Lake Welch Watershed Management and HAB Mitigation Efforts

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Outline

- What is a HAB
- Introduction to Lake Welch Project
- Strategy 1: Monitoring and Water Quality Planning
- Strategy 2: Short-term mitigation efforts
- Conclusions

What is a HAB?

H: **Harmful** (health, economic aesthetics, ecological)

A: **Algal** (freshwater HABs refer to cyanobacteria, not truly algae)

B: **Bloom** (proliferation of cells, dense concentrations)

Know it, Avoid it, Report it

The Lake in Central Park

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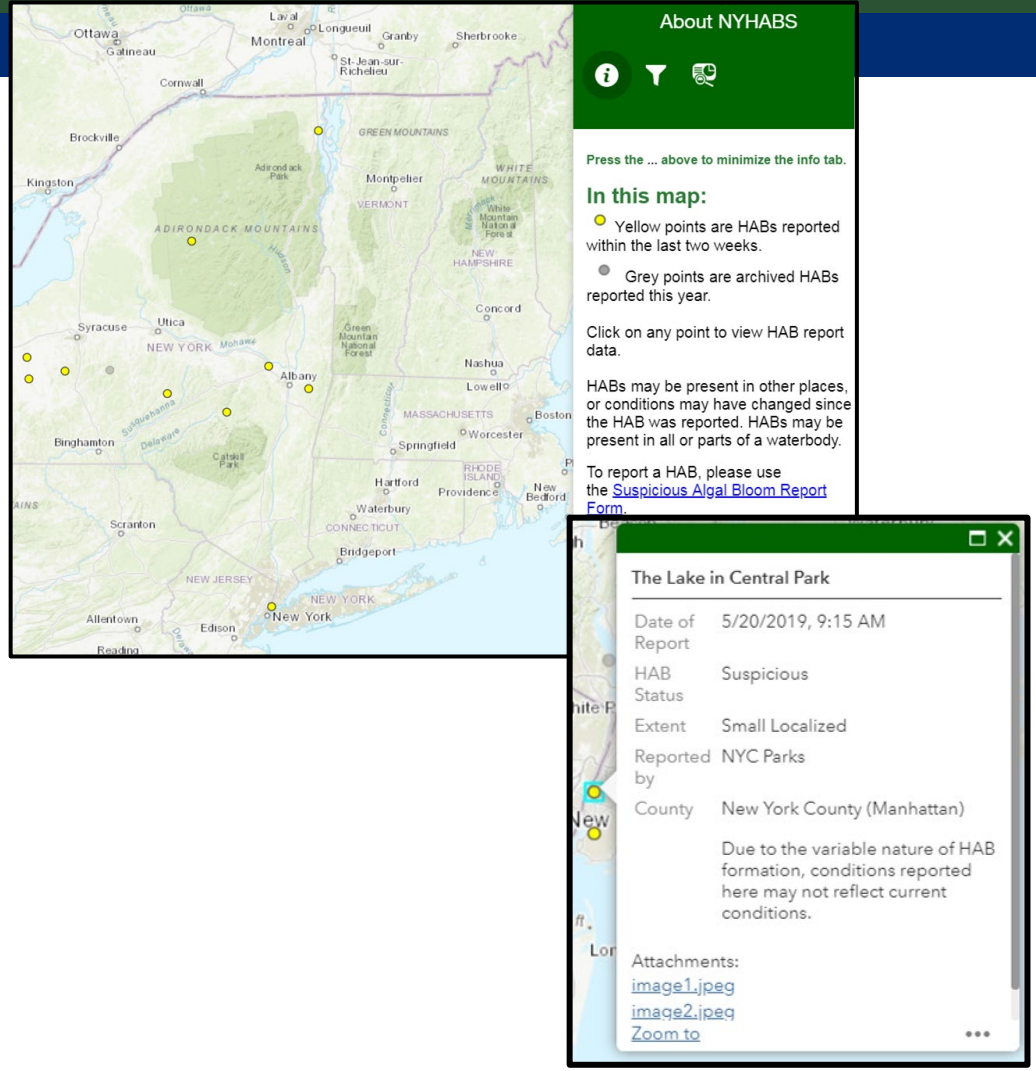
NYHABS - The NY HABs System

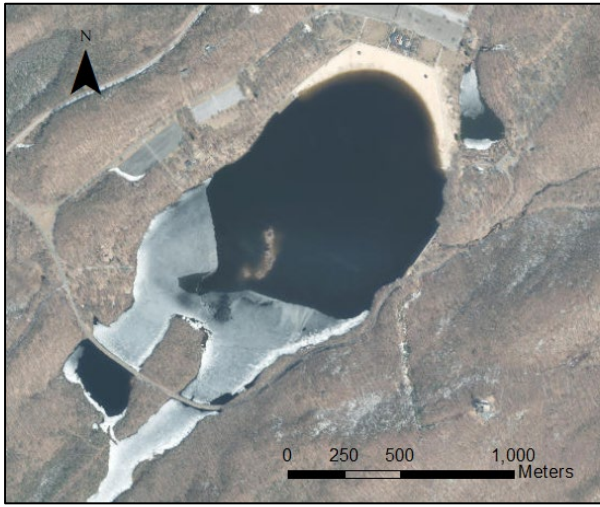
- ArcGIS Online interactive map of HAB reports, updated daily*
- Reports include status, extent, reported by, exact location, photos
- Current Reports: last 2 weeks
- Archived Reports: all previous reports of the year

on.ny.gov/nyhabs



Lake Welch - Harriman State Park

- >320k visitors annually
- Phosphorus impairments (needs verification)



