

Lake Improvement Projects and Topics: Wetland Best Management Practices and Cyanotoxins

**PA DEP and US EPA
Section 319 Watershed Planning & Implementation
Meeting
April 2016**

**Fred S. Lubnow, Ph.D.
Princeton Hydro**

Princeton Hydro



Wetlands – Valuable Natural Resource

- * Important for re-charge of groundwater; contributes toward managing stormwater
- * Buffers against wind and wave erosion
- * Effective systems for nutrient removal and reduction of sediments
- * Excellent refuge / spawning habitat for aquatic and terrestrial organisms
- * Highly productive systems

Not Green Infrastructure



Hybrid Infrastructure

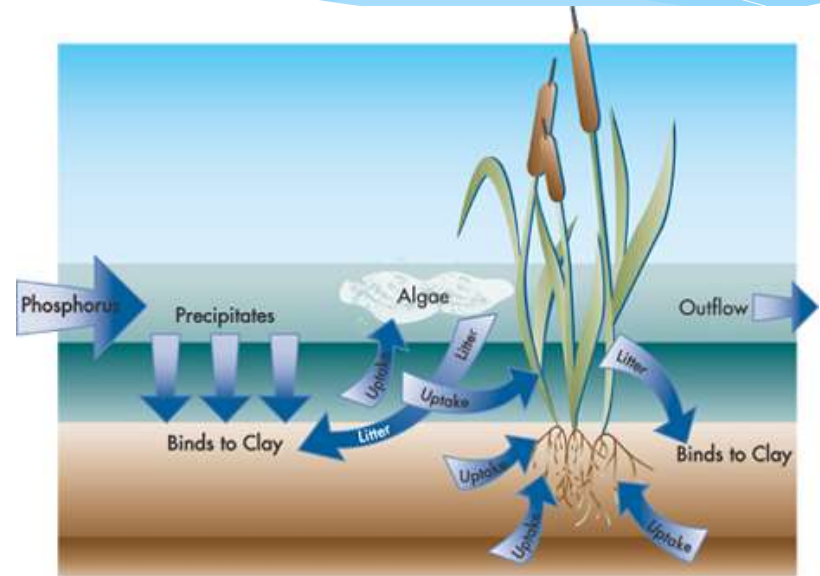


Princeton Hydro

pH

The “Ecosystem Value” of Lake-Shore Wetland Systems

- Aquatic vegetation provides valuable habitat, food and cover for a variety of organisms, including many gamefish
- Aquatic vegetation oxygenates the water and can “lock in” or bind up nutrients that would otherwise go to nuisance algae
- Stabilizes the sediments and the shoreline
- Increases overall biodiversity of a lake ecosystem



The Hideout, Wayne County, PA

- * The Hideout Property Owners Association, Inc. is a large, private residential community in Wayne County, PA
- * The community has over 4,000 residential lots; 2,800 acres in size; 50 miles of roads; 3 major lakes; a ski Hill; Golf Course, Lodge and Recreational facility
- * A sewerred community
- * Part of the Lake Wallenpaupack watershed

Memorial Day Weekend, 2012

Photo by John Gigliotti



Princeton Hydro







Princeton Hydro



Property Owned vs. Watershed



Roamingwood Lake Water Quality

- * Excellent Water Quality Conditions
- * Generally well oxygenated, with a minor amount of anoxic ($\text{DO} < 1 \text{ mg/L}$) immediately over the sediments
- * Summer mid-lake Secchi depths consistently greater than 1 m (3.3 ft), frequently greater than 2 – 3 m (6.6 to 10 ft)
- * TP concentrations frequently at or below 0.02 mg/L
- * Chlorophyll *a* concentrations frequently less than 10 ug/L
- * Some sporadic macrophyte (submerged plants and mat algae) growth in shallow cove areas

Roamingwood Lake

- * Thus, the management strategy for Roamingwood Lake focuses more on protection rather than rehabilitation – let's avoid / minimize major water quality problems before they occur
- * The largest portion of the lake's phosphorus load comes from the Brooks Lake / Ariel Lake sub-watersheds
- * The Brooks Lake / Lake Ariel sub-watersheds accounts for between 34 to 57% of Roamingwood Lake's annual, watershed based load of total phosphorus

