Managing the Water Quality of Lake Hopatcong; Some Information on its Past, Present and Future

Presentation to the Lake Hopatcong Foundation

Fred S. Lubnow, Ph.D., Director of Aquatic Programs
Princeton Hydro, LLC
120 East Uwchlan Avenue
Suite 204
Exton, PA 19341 (offices in NJ and CT)
flubnow@princetonhydro.com

Lake Hopatcong, Sussex and Morris Counties, New Jersey

- Largest lake in NJ (2,686 acres).
- Five municipalities in watershed (13,548 acres).
- More than 500,000 people visit the lake or live within the watershed.

Water Quality / Ecological Impacts of Concern (Symptoms)

- Algal Blooms (size and frequency of bloom and well as types of algae)
- Aquatic Plants (abundance; natives and invasive species)
- Fecal coliform / *E. coli* (issues associated with beaches)
- High turbidity / suspended solids
- Existing fishery community (other invasive species)

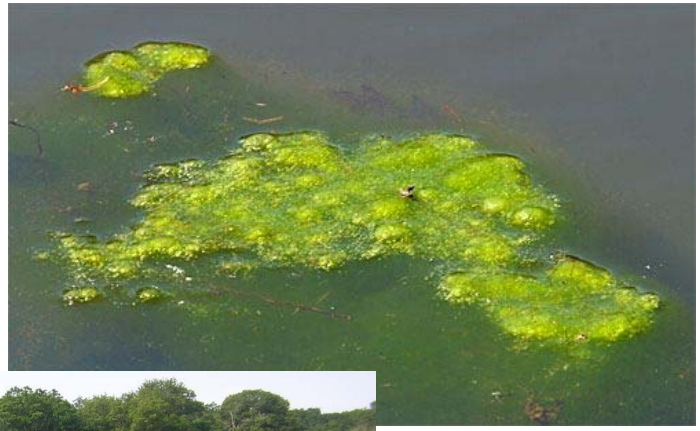
Symptoms of Water Quality / Ecological Impacts on Lakes

Water Quality / Ecological Impacts of Concern (Causes)

- Nutrients (particularly nitrogen and phosphorus) from the watershed and internally
- On-site wastewater effluent; waterfowl and other organisms
- Shoreline and streambank erosion; improper land management (settling of suspended solids)
- Lack of understanding of potential invasive species

Causes of Water Quality / Ecological Impacts on Lakes

More nutrients, in particular phosphorus, results in more…..



Why focus heavily on phosphorus?

- Tends to be the primary limiting nutrient.
- Strong relationship between phosphorus and algal growth.
- A substantial proportion of the phosphorus is adsorbed onto sediment particles.
- Blue-green algae thrive / bloom in high phosphorus conditions.

How do we know what we know?

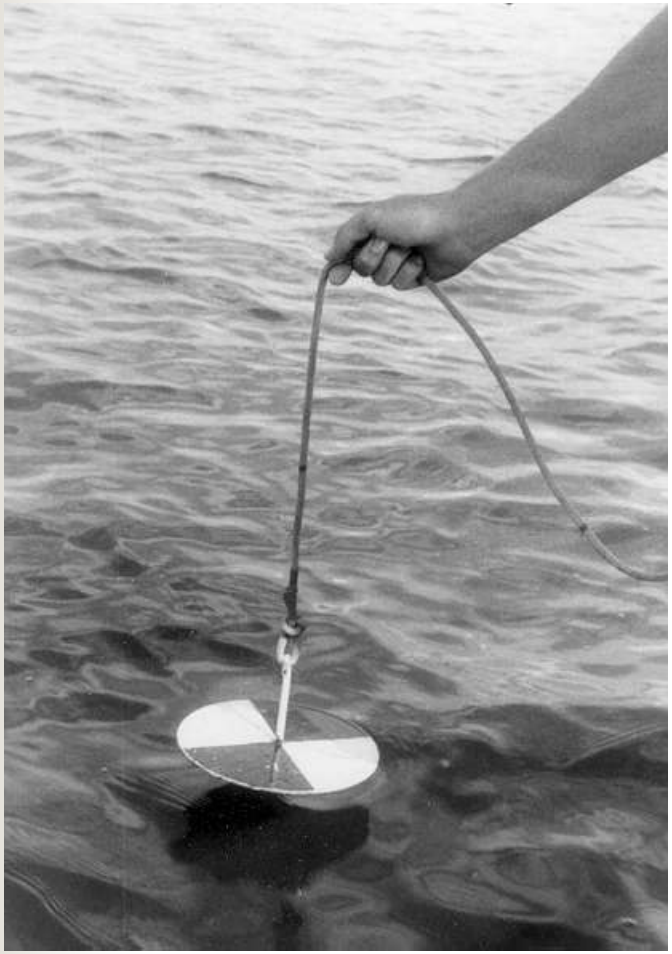
- In-Lake monitoring
- Plankton surveys
- Plant surveys
- Stormwater monitoring
- Monitoring of projects

Lake Hopatcong Monitoring

- Focuses on the growing season; five events from May through September each year.
- A total of 11 long-term sampling stations (since the early 1980's – original Phase I Study)
- Five near-shore, in-lake stations are also monitored to evaluate water quality relative to implemented projects
- Collect a variety of physical, chemical and biological data

Lake Hopatcong *In-Situ* Monitoring

- Princeton Hydro uses a calibrated multi-probe meter to measure dissolved oxygen, temperature, pH and conductivity at each sampling stations from the surface to the bottom at 0.5 to 1 meter (1.5 – 3.3 ft) intervals
- Princeton Hydro is State-certified for *in-situ* monitoring and the collection of water quality samples (Certification # 10006)
- Water clarity was measured with a Secchi disk