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2022 Lake-Wide HAB

June 2022 → October 2022

NYSDEC HABs Approach

1. Watershed Management
2. Research HABs and their causes
3. In-Waterbody Mitigation

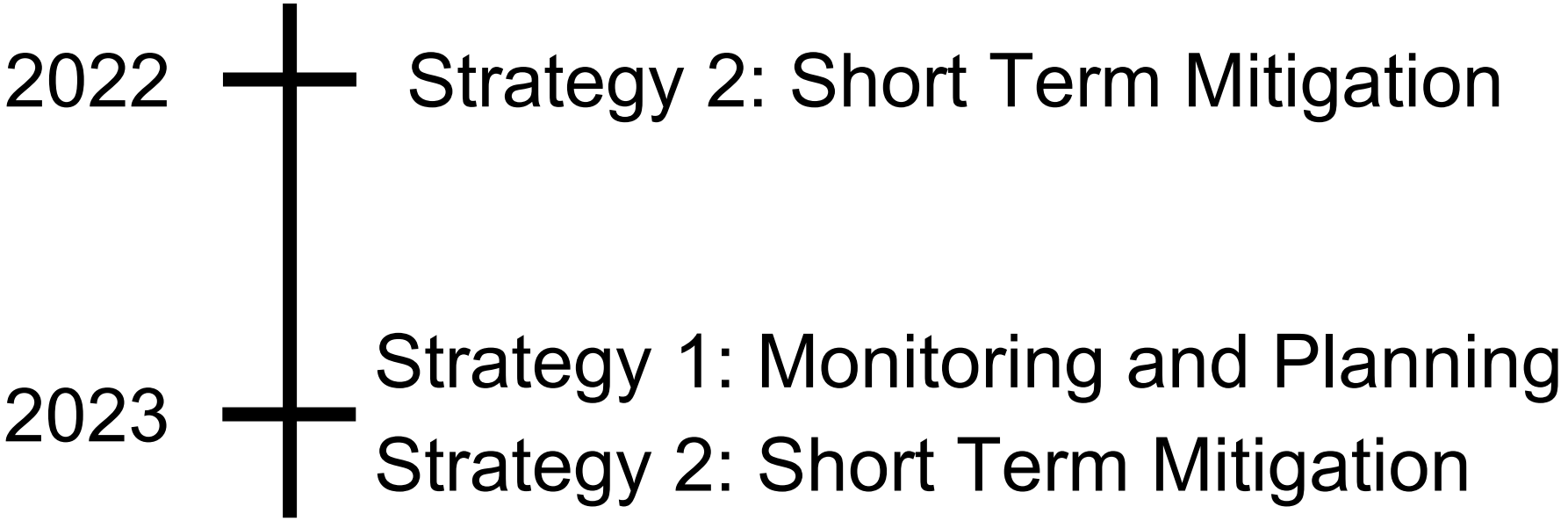
Water Quality Improvement and HAB Mitigation Efforts

Partnership between DOW, OPRHP, UFI

“All hands” approach

1. Monitoring and Water Quality Planning
2. Short-term mitigation efforts to keep beach open

Timeline

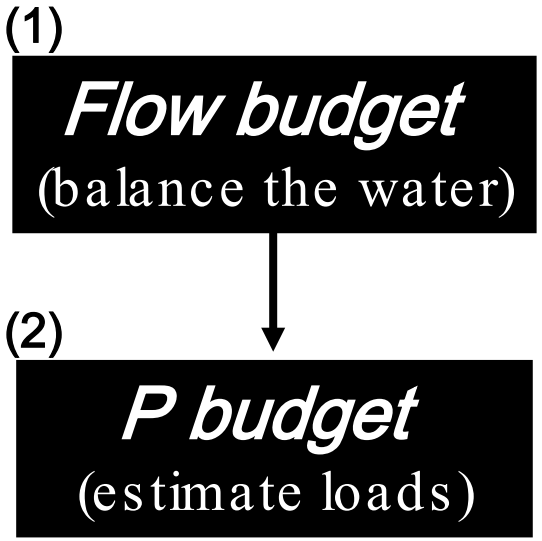

2022
Strategy 2: Short Term Mitigation
2023
Strategy 1: Monitoring and Planning
Strategy 2: Short Term Mitigation

Monitoring and Water Quality Management Planning

The Goal

Estimate P load to Lake Welch from various sources

- Help to identify where P is likely coming from
- Use to inform management recommendations and actions



