



# BEAVER POND MANAGEMENT AS A TOOL TO CONTROL ALGAE BLOOMS IN A SMALL, PRIVATE LAKE

Patrick Rose



# Summary

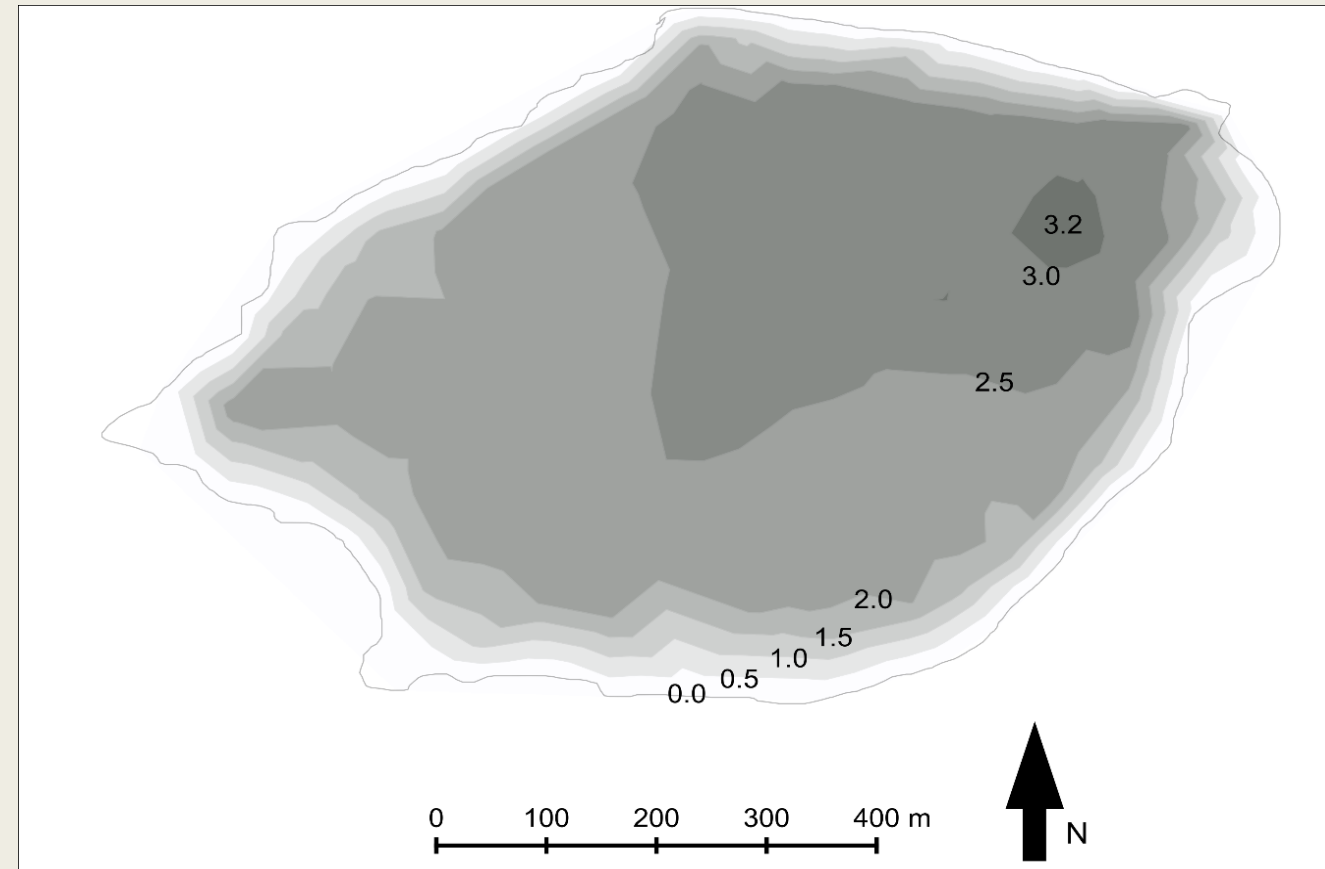
- SUNY Oneonta Lake Management Masters Program
- Interim management plan for Plymouth Reservoir, NY
- Monitoring of Lake and watershed
  - *Bathymetry*
  - *Fisheries survey*
  - *In-lake water quality*
  - *Nutrient samples from lake surface and watershed*