HYDROLAB
DATASONDE 4a
HYDROLAB
MINISONDE 4a

Lake Hopatcong
Discrete, chemical Monitoring

- Collect sub-surface samples at most stations and deep samples at the mid-lake station for a number of parameters
- Total phosphorus, nitrate-N, ammonia-N, and total suspended solids

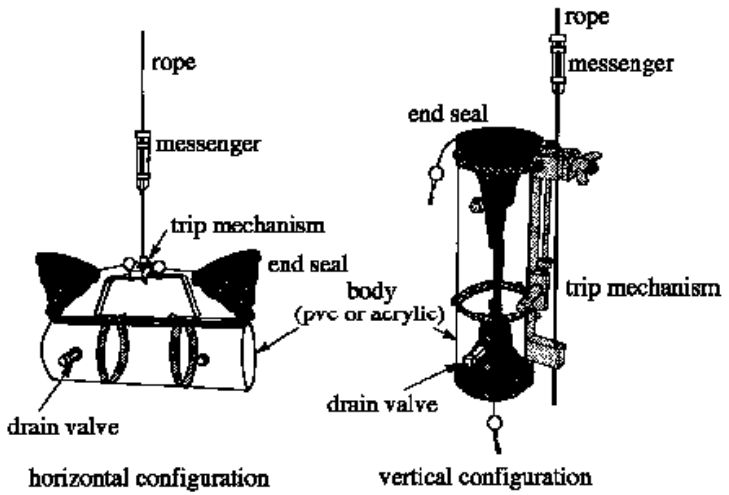


Figure 1. Van Dorn sampler

Lake Hopatcong Biological Monitoring

- Phytoplankton and zooplankton samples
- Samples collected and analyzed for chlorophyll *a*
- Aquatic plant surveys

What Did the Database Lead to?

- In 2003-04 NJDEP develop a Total Maximum Daily Load (TMDL) for total phosphorus (TP) in Lake Hopatcong
- In turn, Princeton Hydro developed a Restoration Plan for the Lake to reduce its existing phosphorus load to a targeted (desirable) amount that minimizes water quality problems.

Municipal-based Phosphorus Loads for Lake Hopatcong

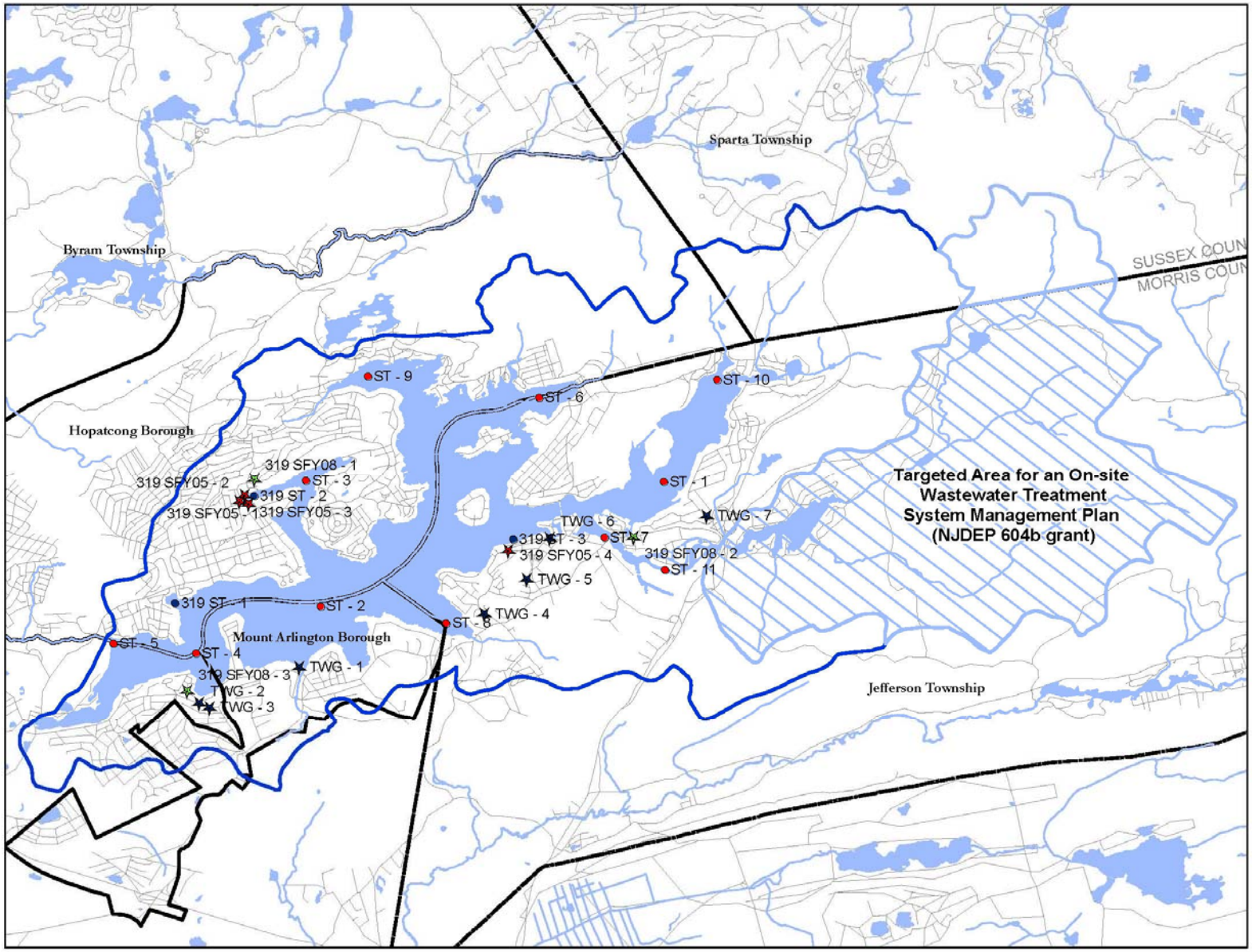
Municipality	kg per yr	Percent Contribution	Required Reductions (kg / yr)
Jefferson Township	4,201	57.6	1,899
Borough of Mt. Arlington	322	4.4	145
Roxbury Township	235	3.2	106
Borough of Hopatcong	2,538	35	1,147
Total	**7,296**	**100**	**3,297**