Outlet of Lake Ariel

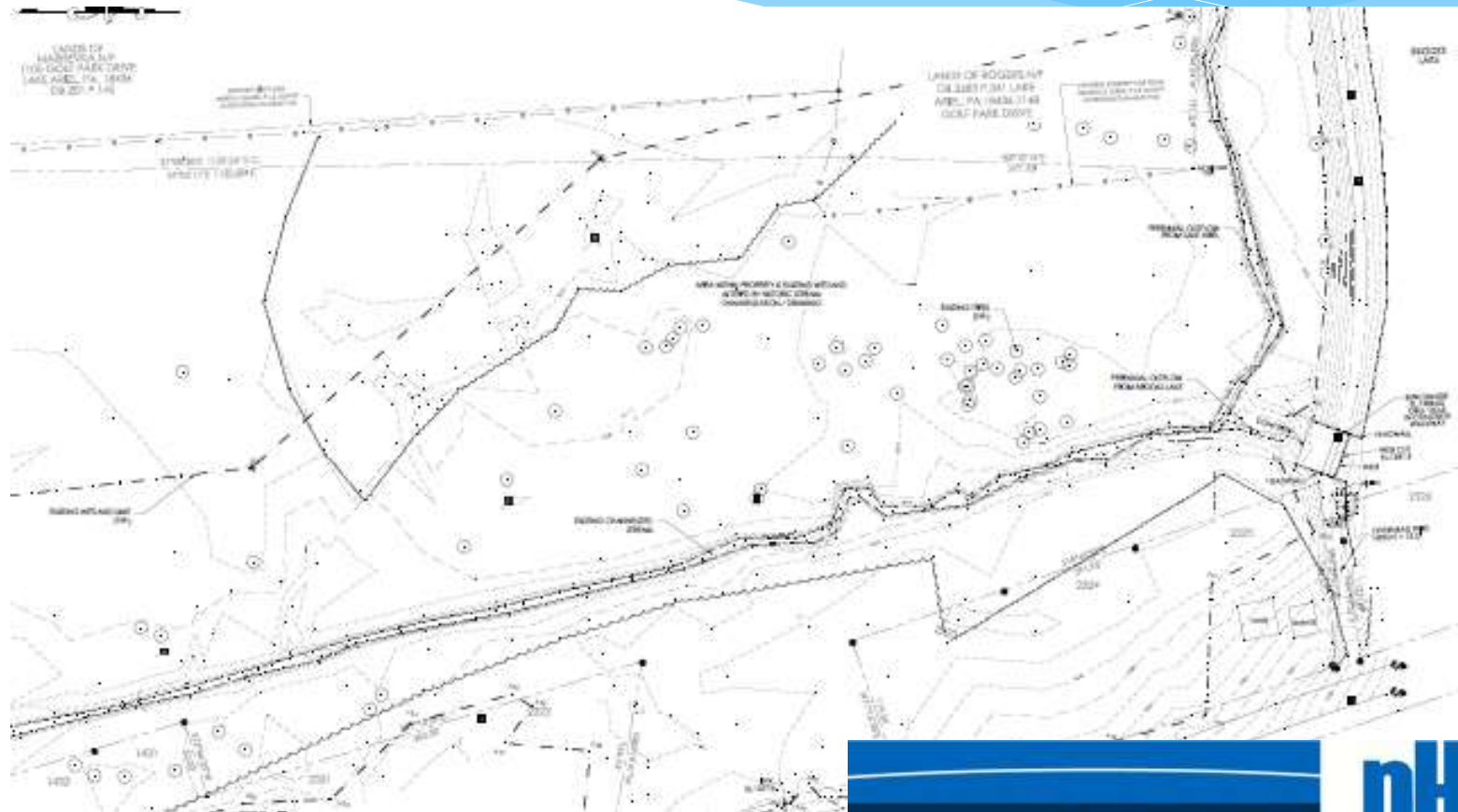
- * Outlet of has had TSS concentrations as high as 64 mg/L and TP concentrations as high as 0.12 mg/L (early June 2013)
- * Concentrations are typically higher in the spring

Project Site

Figure 1. Channel alignments circa 1959 and 2005.
Contrast typical sinuosity (1959) with current
straightened alignment (2005).



