# Honeoye Lake Watershed Task Force

## Newsletter

### Winter 2018

*Picture Credit: Dr. Roxanne Razavi, SUNY ESF*

## Governor Cuomo Unveils 12th Proposal of the 2018 State of the State: Protecting New York Lakes from Harmful Algae blooms

Governor Cuomo announced on 12/21/17 a proposal for next year's NYS budget to allocate $65M to launch an aggressive program to address the Harmful Algae Boom (HAB) issue in 12 high priority NYS lakes including Honeoye Lake! Each of the 12 lakes will receive $500,000 of funding for project engineering to finalize their HABs actions plans. Once the NYSDEC developed HAB mitigation plan for each lake is approved, the $60M of funding will be divided up between the 12 lakes based on the funding needed for each lake's plans.

Press Release: https://www.governor.ny.gov/news/governor-cuomo-unveils-12th-proposal-2018-state-state-protecting-new-yorks-lakes-harmful-algal

Key New York State HABs proposal milestone dates are:

April 1st, 2018 approved state budget.
May 2018, all 12 lakes HABs Action Plans approved by NYSDEC.
Summer 2018, HAB Action Plan Implementation Starts.

The Honeoye Lake Watershed Task Force will provide updates throughout 2018 as key milestones are met.

## HLWTF Chairman's 2017 Project Update: Terry Gronwall

HLWTF projects to improve water quality in Honeoye Lake and its watershed.

The common focus of these Honeoye Lake Watershed Management Plan-based projects is to implement Best Management Practices (BMP's) to reduce external sources of nutrients and sediments reaching Honeoye Lake.

**NYSDEC WQIP Round 11 Grant Project:** Ontario County Soil and Water Conservation District and HLWTF have received a NYSDEC Water Quality Improvement Program (WQIP) Round 11 Grant for over $170,000 including local match funding to address stream bank erosion in public road right of ways, build several detention basins and vernal pools in the Honeoye Lake Watershed. Implementation in progress. Will be completed in 2018.

**NYSDEC WQIP Round 12 Honeoye Lake Inlet Restoration Project:** This project includes four elements that work together to allow inlet stream flows during storms to spread out, slow down and drop sediment and nutrient loadings before reaching the lake. OCSWCD received the grant award for $300,000 with $100,000 local match to fund the implementation of this project, which began in September and was completed in early October 2016. Several project enhancements were implemented in 2017.

**Blue-Green Algae Monitoring Project:** At the request of NYSDC, BGA samples were collected weekly from Honeoye Lake June through October 2017 for testing of blue-green algae blooms and toxin levels. Results are posted on DEC Harmful Algal Blooms web site on Friday afternoons: http://www.dec.ny.gov/chemical/83310.html

**Collected lake water quality data June-Sept. –** HLWTF collected weekly surface water temperature, dissolved oxygen, and water clarity data. Also, we collected water samples twice a month (Jun-Sep) for lab testing for phosphorus and nitrogen.

**Electronic Macrophyte Mapping Service –** HLWTF provided three (Early Jul, Late Jul, Late Aug) macrophyte maps to our weed harvesting team to help focus weed harvesting efforts in the areas of greatest macrophyte density. Bathymetric and Bottom Hardness maps have also been produced.

**Cornell-FLCC-HLWTF Honeoye Lake Research Collaboration:** Professors Nelson Hairston (CU) and Bruce Gilman (FLCC), in collaboration with HLWTF Chairman Terry Gronwall and Dorothy Gronwall are studying the causes of summer blooms of cyanobacteria (blue-green algae). This 3-year (2016-2018) research project is funded by a grant from the US Department of Agriculture.

**Finger Lakes Institute FluoroProbe Project:** The goal of this 2017 project was to characterize algal blooms throughout a summer season in Honeoye Lake. Assessing the water chemistry conditions before, during and after successive algal blooms will help to determine factors associated with the blooms.