Establishing both the TMDL and its Associated Restoration Plan led to..

- Installation of large structural Best Management Practices (BMPs) through two NJDEP 319 grants (SFY2005 and SFY2010) and an US EPA Targeted Watershed Grant.
- Implementation of smaller-scale catch retrofits and shoreline / streambank stabilization efforts.
- Aggressive phosphorus-free fertilizer campaign.
- Mechanical weed harvesting and associated phosphorus / plant study.
- These efforts can more have been managed and overseen by the Lake Hopatcong Commission, the State steward of the lake and watershed

What is being done to reach the targeted TMDL-established TP load?

- Development of an on-site wastewater treatment Management Plan for the Lake Shawnee community in Jefferson Township (NJDEP 604(b) grant).
- Jefferson Township developing and passing septic ordinances.
- Detailed aquatic plant survey and development of a plan management plan; managed and overseen by the Lake Hopatcong Alliance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MORRIS COUN
Hopatcong Borough
Mount Arlington Borough
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319 SFY05 - 4
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TWG - 5
319 ST - 1
TWG - 4
319 SFY08 - 3
TWG - 1
TWG - 2
TWG - 3
Targeted Area for an On-site
Wastewater Treatment
System Management Plan
(NJDEP 604b grant)

Long-Term Water Quality Goals

Phosphorus

- State Surface Water Quality Standards (SWQS, N.J. A.C. 7:9B – 1.14(c)5)…
- For most lakes TP concentrations shall not exceed **0.05 mg/L**. Includes the surface, standard waters of lakes and the point at which a tributary enters a lake
- For flowing waters, TP concentrations shall not exceed 0.10 mg/L

