White Meadow Lake
2024 Year in Review

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PRINCETON HYDRO
SCIENCE ENGINEERING DESIGN

Introduction - Chris L. Mikolajczyk, CLM

- ✓ Senior Manager –Aquatics PH Colorado office
- ✓ Certified Lake Manager
- ✓ PH employee for 25+ years 30+ years experience
- ✓ A.A.S., B.S., M.S. degrees
- ✓ NALMS Past-President
- ✓ CLRMA President-Elect

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Objectives - Lake Monitoring Program

- Lake water quality data is the key to the proactive management of the lake,
- Provides data needed to objectively make lake management decisions:
  - Alum dosing (Permit as of July 1, 2024),
  - Timing of herbicide/algaecide applications,
  - Operation of aeration system

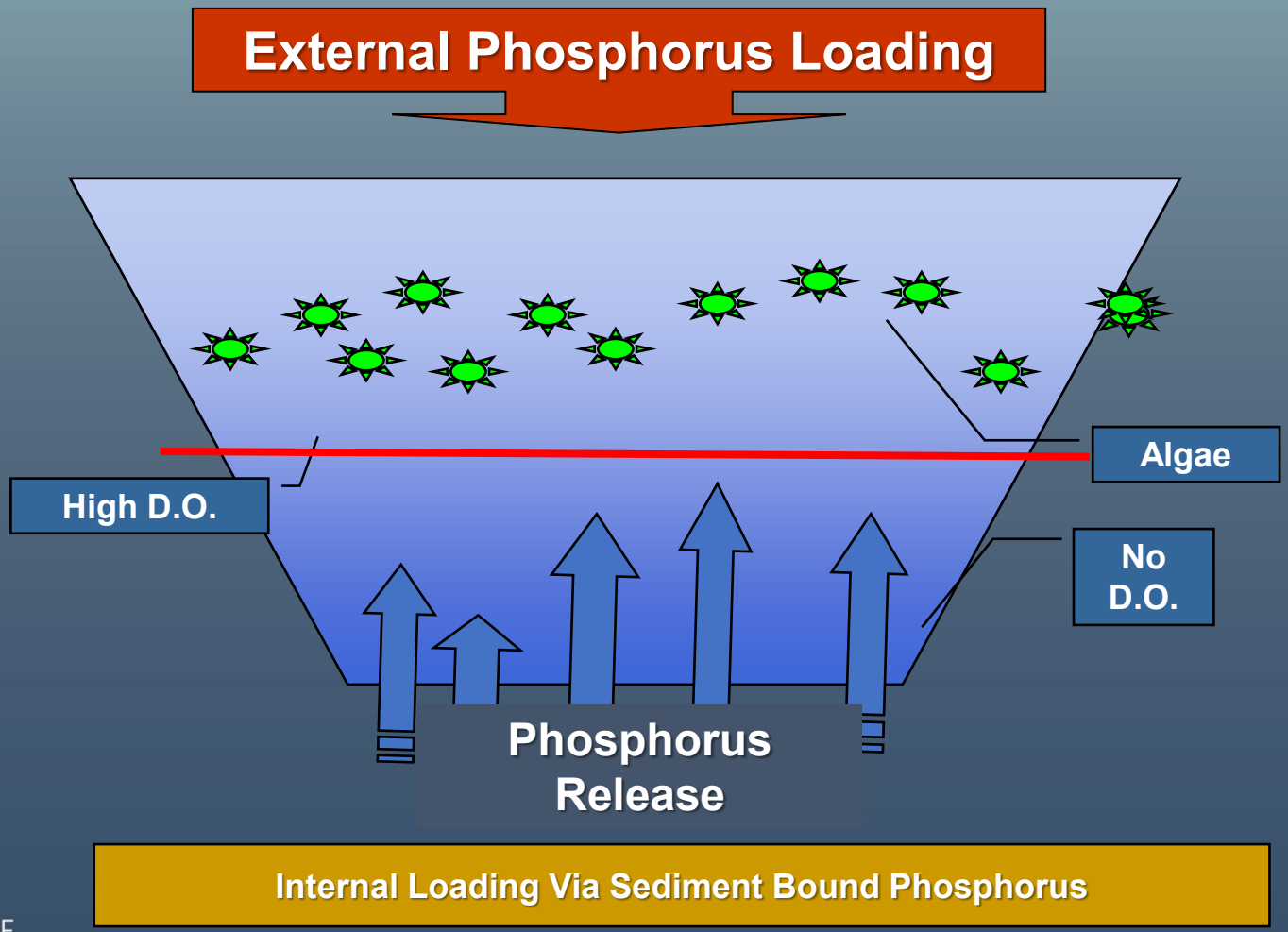
Controlling Phosphorus

- P control cornerstone of the lake's management
- Operation of low-dose alum injection system
- Operation of destratification aeration system
- Careful timing and limited use of algaecides
- **Manage inflow from Mt. Hope Lake**

Thermal Stratification and Oxygen Concentrations

- Destratification aeration system maintains lake in a well mixed state,
  - Prevents thermal stratification.
  - Prevents dissolved oxygen depletion.
- Maintaining lake in destratified, oxic state (prevents the internal regeneration of phosphorus)
- Internal P loading fully controlled.
- Also helps maximize quality of fish habitat.