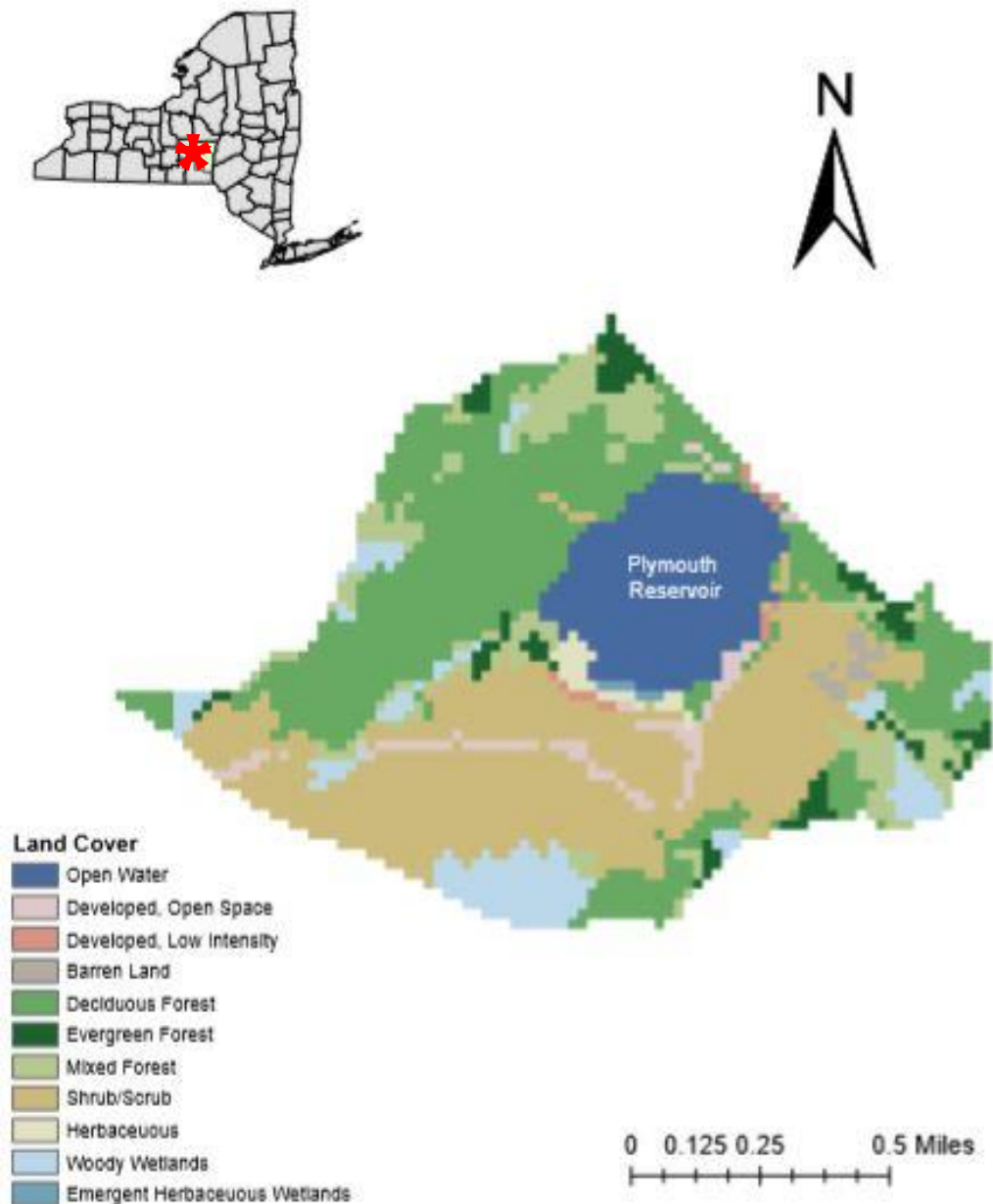
Source: PRLOA

# Background

- Chenango County
- 77 acre mesotrophic waterbody
- Max depth of 10 feet
- “Class B” lake
- Created in the 1800s when a hilltop tributary to Canasawacta Creek was dammed



## Land Cover of Plymouth Reservoir Watershed



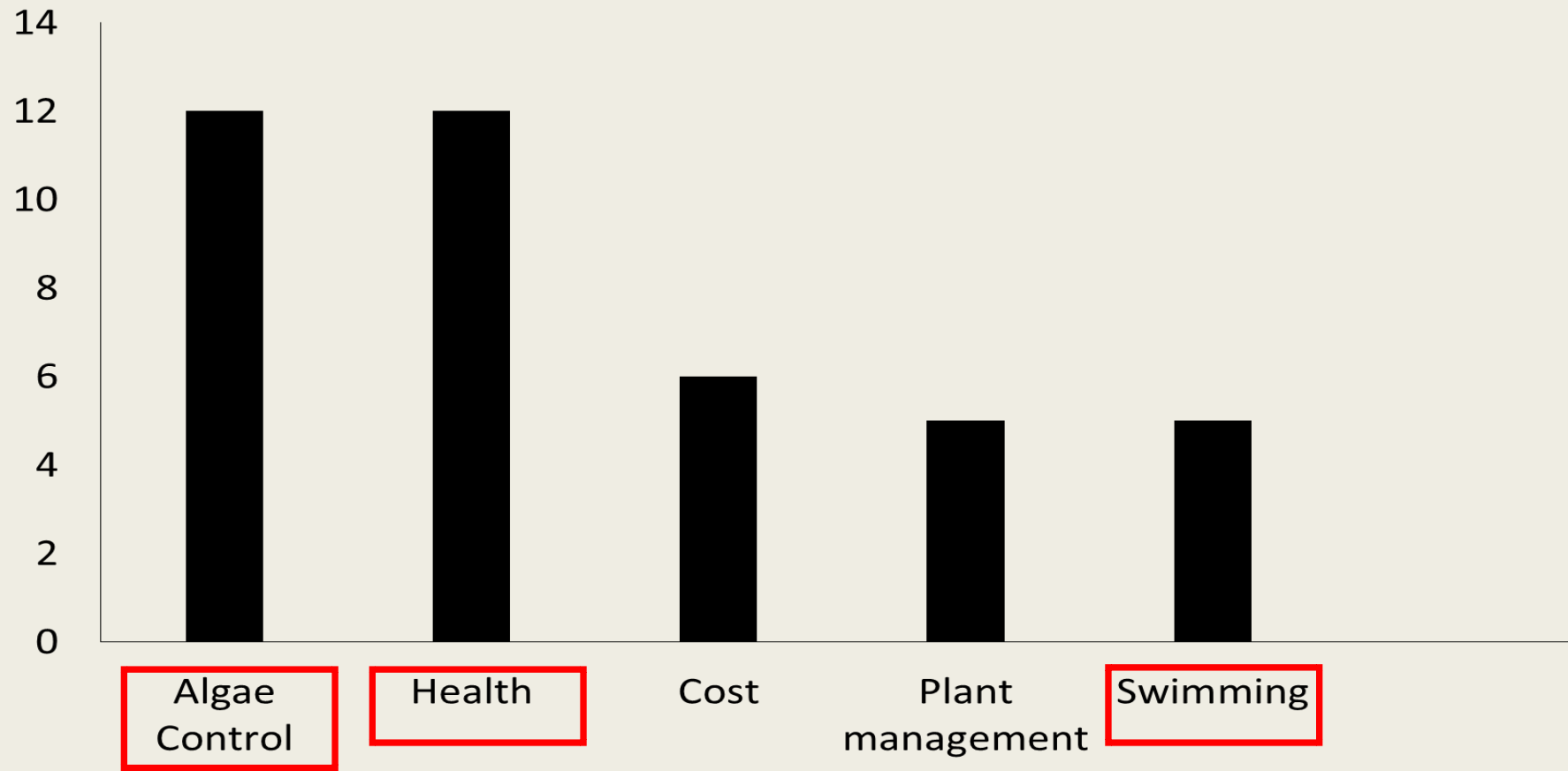
Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickham, J.D., and Megown, K., 2015, Completion of the 2011 National Land Cover Database for the conterminous United States- Representing a decade of land cover change information. Photogrammetric Engineering and Remote Sensing, v. 81, no. 5, p. 345-354

