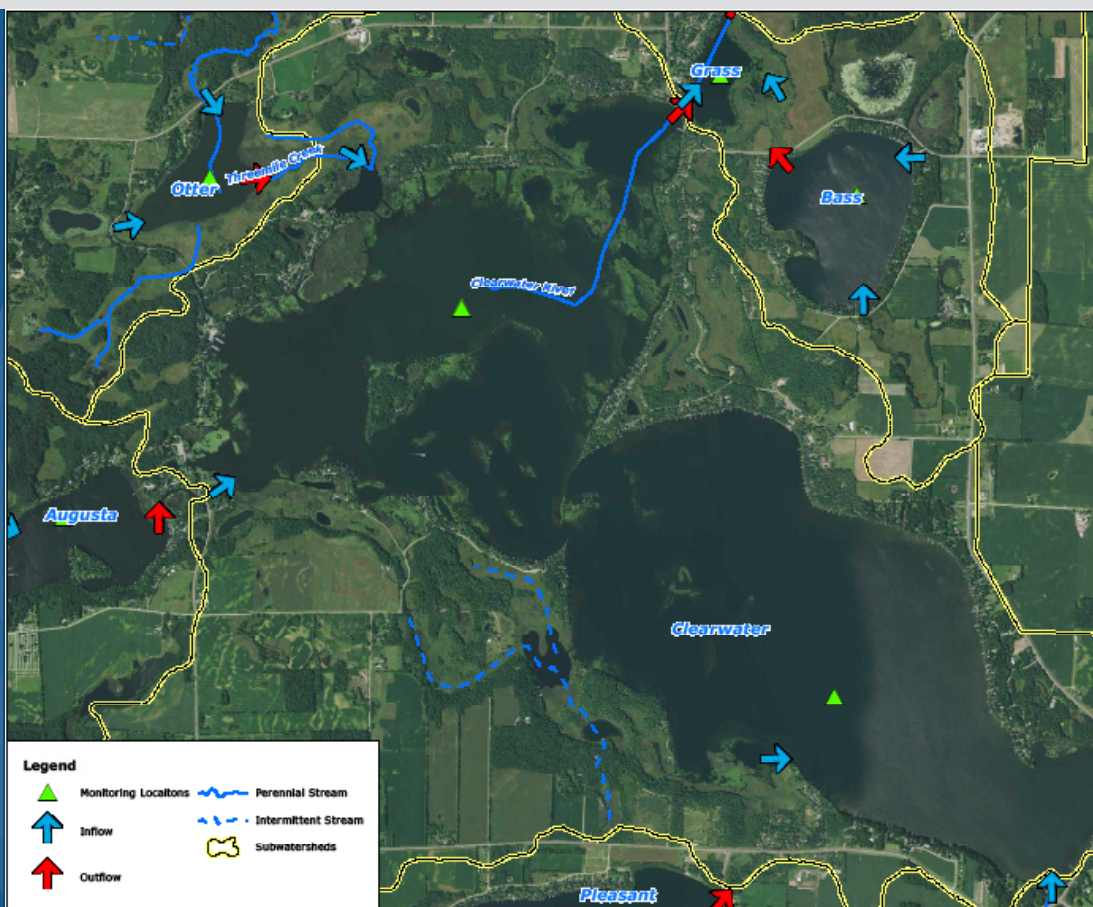
Obtaining Recent Survey from DNR

Invasive Species

Eurasian water milfoil, curly-leaf pondweed, zebra mussels

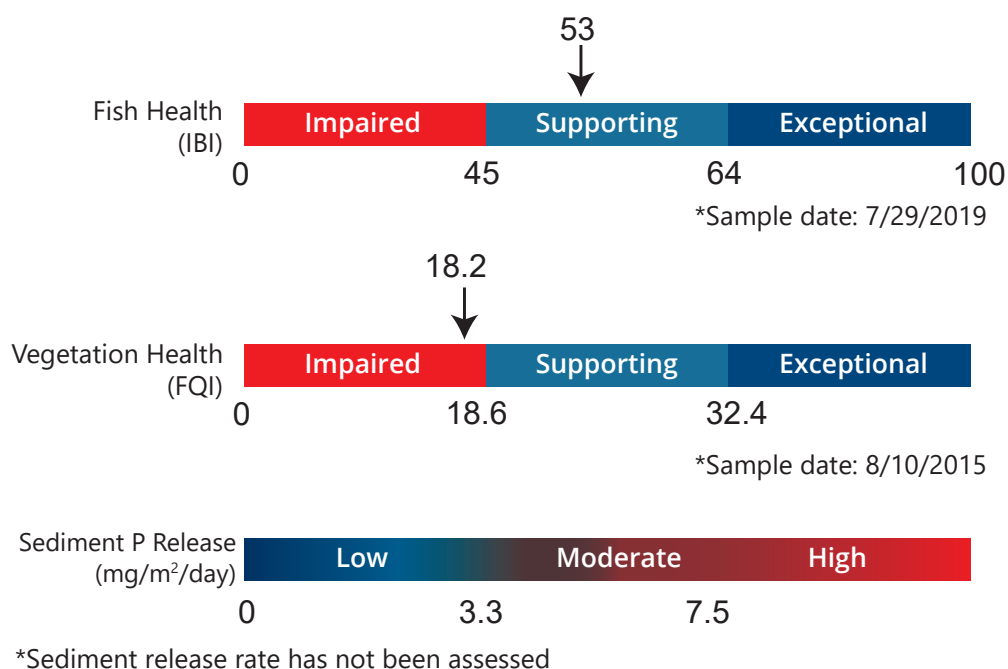
Status

Not Impaired



TO DO LIST

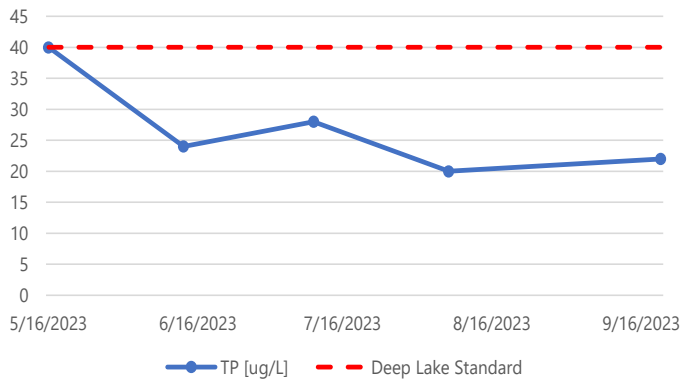
- Protect water quality
- Manage upstream loads
- AIS management



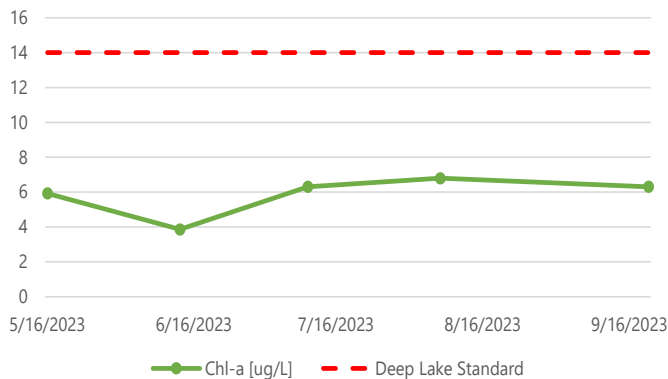
CLEARWATER LAKE

2023 Water Quality

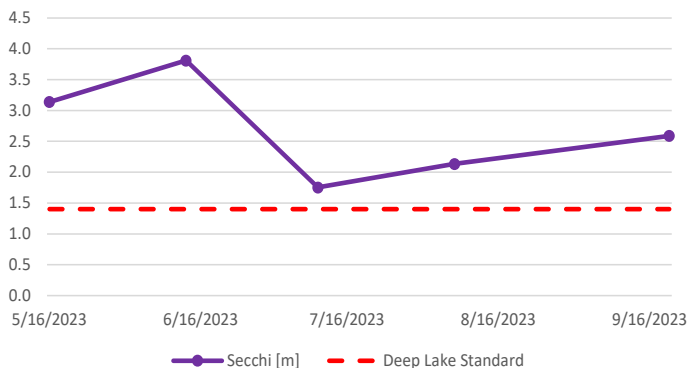
Clearwater West - TP [ug/L]



Clearwater West - Chl-a [ug/L]

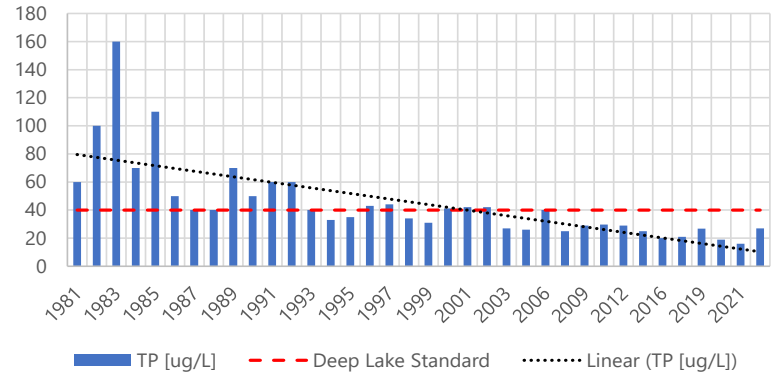


Clearwater West - Secchi [m]

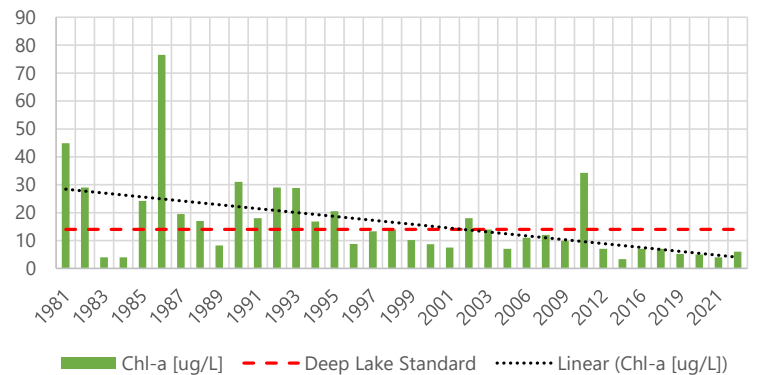


Historic Water Quality

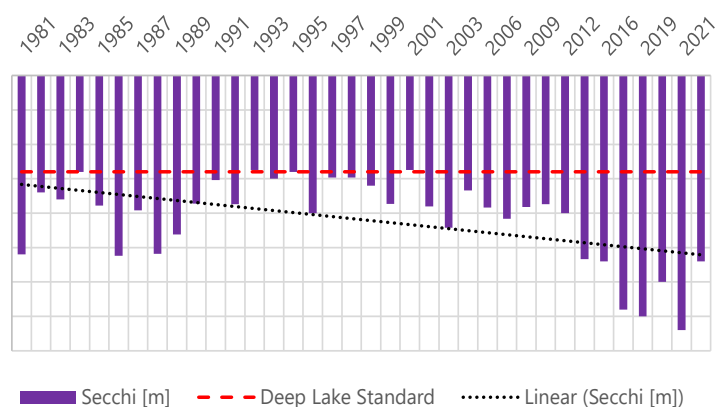
Clearwater West - Historical TP [ug/L]



Clearwater West - Historical Chl-a [ug/L]



Clearwater West - Historical Secchi [m]



GRASS LAKE

QUICK FACTS

Littoral Area: 62 acres

Surface Area: 71 acres

Subwatershed Area: 101,508 acres

Maximum Depth: 35 feet

Upstream Waters: Clearwater Lake, Clearwater River, Bass Lake

Common Fish

Bluegill,
Northern Pike,
Yellow Bullhead

Dominant Vegetation

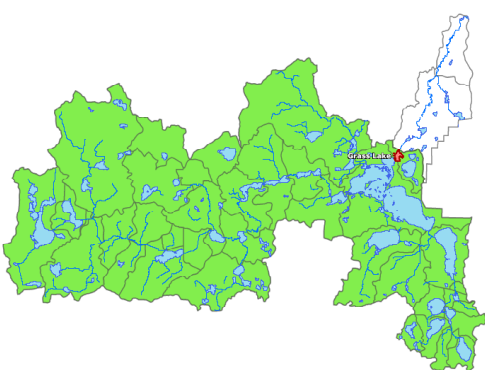
No Recent Survey

Invasive Species

Zebra Mussels

Status

Not Impaired



TO DO LIST

- Protect water quality
- Manage upstream loads
- AIS Management

Fish Health
(IBI)

Impaired

Supporting

Exceptional

0

38

59

100

*Fish IBI has not been assessed

Vegetation Health
(FQI)

Impaired

Supporting

Exceptional

0

18.6

32.4

31.6

*Sample date: 8/01/2005

Sediment P Release
(mg/m²/day)

Low

Moderate

High

0

3.3

7.5

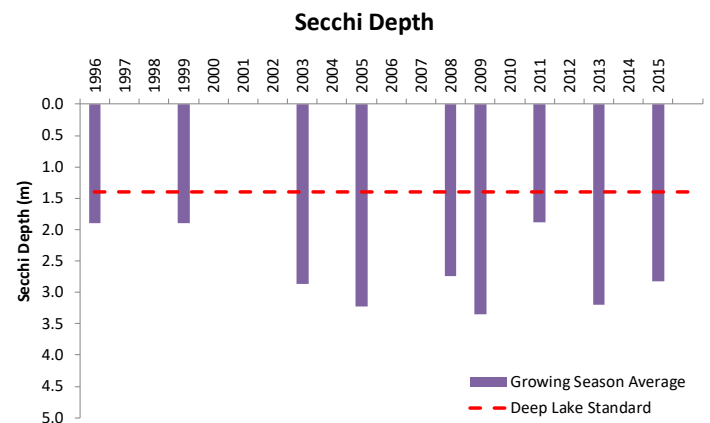
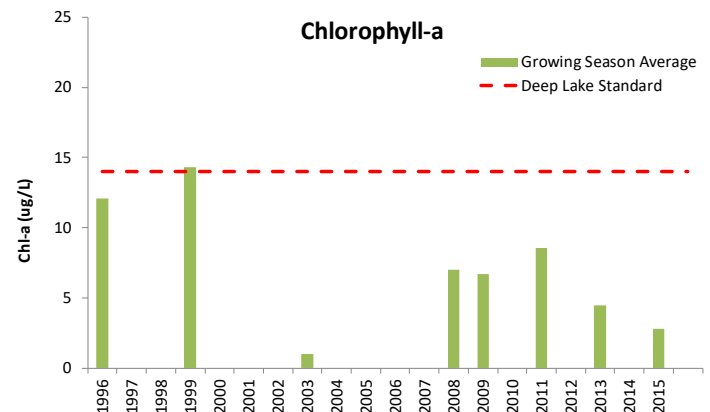
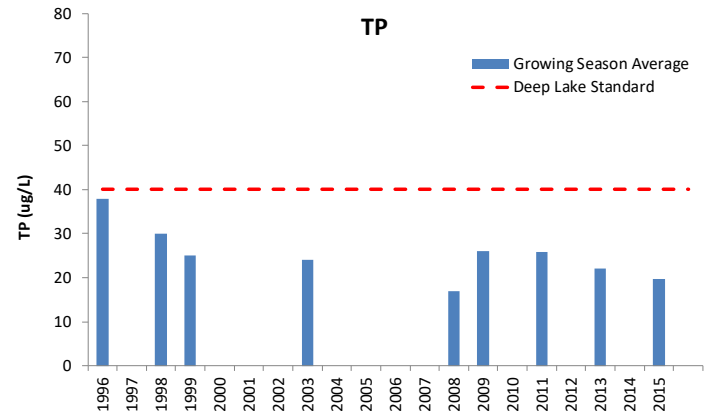
*Sediment release rate has not been assessed

GRASS LAKE

2023 Water Quality

Lake not sampled

Historic Water Quality



HENSHAW LAKE

QUICK FACTS

Littoral Area: 271 acres

Residence Time: 1,697 days

Surface Area: 272 acres

Subwatershed Area: 903 acres

Maximum Depth: 8 feet

Upstream Waters: None

Common Fish

Black Bullhead,
Common Carp

Dominant Vegetation

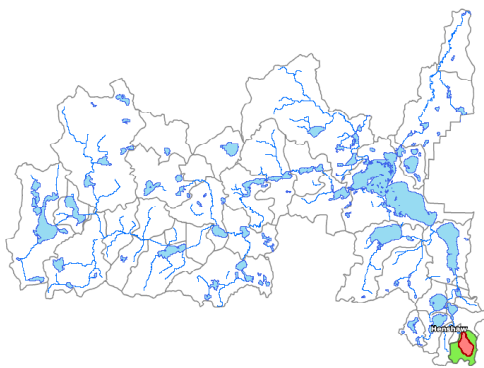
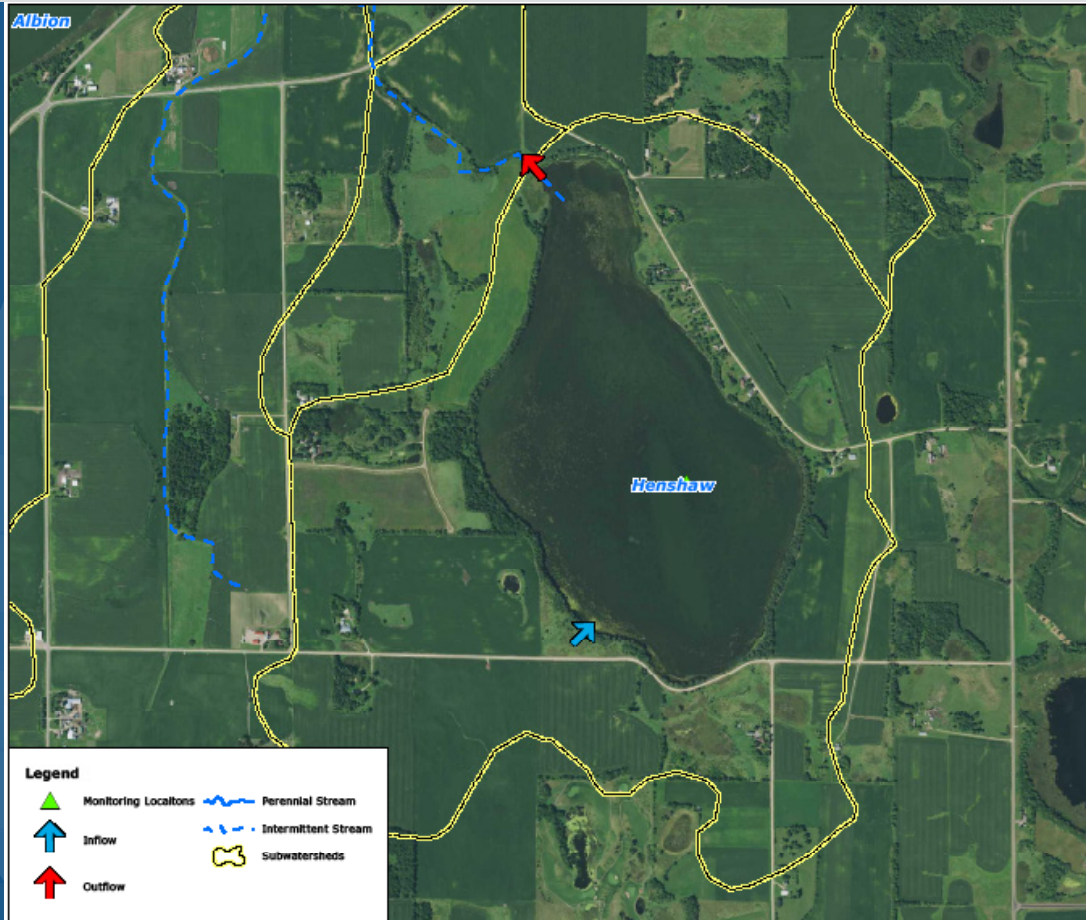
Sago pondweed,
Coontail, Bushy
pondweed