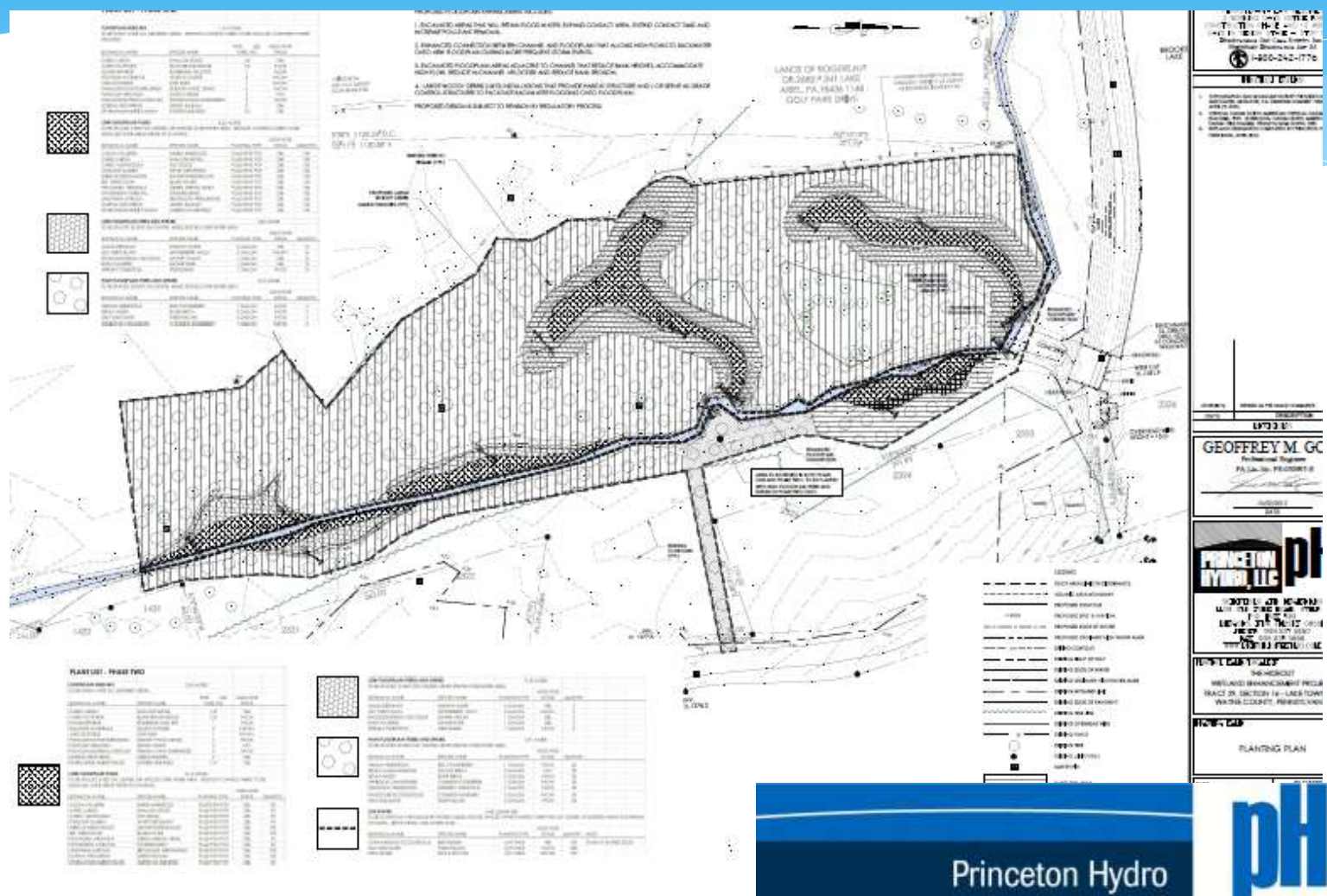
Tract 29, Existing Conditions



Tract 29, Proposed Conditions



Tract 29, Proposed Conditions



Tract 29, April 2009



Princeton Hydro



Tract 29, April 2009



Princeton Hydro



Permitting for the Project

- * The Hideout's experience with the permitting process
- * Wayne Conservation District, Individual NPDES Permit (E&S Control Plan)
- * PA DEP / US Army Corp of Engineers – Wetland Data Forms for approval
- * PA DEP pesticide permit to treat the reed Canary grass
- * Development of design plans and bid specifications
- * Approval was obtained in late 2012