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Flow Budget

Estimate daily flows
April through October

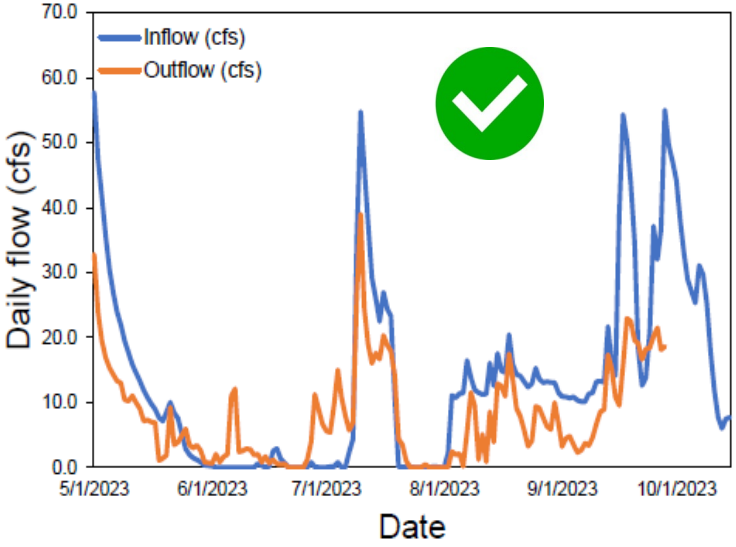
(1) **Flow budget** (balance the water)
(2) **P budget** (estimate loads)

INFLOWS:

- Beaver Pond Brook = HOBO pressure sensor
- WWTP = daily flows from NYSOPRHP/Ramboll
- Unmeasured = ratio of watershed areas

OUTFLOW:

- Minisceongo Creek = HOBO pressure sensor



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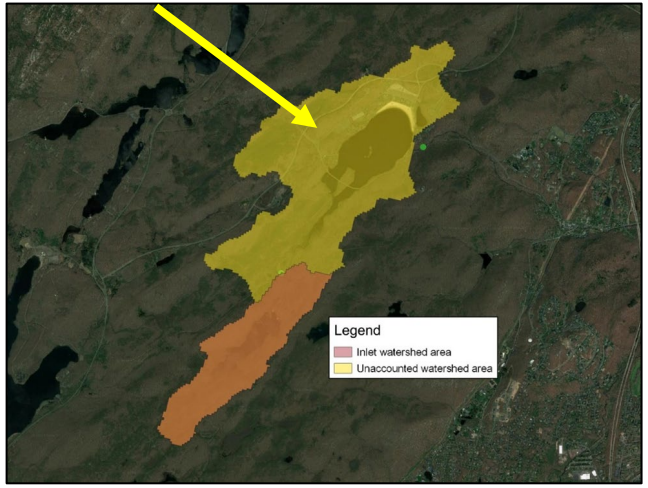
Phosphorus Sources

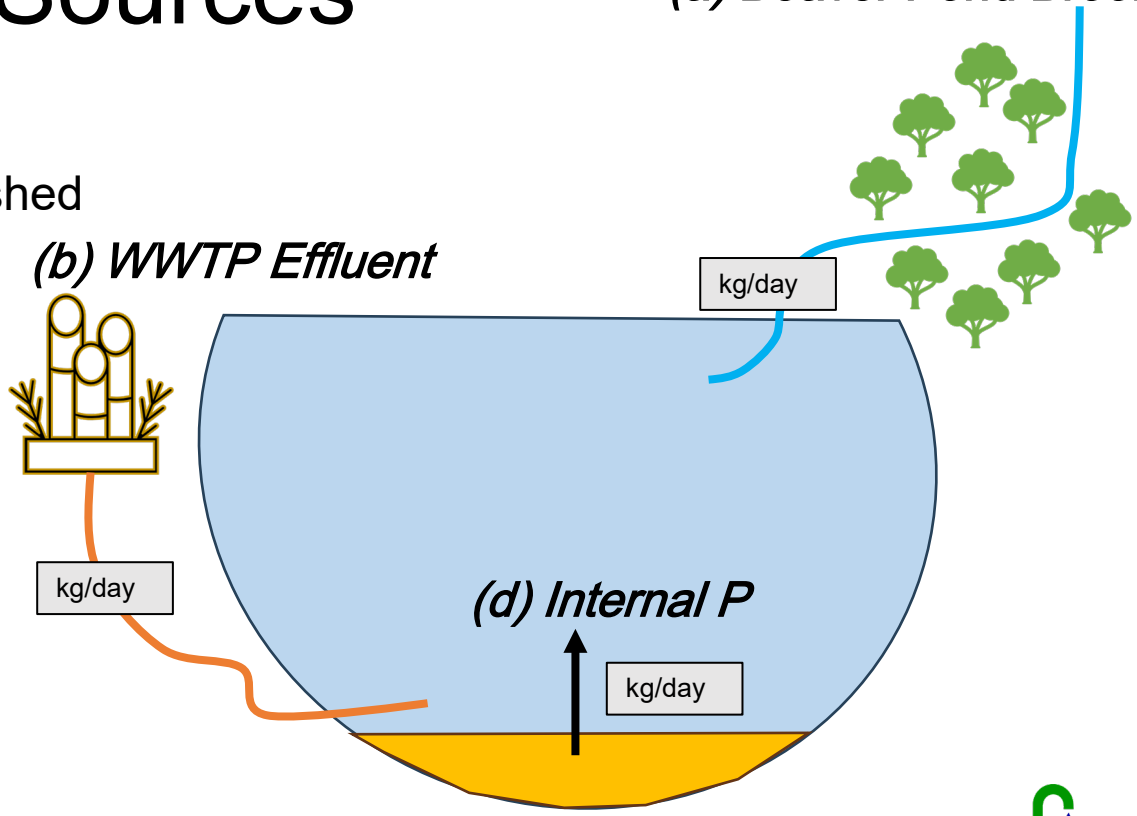
a) Inlet tributary
b) WWTP
c) Unmeasured watershed
d) Internal