Invasive Species

Curly-leaf
pondweed

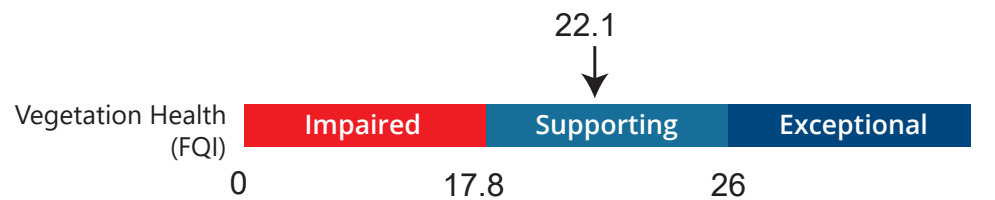
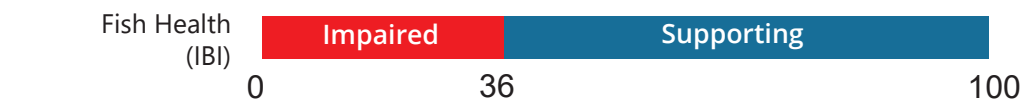
Status

Impaired, TMDL
Completed 2010



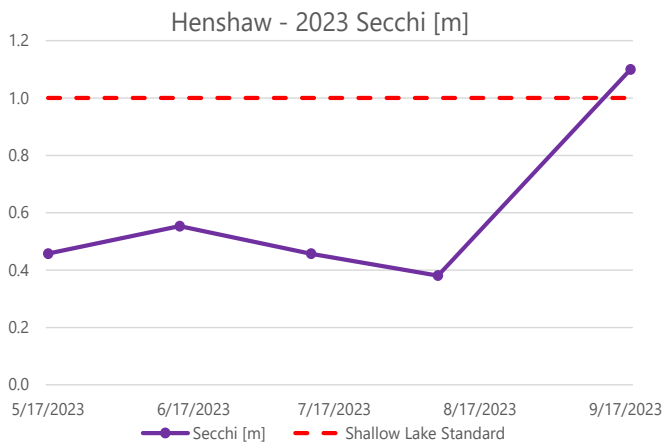
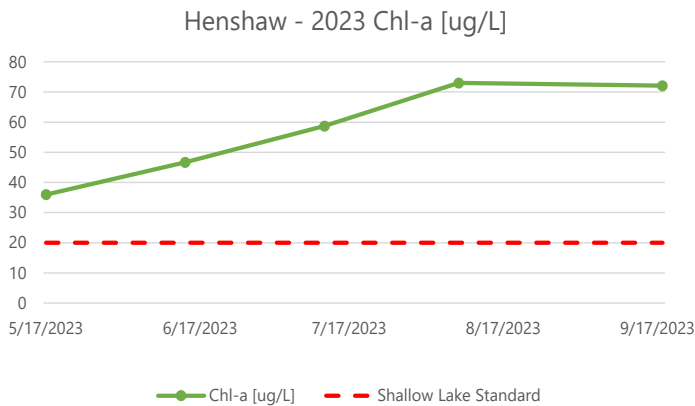
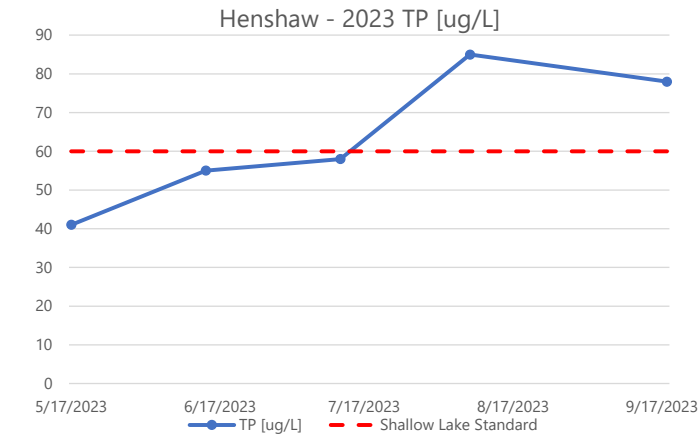
TO DO LIST

- ▲ Rough fish management
- ▲ AIS management
- ▲ Internal load management study
- ▲ Manage upstream load

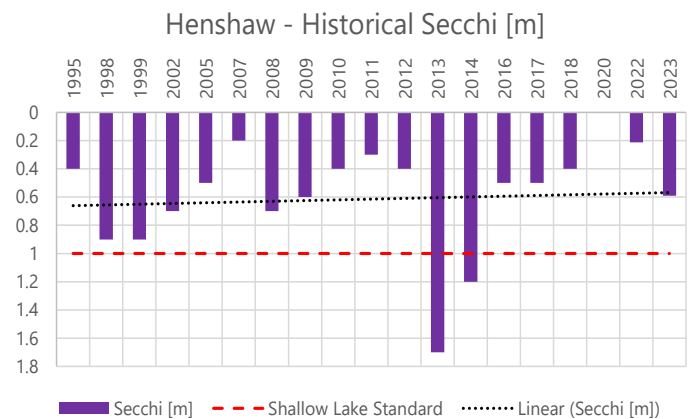
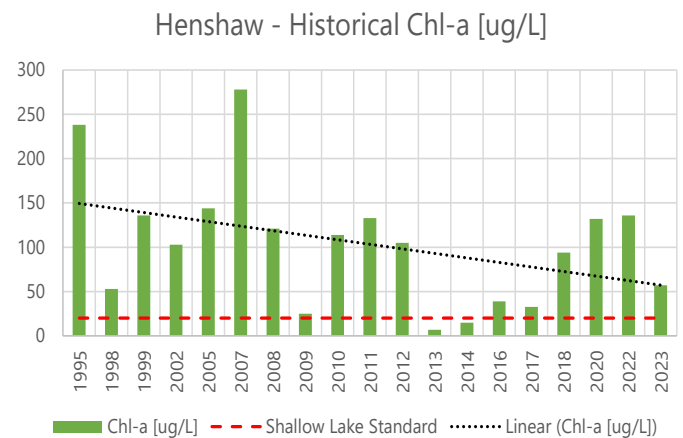
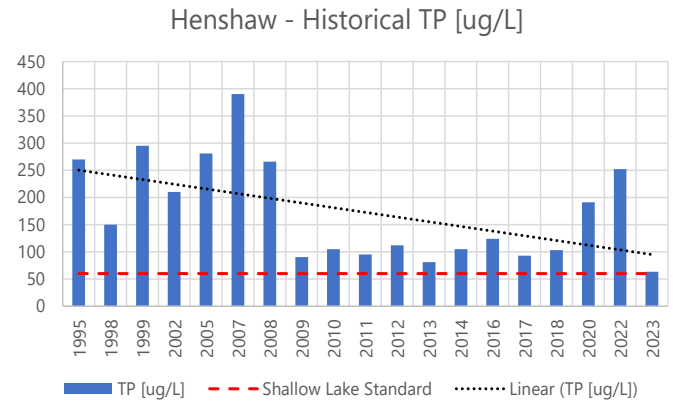


HENSHAW LAKE

2023 Water Quality



Historic Water Quality



LITTLE MUD LAKE

QUICK FACTS

Littoral Area: 25.1 acres

Residence Time: 1299 days

Surface Area: 37.4 acres

Subwatershed Area: 294 acres

Maximum Depth: 42 feet

Upstream Waters: None

Common Fish

No Recent Survey

Dominant Vegetation

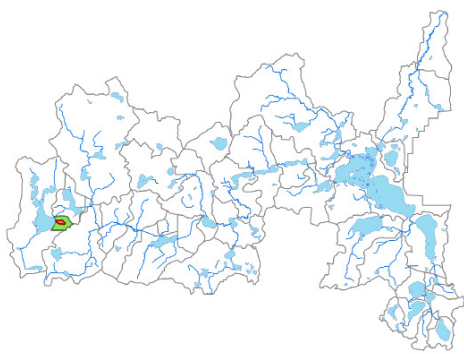
Coontail

Invasive Species

Eurasian watermilfoil

Status

Not Impaired



TO DO LIST

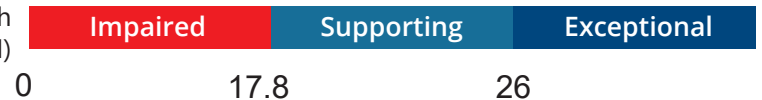
- ▲ Rough fish management
- ▲ AIS management
- ▲ Internal load management study
- ▲ Manage upstream load

Fish Health
(IBI)



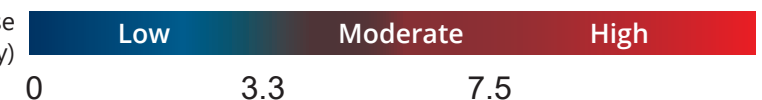
*Fish IBI has not been assessed

Vegetation Health
(FQI)



*Vegetation FQI has not been assessed

Sediment P Release
(mg/m²/day)



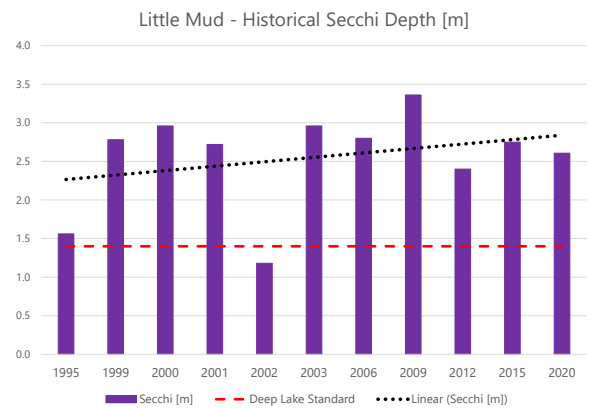
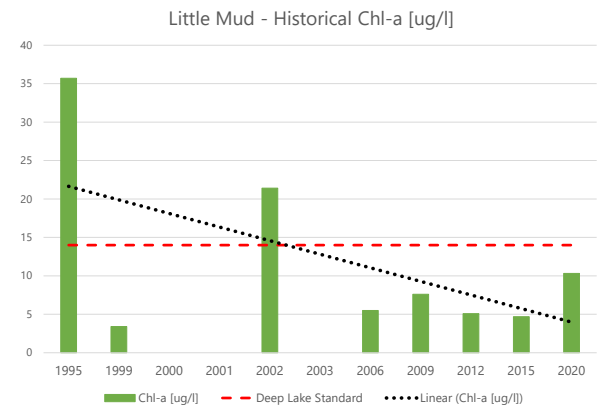
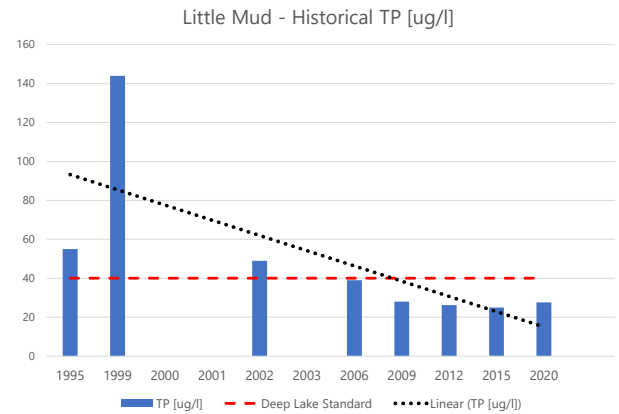
*Sediment release rate has not been assessed

LITTLE MUD LAKE

2023 Water Quality

Lake not sampled

Historic Water Quality



LAKE AUGUSTA

QUICK FACTS

Littoral Area: 65 acres

Residence Time: 55 days

Surface Area: 187 acres

Subwatershed Area: 62,936 acres

Maximum Depth: 82 feet

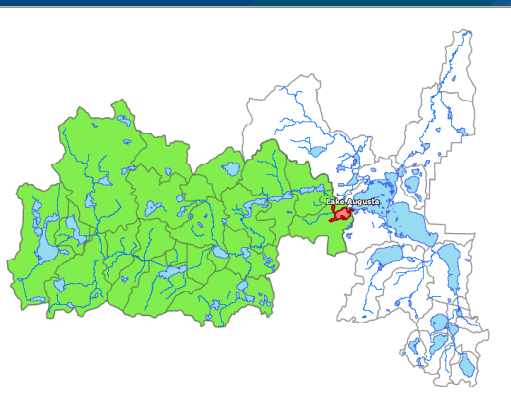
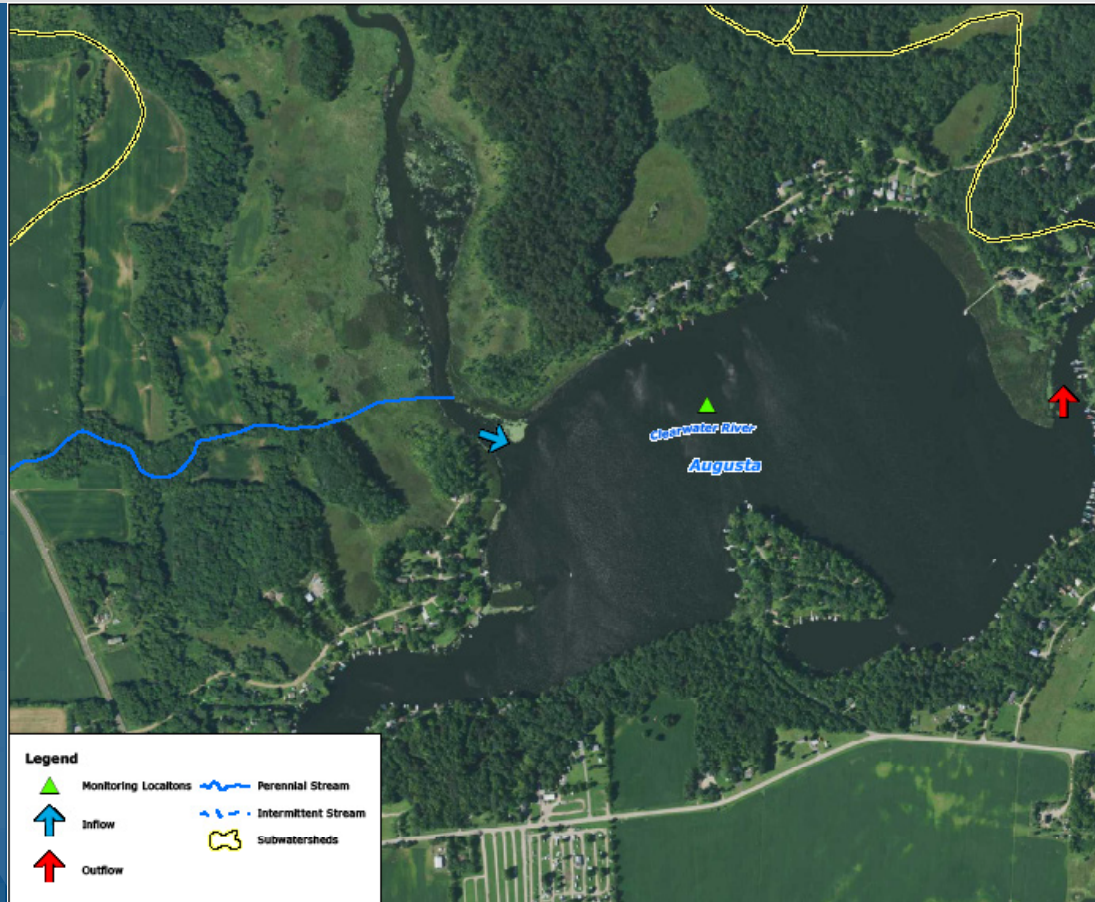
Upstream Waters: Caroline, Louisa, Marie

Common Fish Bluegill, Northern Pike, Crappie, Yellow Bullhead, Common Carp

Dominant Vegetation No species was dominant (>50% occurrence)

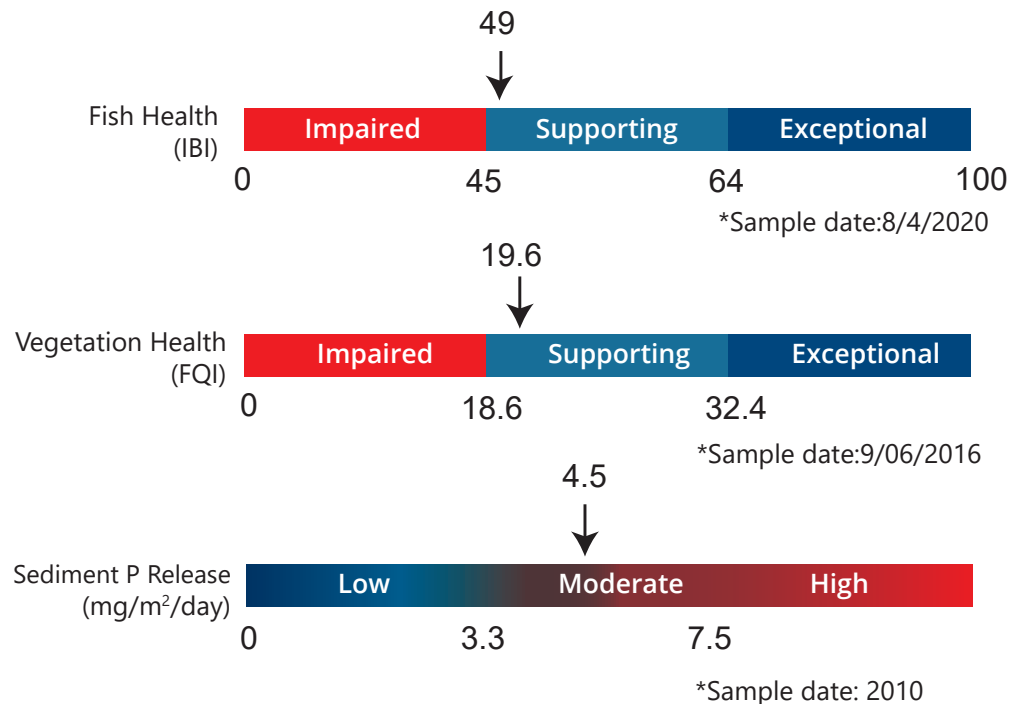
Invasive Species Eurasian water milfoil, curly-leaf pondweed, zebra mussels

Status Removed from Impaired Waters List in 2022; TMDL completed in 2010



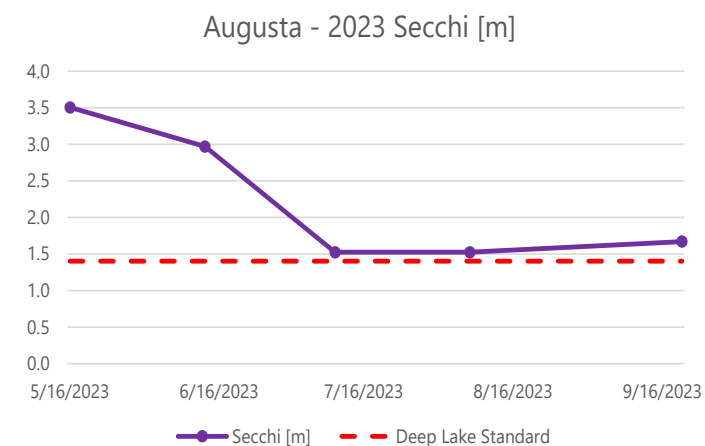
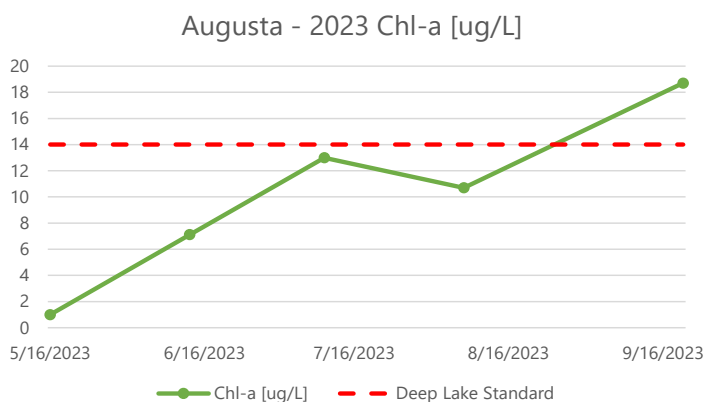
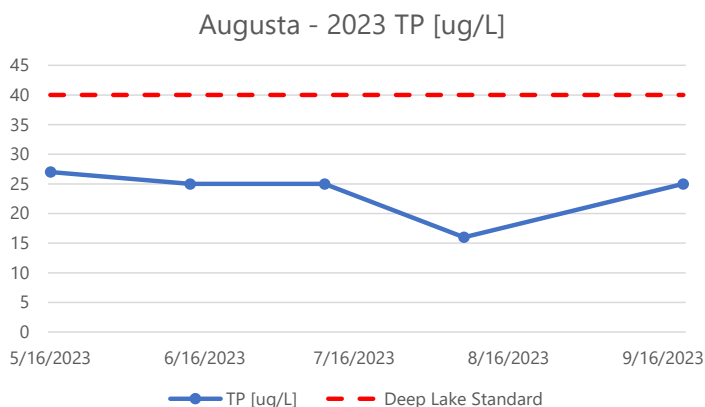
TO DO LIST