- 670 acre watershed
- 97% undeveloped land
- Majority of the watershed is owned by New York State
- Shoreline property privately owned
- Accessible to ~ 100 properties with deeded rights
- HABs over past few years

# Objective

Create an interim management plan for the Plymouth Reservoir Lot Owners Association (PRLOA), focused around their biggest concerns

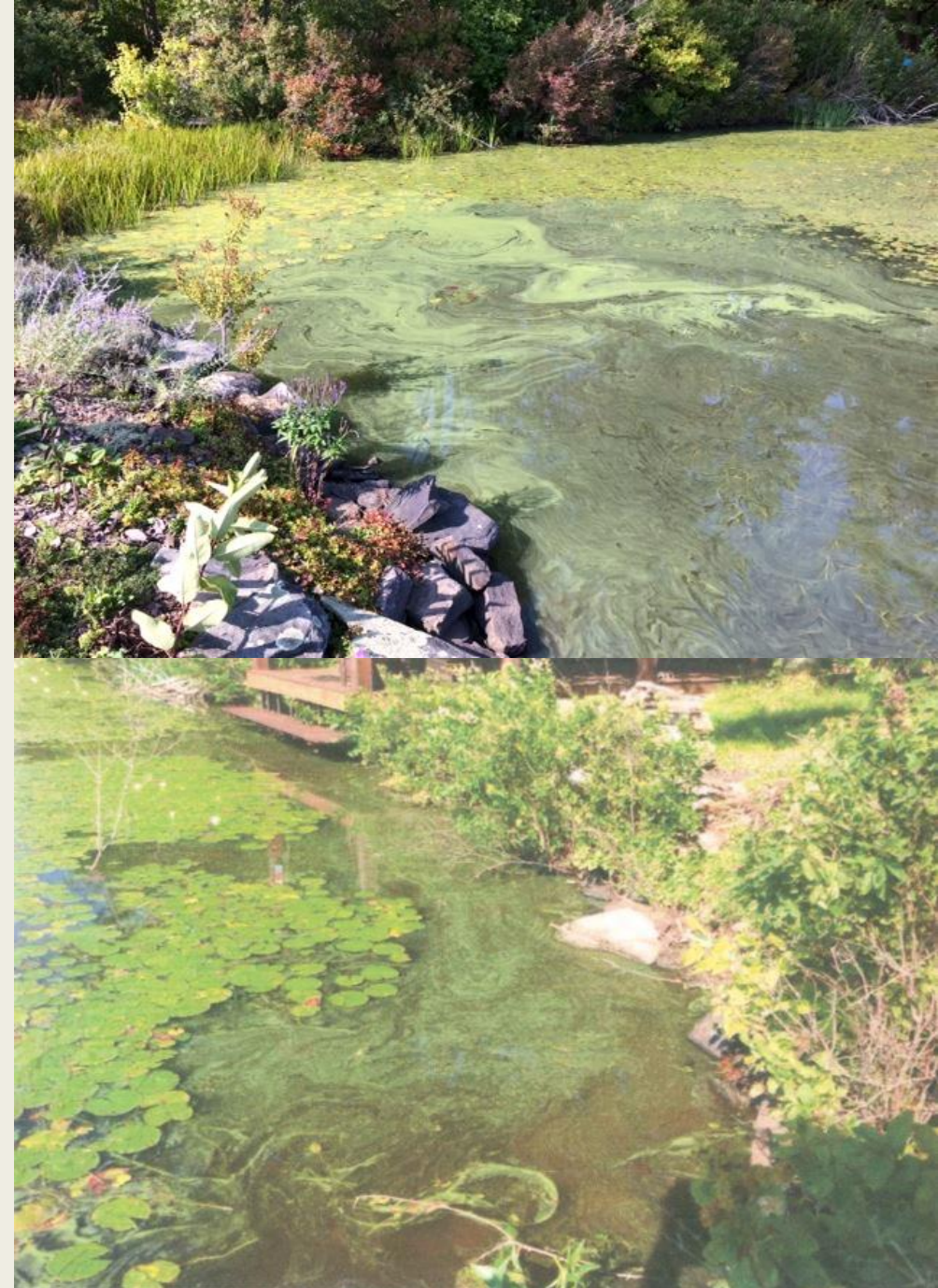