(a) Beaver Pond Brook

(b) WWTP Effluent

(c) Unmeasured





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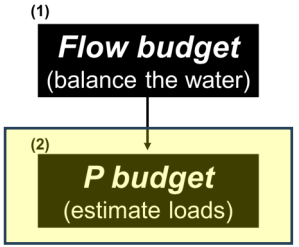
Phosphorus Loads



P load = (concentration x flow)

2023 monitoring

Flow budget

Average TP concentrations – Apr-Oct

- Inlet = 19 µg/L
- Unmeasured = 19 µg/L
- WWTP = 1901 µg/L

Daily flows – April to October

Average TDP concentrations – April-Oct

- Inlet = 11 µg/L
- Unmeasured = 11 µg/L
- WWTP = 1822 µg/L

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Sources

Sources:

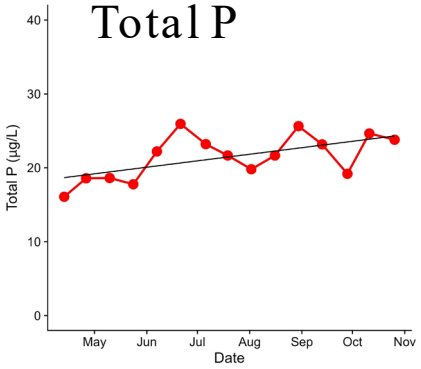
1. Inlet tributary
2. WWTP
3. Unmeasured watershed
4. ~~Internal~~

Similar pattern in 2022 (NYSDEC LCI data)

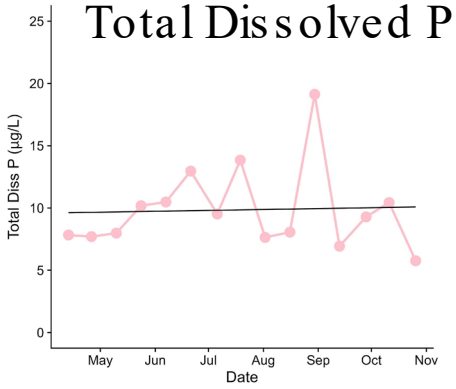
Negligible internal P release …

… simplifies the P budget and management

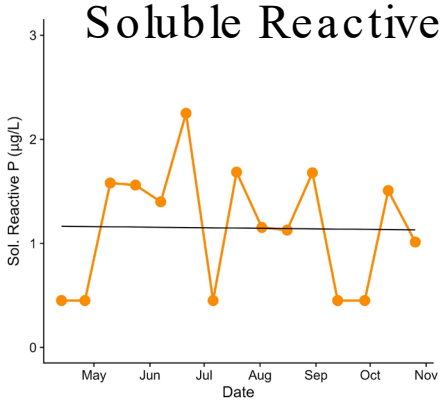
Total P



Total Dissolved P



Soluble Reactive P



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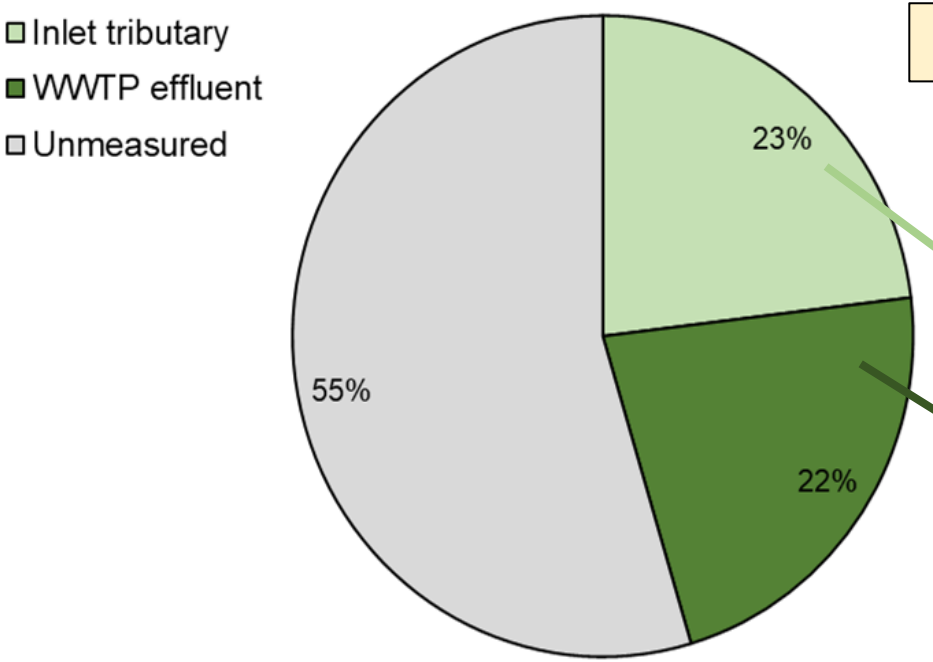
Nutrient Budget – Total P



NOTE: Budget based on flow data from 2023 (wet year).