- ▲ Manage upstream loads
- ▲ AIS management

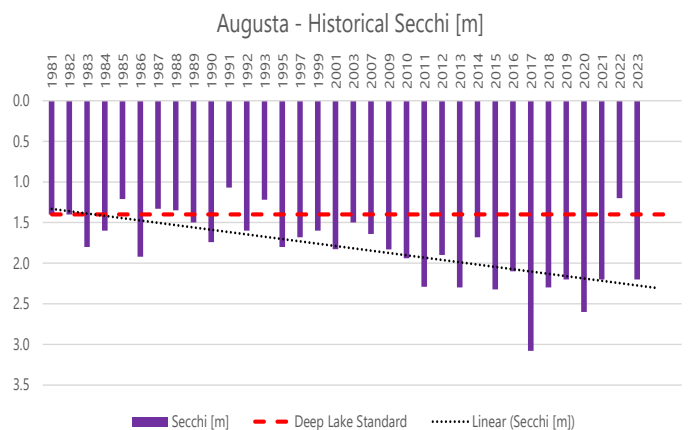
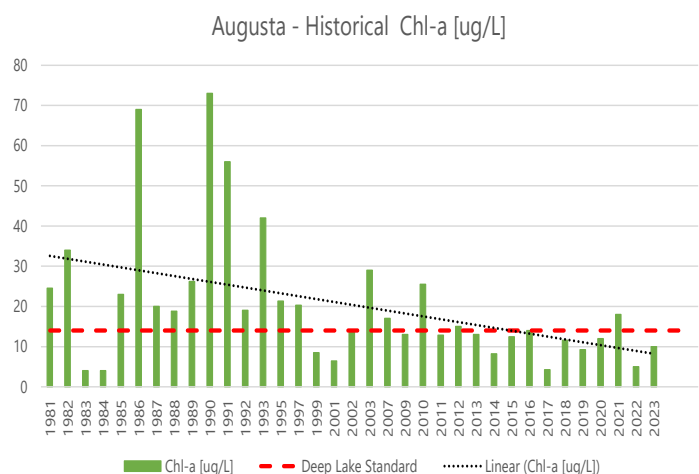
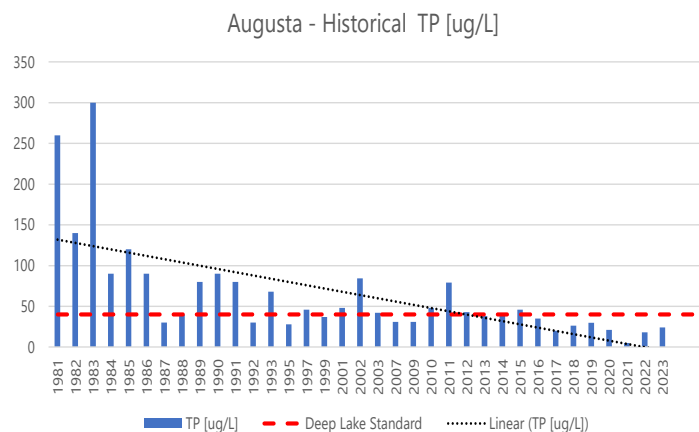


LAKE AUGUSTA

2023 Water Quality



Historic Water Quality



LAKE BETSY

QUICK FACTS

Littoral Area: 90 acres

Residence Time: 33 days

Surface Area: 154 acres

Subwatershed Area: 43,789 acres

Maximum Depth: 29 feet

Upstream Waters: Clearwater River

Common Fish

Channel Catfish,
Northern Pike, Black
Crappie, Bluegill,
Common Carp

Dominant Vegetation

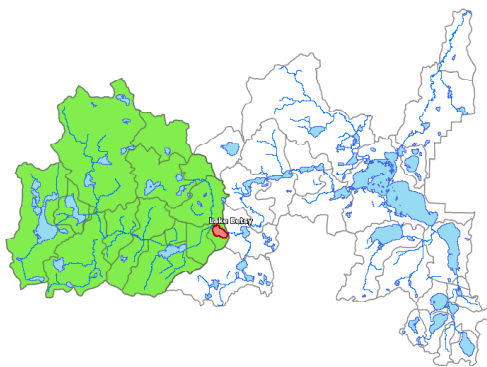
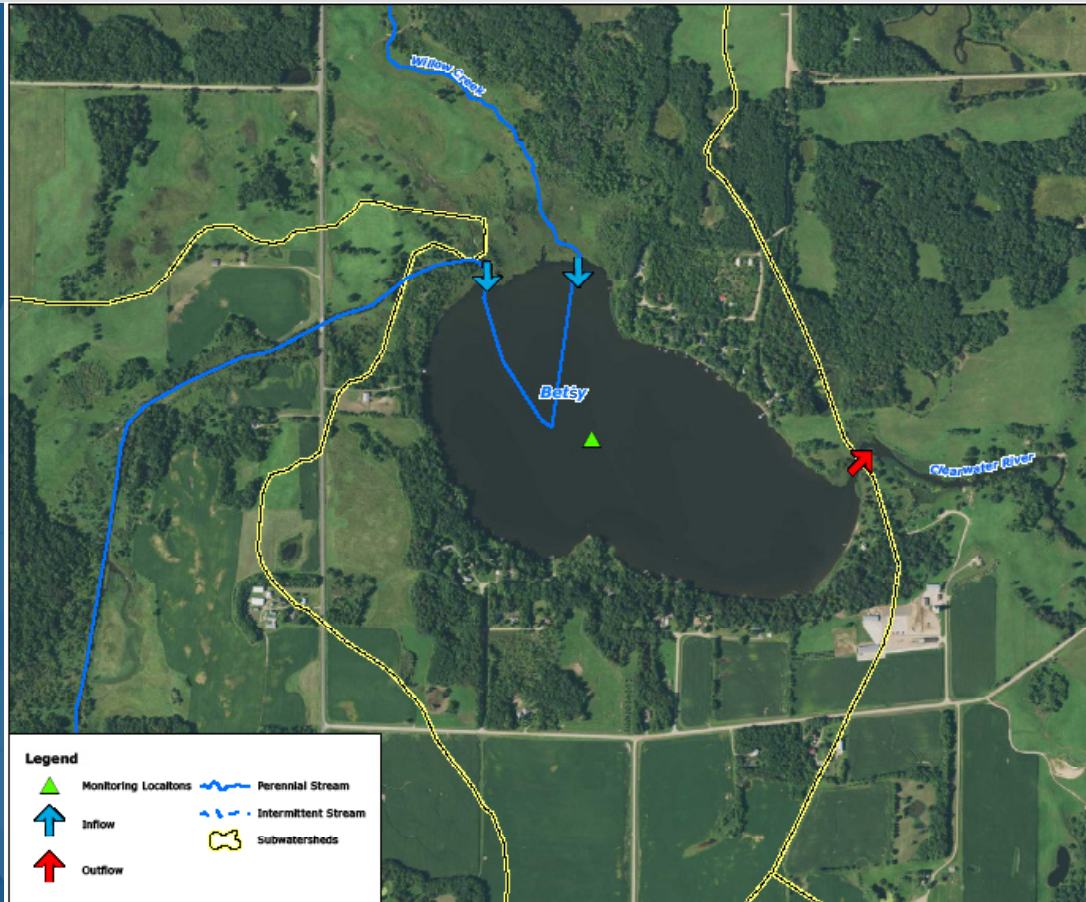
Coontail, Curly-
leaf pondweed

Invasive Species

Curly-leaf
pondweed

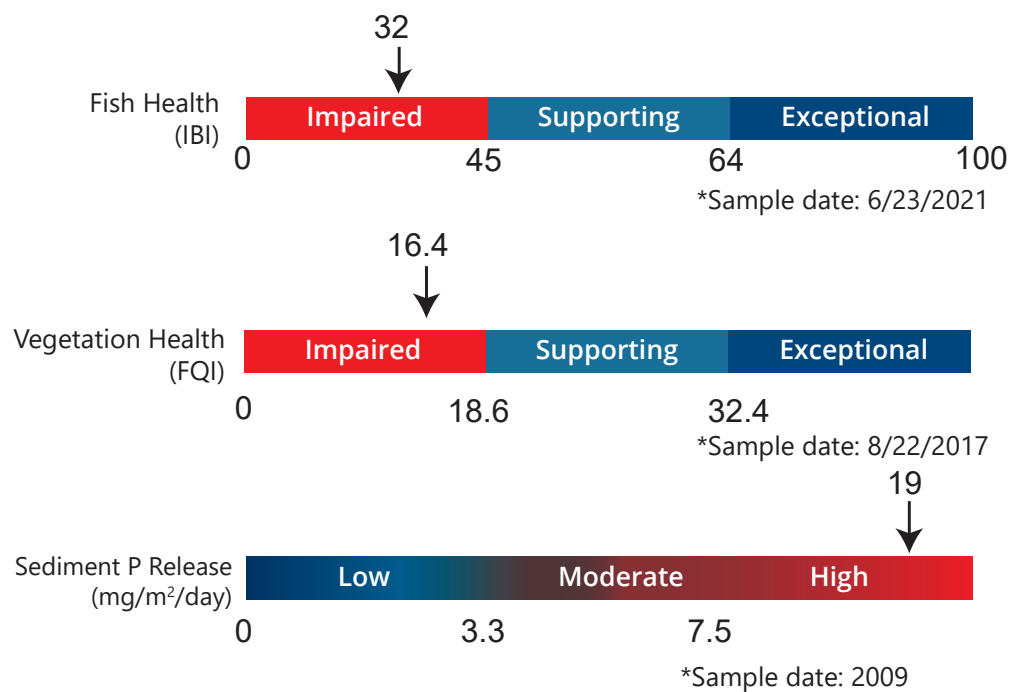
Status

Impaired, TMDL
completed in 2009



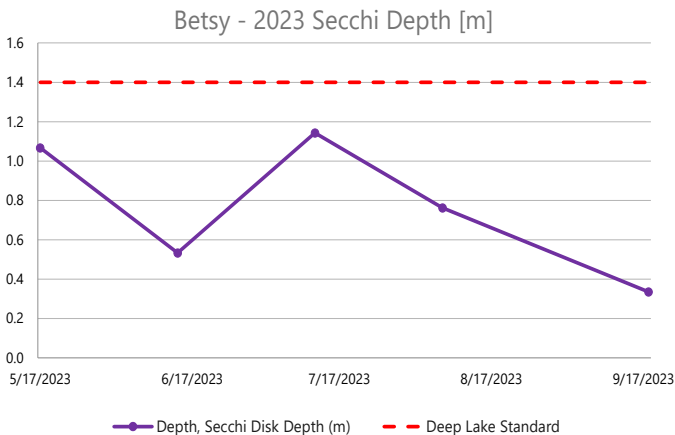
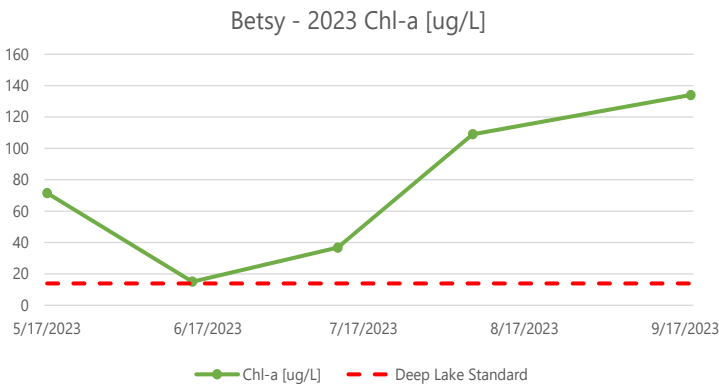
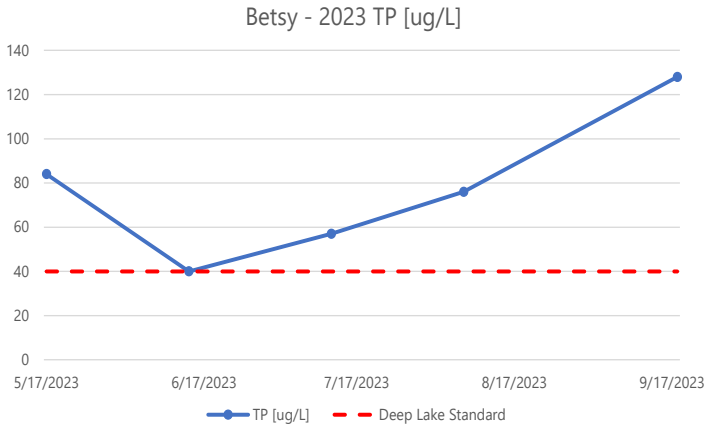
TO DO LIST

- ▲ Rough fish management
- ▲ Internal load reduction study and implementation
- ▲ Manage upstream loads
- ▲ AIS management



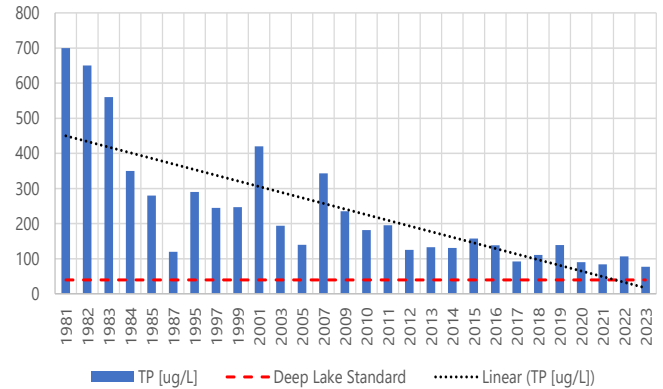
LAKE BETSY

2023 Water Quality

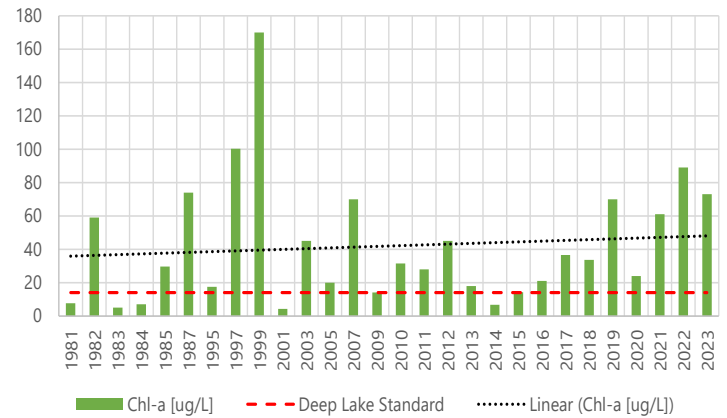


Historic Water Quality

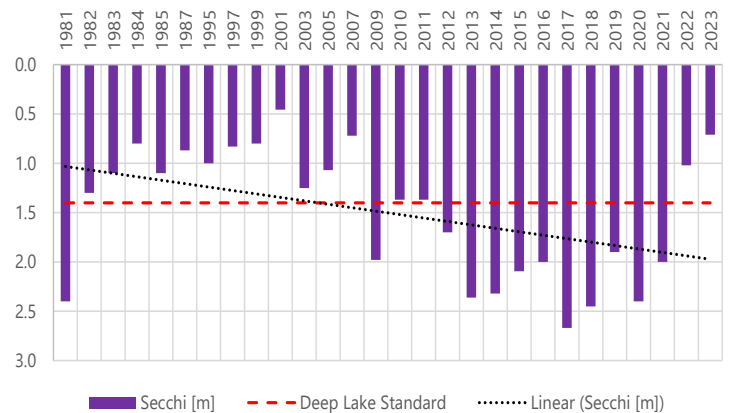
Betsy - Historical TP [ug/L]



Betsy - Historical Chl-a [ug/L]



Betsy - Historical Secchi [m]



LAKE CAROLINE

QUICK FACTS

Littoral Area: 46 acres

Residence Time: 26 days

Surface Area: 135 acres

Subwatershed Area: 60,132 acres

Maximum Depth: 45 feet

Upstream Waters: Louisa, Marie

Common Fish

Black Crappie,
Bluegill, Northern Pike,
Largemouth Bass,
Common Carp, Walleye,
White Sucker

Dominant Vegetation

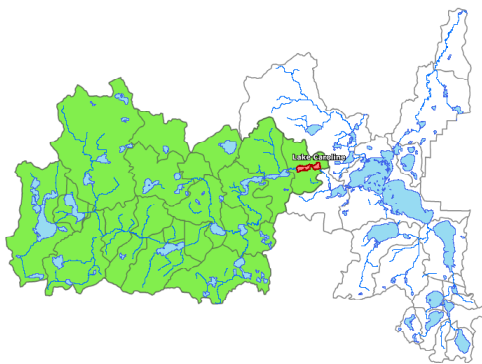
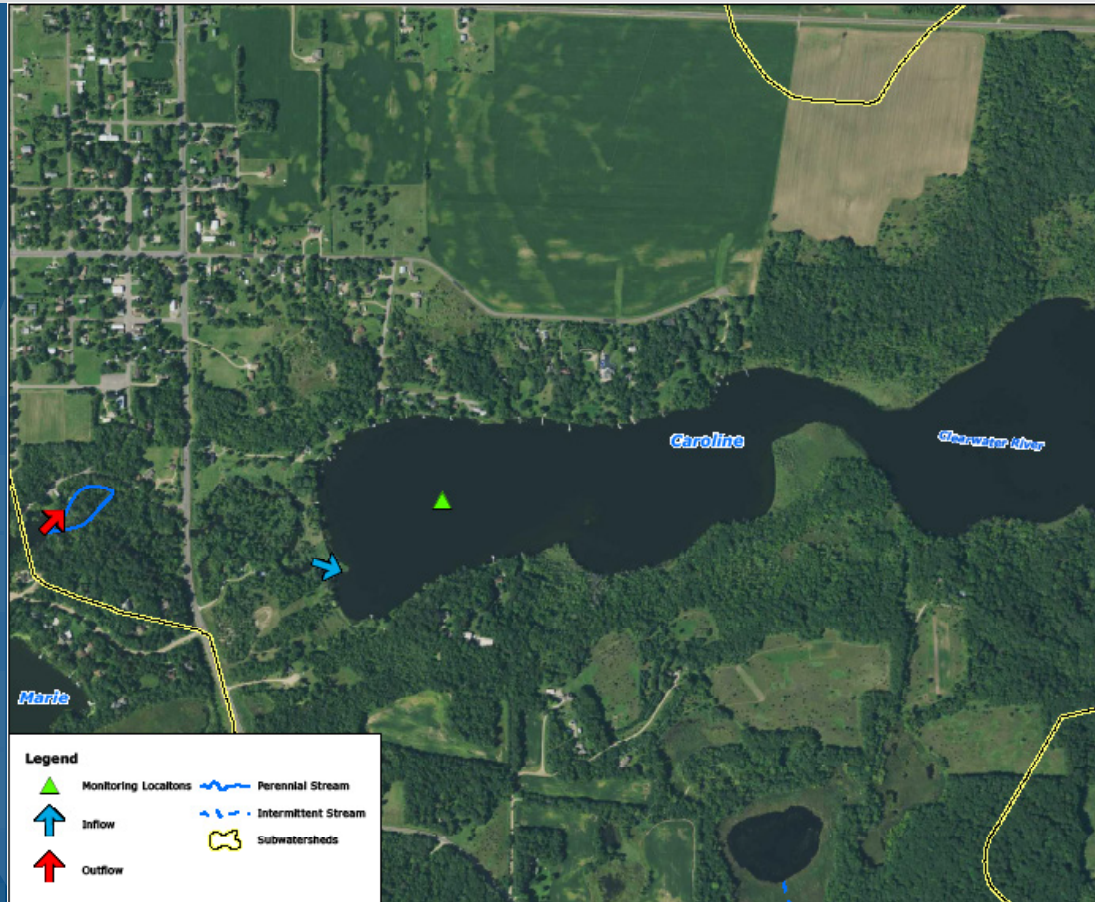
No Recent Survey