Thermal Stratification and Oxygen Levels



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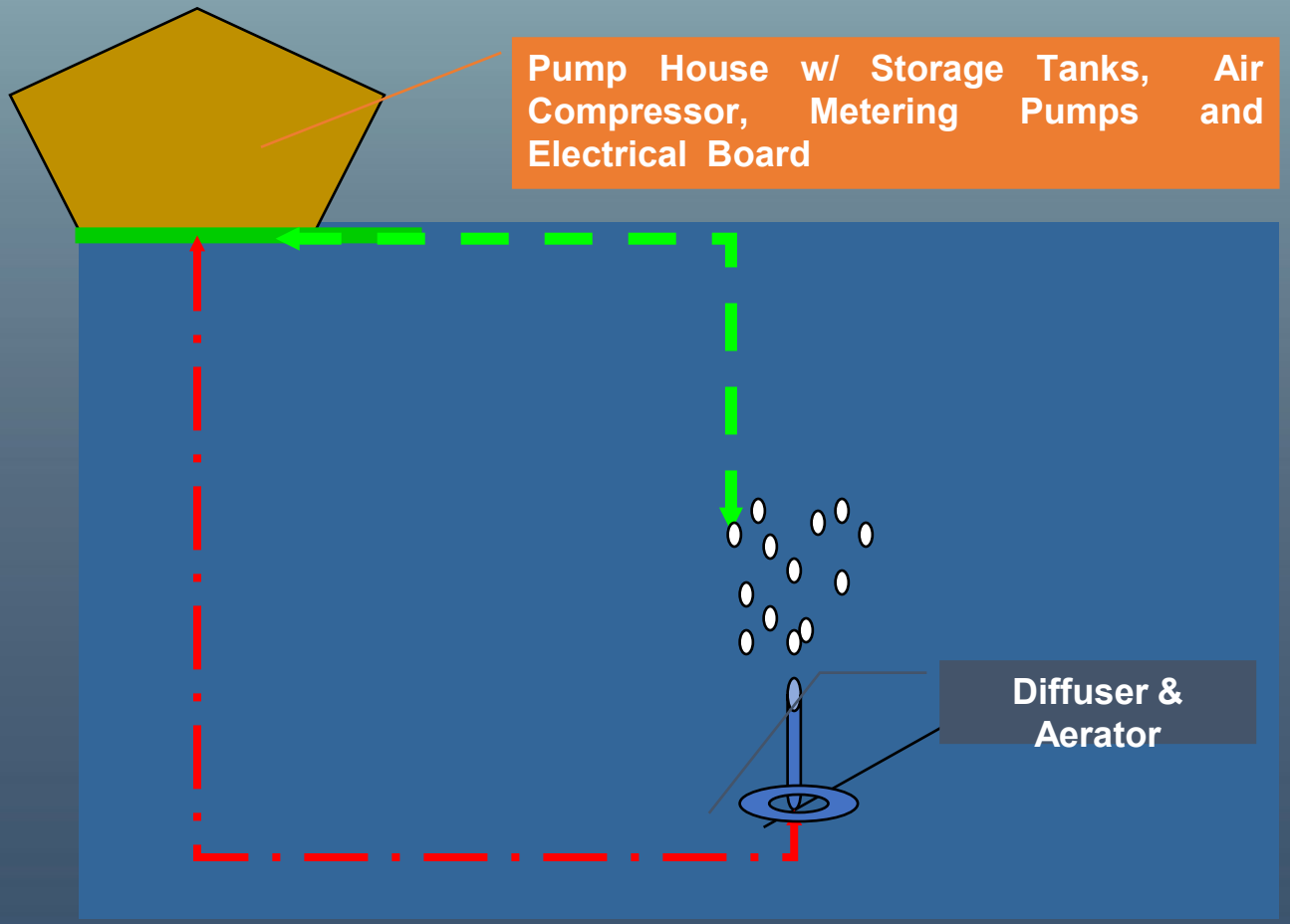
In-Lake Metered Dosing



2024 Weather

Weather Conditions for Morris County, New Jersey in 2024				
Month	**Average temperature (°F)**	**Normal temperature (F°)**	**Total precipitation (in)**	**Normal precipitation (in)**
April	50.4	50.1	4.96	3.63
May	63.0	60.1	4.71	3.95
June	72.0	69.7	1.57	4.91
July	77.0	74.7	4.20	4.70
August	62.9	62.1	11.13	3.67
September	65.0	65.5	1.38	4.68
Data obtained from station climod2.nrcc.cornell.edu, Boonton 1 SE station				