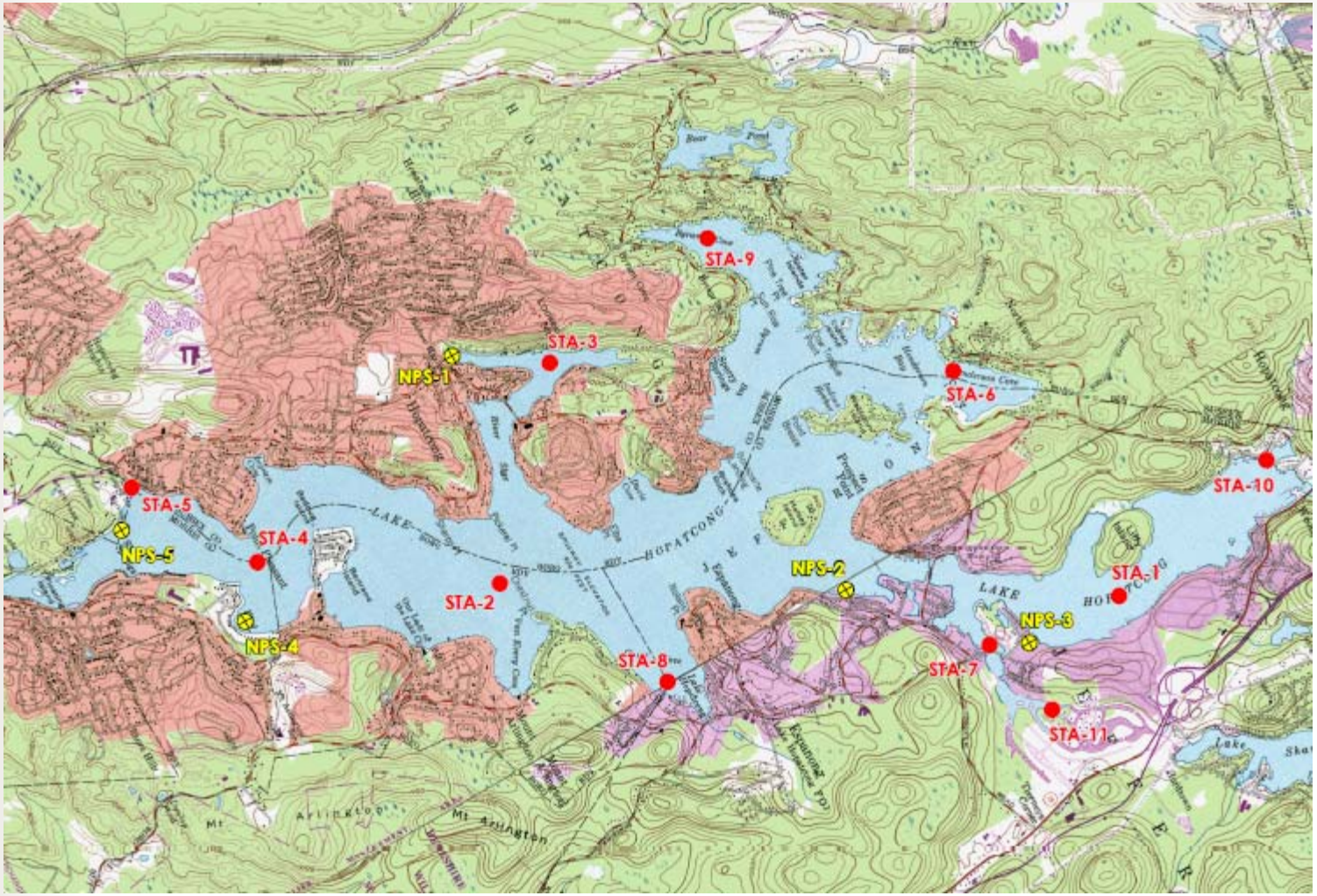
Long-Term Water Quality Goals

Phosphorus

- Based on US EPA TP concentrations at **0.03 mg/L** are moderately to highly productive (mesotrophic to eutrophic)
- Based on Princeton Hydro's project experience, nuisance planktonic / mat algae conditions (from a layperson's perspective) tend to occur when TP concentrations exceed **0.06 mg/L**

Long-Term Water Quality Goals
Phosphorus – Lake Hopatcong

- The targeted mean TP concentration, under the TMDL, for the lake is 0.03 mg/L due to the lake's sensitivity to phosphorus
- Most stations are in compliance with the TMDL goal, with the exceptions being Stations #3, #7 and #11
- Elevated nitrates at Stations #7 and #11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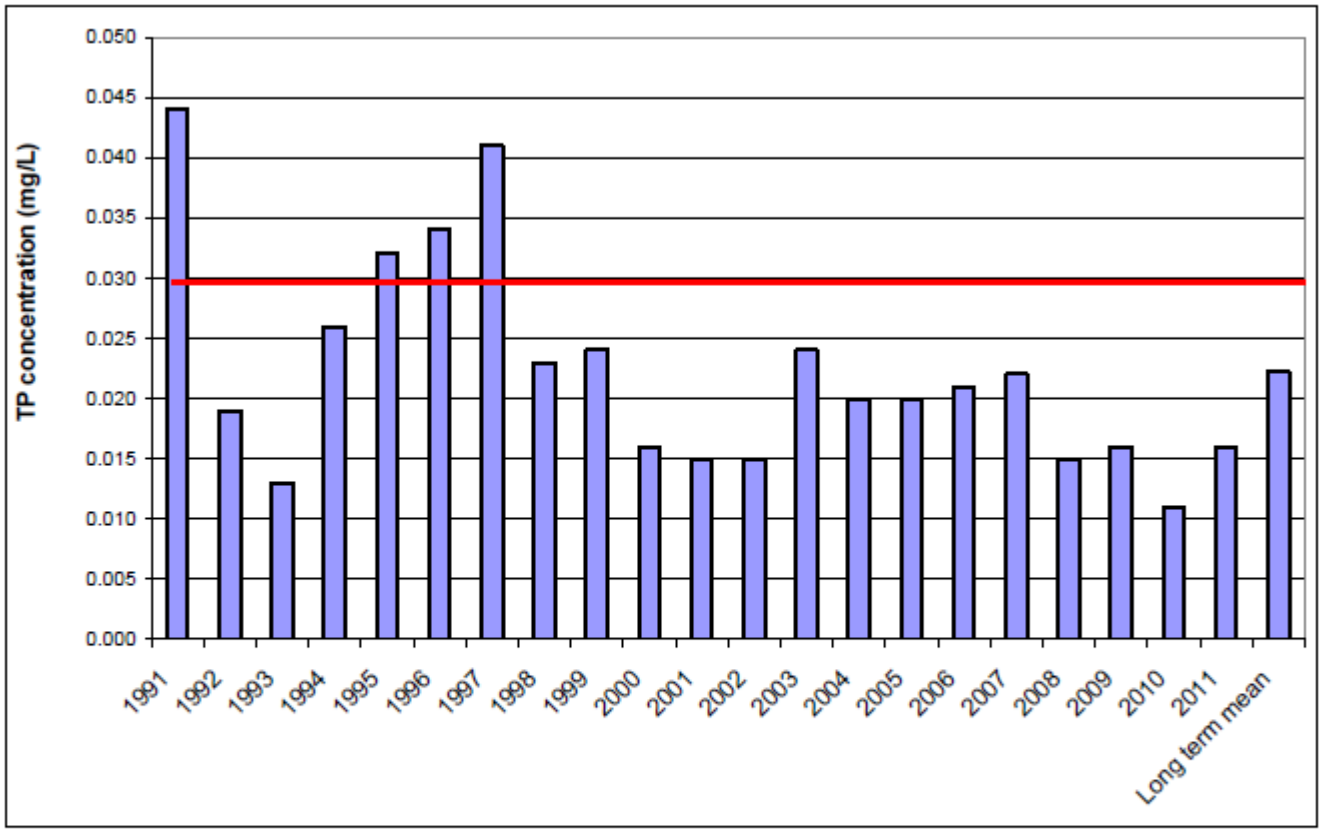


Figure 4 - Lake Hopatcong Long-Term Total Phosphorus Concentrations (mg/L)