Treatment for reed Canary grass

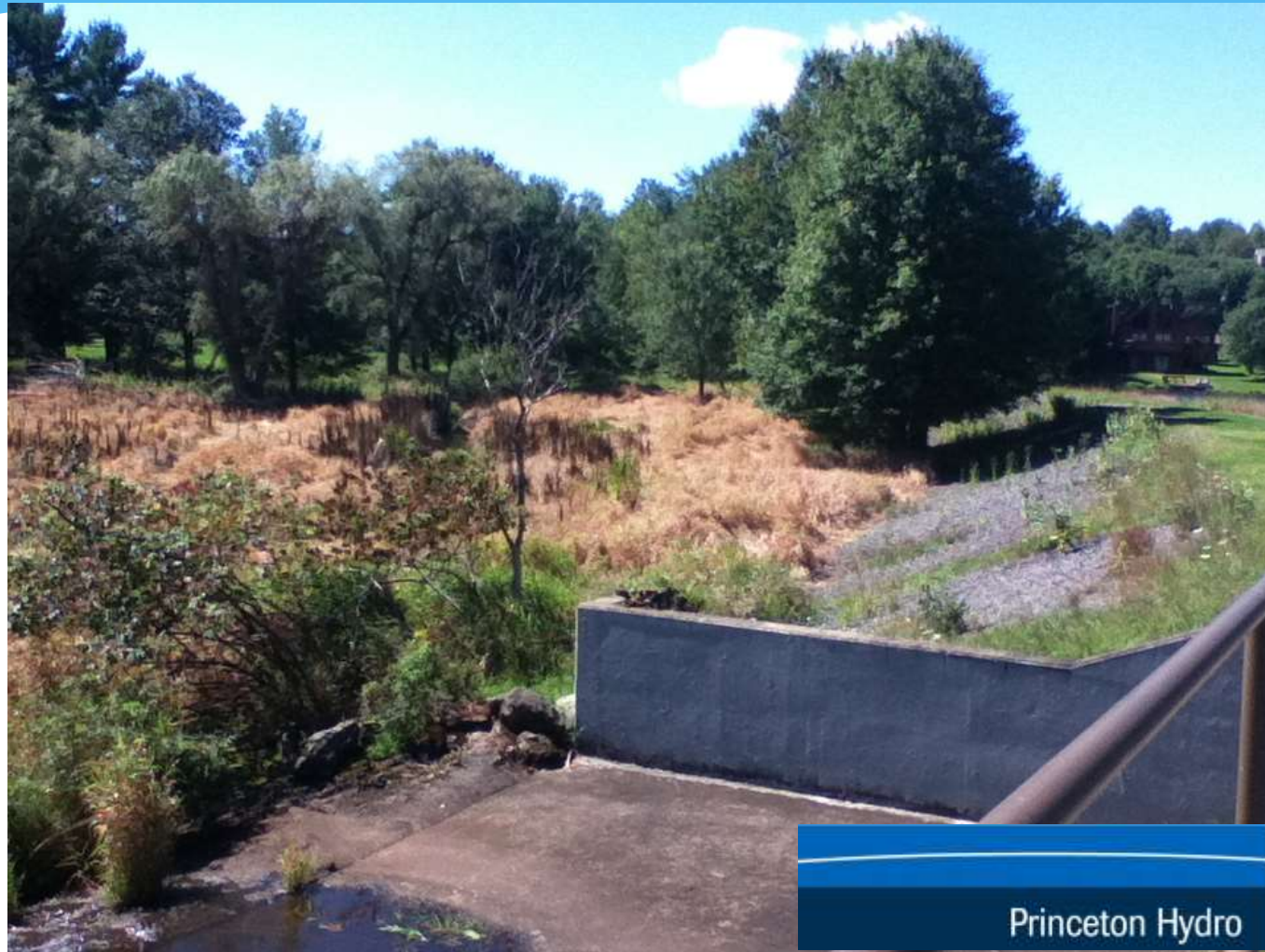
August 2013



Princeton Hydro



Tract 29, early September 2013



Princeton Hydro



Tract 29, early September 2013



Princeton Hydro

pH

Tract 29, late September 2013

Construction work awarded to Flyway Excavating, Inc.