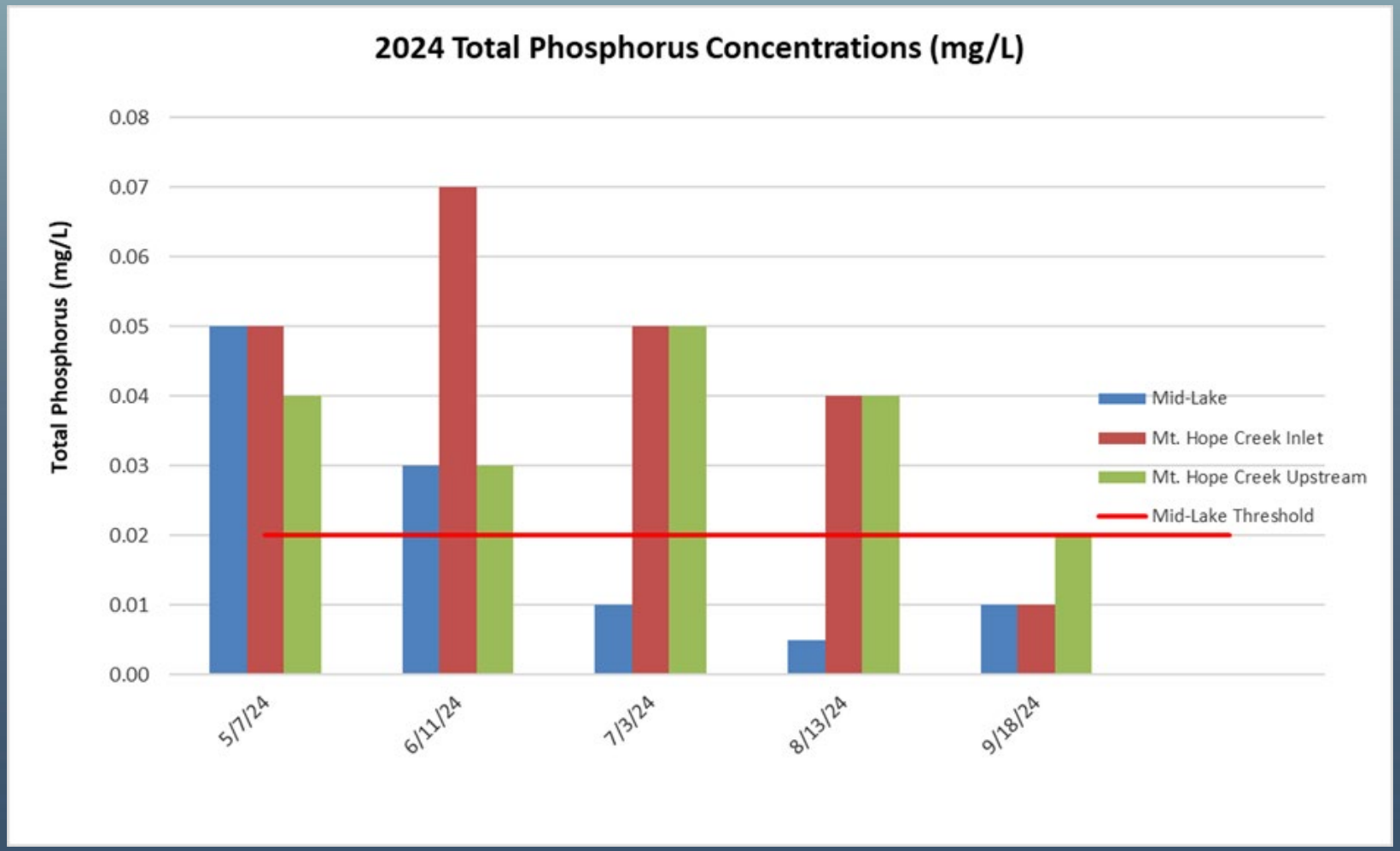
2024 Key Water Quality Parameters

White Meadow Lake 2024 Growing Season - Key Diagnostic Parameters							
Date	**TP (mg/L)**	**SRP (mg/L)**	**TDP (mg/L)**	**DOP (mg/L)**	**Nitrate-N (mg/L)**	**Chl. *a* (mg/M³)**	**Secchi (meters)**
5/7/24	0.05	0.002	0.01	0.008	0.09	2.3	2.20
6/11/24	0.03	0.003	0.01	0.007	ND <0.05	11.0	1.00
7/3/24	0.01	0.001	0.04	0.009	0.08	11.0	1.00
8/13/24	ND <0.01	0.003	0.04	0.007	ND <0.05	15.0	0.80
9/18/24	0.01	0.001	ND <0.01	ND <0.01	ND <0.05	9.4	1.00
Mean ± Std.Dev	0.03 ± 0.02	0.002 ± 0.001	0.03 ± 0.02	0.008 ± 0.001	0.09 ± 0.01	9.7 ± 4.6	1.20 ± 0.57

TP - Total Phosphorus; SRP - Soluble Reactive Phosphorus; Total Dissolved Phosphorus; Dissolved Organic Phosphorus; Chl.a - Chlorophyll-*a*