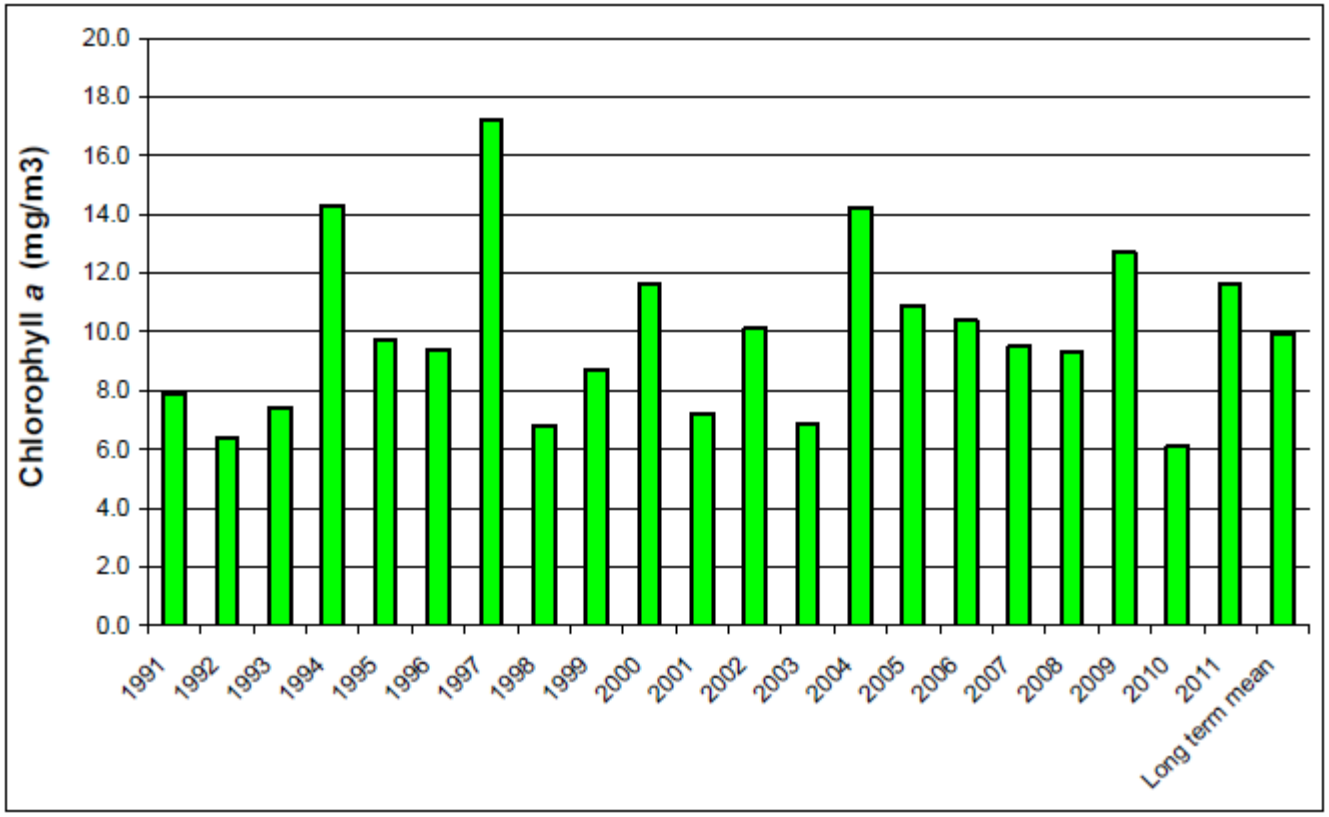


Figure 3 - Lake Hopatcong Long-Term Chlorophyll a Concentrations (mg/m3)