**Finger Lakes Institute Nitrogen Research Project:** Freshwater systems are thought to be phosphorus limited. Current management practices aim to curb harmful algal blooms (HABs) by phosphorus control strategies. Despite these controls, HABs continue to proliferate. Research shows cyanobacteria growth is higher with the addition of both phosphorus and nitrogen compared to either nutrient alone. The goal of this 2016-2018 project is to determine if nitrogen is a factor in Honeoye Lake HABs.

**Sponsored a fall yard waste disposal initiative:** The Town of Richmond allowed watershed residents to properly dispose of yard waste in their town brush pit. This keeps leaf nutrients from reaching the Lake. OCPD, HVA, and HLWTF promoted this initiative.

*These efforts to improve Honeoye Lake and watershed water quality are a true partnership of The Nature Conservancy, NYS DEC, Ontario County Planning Department, Ontario County SWCD, Finger Lakes Community College, Finger Lakes Institute, Cornell University, Honeoye Valley Association, the Towns of Richmond, Canadice, Bristol, South Bristol and Naples; and all lake residents and users. We appreciate everyone's support. For more information, please contact me at:* Terry Gronwall, HLWTF Chairman (585)367-3000 watershedtaskforce@gmail.com

# Honeoye Lake Water Quality Research Projects Update

*Terry Gronwall Chairman*
*Honeoye Lake Watershed Task Force (HLWTF)*

We are taking a holistic approach to improve the water quality of Honeoye Lake and its watershed. This includes several erosion control projects on publicly owned land, encouraging residents to utilize best management practices to reduce their contribution of nutrients and pesticides, and launching two significant internal lake research studies to better understand the role that the legacy nutrients in the lake's bottom sediments have in fueling our blue-green algae blooms.

Over the last several years the HLWTF has secured grant funding and partnerships that that have allowed the aggressive implementation of several significant erosion control projects; Inlet Restoration Project, sediment control basins, vernal pools, road side ditch rock armoring, etc. Plans are in place to continue these types of projects going forward.


In 2015 the Honeoye Valley Association (HVA) published and distributed "A **Homeowner's Guide to Honeoye Lake-Friendly Living**" to every resident in the watershed. It is also available on the HVA web site at www.hvaweb.org.

## In May of 2016 we launched two new multi-year internal lake research projects:

**Cornell-FLCC-HLWTF Honeoye Lake Research Collaboration:** Professors Dr. Nelson Hairston (Cornell University) and Dr. Bruce Gilman (Finger Lakes Community College), Lindsay Schaffer, Cornell Research Support Specialist, Dr. Allie King, Cornell Research Associate, and several Cornell student interns in collaboration with HLWTF Chairman Terry Gronwall and Dorothy Gronwall are studying the causes of summer blooms of cyanobacteria (blue-green algae). This 3-year (2016-2018) research project is funded by grants from the US Department of Agriculture.

**Finger Lakes Institute Nitrogen Research Project:** Dr. Roxanne Razavi, SUNY-ESF, Dr. Mark McCarthy and Dr. Silvia Newell at Wright State in Dayton, OH, Dr. Lisa Cleckner, Director Finger Lakes Institute (FLI), and a team of FLI staff, and Hobart William Smith undergrads have been working with Terry and Dorothy Gronwall, HLWTF to measure different nitrogen forms in the lake on a weekly basis during 2016-2017.

Research shows cyanobacteria growth is higher with the addition of both phosphorus and nitrogen compared to either nutrient alone. The goal of this 2016-2018 project is to determine if nitrogen is a factor in Honeoye Lake HABs. This 3-year research project is funded by a grant from the Great Lakes Research Consortium.

**Cornell University & Finger Lakes Community College**

***Effects of Climate Warming in NY's Shallow Large Lakes***

***(Temperature Stratification and Water Quality)***

***A simple question with a complex answer….***

The Hypothesis being researched is that climate warming is causing the surface water to be warmer creating stronger and longer time periods of stratification. This causes the water near the lake bottom to be anoxic (no dissolved oxygen) for longer periods of time increasing the amount of phosphorus being released from bottom sediments.