**PRLOA Concerns**





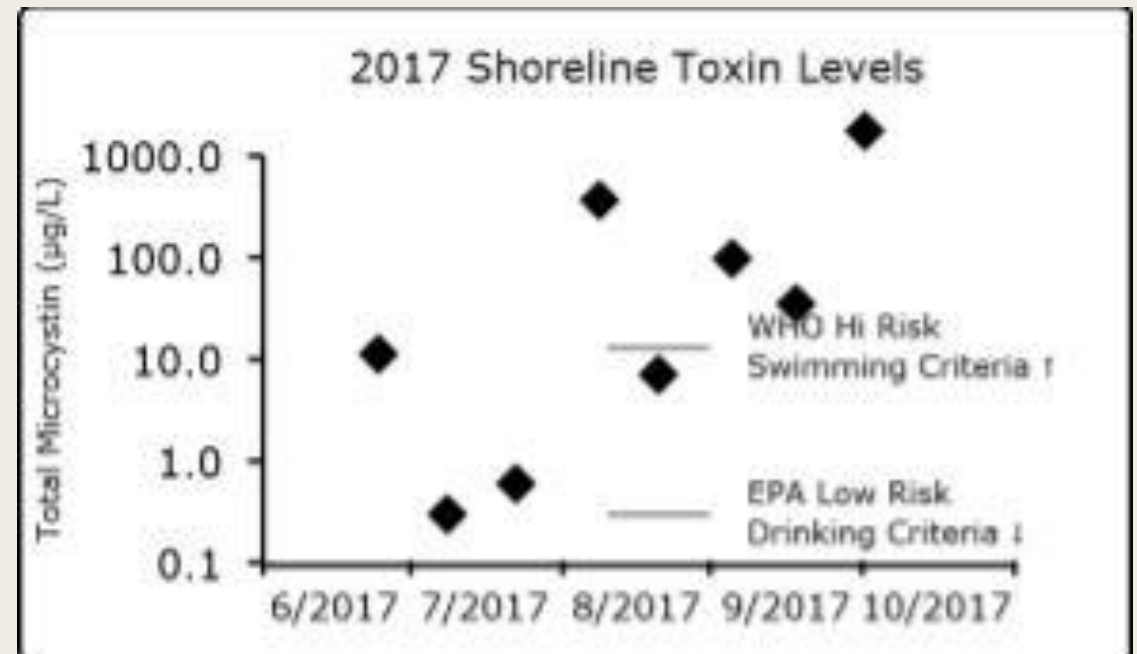
# Harmful algal blooms

- *Microcystis*
- *Dolichospermum*
- *Snowella*
- *Woronichinia*



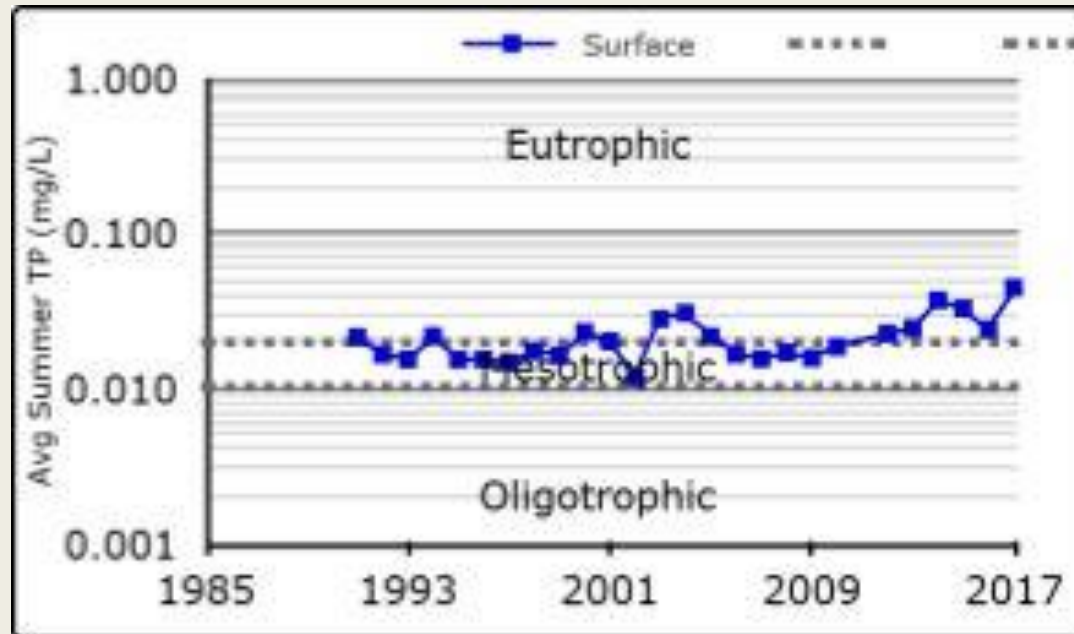
Source: PRLOA

# CSLAP: Algae samples and toxin levels

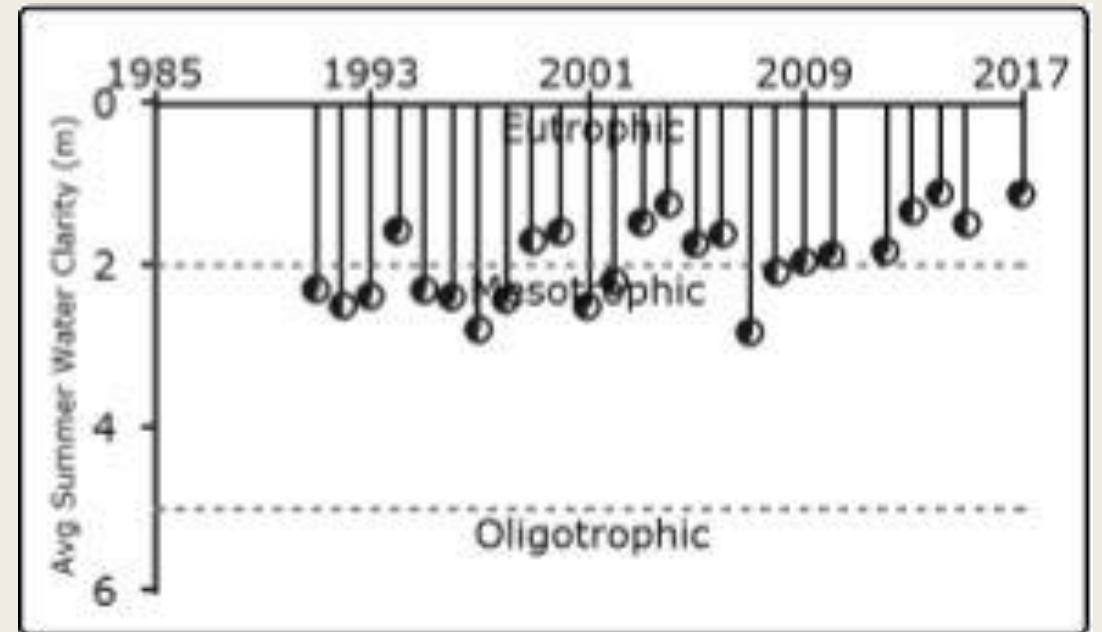


# CSLAP: Long term trends

Total Phosphorus

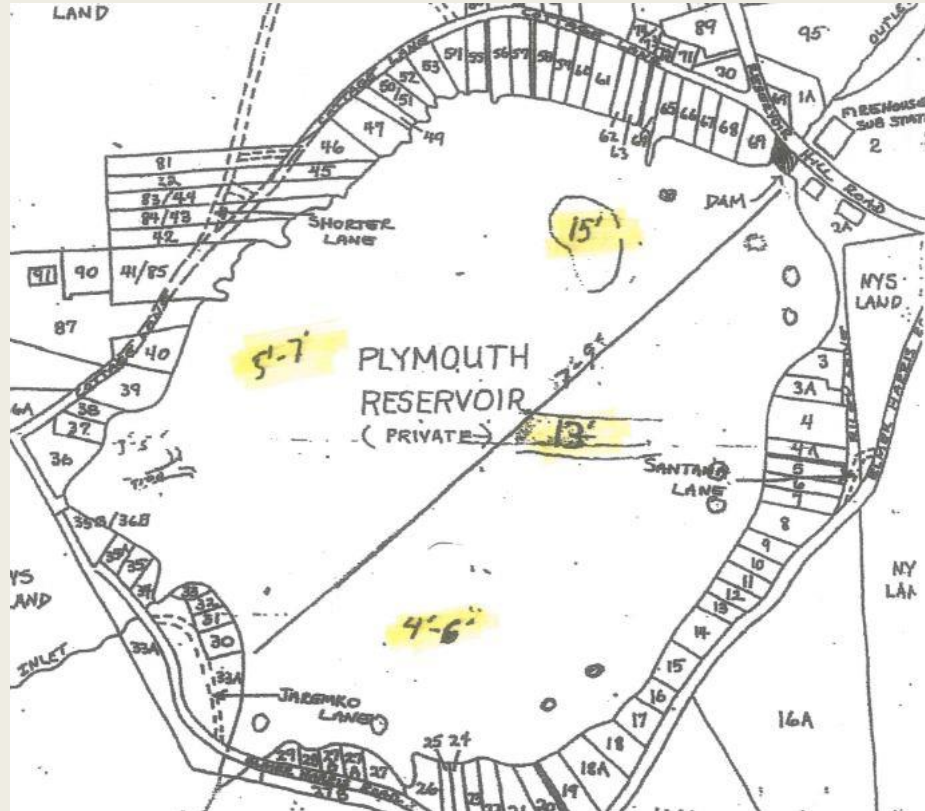