Invasive Species

Curly-leaf
pondweed,
Eurasian watermilfoil

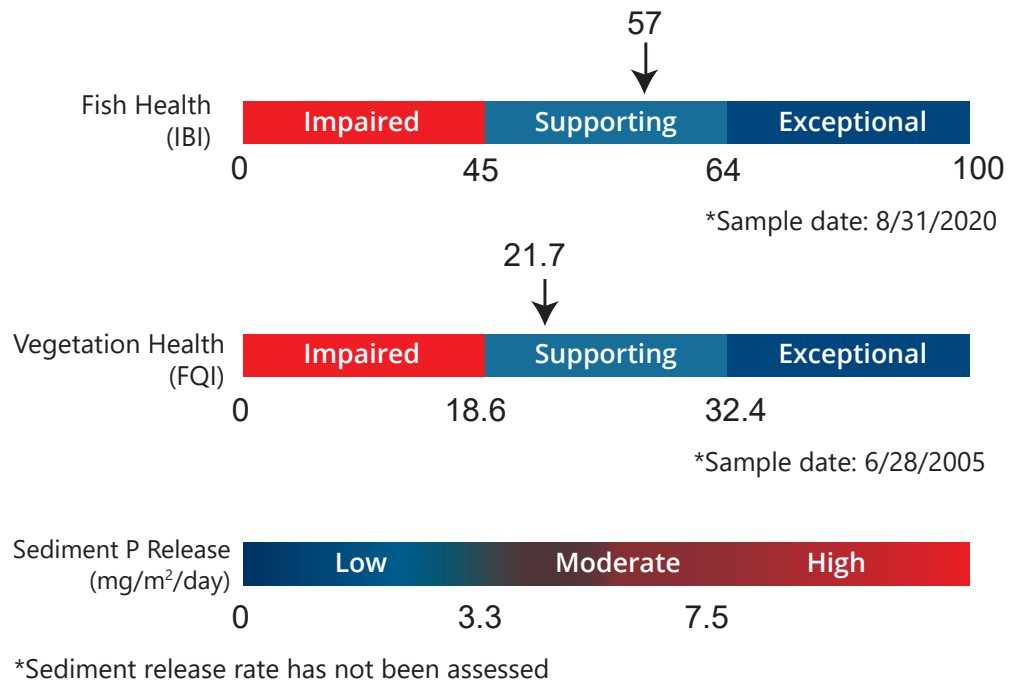
Status

Impaired, TMDL
completed in 2010



TO DO LIST

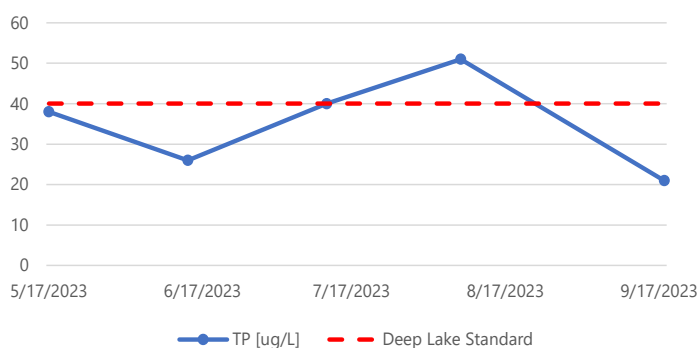
- Manage upstream loads
- AIS management
- Internal load management study



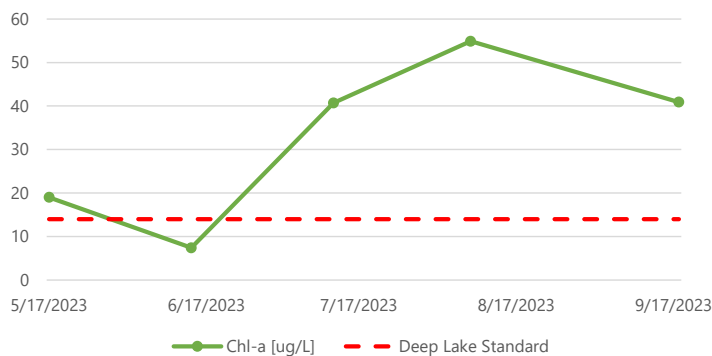
LAKE CAROLINE

2023 Water Quality

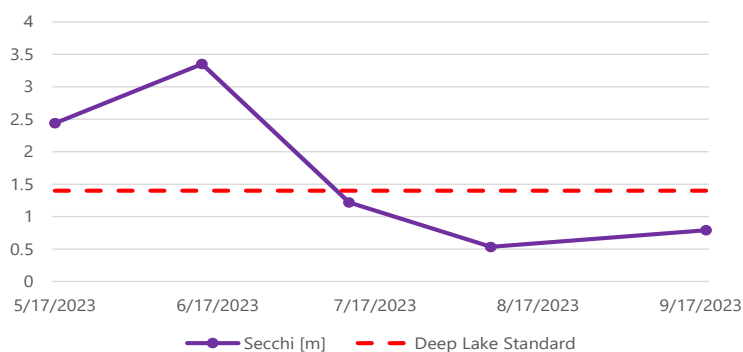
Caroline - 2023 TP [ug/L]



Caroline - 2023 Chl-a [ug/L]

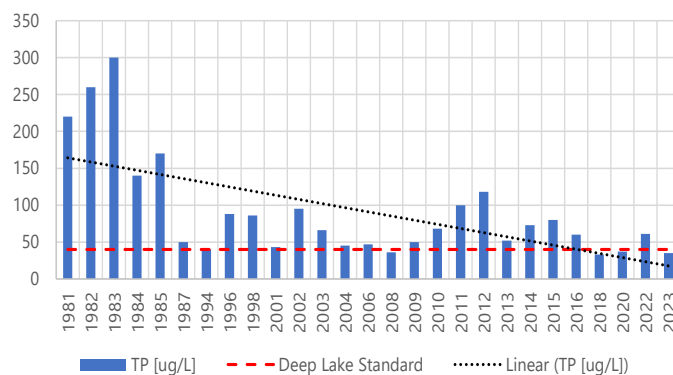


Caroline - 2023 Secchi [m]

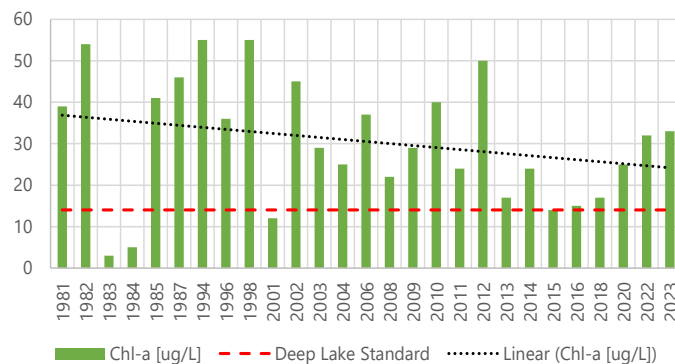


Historic Water Quality

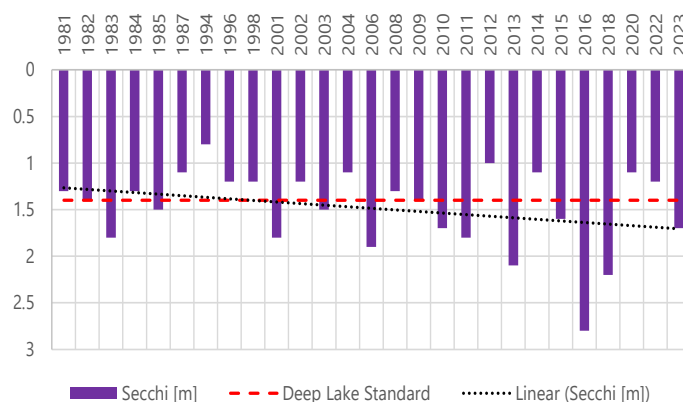
Caroline - Historical TP [ug/L]



Caroline - Historical Chl-a [ug/L]

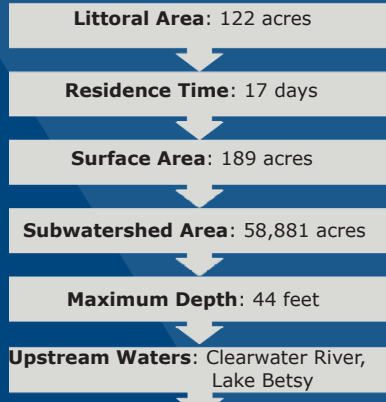


Caroline - Historical Secchi [m]



LAKE LOUISA

QUICK FACTS



Common Fish

Bluegill, Northern Pike, Largemouth Bass, White Sucker

Dominant Vegetation

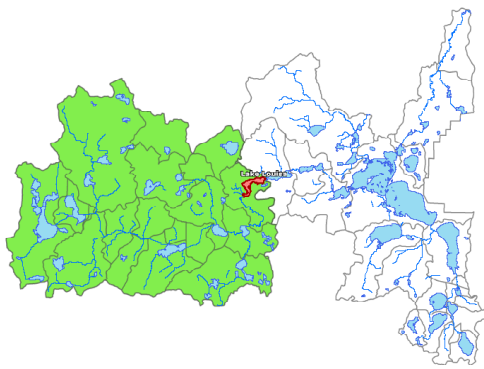
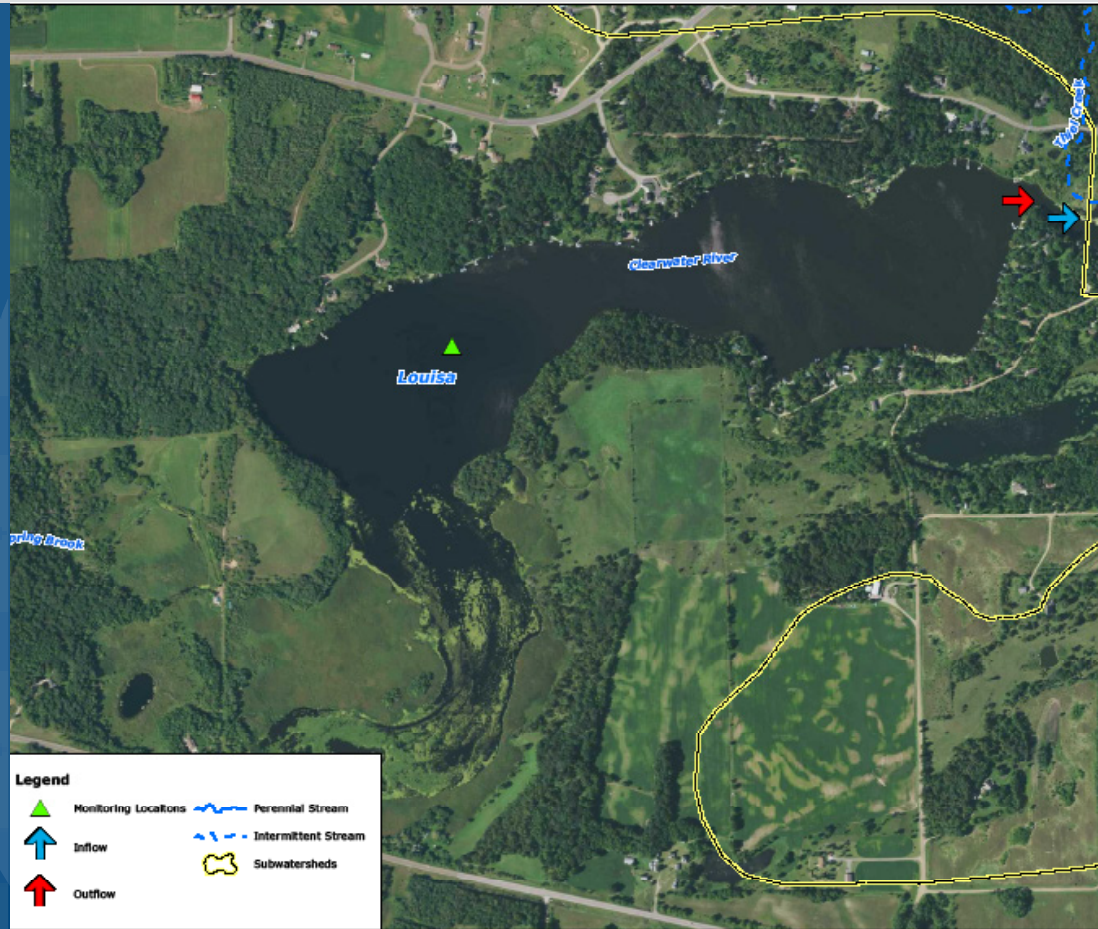
Coontail

Invasive Species

Curly-leaf pondweed

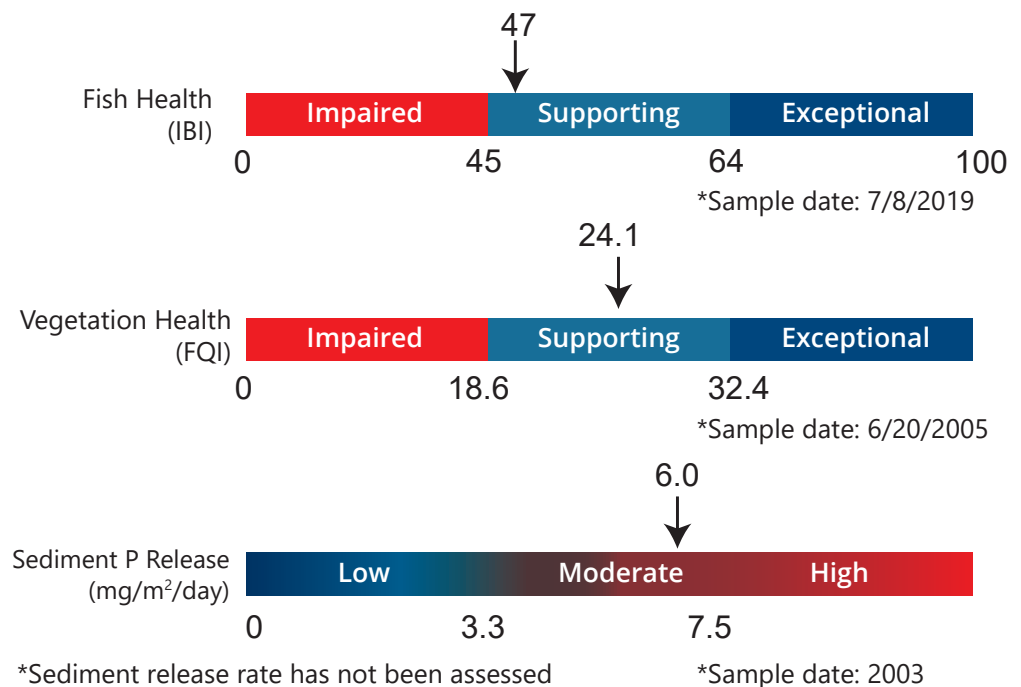
Status

Impaired, TMDL Completed 2009



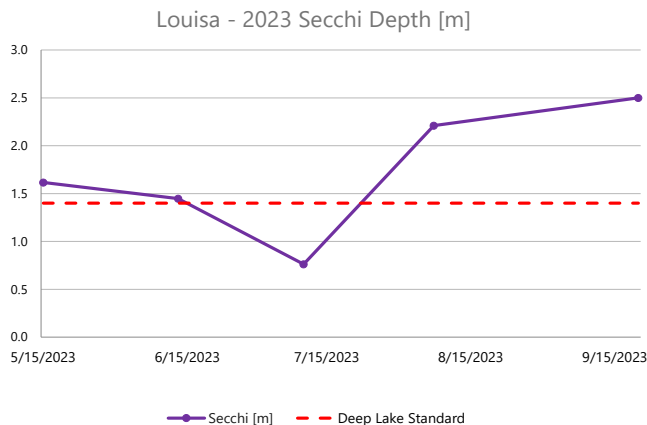
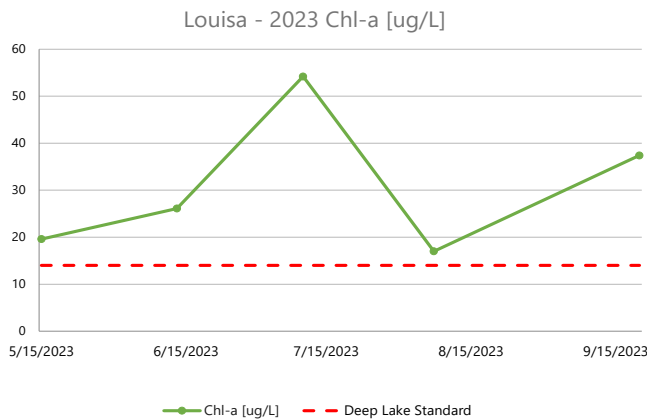
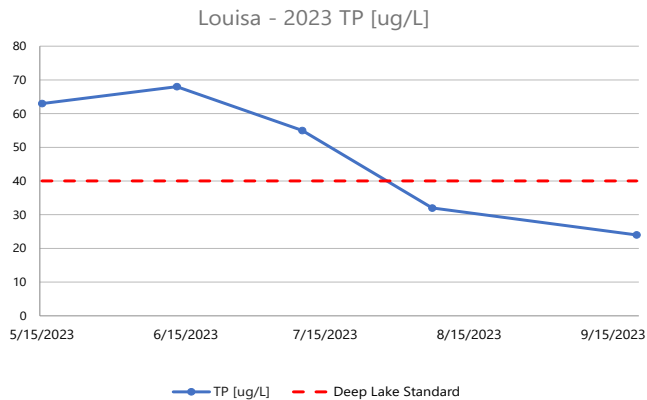
TO DO LIST

- ▲ Manage upstream loads
- ▲ AIS management
- ▲ Internal load management study

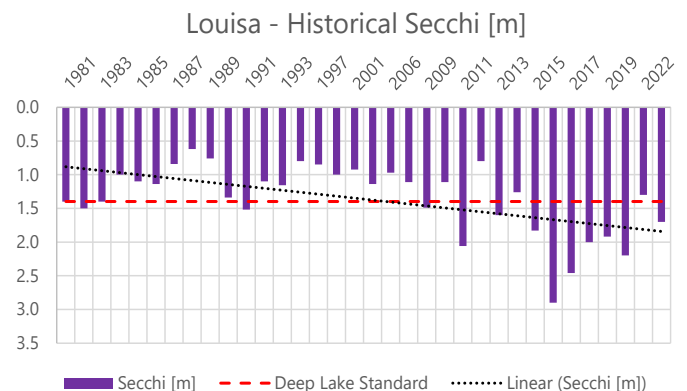
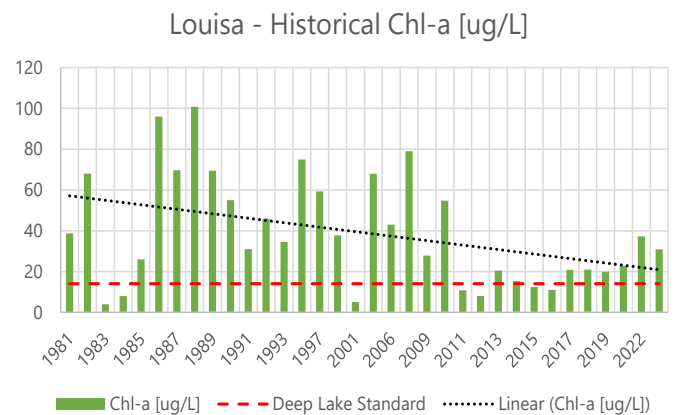
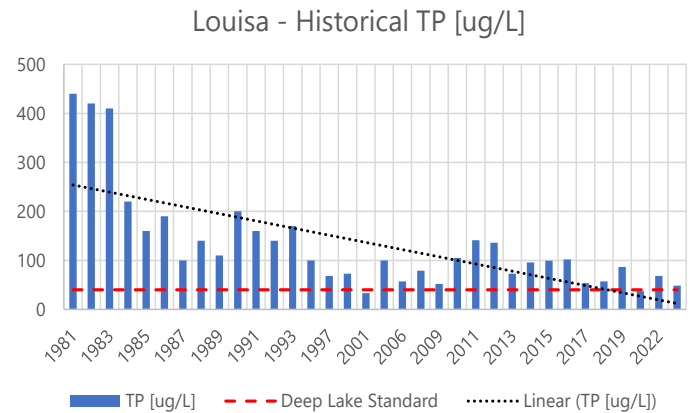