Tract 29, late September 2013



Princeton Hydro



Tract 29, early October 2013



Planting Occurred in Fall of 2013 and Spring of 2014

- * **Floodplain seed mix** (shallow sedge, soft rush, PA smartweed, eastern bur reed)
- * **Low Floodplain plugs** (marsh marigold, blueflag iris, swamp rosemallow, pickerelweed)
- * **Low Floodplain trees and shrubs** (smooth alder, winterberry holly, swamp rose, steeplebush)
- * **High Floodplain trees and shrubs** (red chokeberry, river birch, pussywillow, common elderberry)

Early April 2014



April 2014



Early April 2014



Early May 2014



Early May 2014



June 2014



September 2014



November 2014



Mid-September 2015



Mid-September 2015



Mid-September 2015



Mid-September 2015



Mid-September 2015



Mid-September 2015



Mid-September 2015



November 2014



Targeted 5 acres for Project



Growing Greener Grant

- * Submitted a Growing Greener Grant application in 2012
- * Partnered with the Lake Wallenpaupack Watershed Management District in the application
- * Grant focuses primarily on the purchase of more vegetation for the 3.5 acres that was removed from the implemented plan
- * Grant will also include additional treatment of reed carney grass and some water quality monitoring

Vegetation to be Planted in 2015 in the Additional 3.5 acres

- * **Floodplain seed mix** (sedges, soft rush, switch grass)
- * **Live Stakes** – adjacent to the stream channel (buttonbush, pussywillow and black willow)
- * **Low Floodplain trees and shrubs** (smooth alder, winterberry holly and swamp azalea)
- * **High Floodplain trees and shrubs** (yellow birch, river birch, common elderberry, pussywillow)

Early December 2015



Automated Stormwater Sampling



Princeton Hydro

pH

Early December 2015



Early December 2015



Early December 2015



Early December 2015



Estimated Amount of Phosphorus Removal and 2016

- * Depending on the amount of phosphorus coming from Lake Ariel, the amount of TP removed on an annual basis is between 390 and 545 lbs per year
- * Need to do some additional seeding in 5 acre site
- * Need to treat for more reed Canary grass
- * Possibly additional plantings with any remaining money
- * Another attempt at stormwater monitoring
- * Growing Greener grant ends this year; long-term monitoring

Some Data from 2015

- * **18 May 2015**, TSS and TP concentrations prior to entering the wetland were 16 and 0.07 mg/L, respectively
- * **18 May 2015**, TSS and TP concentrations leaving the wetland were < 3 and 0.04 mg/L, respectively
- * **6 July 2015**, TSS and TP concentrations prior to entering the wetland were < 3 and 0.03 mg/L, respectively
- * **6 July 2015**, TSS and TP concentrations leaving the wetland were 3 and 0.03 mg/L, respectively

Lake Luxembourg



Conservation Pool



Main Body of Lake Luxembourg (9 July 2014)



Conservation Pool

(9 July 2014; note high turbidity)



Conservation Pool

- * Originally designed to function as a BMP.
- * Now a source of pollutants instead of a sink.
- * In order for any update BMPs or watershed management activities to have a positive impact on Lake Luxembourg, something must be done with the conservation pool.
- * Converting the conservation pool into a large-scale, regional BMP (flood plain / wetland BMP) is estimated to completely comply with the TSS TMDL and with most of the TP TMDL (17% remaining).

Conservation Pool

- * To date, no management activity has been conducted on the conservation pool.
- * The County is willing to take on the responsibility of maintaining the pool.
- * In addition to pollutant removal, there will be a substantial benefit to local wildlife / fisheries.
- * Potential educational opportunities as well.

THANK YOU



Princeton Hydro

pH