WWTP effluent 22% of TP load in 2023

Reminder -
Load is a function of concentration *and* flow …

Inlet/unmeasured = 19 µg/L
- Low concentration, high flow

WWTP effluent = 1901 µg/L
- High concentration, low flow

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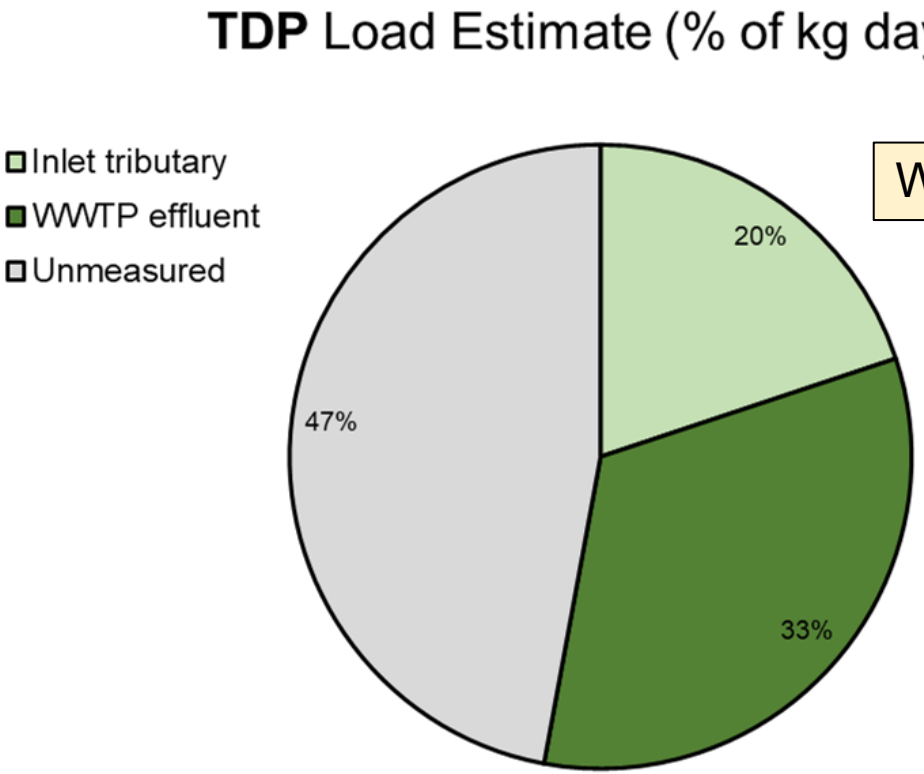
Nutrient Budget – Total Dissolved P

Dissolved P considered ultimately bioavailable to phytoplankton



WWTP effluent 33% of TDP load in 2023

Very small flow, but very high concentration

NOTE: Budget based on flow data from 2023 (wet year).

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CONCLUSIONS

Sources of P load to Lake Welch

a) Nonpoint (inlet, watershed)
b) WWTP effluent
~~c) Internal~~

- **Inlet load**
  - "Background" concentrations, hard to reduce further through management
  - Load driven by high(er) flow
- **WWTP load**
  - Very low flow
  - Load driven by high(er) P concentrations
  - Increased load of total dissolved P (TDP) – bioavailable to algae

Increased likelihood of minimizing algal growth by removing WWTP effluent to Lake Welch