From mid-May to mid-October 2016 and 2017 the research team collected a large set of water quality related data:

- Weather data – Air temperature, wind direction & speed, rainfall, humidity.

- Water Temperature (once per minute) every meter (~3.3 feet) from lake bottom to surface using two water quality buoys

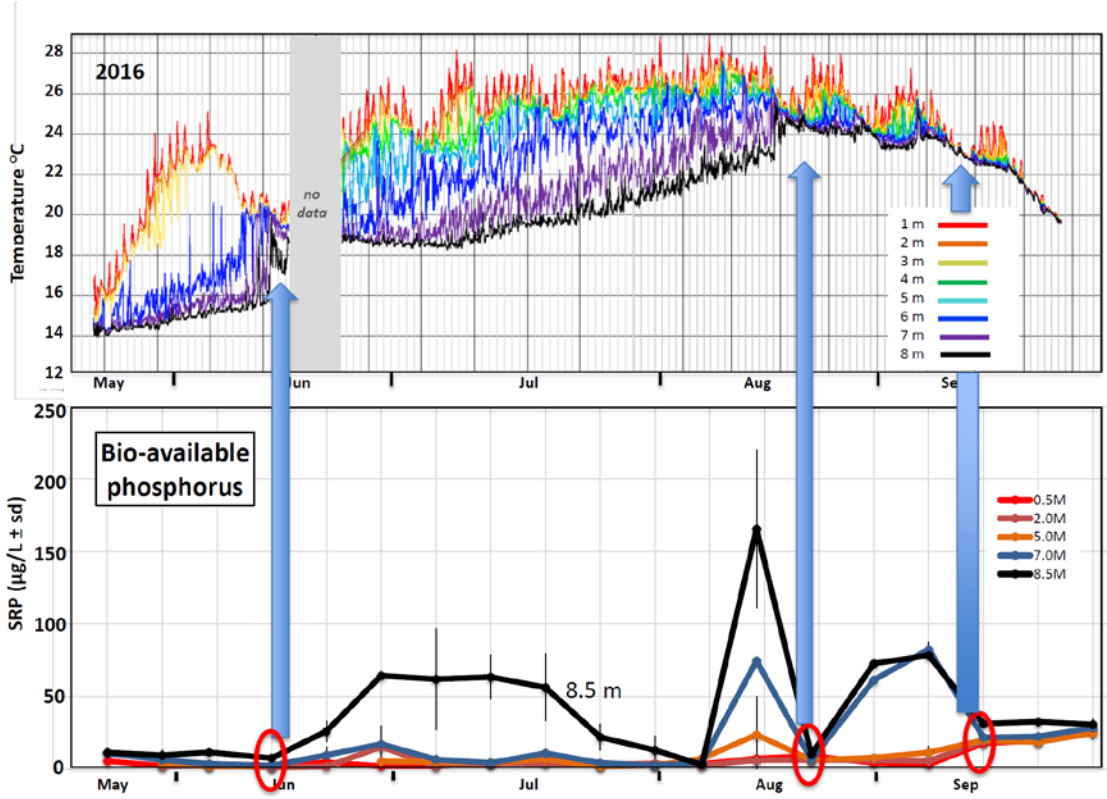
- Water column monitoring
  - Temperature & Dissolved Oxygen
  - Chlorophyll-a (algae level) top 5 m
  - Zooplankton & Phytoplankton
  - Phosphorus, Nitrogen, Iron & Sulfur samples 5 different water depths

- This data are currently being analyzed.

A few significant observations from the first two years of research are:

- The prevailing winds were out of the South or North aligned with the long axis of the lake.
- The amount of rainfall during 2016 was significantly below long-term averages.
- The amount of rainfall during 2017 was a record high for the last ~30 years.

- In 2016 the lake stratified (thermocline present) in May, destratified in an early June storm and restratified by June 20th and remained stratified until August 21st (two months)
- Normally the lake experiences strong wind generated vertical water column mixing events every few
- Weeks during the summer (i.e.Polymictic Lake) because it is realtively shallow (9m/30ft.)
- The impact of the 2-month stratification period is showed graphically below along with the corresponding trends of soluble reactive phosphorus (SRP):




During the two-month time (mid-Jun to mid-Aug) when the lake was stratified, SRP released from the bottom sediments under anoxic (no dissolved oxygen) conditions built up to a high level at 8.5 m during July.