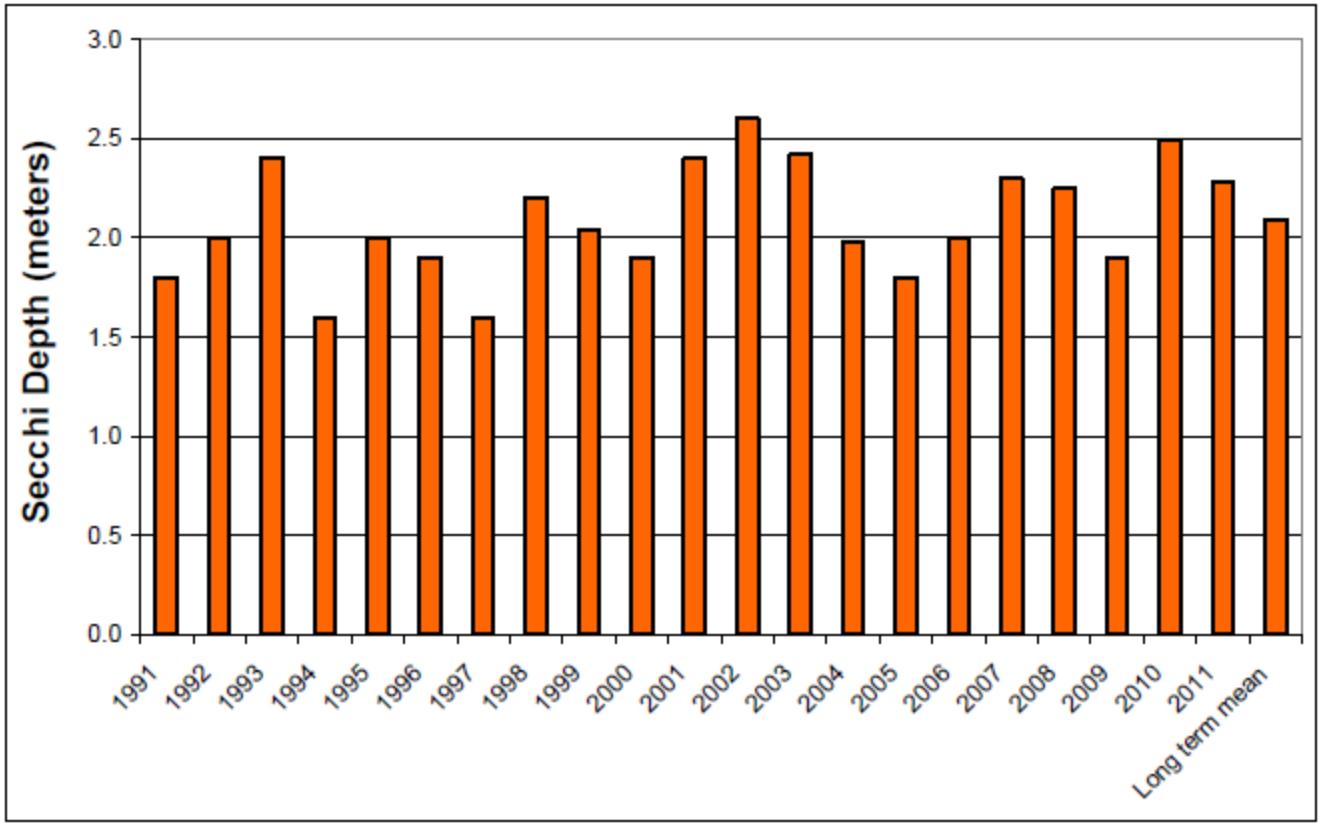


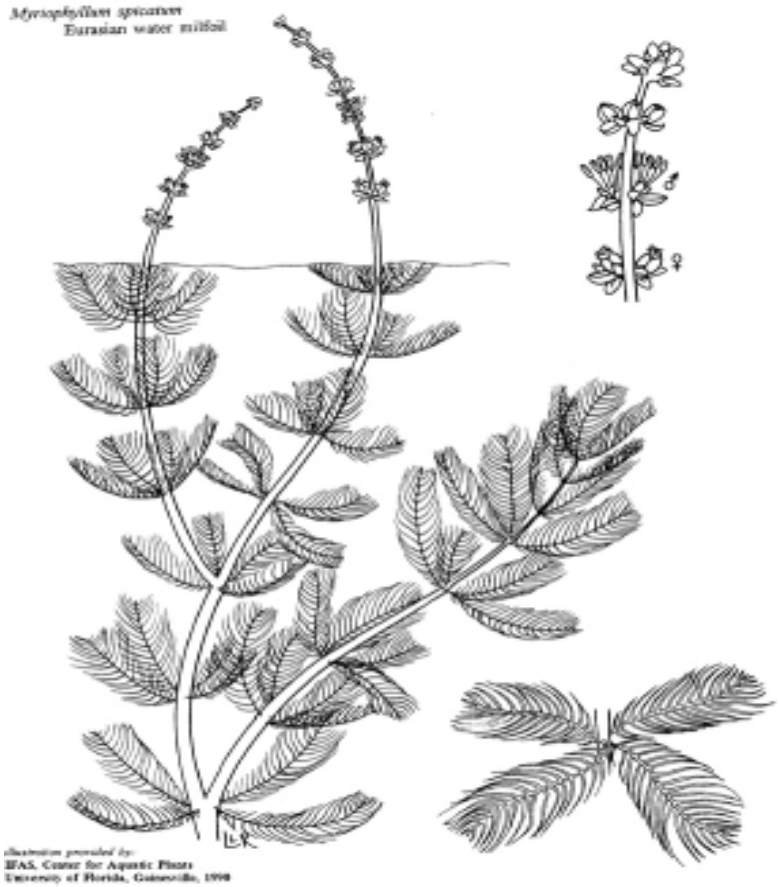
Figure 2 - Lake Hopatcong Long-Term Secchi Depth (meters)

Aquatic Macrophytes (Plants)

- Detailed aquatic plant surveys were conducted in Lake Hopatcong in the early 1980's and 2010, approximately 30 years apart
- The plant community was dominated by two species during both surveys (Eurasian watermilfoil and tapegrass)

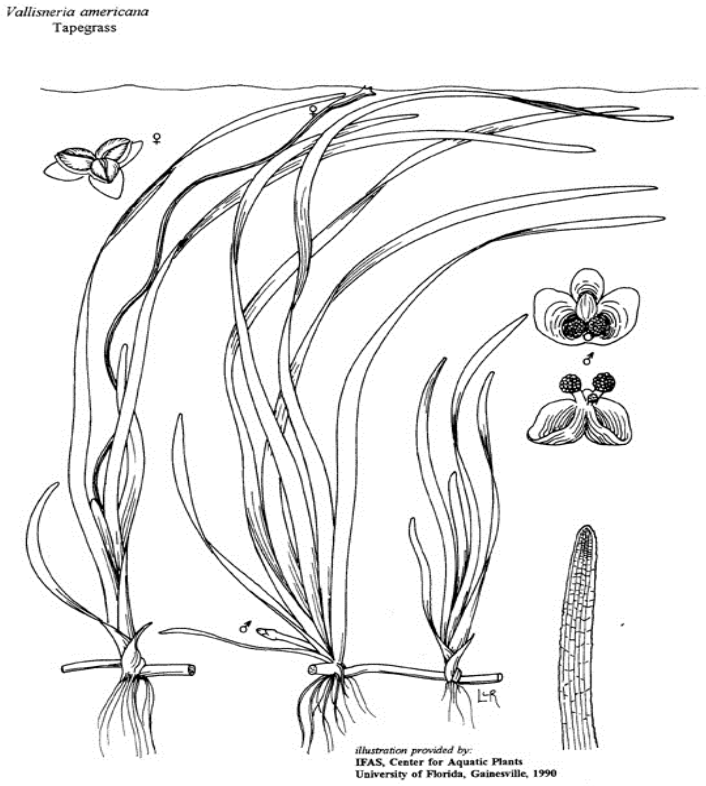
Eurasian watermilfoil (*Myriophyllum spicatum*)