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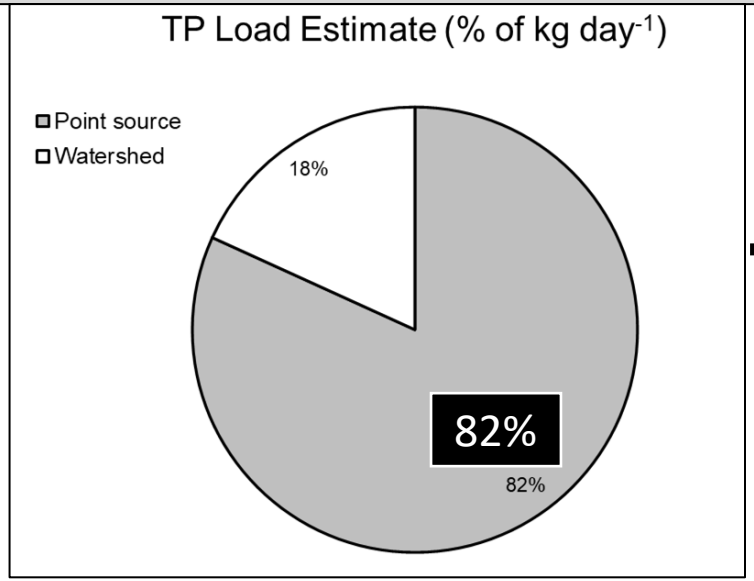
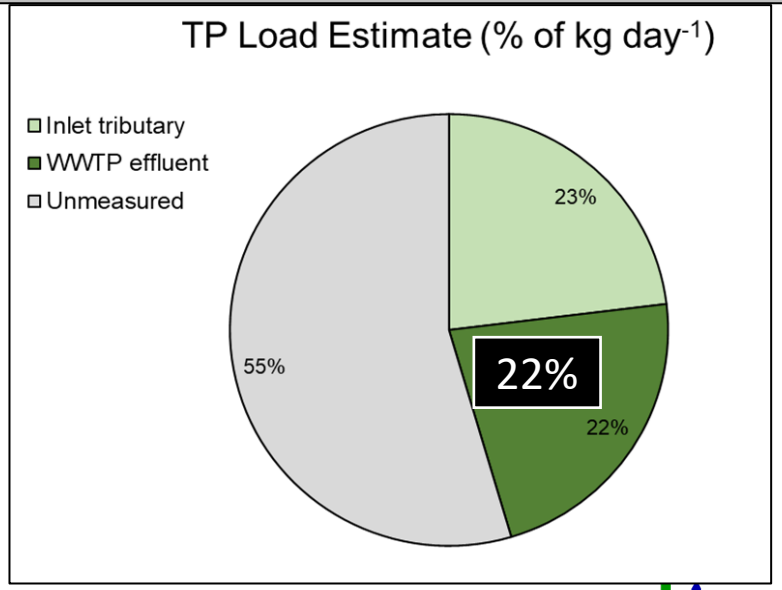
CONCLUSIONS

Value of planning and monitoring …

Before site-specific monitoring and analyses:



After site-specific monitoring and analyses:



Same recommendation, updated expectations

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Short Term HAB Mitigation Efforts

Harmful Algal Blooms

2022

2023

Short Term Mitigation Strategies

2022

Ultrasonic Devices

2023

Ultrasonic Devices
Boom
Algaecide

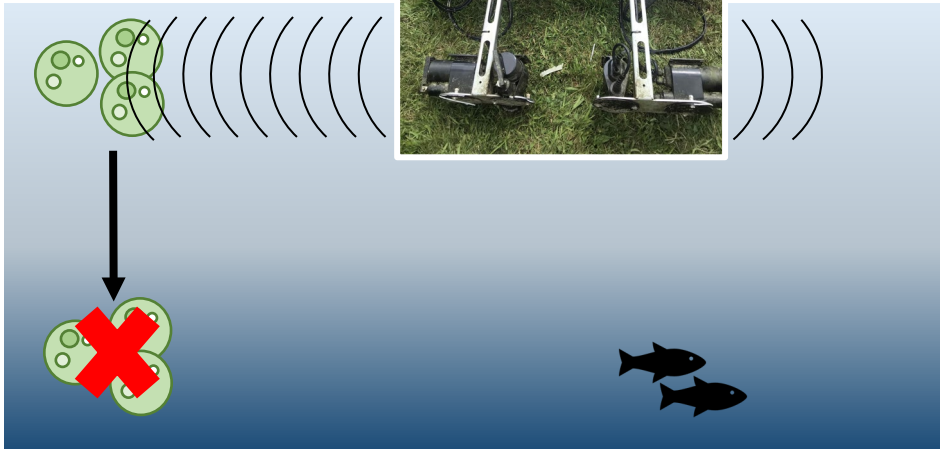
Ultrasonic Devices (UDs)

<u>How it works</u>

- Emits ultrasound near surface
- Damages algal buoyancy structures / function

<u>Pros:</u>

- Easy to use
- Low environmental impact



<u>Cons:</u>

- Multiple units recommended
- Requires persistent use
- Cost
- ***Few documented applications – unproven technology***

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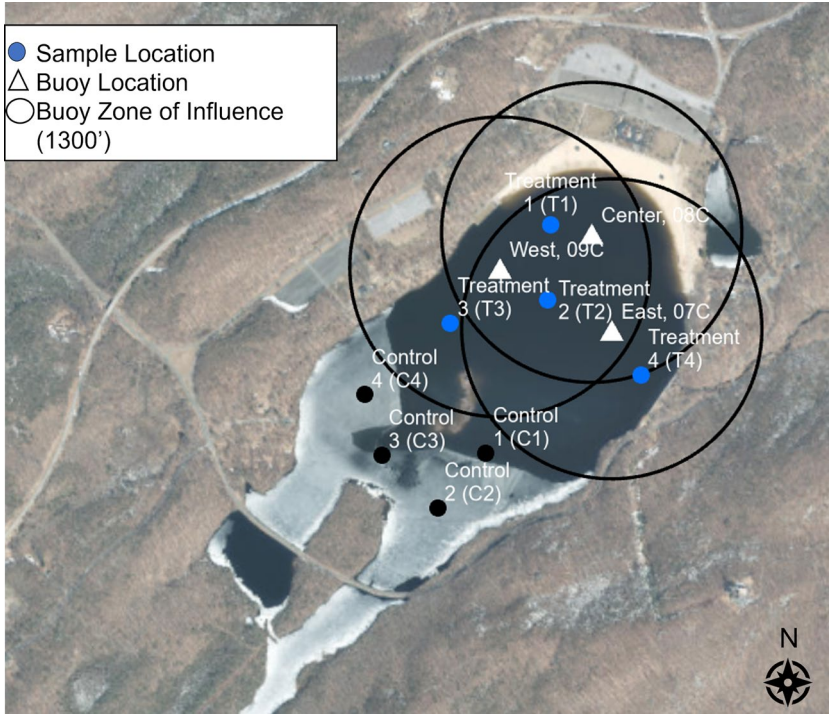
2022 Ultrasonic Device Efficacy Study