DOP = SRP + TDP

2024 Mid-Lake/Inlet/Mt. Hope Outlet TP Conc



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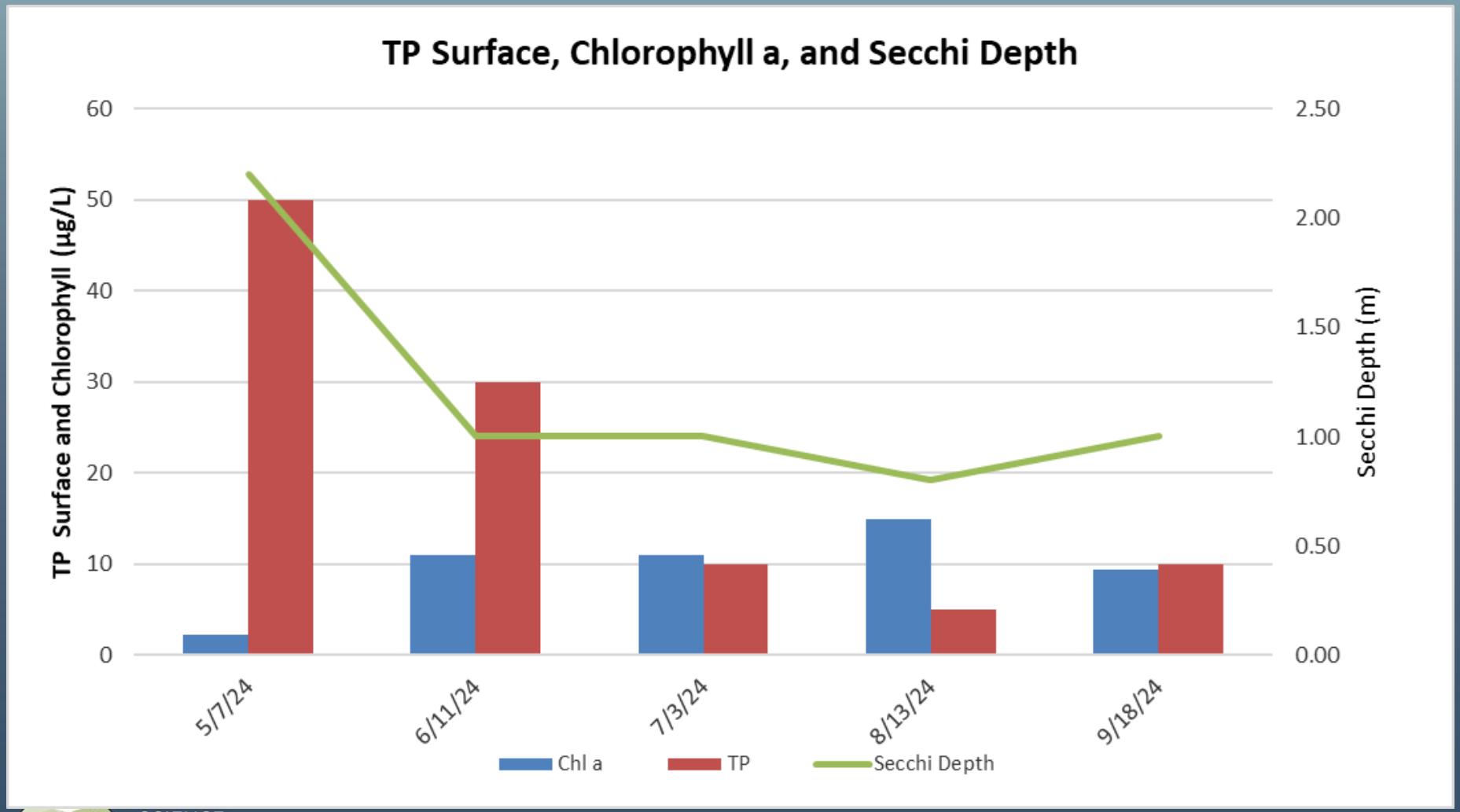
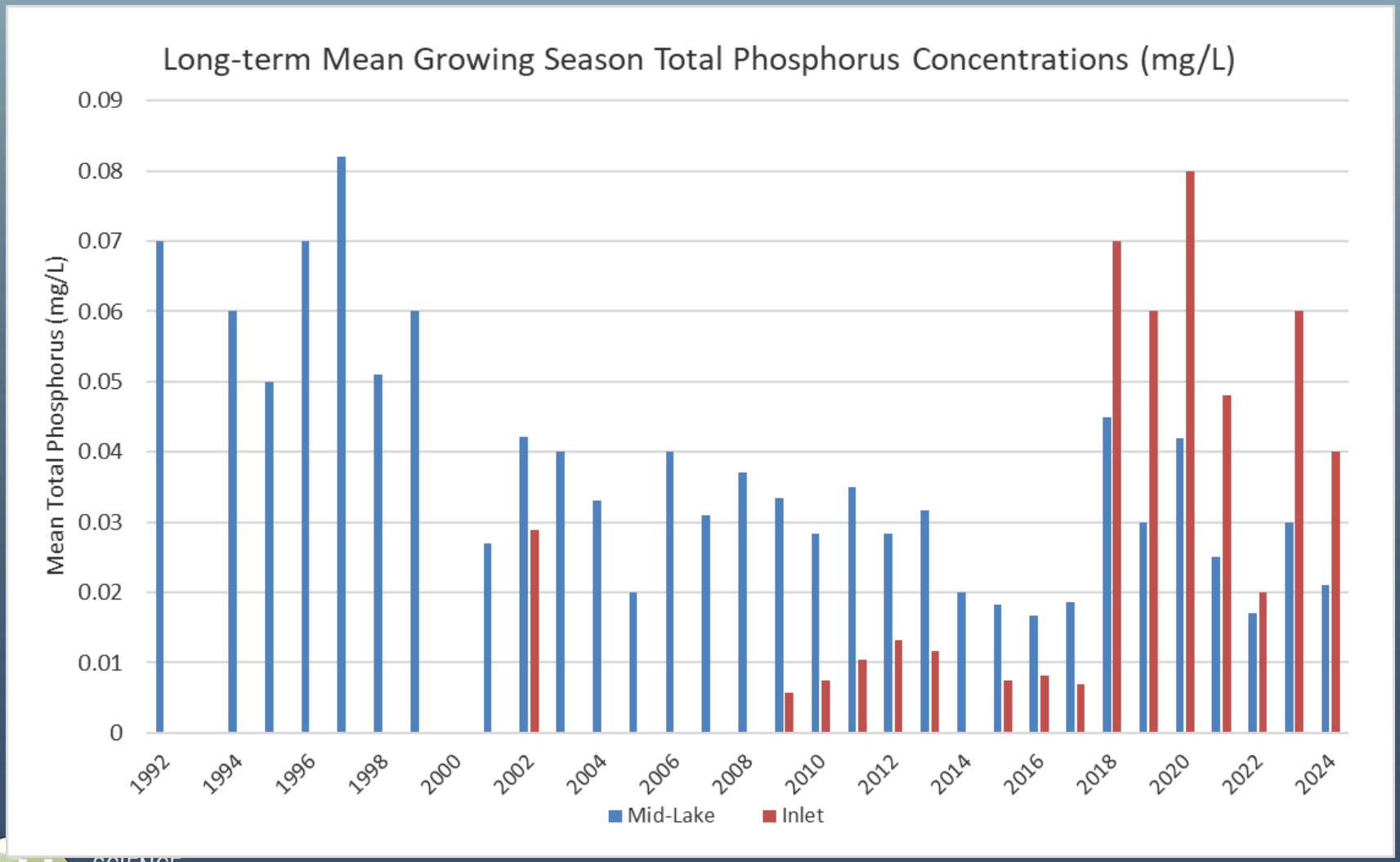
2024 Mid-Lake TP/Chl a/Secchi Conc