Secchi Depth

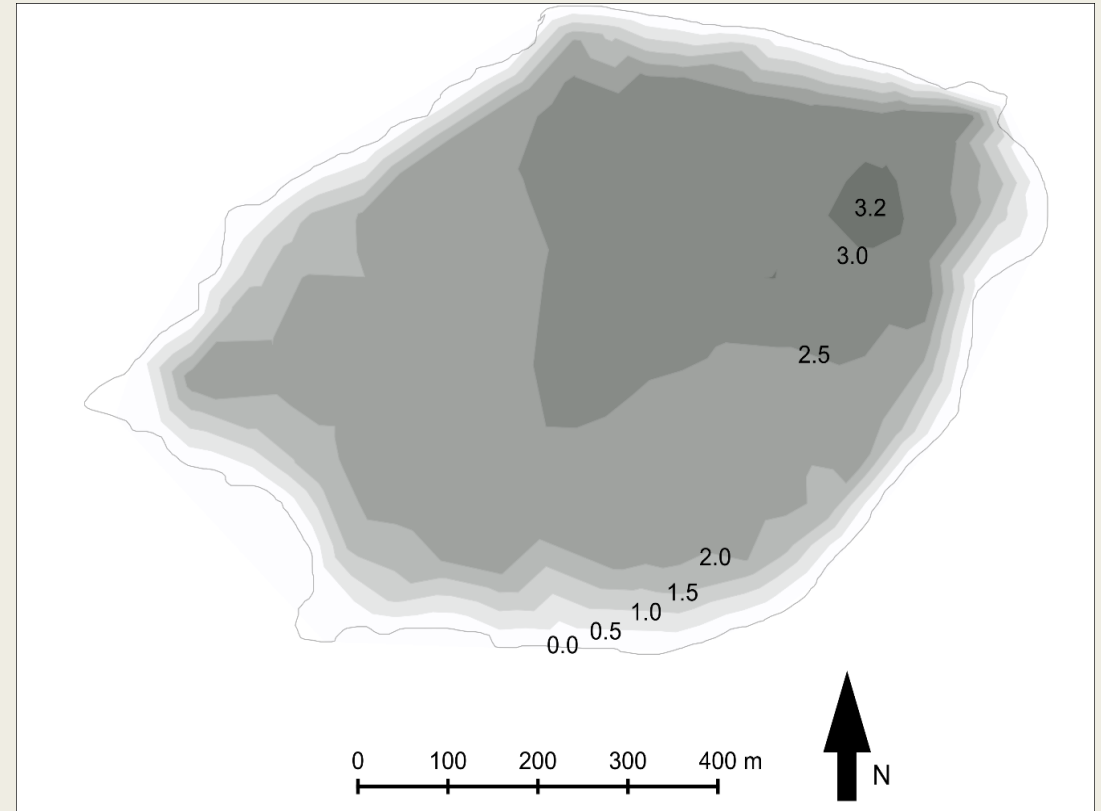




# Sedimentation



Source: PRLOA





# Beaver Ponds



Source: PRLOA



Source: PRLOA



# Management history

- PRLOA has been managing the lake since the 1960s
- Became concerned with excessive plant growth in the 1990s.
- Hired contractors in 1991 and 1992
- Built mechanical harvester in 1993
- Grass carp stocking began in 1994