<u>3 Buoys</u>

<u>Water Quality Sampling</u>

- 8 sites
  - 4 treatment, 4 control
- Sampled 12 times

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2022 Ultrasonic Device Efficacy Study

HABs Parameters

- Microcystin (***not detected***)
- FluoroProbe total chlorophyll-a
- FluoroProbe cyanobacteria concentration

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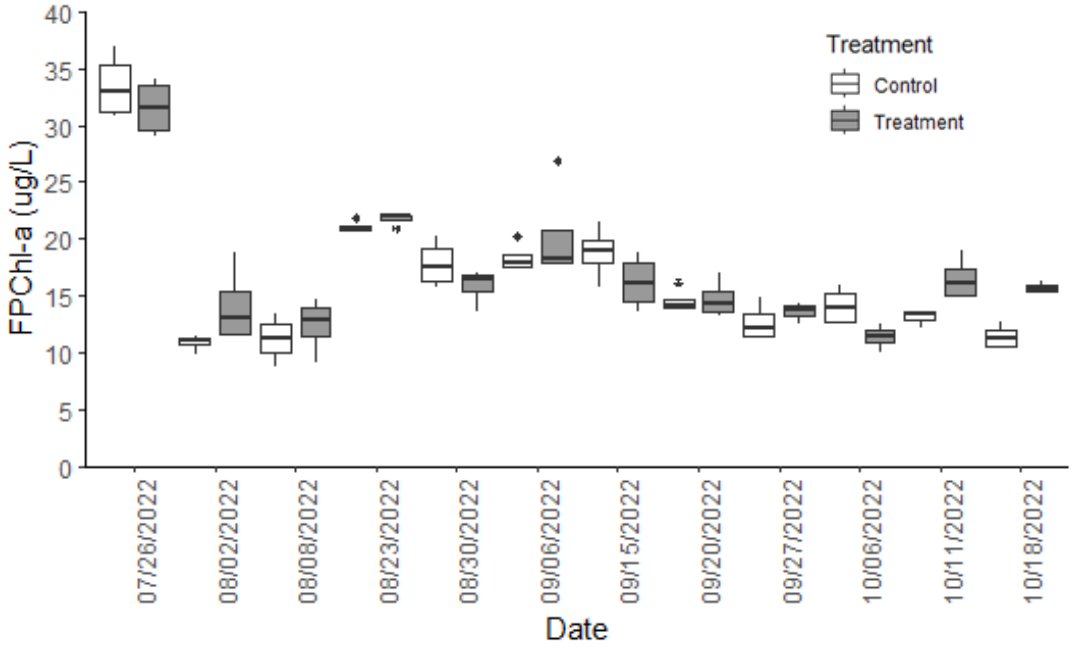
Results: Fluoroprobe Chl-a

Ultrasonic Devices did not significantly affect Chl-a concentrations

Mixed-Effects Model
df = 84, *t* = 1.25, P = 0.21



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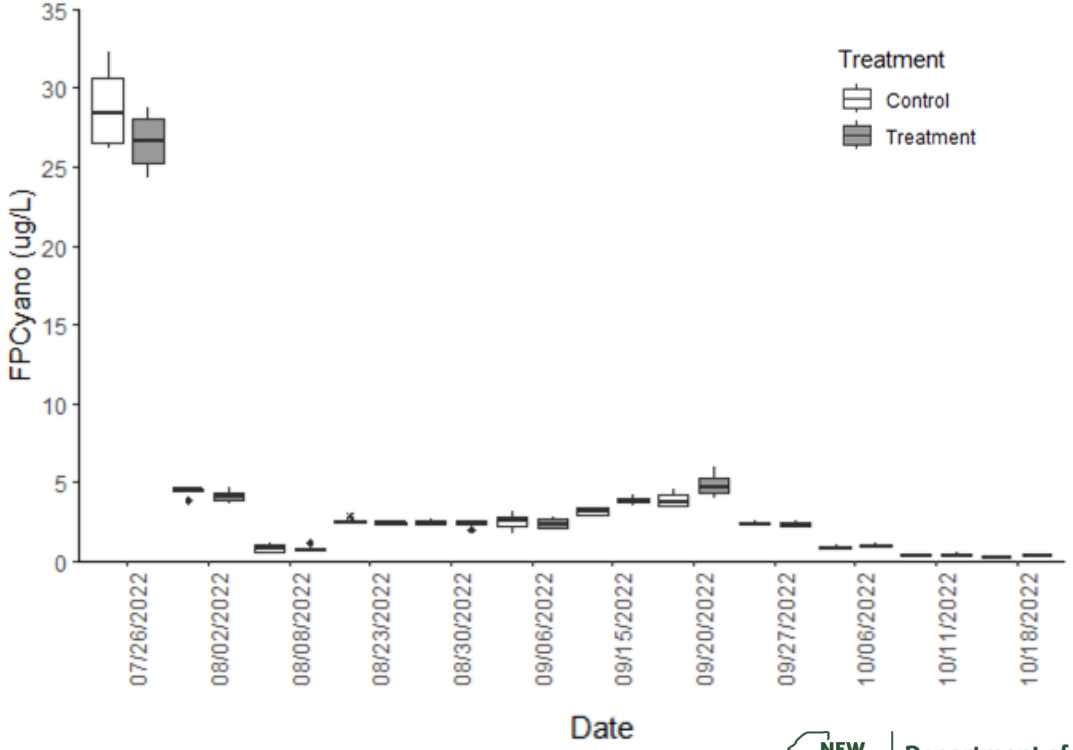
Results: Fluoroprobe Cyanobacteria Conc.