- An invasive species
- Aggressive
- Can grow in deeper waters right to the surface



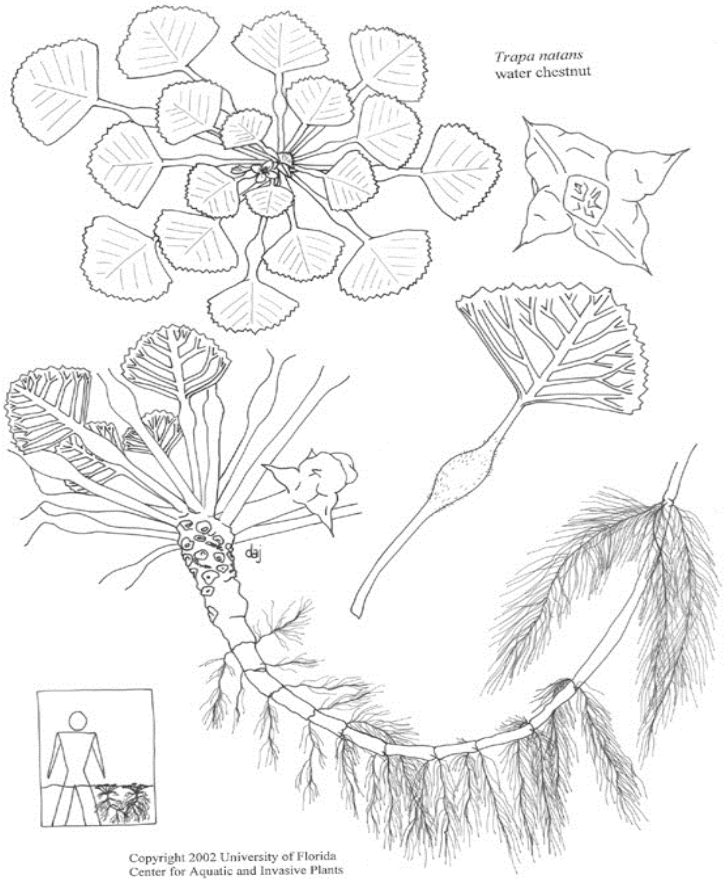
Tapegrass (*Vallisneria americana*)

- Native species
- Desirable food for life but can produce nuisance conditions
- Extremely difficult to control with chemicals



Water Chestnut (*Trapa natans*)

- Invasive species
- Was identified in the lake in 2010 by trained volunteers of the Knee Deep Club
- Removed through hand pulling

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Mechanical Weed Harvesting

- Through a study conducted in 2006, we quantified how much phosphorus is in the harvested plant material
- From 2006 to 2011, the % of TP targeted under the TMDL that was actually removed through harvesting has varied between 1.2 and 8% per year

Mechanical Weed Harvesting

- In 2011, 513 tons of plant biomass were removed (mid-July – mid-September)
- This translates to 183 lbs of TP (2.5% of the TP targeted for removal under the TMDL)
- One pound of TP has the potential to generate up to 1,100 lbs of wet algae “goo”
- Thus, the removal of 183 lbs in 2011 equates to approximately 201,300 lbs of wet algae biomass

Comparing lawn runoff TP concentrations from applications of fertilizers with and without TP