Long-Term Mean Mid-Lake And Inlet TP Conc



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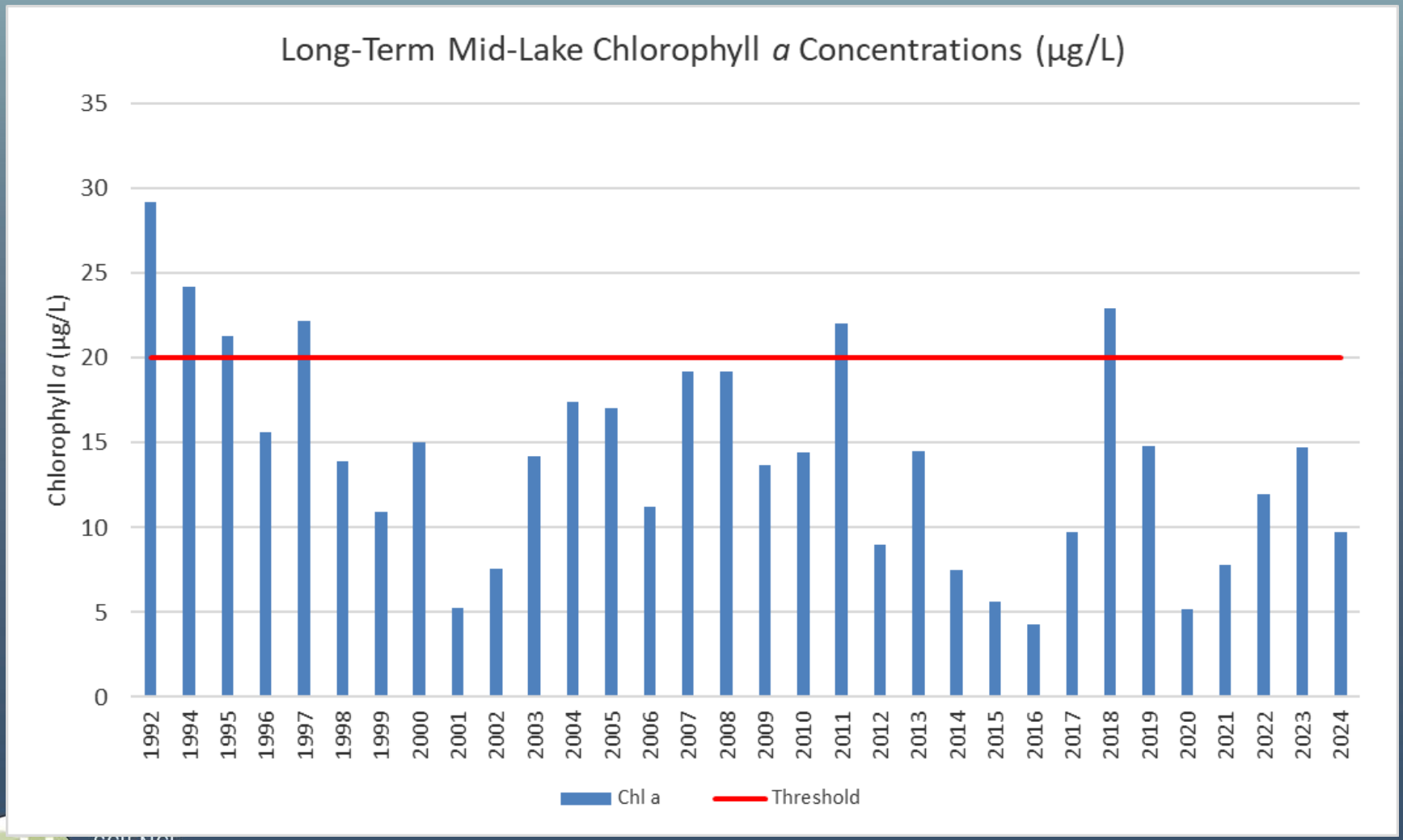
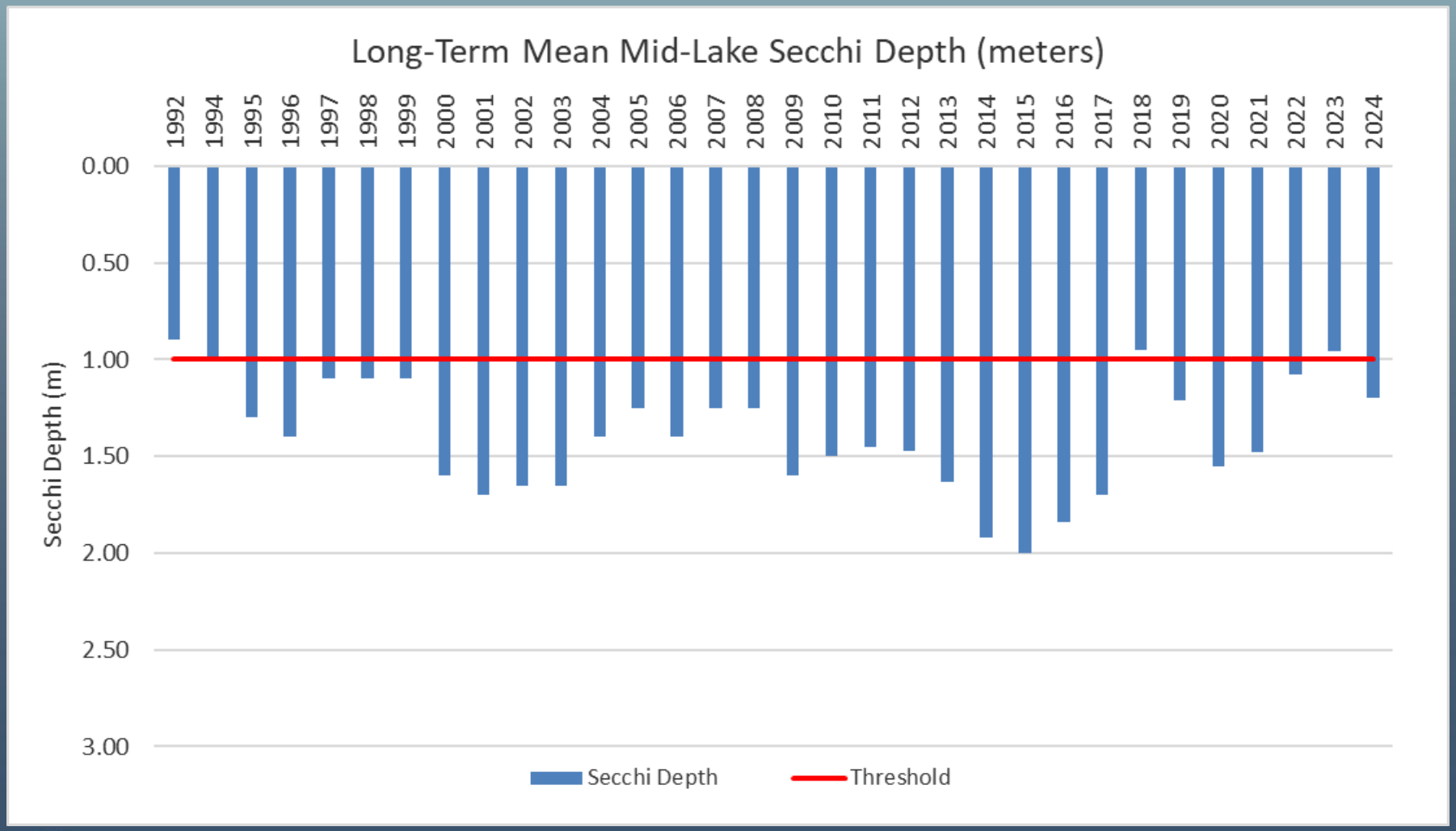
Long-Term Mean Mid-Lake Chlorophyll Conc