LAKE LOUISA

2023 Water Quality



Historic Water Quality



LAKE MARIE

QUICK FACTS

Littoral Area: 107 acres

Residence Time: 24 days

Surface Area: 146 acres

Subwatershed Area: 59,837 acres

Maximum Depth: 36 feet

Upstream Waters: Clearwater River, Louisa

Common Fish

Black Crappie, Bluegill, Northern Pike, White Sucker, Yellow Perch

Dominant Vegetation

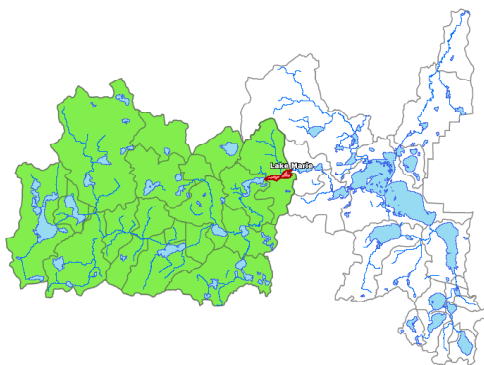
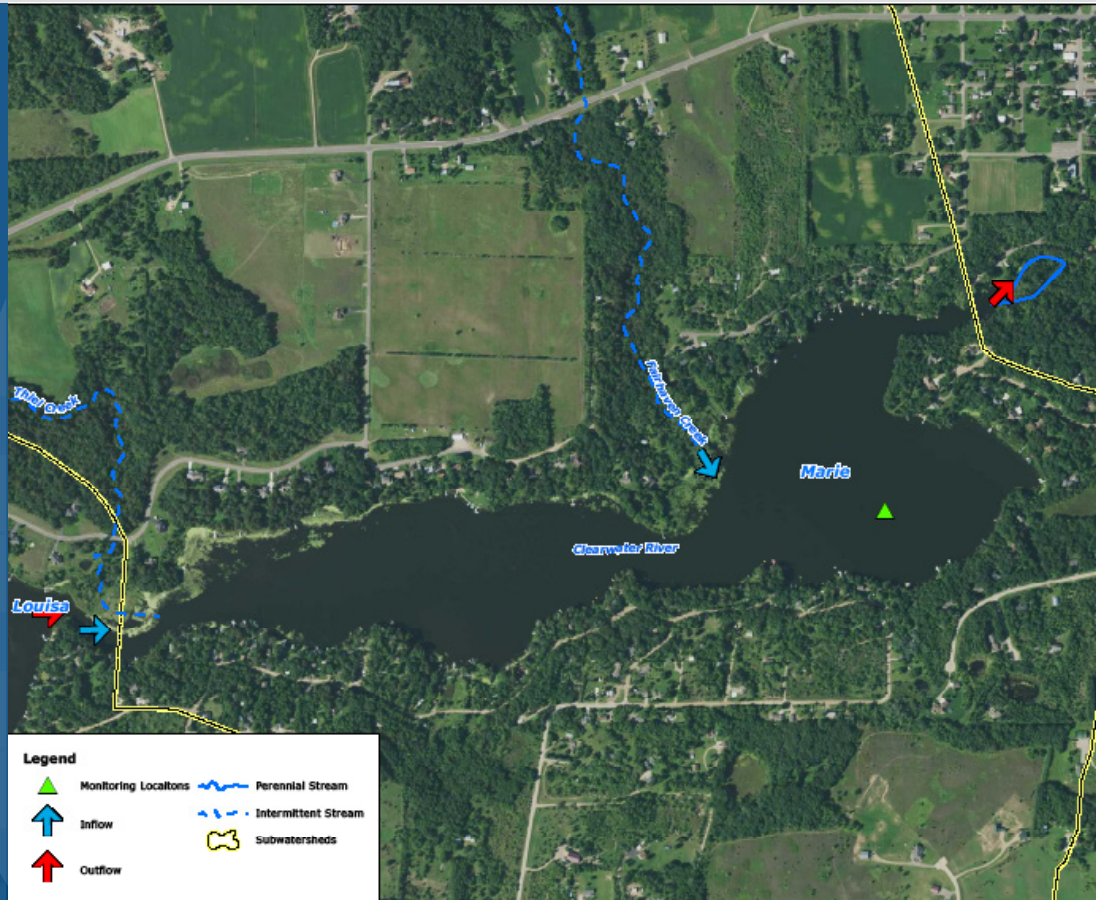
Coontail, Canadian waterweed

Invasive Species

Curly-leaf pondweed

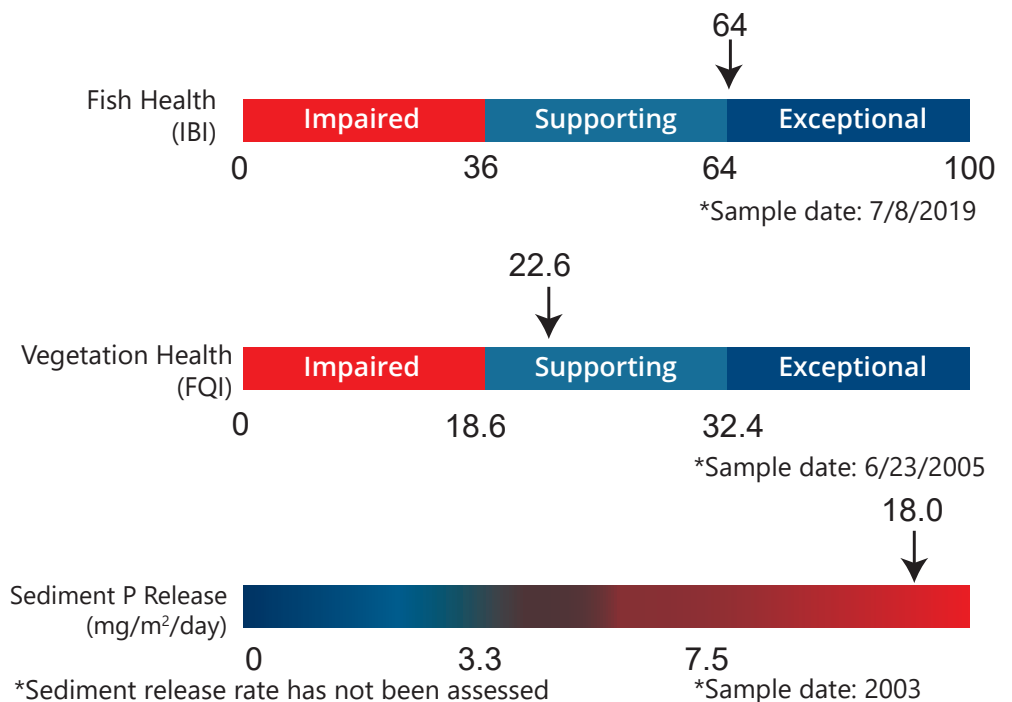
Status

Impaired, TMDL Completed 2009



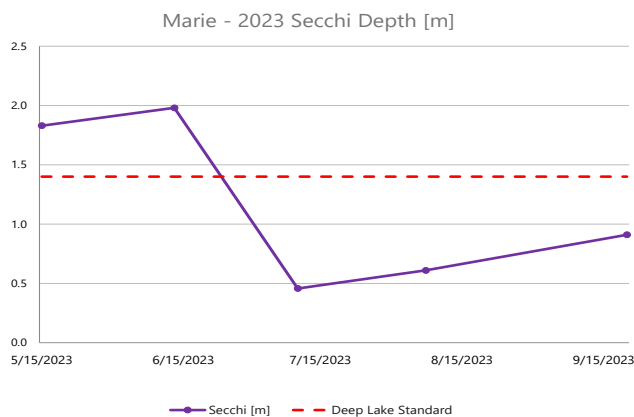
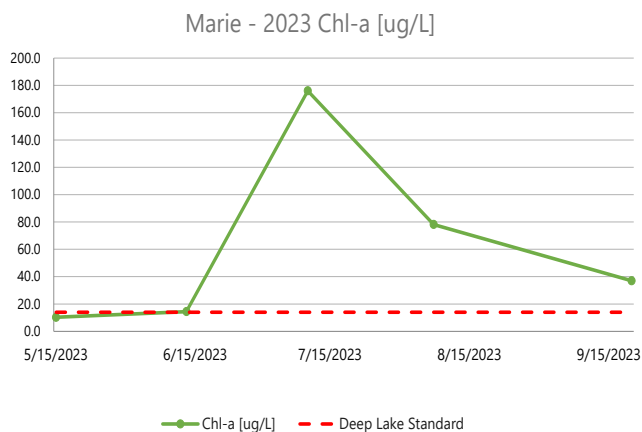
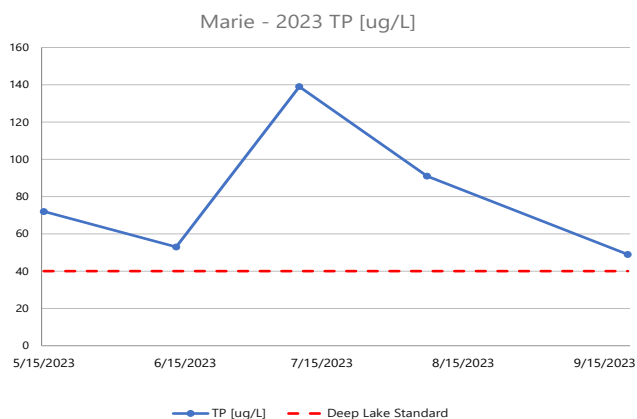
TO DO LIST

- ▲ Manage upstream loads
- ▲ AIS management
- ▲ Internal load management study

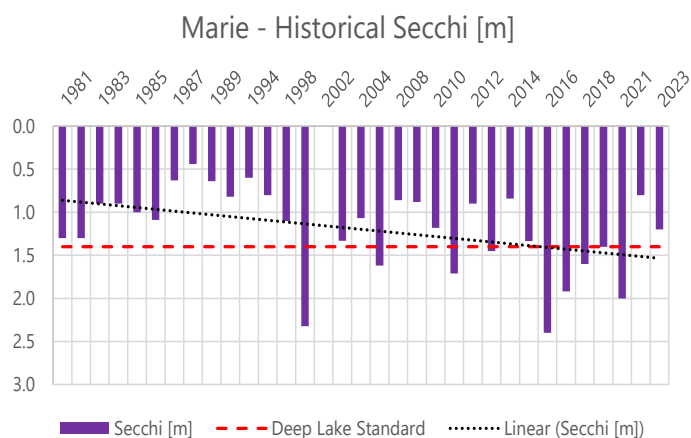
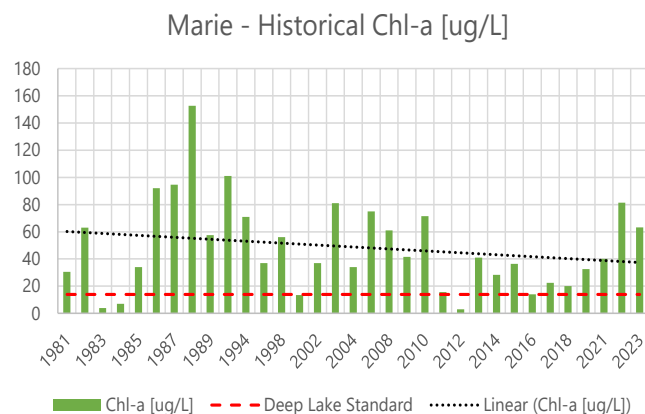
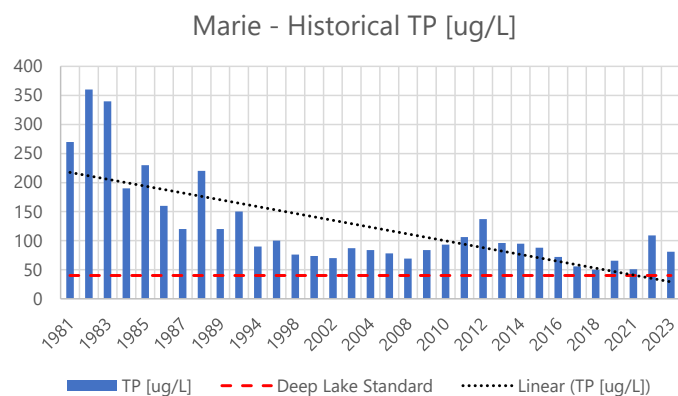


LAKE MARIE

2023 Water Quality



Historic Water Quality

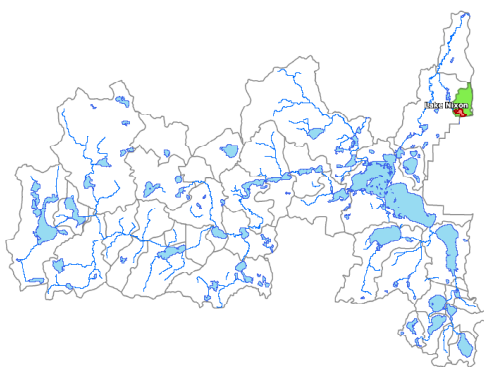
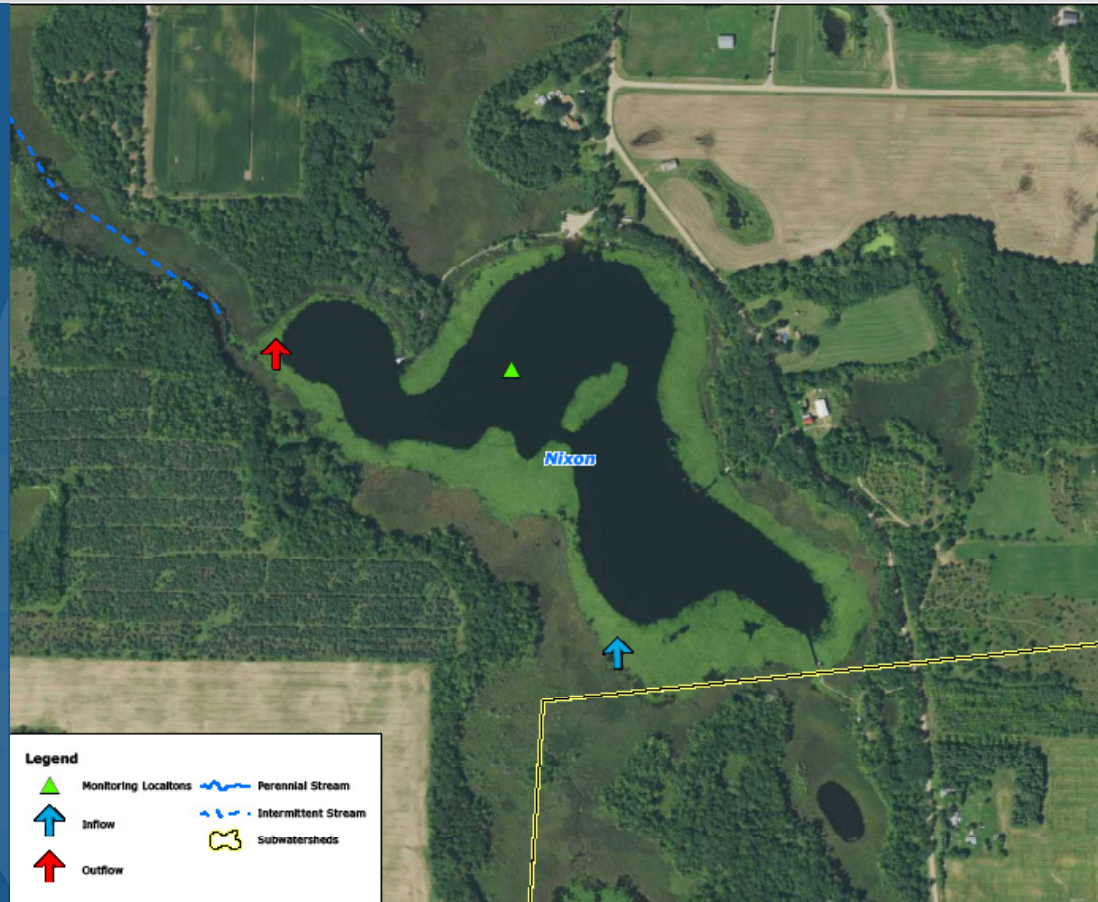


NIXON LAKE

QUICK FACTS

Littoral Area: 33 acres
Surface Area: 60 acres
Subwatershed Area: 690 acres
Maximum Depth: 67 feet
Upstream Waters: None

Common Fish	Bluegill, Northern Pike, Yellow Bull-head, Largemouth Bass
Dominant Vegetation	Currently obtaining vegetation info from DNR
Invasive Species	Currently obtaining vegetation info from DNR
Status	Not impaired

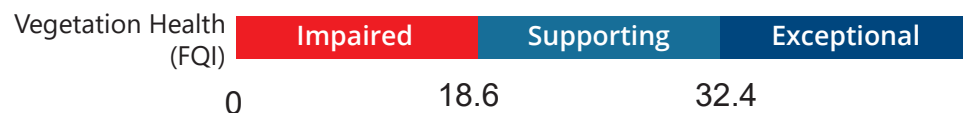


TO DO LIST

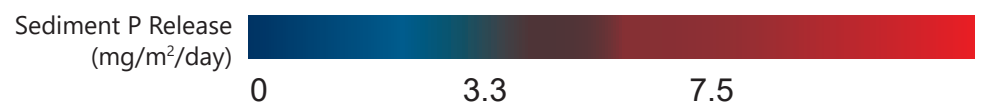
- ▲ Protect water quality
- ▲ Manage upstream loads
- ▲ AIS management and prevention



*Fish IBI has not been assessed



*Vegetation FQI has not been assessed



*Sediment release rate has not been assessed

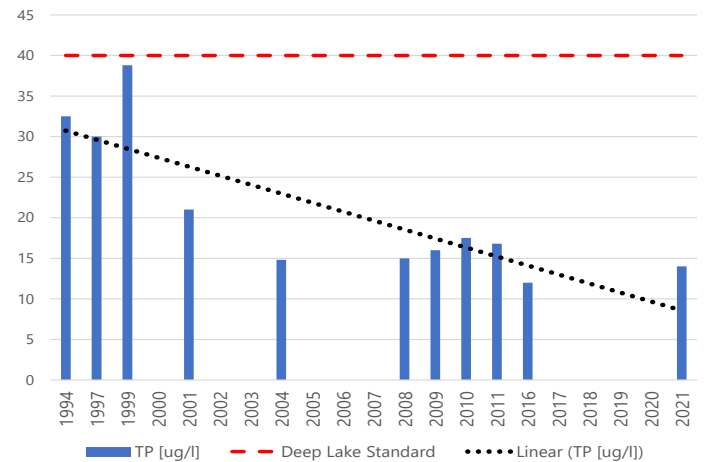
NIXON LAKE

2023 Water Quality

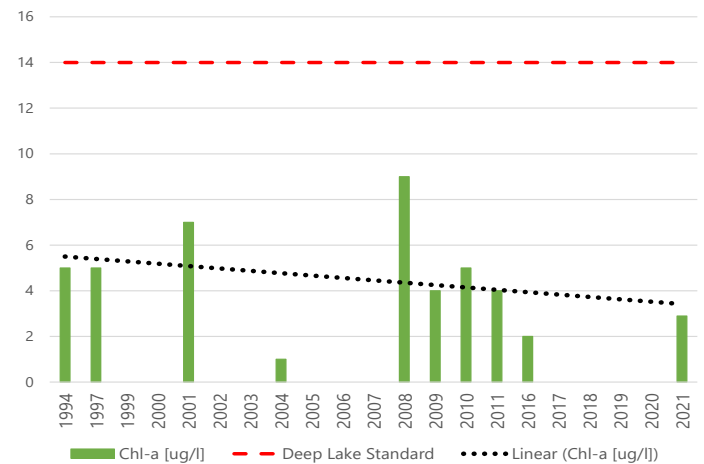
Lake not sampled

Historic Water Quality

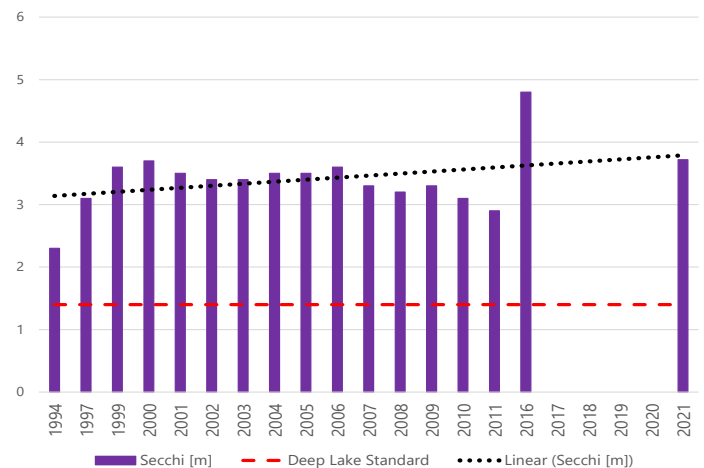
Nixon - Historical TP [ug/l]