Source: PRLOA

# Grass Carp

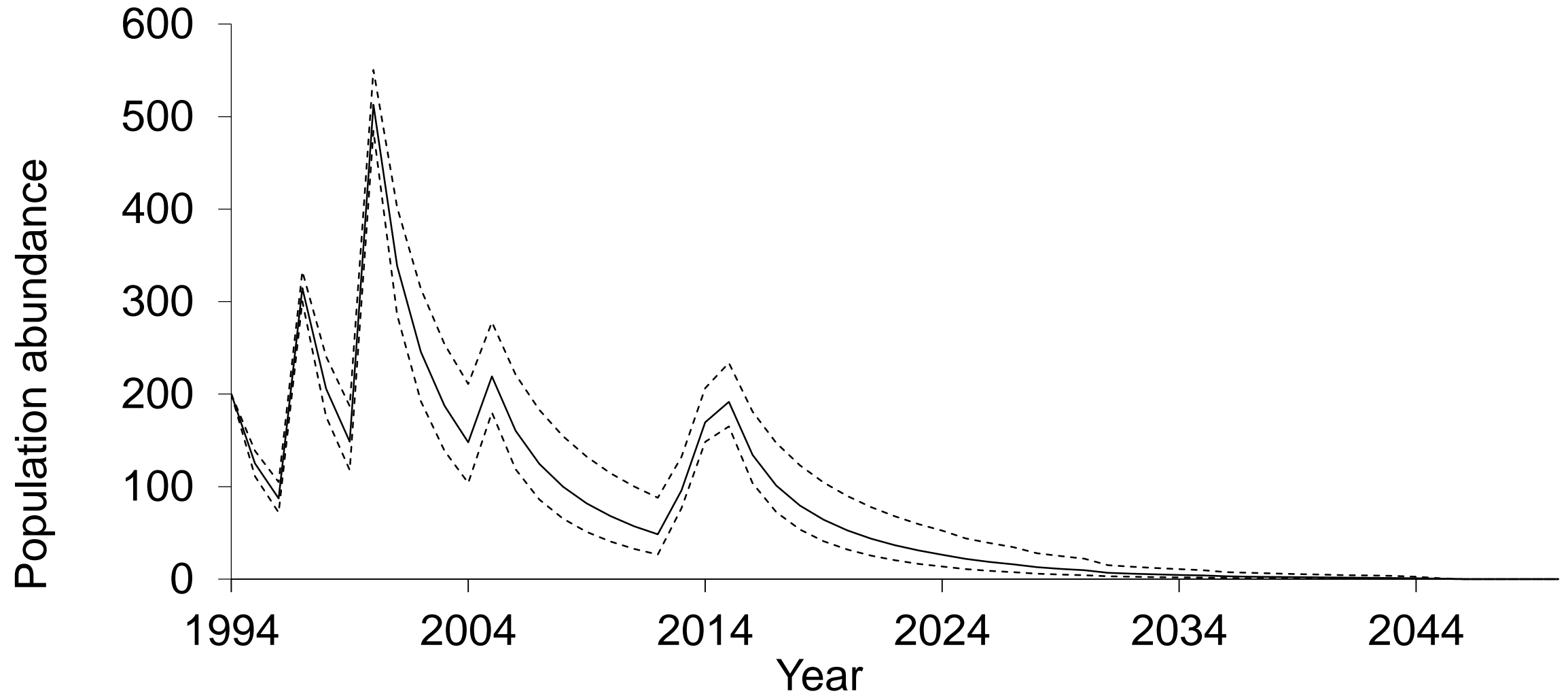
- 1,190 triploid grass carp stocked
- Targeting Eurasian watermilfoil
- Fish kill of ~150 grass carp in winter of 2016