Long-Term Lake Clarity



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Planktonic Algae Control

- The greatest densities of planktonic algae typically occur in late-July through August,
- In 2024, May-June, little from then onwards
- Planktonic algae densities rarely reach levels requiring copper sulfate treatment,
- Preventative copper sulfate treatments only to the beach areas and swim lanes,
- Limiting copper treatments critical to preventing cyanobacteria blooms.

2025 Lake Management
Lake Monitoring

- Begin SAV and algae monitoring in early spring (Ice out).
- Start collecting WQ data in May,
  - Quantify lake's overall ecological health,
  - Forecast SAV and algae treatment needs; assess effectiveness,
  - Regulate alum and aeration system operation,
  - Identify and proactively respond to deviations in lake quality.

2025 Lake Management
Alum and Aeration

- **NJDEP PERMIT NOW REQUIRED**
- Alum injection and aeration systems ready to operate by late-April,
- Start total alum daily dosing rates, should be in the range of 50 GPD/system (distributed evenly; the north and south metering systems),
- Upgraded aeration system compressors and upgraded south end aeration system at Beach 3 system.

2025 Mt. Hope Creek Management

- Mt. Hope Creek is a significant source of TP loading to the lake,
- Control Mt. Hope Creek TP load passively using FlocLogs,
- Replace as needed,
- If TP >0.04 mg/L use in-stream diffuser to introduce 25 gpd of alum into stream,
- Additional measures? Eutrosorb!

2025 SAV Control

- Conduct initial lake inspection in mid-March (ice-out).
- Follow adaptive SAV treatment program as started in 2014; updated 2020; revisit as needed
- Early season SAV control using appropriate herbicides (contact),
- Balance of summer conduct larger scale systemic herbicides treatments (Naiad),
- Brittle Naiad challenges.

2025 Algae Control

- Allow spring and early summer diatom, green algae and chrysophyte blooms to take normal course. These are the "good algae",
- During summer do not conduct any open water copper treatments…no need and will only worsen water quality,
- Mid-July thru August practice use copper, or preferably peroxide, judiciously...only when needed, applied as "patch/spot" treatment and use minimum dosages,
- Planktonic algal treatments in 2024.
  May 20 (lakewide), June 17 (Beach 3)

2024 Harmful Algal Blooms

- One set of extra plankton collected in mid-July
- Collected by WMLPOA Lake Committee (Cost savings)
- Beach 1, Beach 2, Beach 3
- Cyanobacteria counts were minimal
- **No HABs in 2024**

So, what is a Harmful Algal Bloom (HAB)?

-A growing global problem, harmful algal blooms (HABs) are not caused by true algae but rather by cyanobacteria that in many ways resemble and behave like algae. These cyanobacteria naturally occur in fresh water and can proliferate to unhealthful levels in sunlight and hot weather, forming dense mats. - NJDEP

What is a HAB?

-A harmful algal bloom (HAB) can be dangerous to people, animals or the ecology. Some, but not all, HABs produce chemicals that can be toxic to humans and animals if ingested, inhaled, or if contacted by skin or mucous membranes. These ***toxins*** *can also accumulate in fish and shellfish which can cause illness when either are consumed. HABs can occur in both the freshwater and marine water environments.* - NJDEP

What are cyanotoxins?