Nixon - Historical Chl-a [ug/l]



Nixon - Historical Secchi Depth [m]



OTTER LAKE

QUICK FACTS

Littoral Area: 32 acres

Surface Area: 92 acres

Subwatershed Area: 10,574 acres

Maximum Depth: 51 feet

Upstream Waters: Lake Laura

Common Fish

Black Crappie,
Bluegill, Northern
Pike, Largemouth
Bass, Walleye

Dominant Vegetation

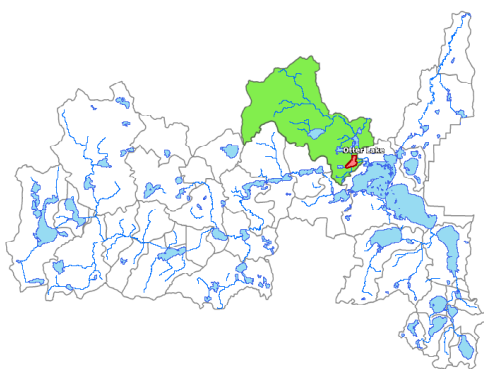
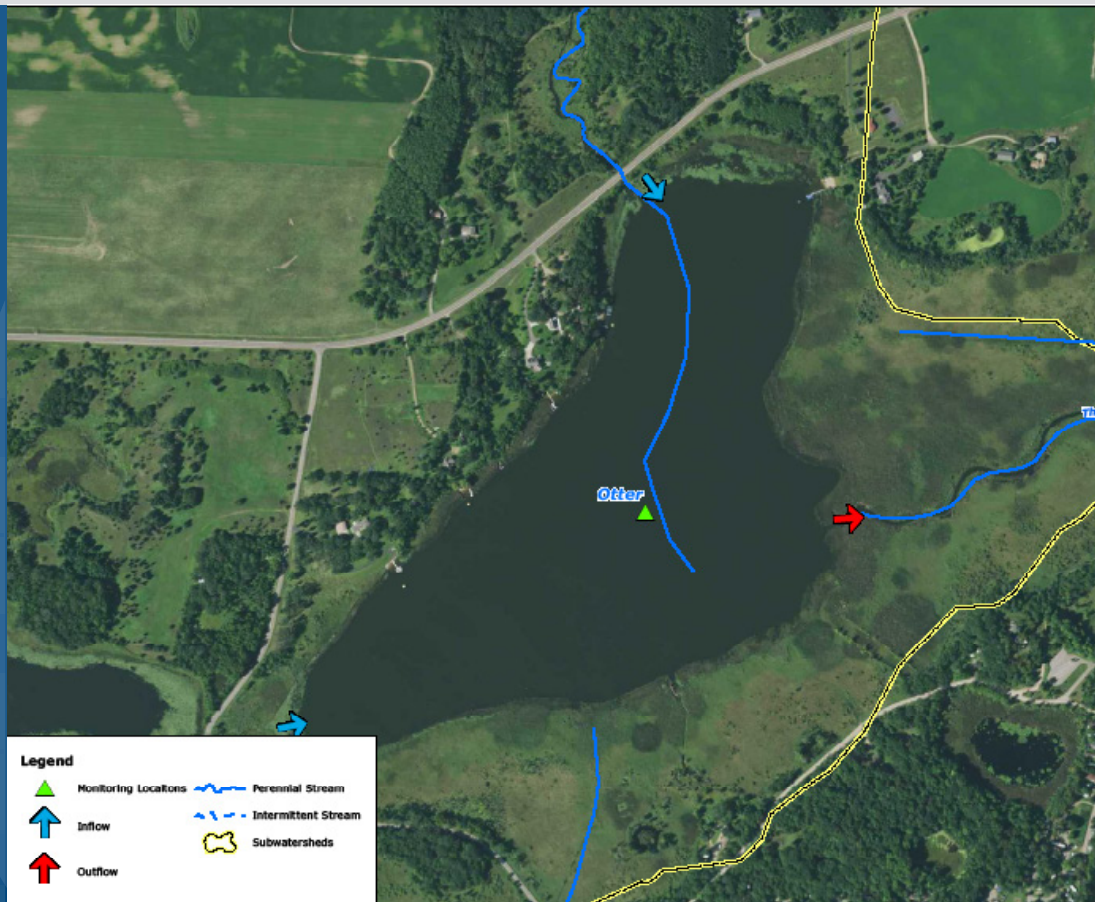
Diverse
community

Invasive Species

Curly-leaf
pondweed,
Eurasian water
milfoil

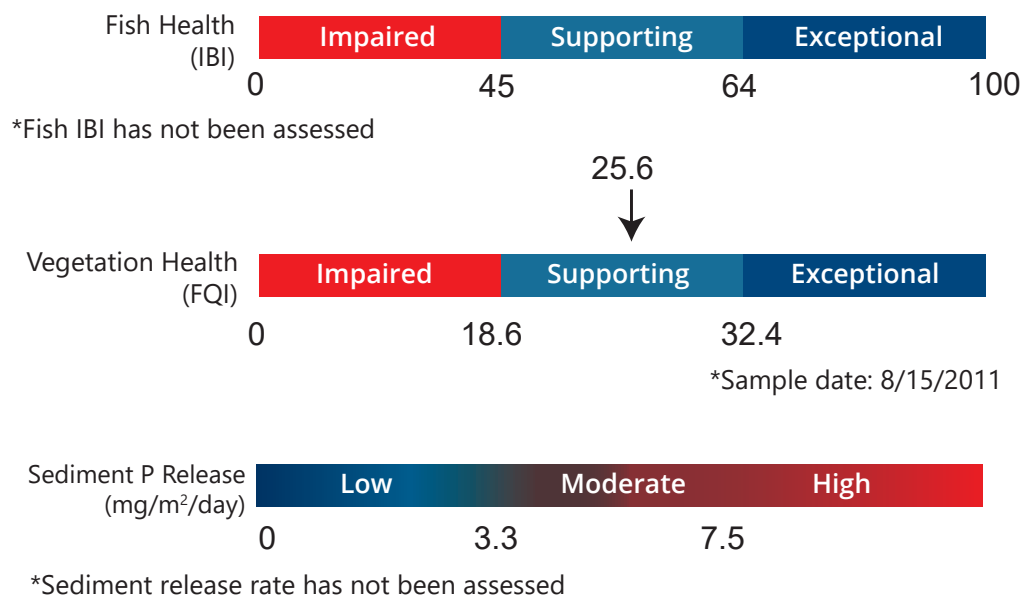
Status

Not impaired



TO DO LIST

- ▲ Protect water quality
- ▲ Manage upstream loads

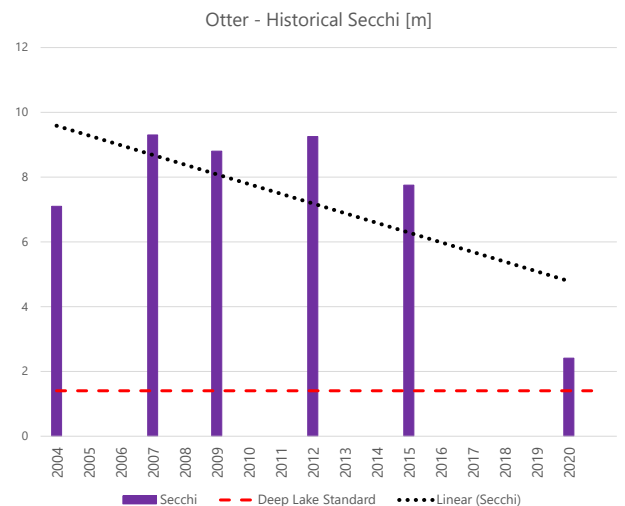
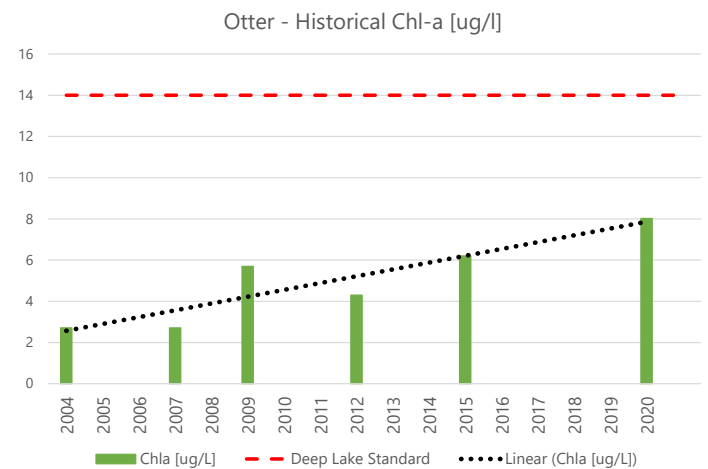
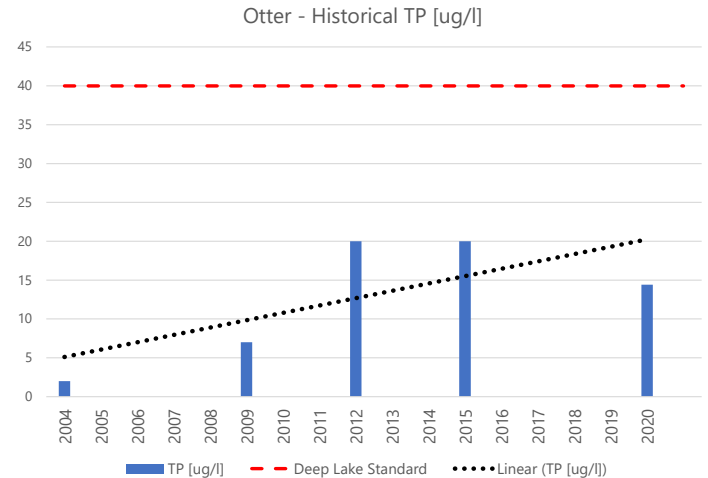


OTTER LAKE

2023 Water Quality

Lake not sampled

Historic Water Quality



PLEASANT LAKE

QUICK FACTS

Littoral Area: 260 acres

Surface Area: 597 acres

Subwatershed Area: 4,325 acres

Maximum Depth: 74 feet

Upstream Waters: None

Common Fish

Bluegill, Yellow Bullhead, Northern Pike, Pumpkinseed Sunfish

Dominant Vegetation

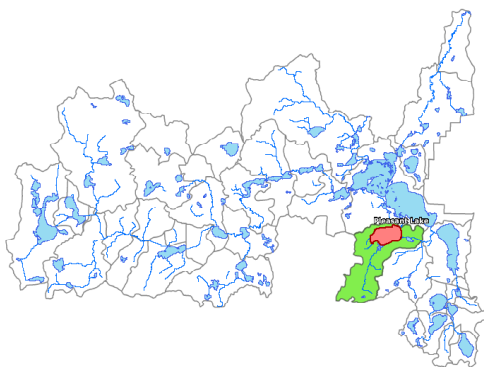
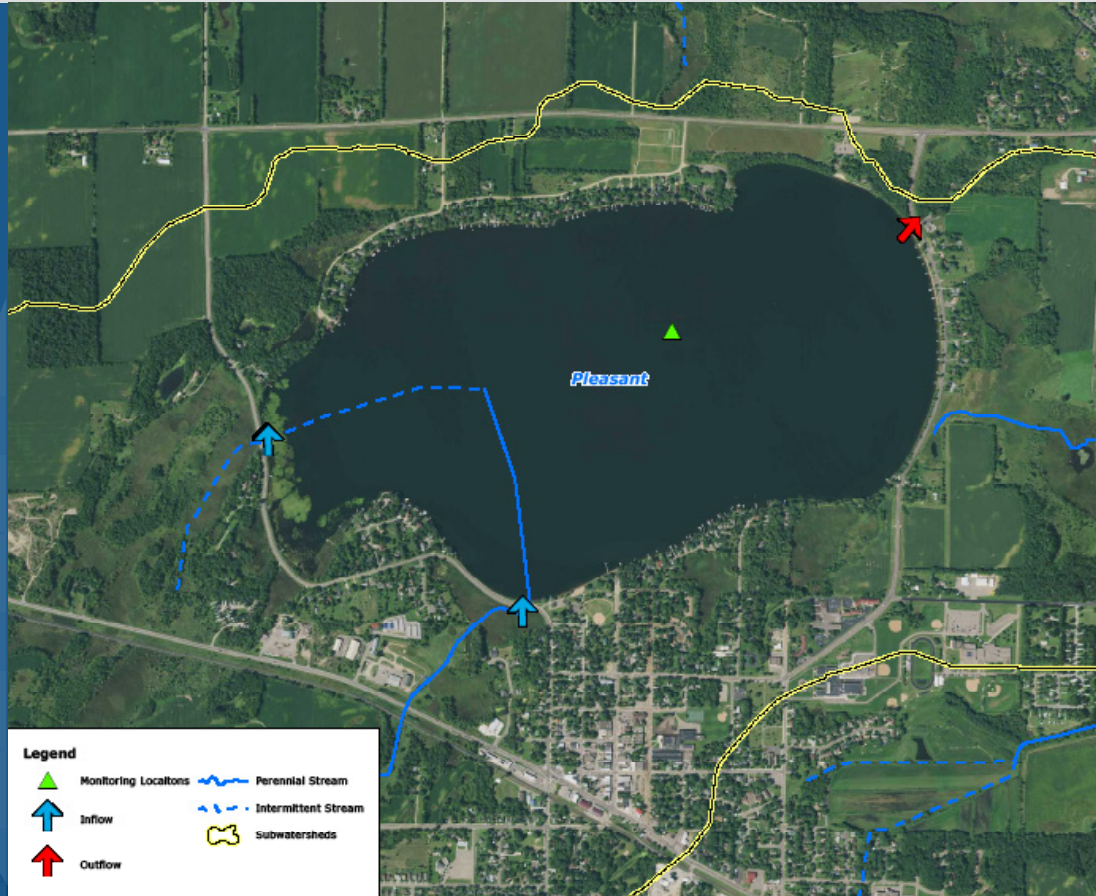
Curlyleaf, Coontail, chara species, Eurasian watermilfoil

Invasive Species

Currently obtaining vegetation info from DNR

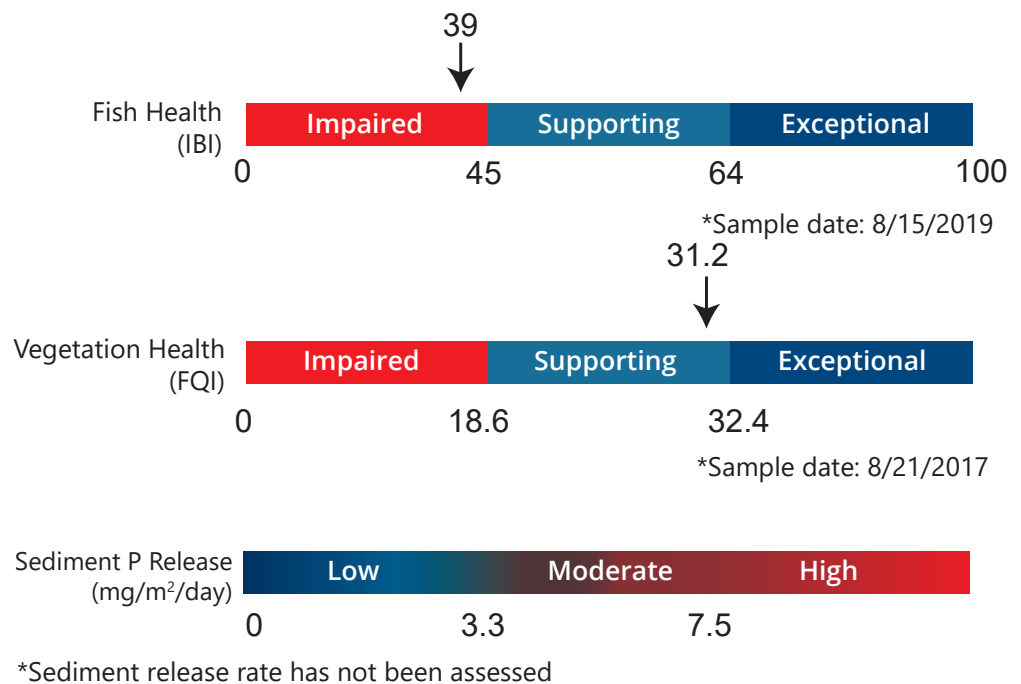
Status

Not impaired



TO DO LIST

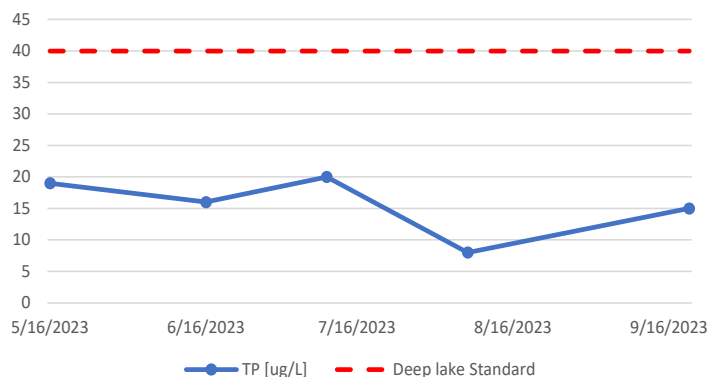
- Manage watershed loads
- Protect water quality
- Operate outlet to minimize flooding



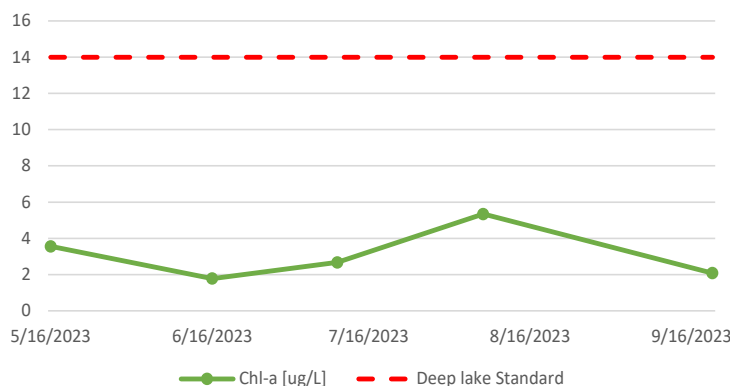
PLEASANT LAKE

2023 Water Quality

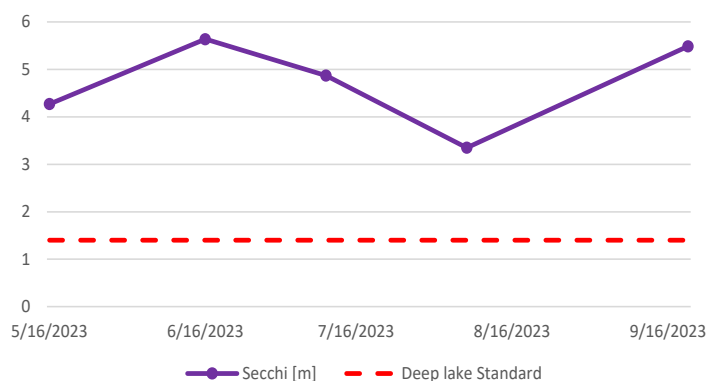
Pleasant - 2023 TP [ug/L]