Year	Number of Carp
1994	200
1997	250
2000	400
2005	100
2013	55
2014	100
2015	75



# Grass Carp population model



# Fisheries

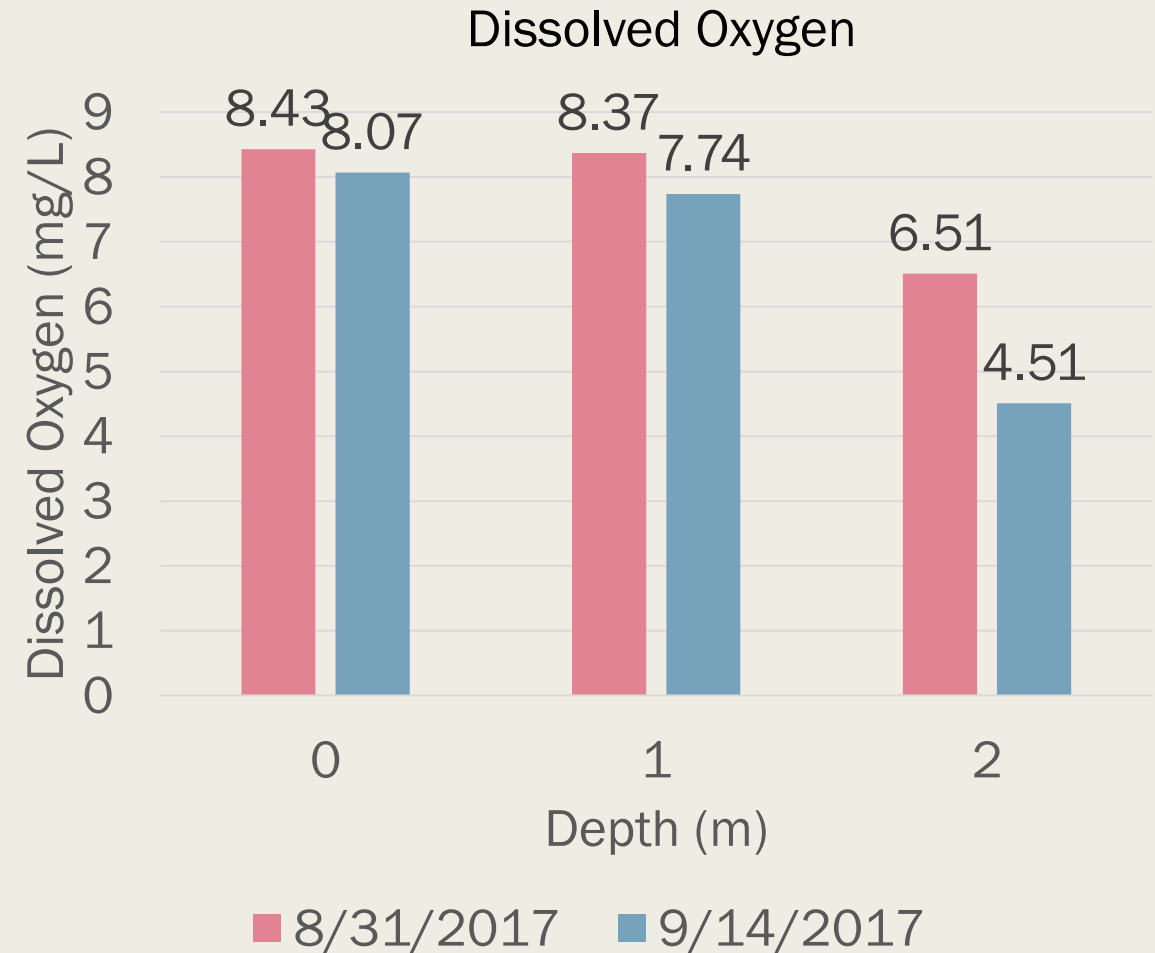
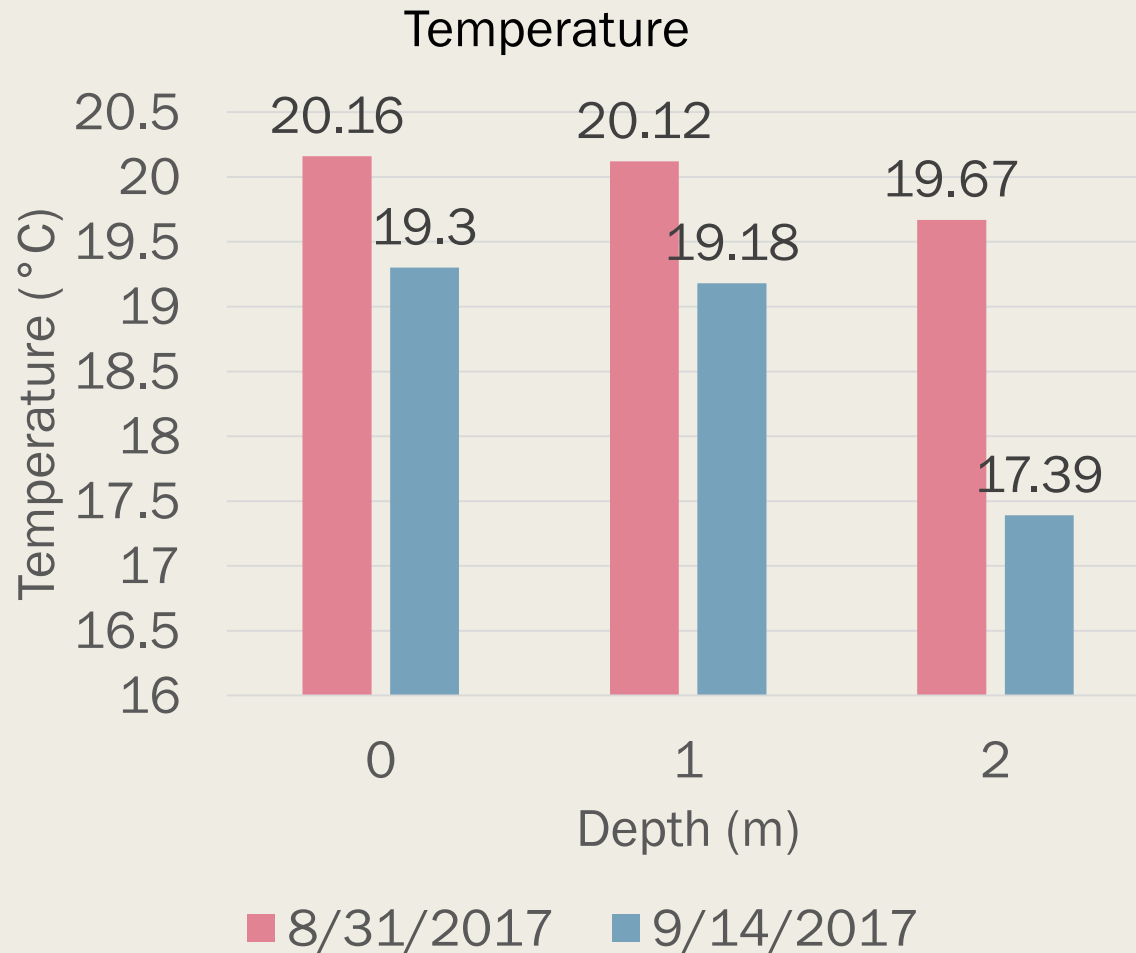
- No previous formal analysis
- Ecological indicators
- Electrofishing survey of shoreline

## Analysis

- Length-frequency
- High relative abundance of small-sized prey species
- High relative abundance of large predators

Common Name	Number
Yellow Perch	249
Bluegill	98
Black Crappie	89
Pumpkinseed	79
Golden Shiner	62
Largemouth Bass	58
Chain Pickerel	7
Smallmouth Bass	2

# Water quality



# Nutrient sampling

- Walked through watershed collecting water samples
- Total nitrogen, nitrate + nitrite, total phosphorus
- Most nitrogen samples below detection or low concentration
- Members of PRLOA suspected 2 beaver ponds may be source of nutrients



Source: PRLOA



Total phosphorus

TP > .020 mg/L = Eutrophic



# Implications

- Our nutrient data leads us to believe that the beaver ponds are a major source of phosphorus
- Water quality data and the location of Plymouth Reservoir at the top of a hill leads us to believe the lake is polymictic
- Extended periods of stratification could be causing the small hypolimnion to become anoxic
- Periods of hypolimnetic anoxia have the potential to activate and release phosphorus from the lake bottom