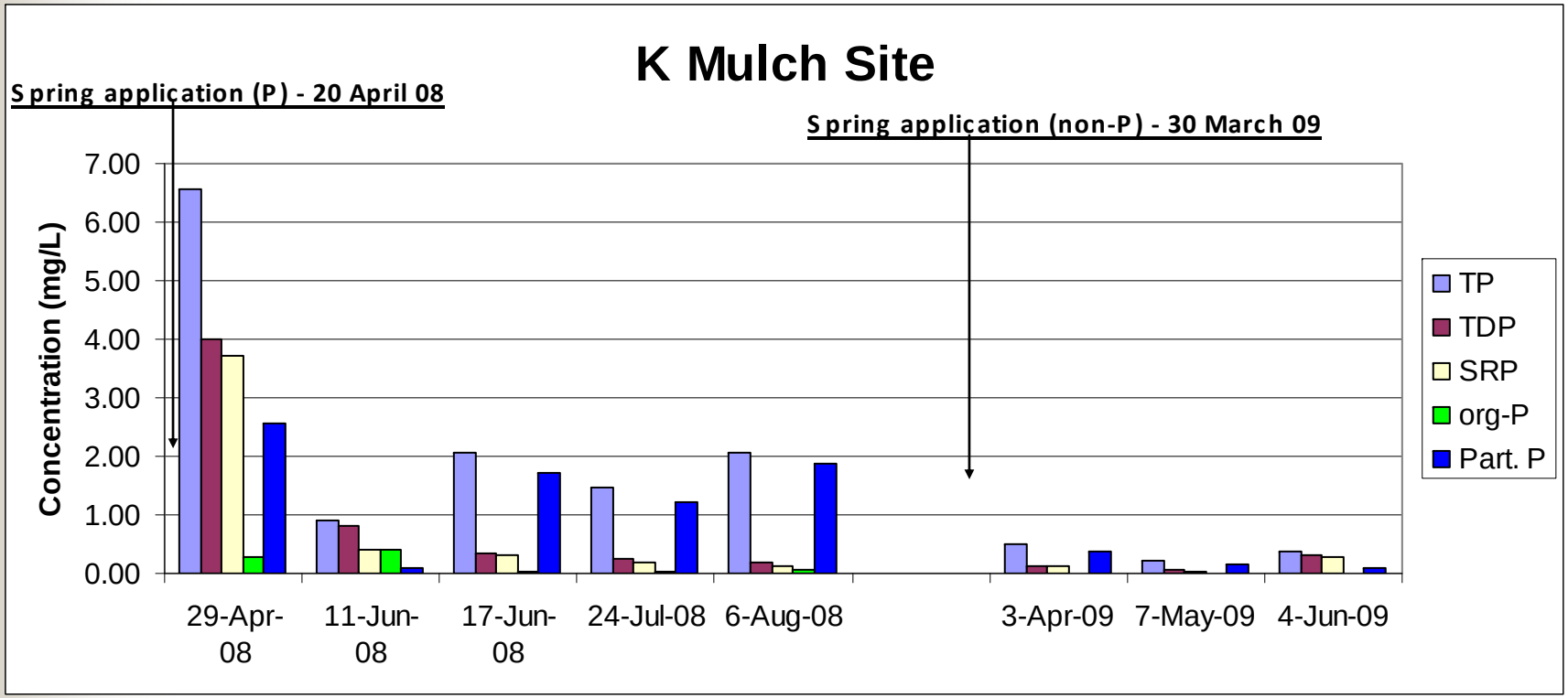
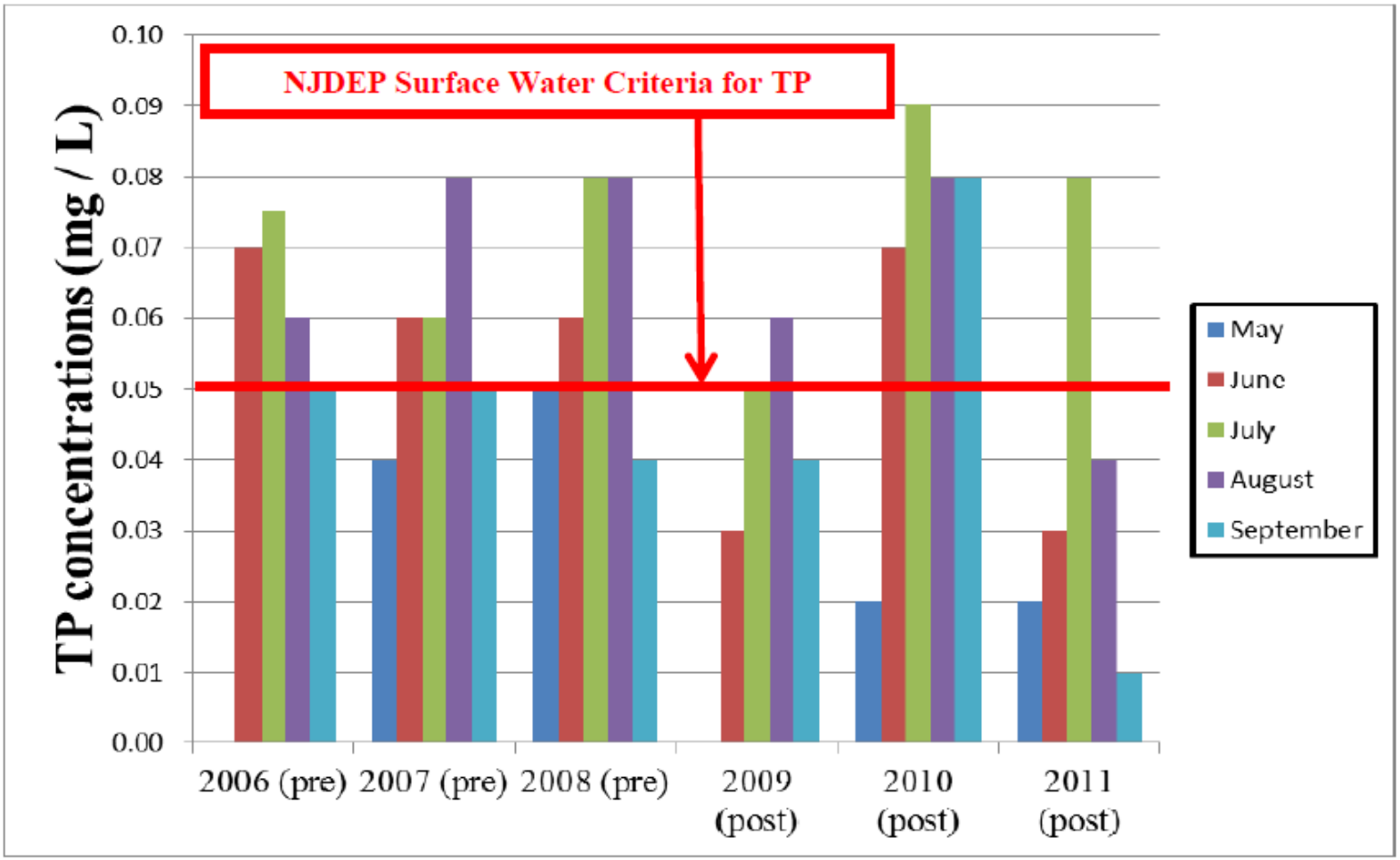


Figure 1 – TP Concentrations at Crescent Cove



Conclusions

- The monitoring of Lake Hopatcong has provided the information needed to obtain State and Federal funding to restore and protect the lake
- The data are used to assess the lake's existing conditions
- The data are also used to evaluate the relative success of watershed-based projects

Thank You

Photo courtesy of Ms. Donna Macalle-Holly