Pleasant - 2023 Chl-a [ug/L]

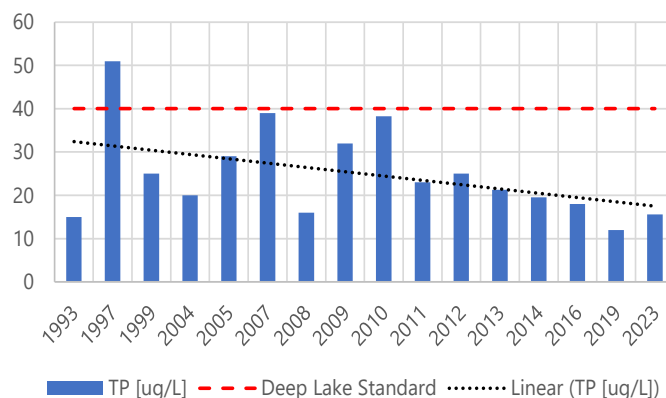


Pleasant - 2023 Secchi [m]

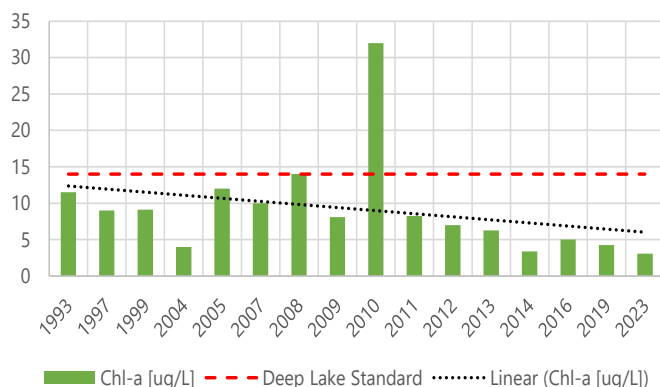


Historic Water Quality

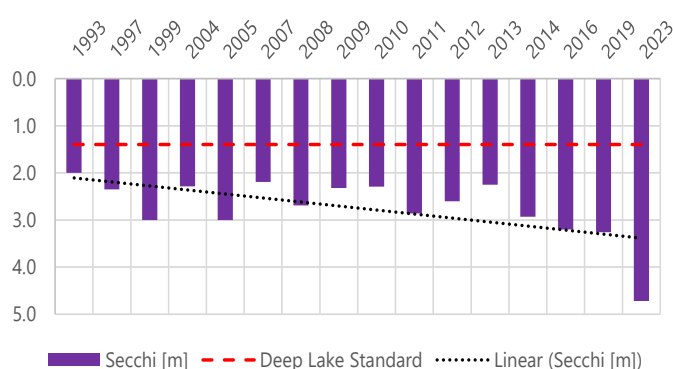
Pleasant - Historical TP [ug/L]



Pleasant - Historical Chl-a [ug/L]



Pleasant - Historical Secchi [m]



SCHOOL SECTION LAKE

QUICK FACTS

Littoral Area: 188 acres

Surface Area: 193 acres

Subwatershed Area: 1,843 acres

Maximum Depth: 12 feet

Upstream Waters: None

Common Fish

Black bullhead, Bluegill, Northern Pike

Dominant Vegetation

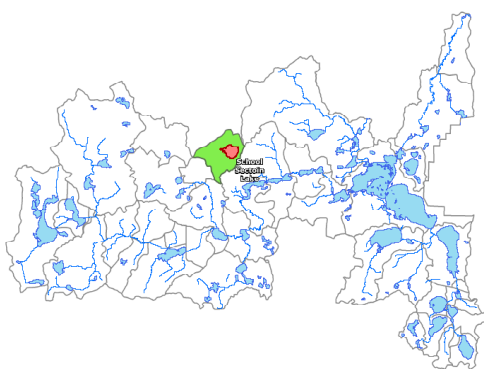
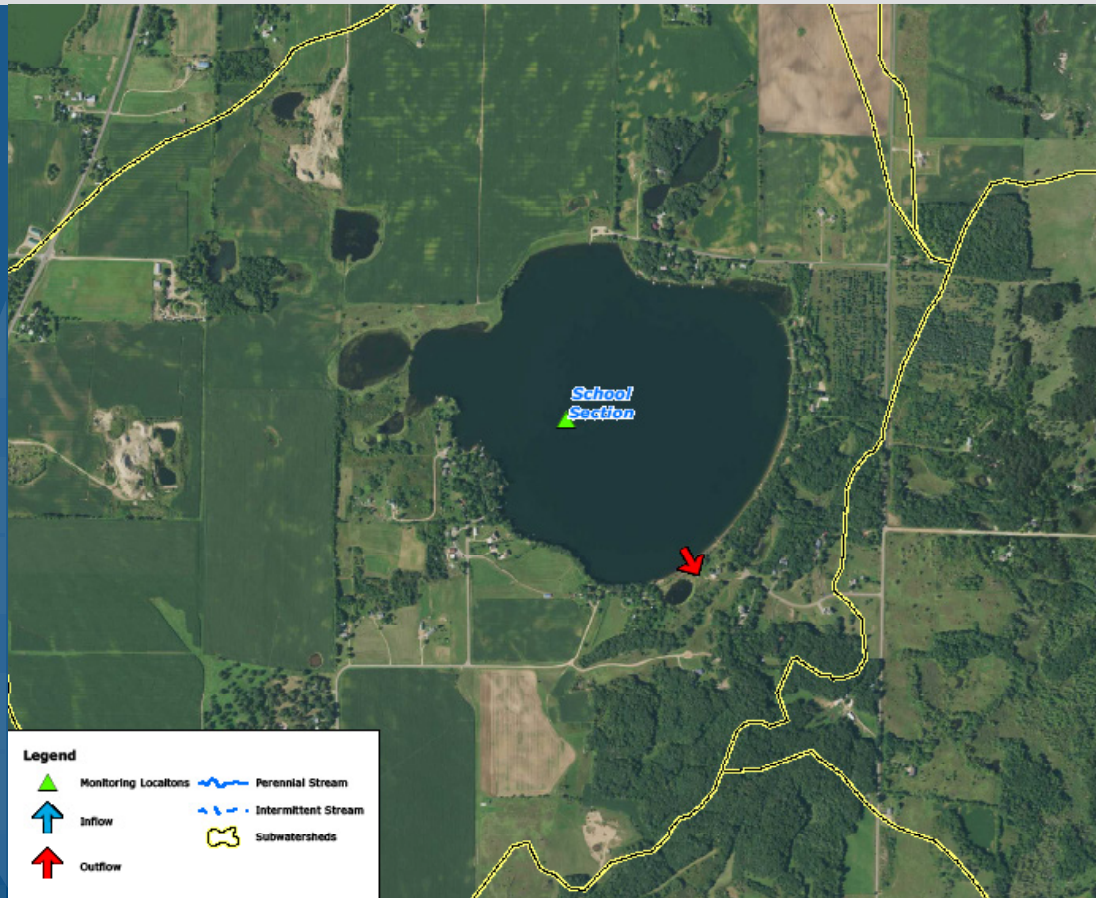
Northern water milfoil, Illinois pondweed, muskrass

Invasive Species

Curly-leaf pondweed

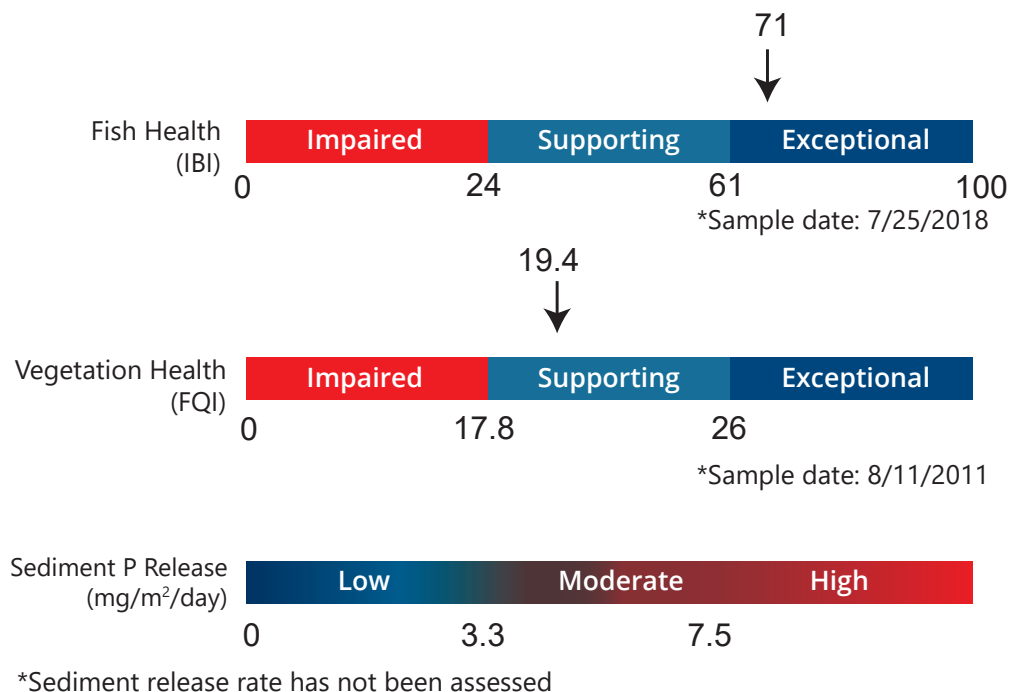
Status

Not impaired



TO DO LIST

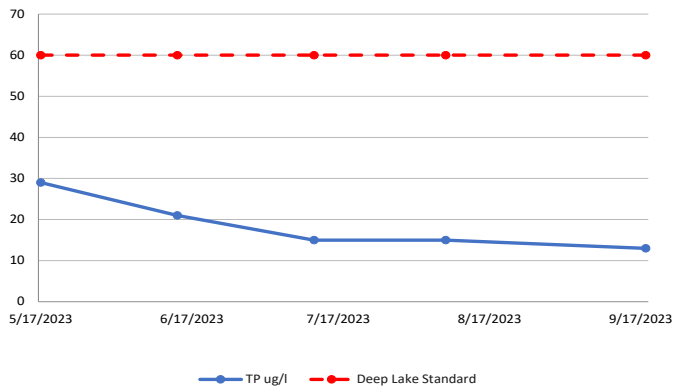
- ▲ Operate outlet to minimize flooding
- ▲ Protect water quality



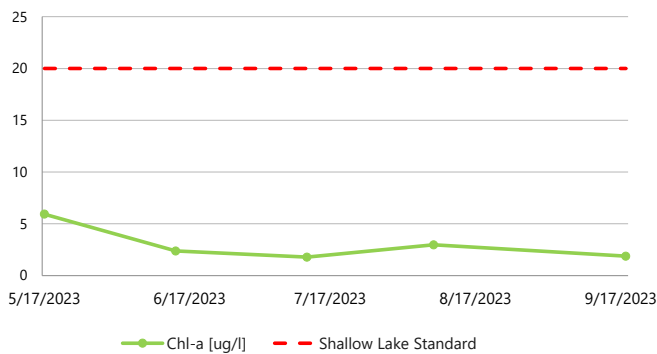
SCHOOL SECTION LAKE

2023 Water Quality

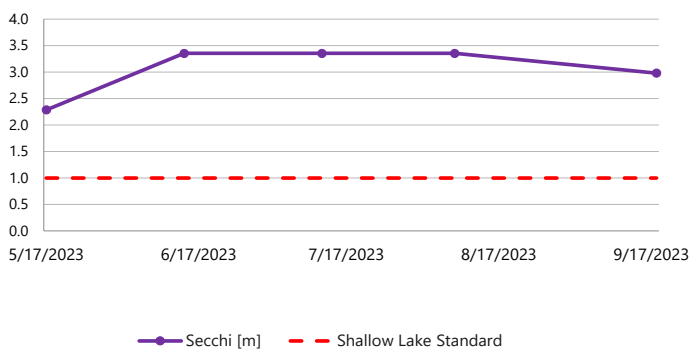
School Section - 2023 TP [ug/L]



School Section - 2023 Chl-a [ug/l]

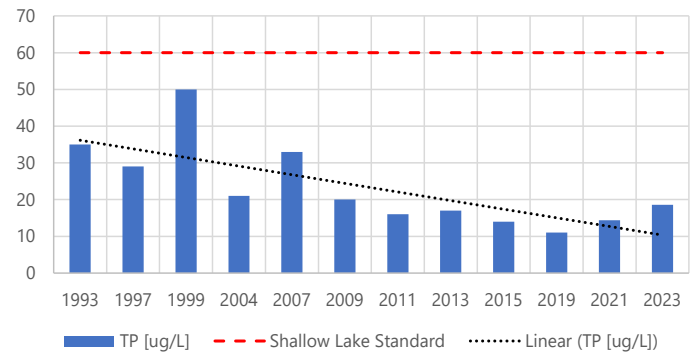


School Section - 2023 Secchi [m]

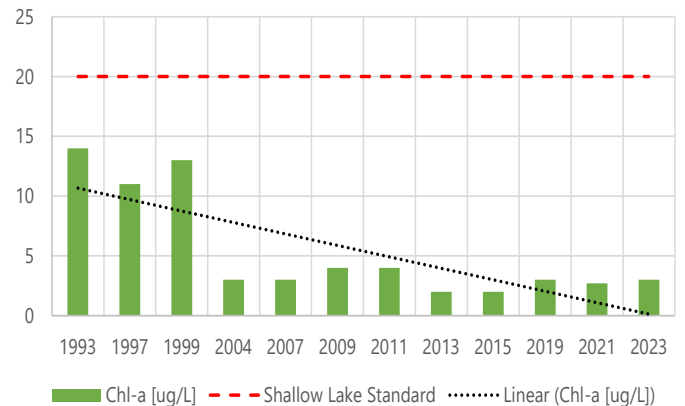


Historic Water Quality

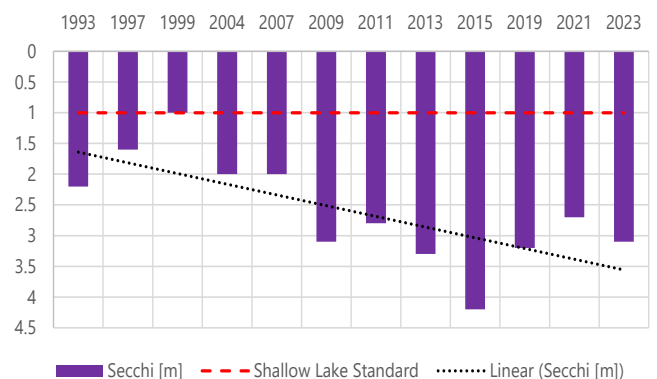
School Section - Historical TP [ug/L]



School Section - Historical Chl-a [ug/L]



School Section - Historical Secchi [m]



SCOTT LAKE

QUICK FACTS

Littoral Area: 52 acres

Residence Time: 12 days

Surface Area: 80 acres

Subwatershed Area: 51,000 acres

Maximum Depth: 23 feet

Upstream Waters: Clearwater River,
Lake Betsy, Union Lake

Common Fish

Black Crappie,
Bluegill,
Channel Catfish,
White Sucker

Dominant Vegetation

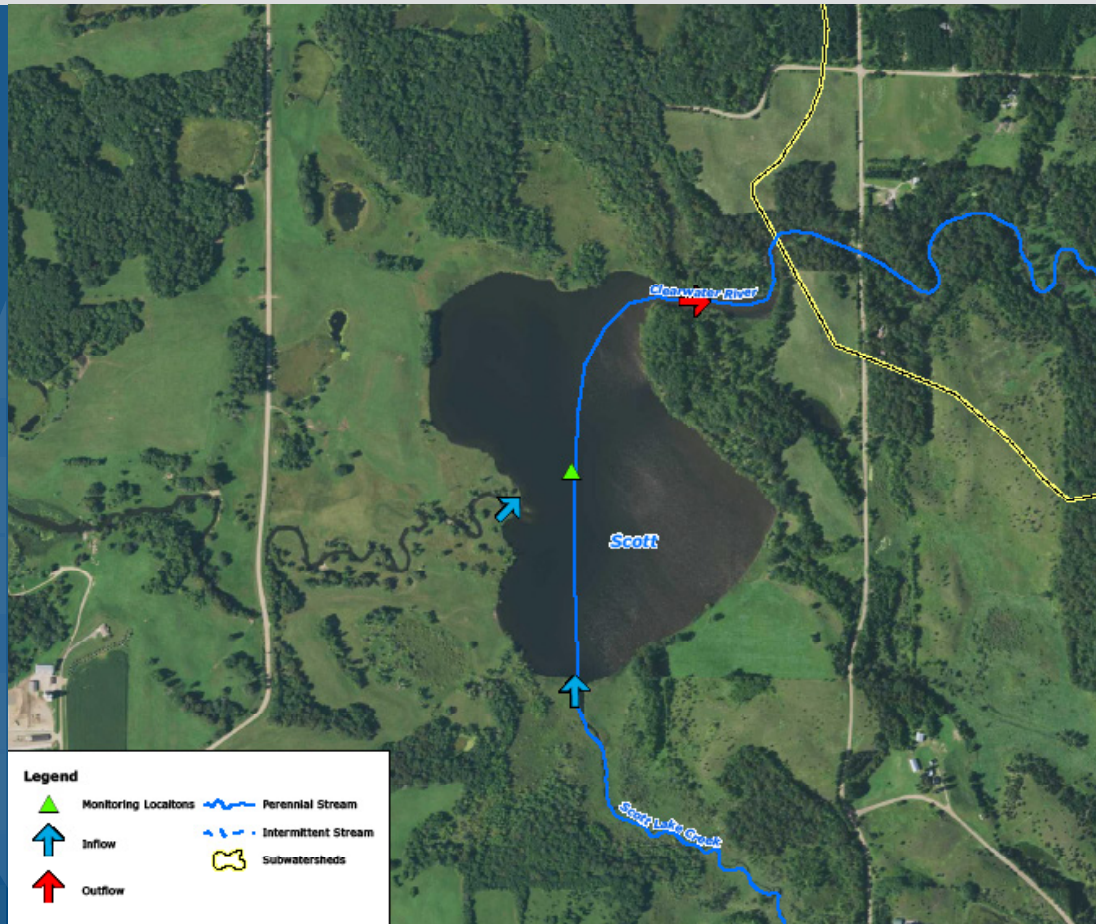
No Recent Survey

Invasive Species

Curly-leaf
pondweed

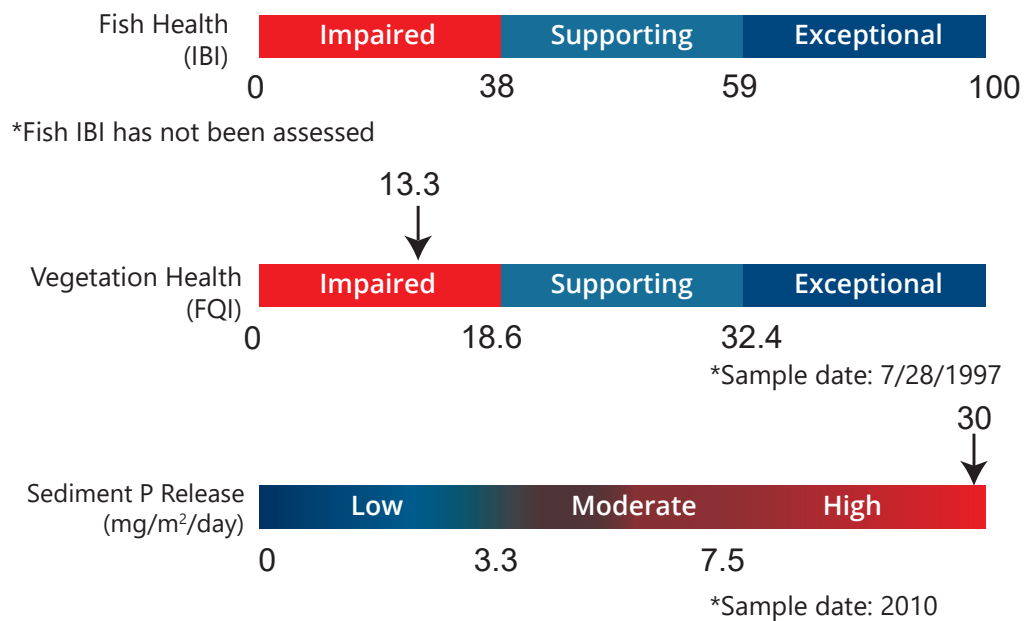
Status

Impaired, TMDL
Completed 2009



TO DO LIST

- ▲ Rough fish management
- ▲ Manage upstream loads
- ▲ Internal load management study