Ultrasonic Devices did not significantly affect fluoroprobe cyanobacteria concentrations

Mixed-Effects Model
df = 84, *t* = -0.42, P = 0.67



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2022 Efficacy Study Summary

This study cannot definitively state if the ultrasonic devices reduced (or enhanced) the concentration of blue green algae and their toxins

2023 Short Term Mitigation Stratgies

Ultrasonic Devices	April- Sept
Boom	May - October
Algaecide	June

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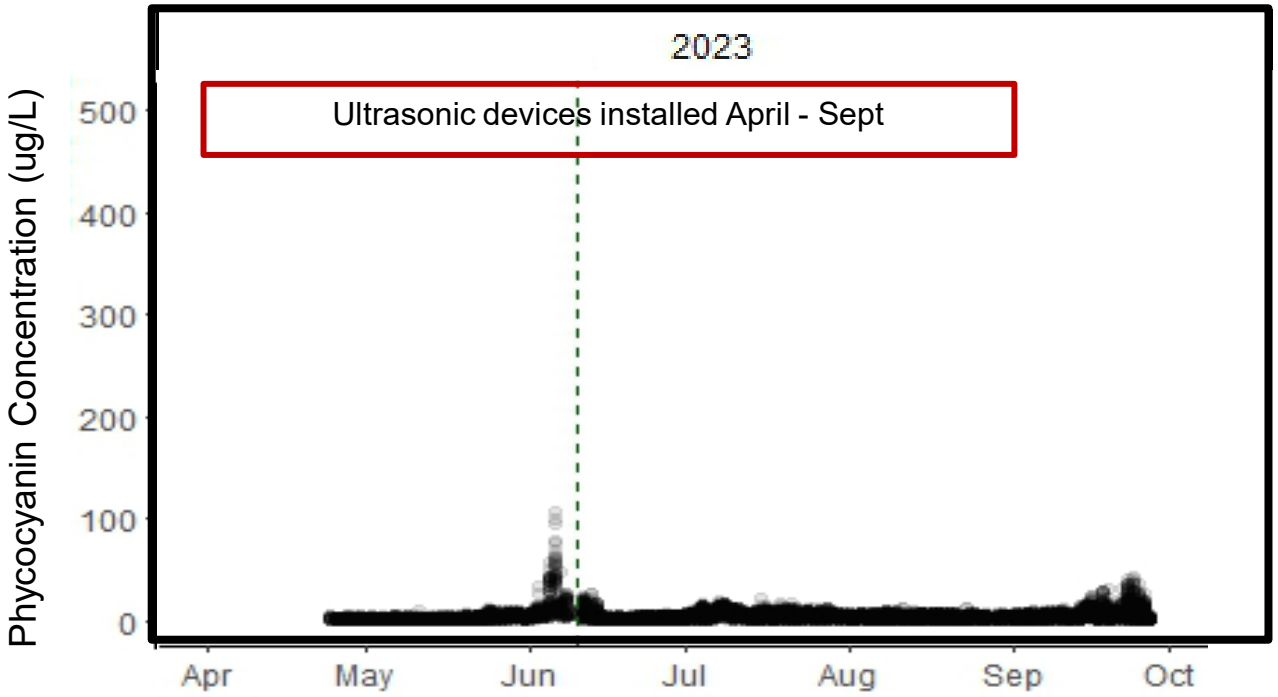
Results: 2023 Season



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Conclusions

Monitoring and Watershed Planning

- Increased likelihood of minimizing algal growth by reducing WWTP effluent to Lake Welch

Ultrasonic Devices In-Lake HAB Mitigation Effort

- This study cannot definitively state if the ultrasonic devices reduced (or enhanced) the concentration of blue green algae and their toxins

Thank You

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Taxa	Percent of Lakes with Blooms
DOLICHOSPERMUM	77
MICROCYSTIS	75
APHANIZOMENON	48
WORONICHINIA	42
PLANKTOTHRIX	39
DIATOMA	26
DINOFLAGELLATA	21
OSCILLATORIA	16
CERATIUM	15
FRAGILARIA	13
PEDIASTRUM	13
STAURASTRUM	13
LYNGBYA	11
SCENEDESMUS	11
LIMNORAPHIS	10