Then in late July/early August the SRP declined to almost zero at 8.5 m. Normally, the SRP level at the bottom would be expected to build up and remain at a high level until a strong wind or cold rain caused a vertical water column mixing event.

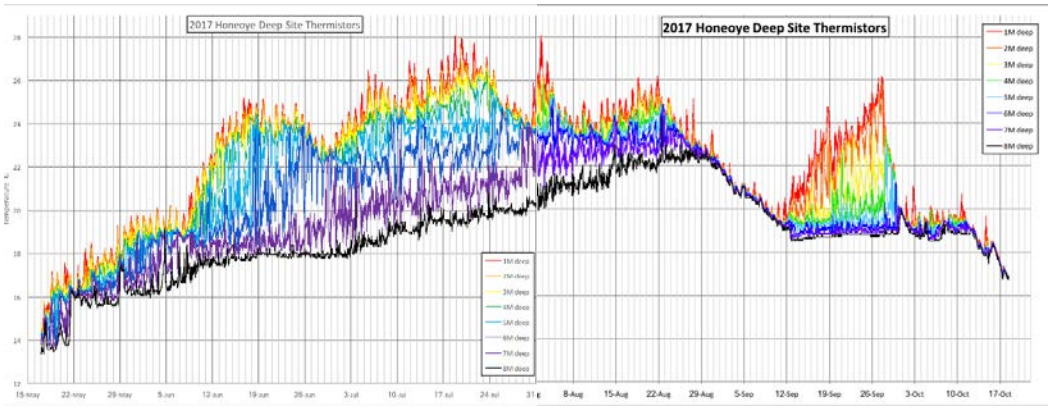
The research team's hypothesis as to how the SRP at 8.5 m was transported to the surface in Late July/early August is that the prevailing winds from the North and South caused the thermocline to rock (under water seiches) along a North/South axis.

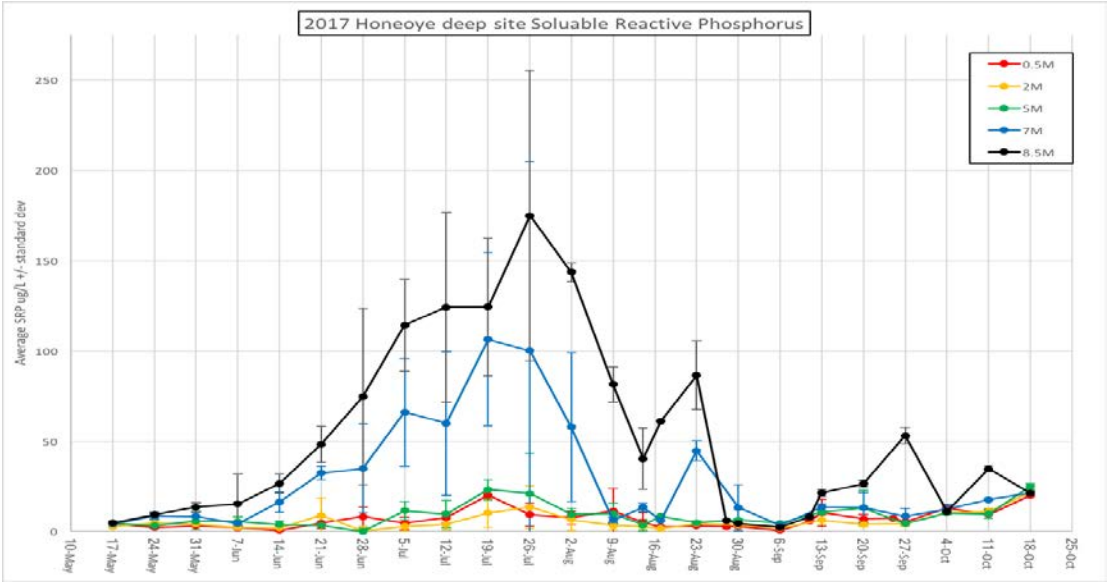
Basically, the wind generated under water waves that disturbed the water causing mixing of the water above the thermocline with surface water. The waves can be seen in the top graph as fluctuating water temperatures at 6m and 7 m. Additional data collection will be made in the summer of 2018 to try and confirm this as the transport mechanism.