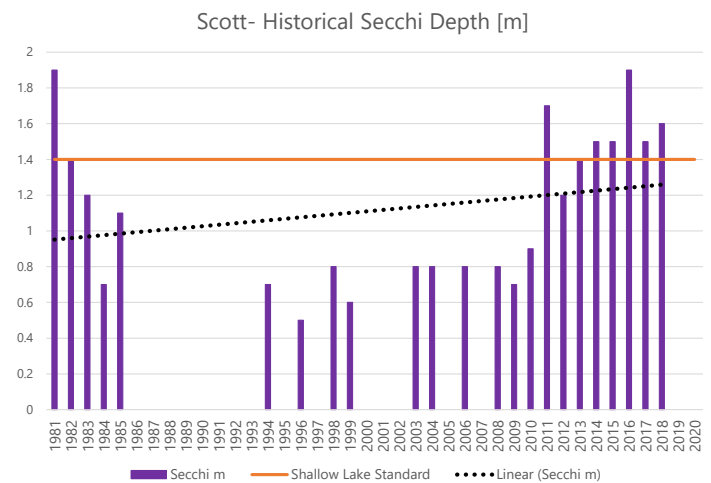
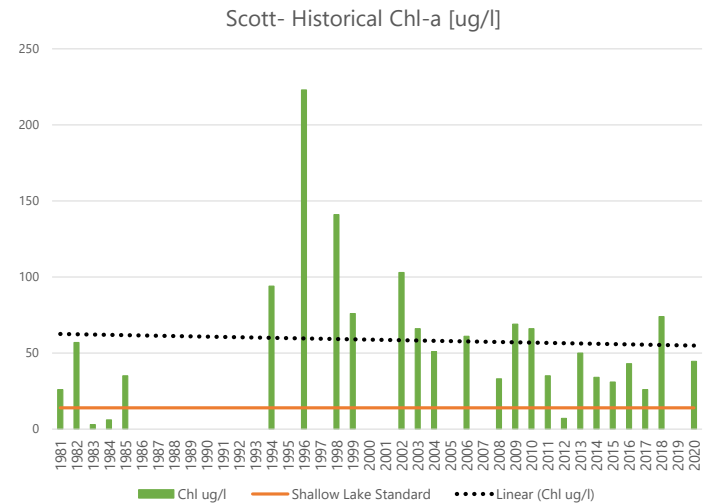
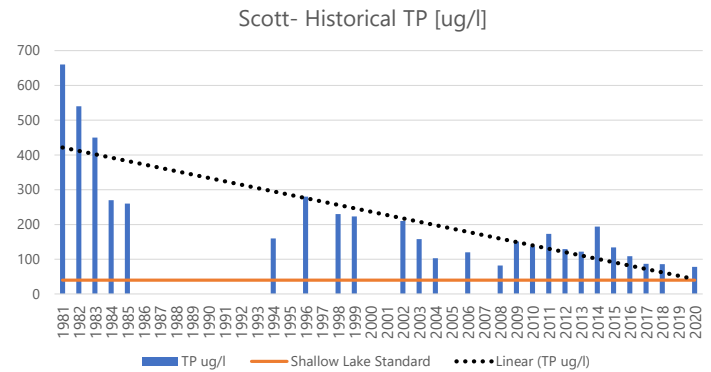


SCOTT LAKE

2023 Water Quality

Lake not sampled

Historic Water Quality



SWARTOUT LAKE

QUICK FACTS

Littoral Area: 171 acres

Residence Time: 460 days

Surface Area: 171 acres

Subwatershed Area: 5,551 acres

Maximum Depth: 12 feet

Upstream Waters: Henshaw, Albion

Common Fish

Black Bullhead,
Black Crappie,
Common Carp

Dominant Vegetation

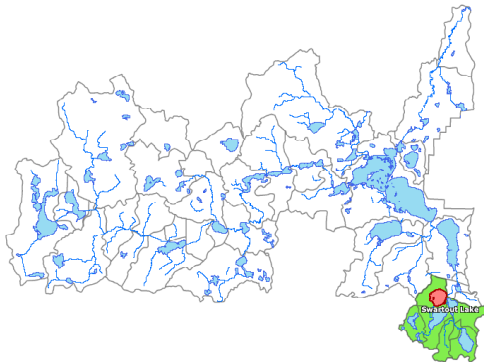
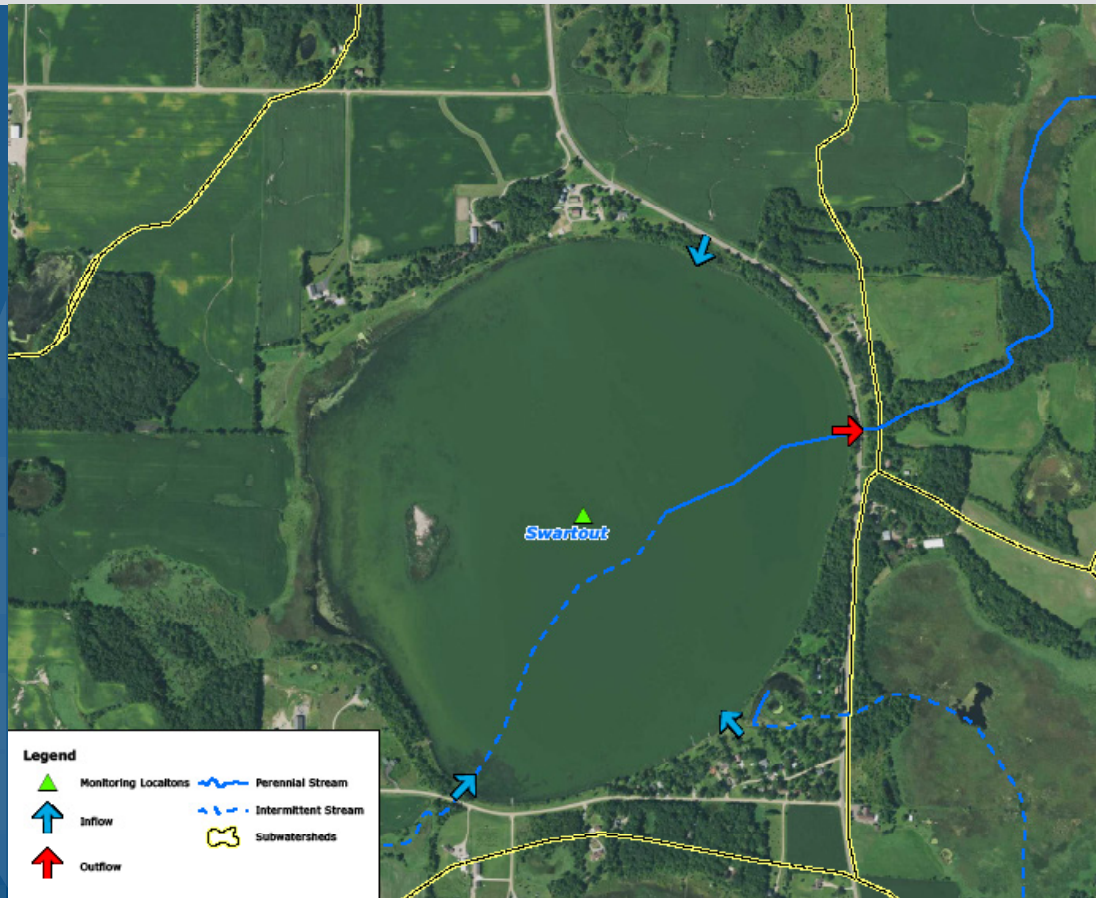
Coontail, sago
pondweed, bushy
pondweed

Invasive Species

Curly-leaf
pondweed

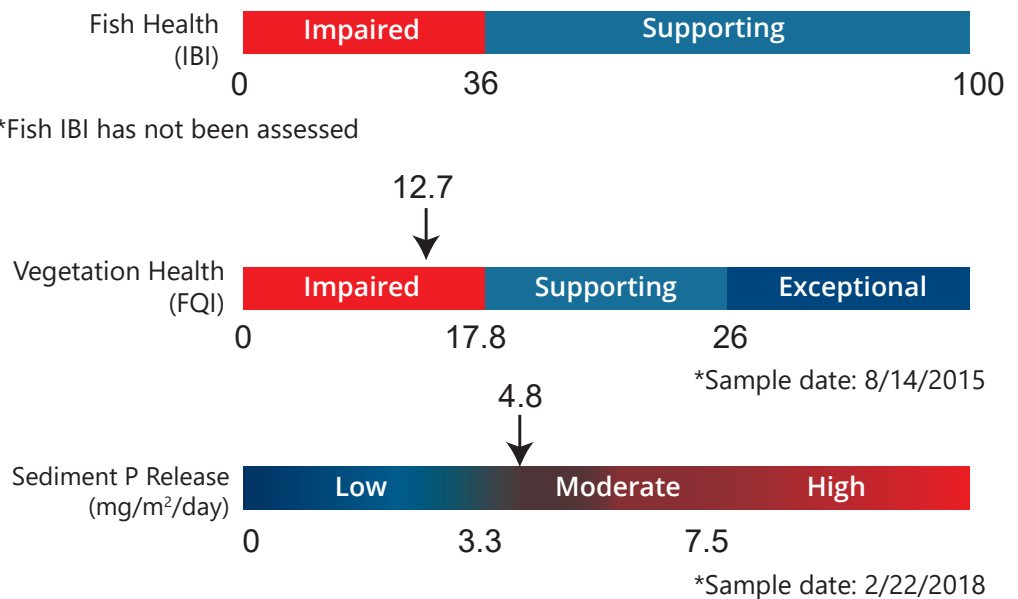
Status

Impaired, TMDL
Completed 2010



TO DO LIST

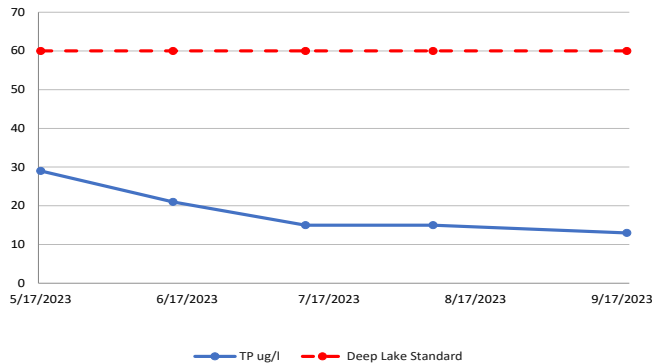
- ▲ AIS management
- ▲ Rough fish management
- ▲ Manage upstream loads



SWARTOUT LAKE

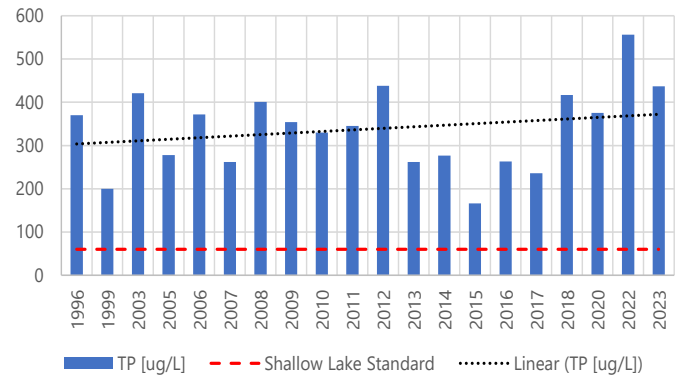
2023 Water Quality

School Section - 2023 TP [ug/L]

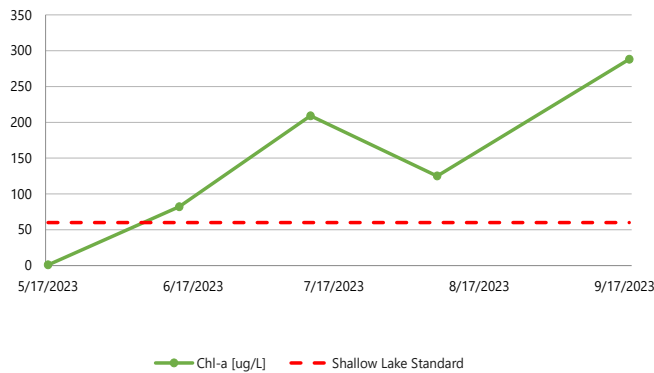


Historic Water Quality

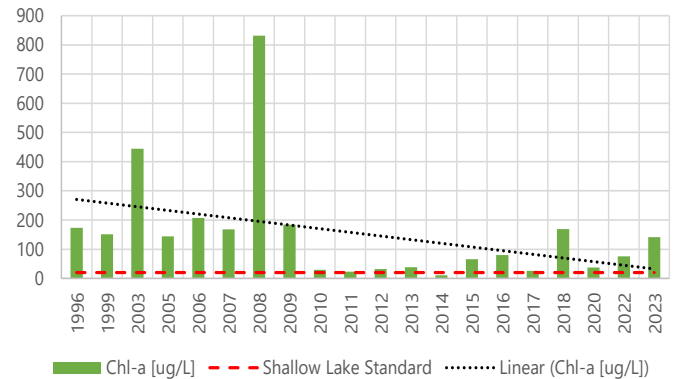
Swartout - Historical TP [ug/L]



Swartout - 2023 Chl-a [ug/L]



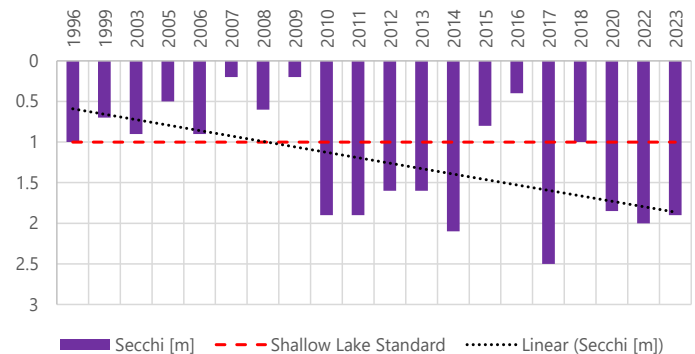
Swartout - Historical Chl-a [ug/L]



Swartout - 2023 Secchi [m]
no secchi readings 08/23 or 09/23



Swartout - Historical Secchi [m]



UNION LAKE

QUICK FACTS

Littoral Area: 27 acres

Residence Time: 291 days

Surface Area: 93 acres

Subwatershed Area: 4,741 acres

Maximum Depth: 35 feet

Upstream Waters: None

Common Fish

Black Crappie,
Bluegill, Northern
Pike, Largemouth
Bass

Dominant Vegetation

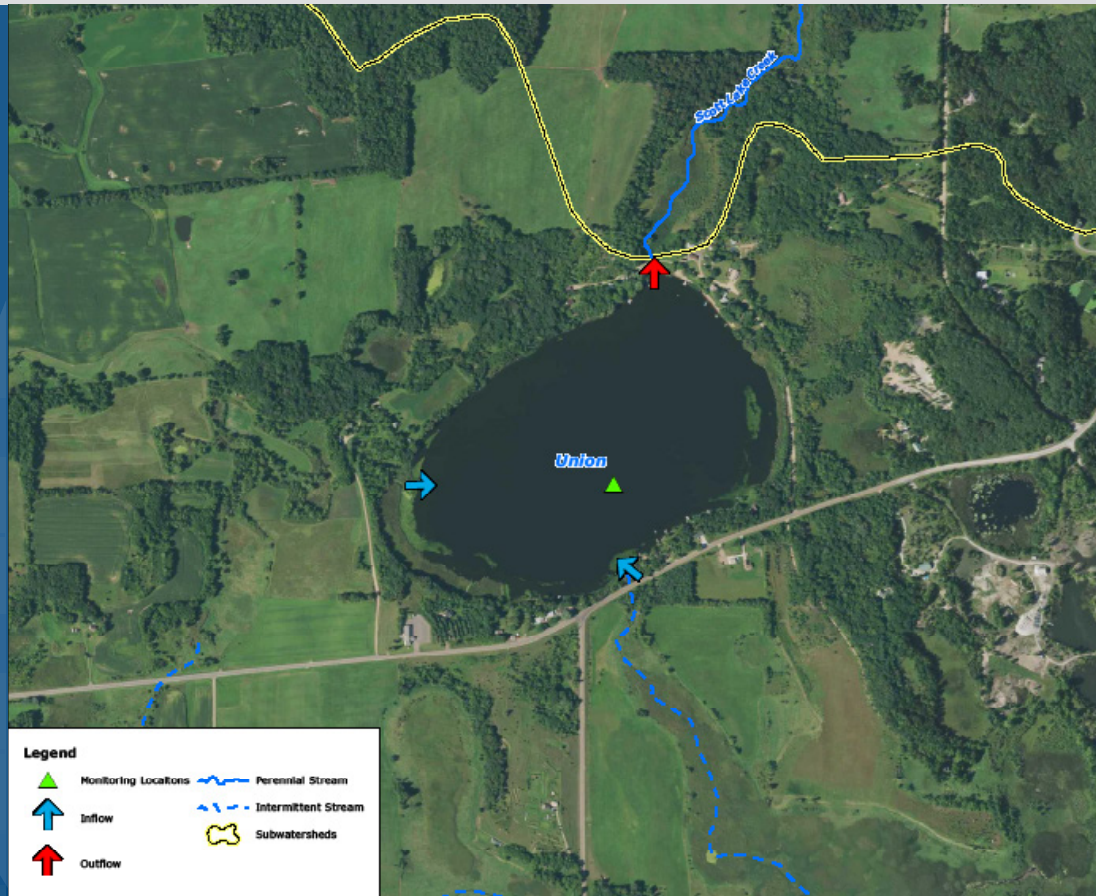
Coontail, curly-leaf
pondweed, sago
pondweed

Invasive Species

Curly-leaf
pondweed

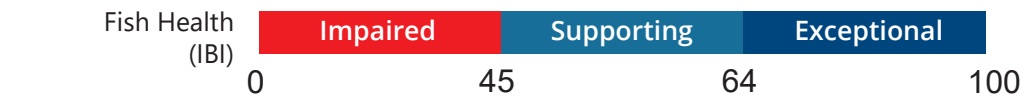
Status

Removed from
Impaired Waters
List in 2022, TMDL
Completed 2009

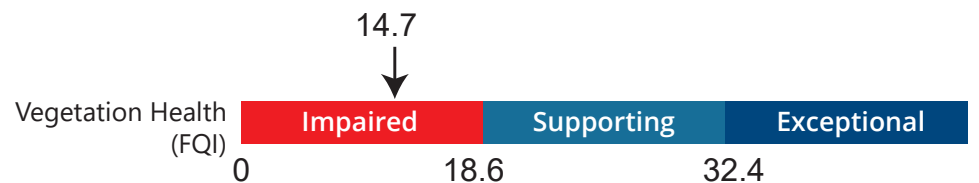


TO DO LIST

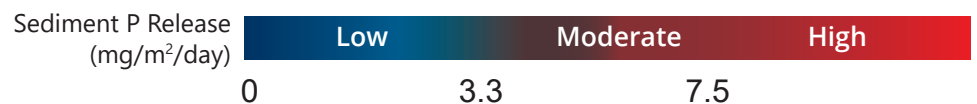
- ▲ Manage upstream loads



*Fish IBI has not been assessed



*Sample date: 6/17/2016



*Sediment release rate has not been assessed

UNION LAKE

2023 Water Quality

Lake not sampled

Historic Water Quality