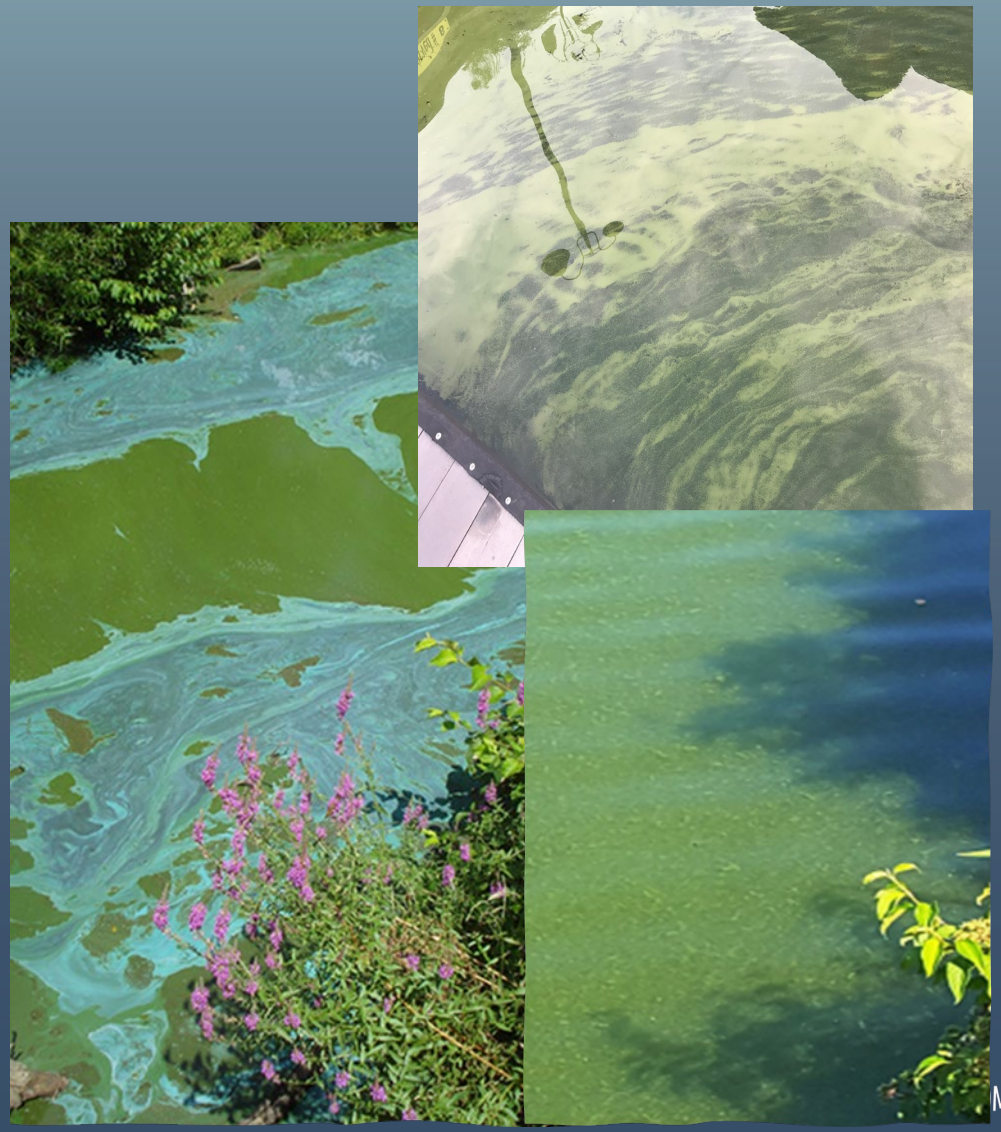
- ✓ Cyanotoxins are diverse group of mostly low-molecular weight molecules produced by cyanobacteria that can have a negative impact on the health of a variety of organisms including pet, livestock and humans.
- ✓ Various "strains" within a species of cyanobacteria have the potential to produce cyanotoxins and they are produced when the population is under some type of "stress"
- ✓ There are three main types of cyanotoxins: heptatoxins, neurotoxins and dermatoxins

Cyanotoxins are NOT Taste and Odor Compounds

- ✓ Cyanotoxins are colorless, tasteless and odorless compounds
- ✓ Taste and odor (T&O) compounds such as Geosmin and MIB can be produced by cyanobacteria (blue-green algae) and some actinobacteria
- ✓ Cyanobacteria can produce T&O compounds and not produce cyanotoxins
- ✓ They can also produce cyanotoxins and no T&O compounds

Common Conditions that can result in Cyanobacteria Algal Blooms

- ✓ High seasonal temperatures
- ✓ Still water conditions / thermal stratification
- ✓ Total Phosphorus (TP) concentrations as low as 0.03 mg/L can generate nuisance blooms / scums
- ✓ TP greater than 0.06 mg/L can almost certainly trigger a bloom



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Contributing Impacts of Climate Change on Mid-Atlantic Region of the United States

- ✓ **Warmer and wetter** throughout the 21st century
- ✓ Temperature could increase between 3 and 7°F
- ✓ More extreme heat days over summer season
- ✓ An increase in the frequency of Extreme Weather Events
- ✓ **Growing season could increase by 15 to 30 days**
- ✓ **Number of frost days could decrease by 20 to 40 days**

So, What Can Be Done About HABs? The Three-Tiered Approach

- ✓ Global issues associated with climate change
- ✓ In-lake Management Plans (aeration, nanobubblers, mixing, nutrient inactivation, dredging, FWIs, BioChar, etc)
- ✓ Watershed Management Plans (data review, mapping, modeling, monitoring, nutrient load reductions, storm water, BMPs, MTDs, green infrastructure, TMDLs, etc)

QUESTIONS?

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Princeton Hydro, LLC

THANK YOU!

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