# INTERIM MANAGEMENT GOALS

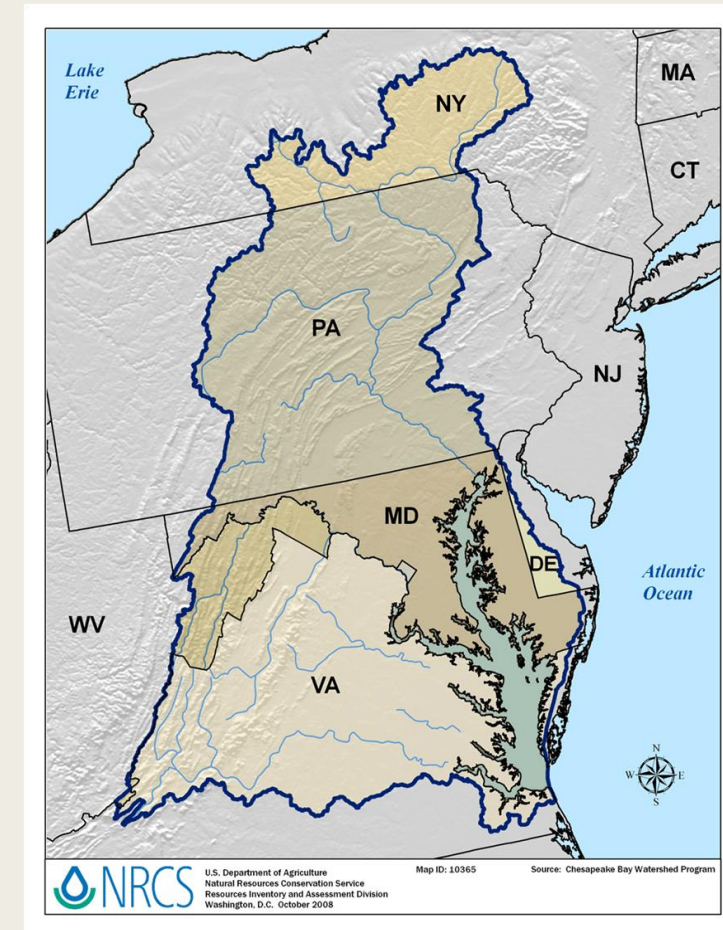




# Watershed Nutrient Management

## 1. Public collaboration

- Majority of watershed is state owned land.
  - *Beaver ponds are dammed along a NYS road*
- Dams breached to prevent flooding of state road
- Canasawacta Creek Watershed Initiative
  - *\$179,000 project*
- Cheseapeake Bay watershed
  - *Possible funding*







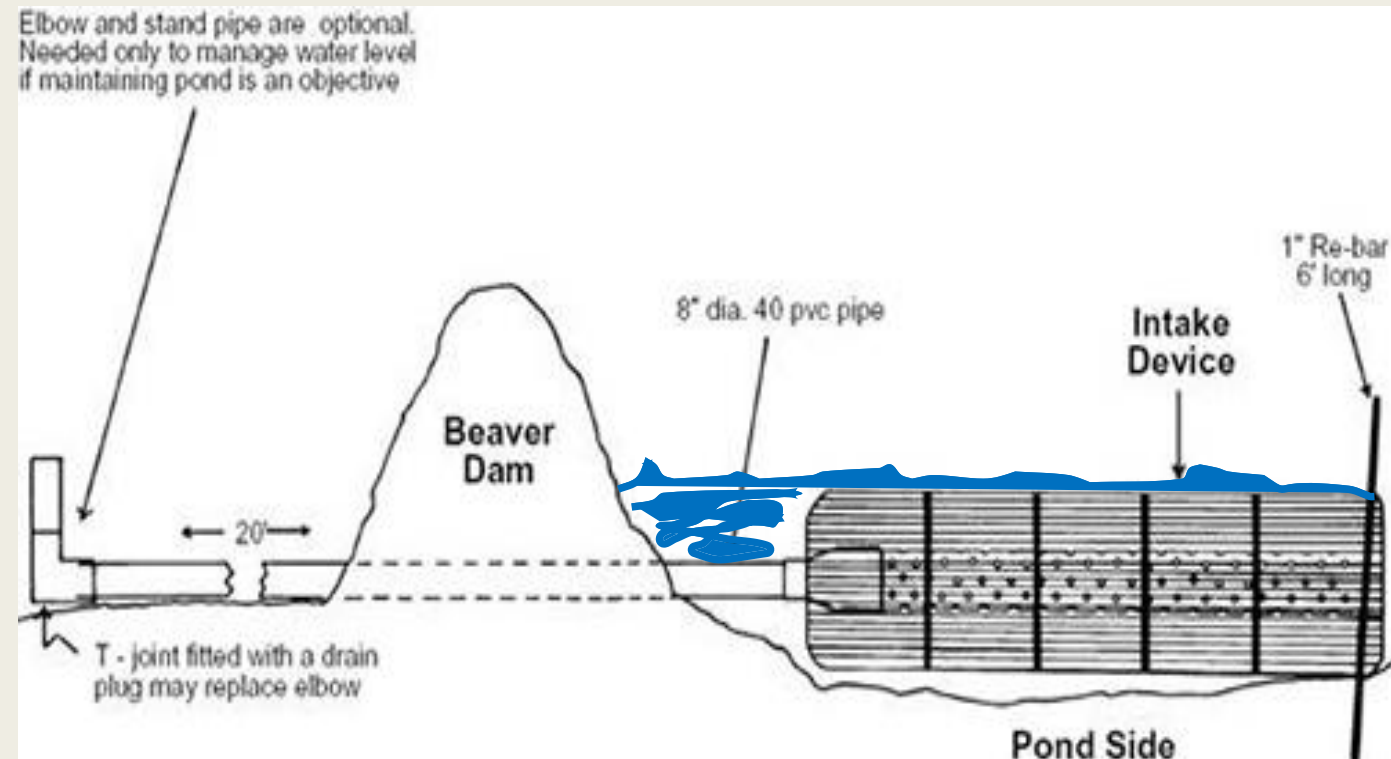
# Watershed Nutrient Management

## 2. Beaver Ponds

- Manipulation of water flow
  - *Stop breaching*
  - *Slowly drain the water*
  - *Maintain desirable level*

### Solution

- Drainage system
  - *Ex: Clemson beaver pond leveler*
    - Beavers cannot detect water flow through the device
    - One device can handle ~3 acre feet/day



Gerich 1994

# Watershed Nutrient Management

## 3. Vegetated swales/Increased vegetation

- Popular stormwater best management practice (BMP)
  - *Sequestration of nutrients*
  - *Increased filtration*
  - *Decreased erosion*
- Grasses and sedges
  - *Dense fibrous root systems*



# In-Lake Management

## 4. Emergent Plants

- Sequester nutrients and reduce runoff
- 2003 plant survey
  - *Broadleaf cattail*
  - *Eastern bur-reed*
- Target area: Two coves where beaver pond flow enters the lake





# Plant management

- Continued use of mechanical harvester
- Grass carp should be present in lake for years to come
- Benthic mats a possibility along shoreline properties
- Balance between plants and algae



Source: PRLOA

# Looking ahead...

- Continued collaboration between Plymouth Reservoir and SUNY Oneonta
- Stakeholder survey
- Increase frequency of water quality monitoring
  - *Look for drops in hypolimnetic oxygen*
  - *Winter monitoring*
- Nutrient samples throughout the water column

# Acknowledgements

- Dan Stich
- Dave Andrews, Sam Carey, Ben Casscles, Stradder Caves, Monica Matt
- The Plymouth Reservoir Lot Owners Association
- SUNY Oneonta Biological Field Station



Source: PRLOA