On August 21st, 2016 there was ¾'s of an inch of cold rain and strong winds causing a complete vertical

water column mixing event. By August 21st the SRP at 8.5 m had built up to its peak high for the summer. A few days later the SRP 8.5 m was almost zero indicating it had complexly mixed vertically in the water column. This would be the expected outcome of a complete vertical mixing event.

**2017 showed a similar pattern of underwater seiches and mixing events:**




In 2018 Cornell University will create a complete computer model of Honeoye Lake using the "CE-QUAL-W2" platform based on all the data collected during 2016 and 2017. Additional water quality data will be collected in 2018 to validate the lake model. Then various legacy nutrient mitigation strategies will be modeled to gauge how effective they would be for Honeoye Lake.

The objective of this 3-year research project is to determine if the legacy nutrients in the bottom sediments play a significant role in fueling the lake's blue-green algae blooms in late summer. Preliminary results indicate that the legacy nutrients in the lake bottom sediments do significantly contribute to the lake's blue-green algae blooms. Although there are also external nutrient inputs from the watershed, input from legacy nutrients in the bottom sediments was sufficient to account in 2016 (a dry year) for between 68% to 100%, and 2017 (a wet year) 41% to 78%, of the phosphorus in the surface lake phytoplankton during July-September. Specific mitigation strategies will be recommended to the HLWTF in 2018.

# Taking A Closer Look
# At How Nitrogen Promotes Harmful Algal Blooms On Honeoye Lake

By Dr. Roxanne Razavi, SUNY-ESF

**Figure 1.** Harmful algal blooms were frequent on Honeoye Lake in 2017. Credit: Dr. R. Razavi

## Harmful algal blooms, a complicated but important problem

In the last ten years, Honeoye Lake residents have unfortunately become very familiar with large blooms of cyanobacteria, commonly referred to as 'blue green algae' that occur in the summer months and disrupt recreational uses of this beautiful lake (**Figure 1**). Some of these blooms can produce toxins that are a risk to the health of humans, pets, and wildlife. Blooms are referred to as harmful algal blooms, or HABs for short, when they produce toxins or severely limit the amount of oxygen available for aquatic life.

Lake scientists (aka limnologists) know that excess nutrients are in part responsible for HABs. Finding a solution to this problem, however, requires a mechanistic understanding of how nutrients influence HABs, and this is where things can get complicated.

## Why research nitrogen?

**Figure 2.** This photograph showing algal blooms present on the side of a lake where phosphorus was added compared to where it was not, was instrumental in proving the role of nutrients in harmful algal bloom occurrence. Credit: iisd.org

Since the famous whole lake nutrient addition experiments took place in the Experimental Lakes Area in Canada in the 1970s, (**Figure 2**) phosphorus has been the focus of many actions aimed at reducing the occurrence of HABs and excess plant and algal growth in lakes. Reductions in phosphorus in detergents and effluents of wastewater treatment plants and other point sources were effective in reducing HABs in the years after that landmark experiment.

However, since the late 1990s and early 2000s, HABs have come back with a vengeance, with an important difference from the blooms decades earlier. Specifically, there has been a shift in the species that dominate many of the HABs we see today. *Microcystis* species (**Figure 3**) are often the dominant phytoplankton of HAB events as seen in Lake Erie as well as in lakes in the northeast and as far away as China. Unlike some cyanobacteria, *Microcystis* are not capable of *nitrogen fixation*, which is the process of converting the unlimited nitrogen gas available in the atmosphere into a usable form of energy for these cyanobacteria. This means current blooms of *Microcystis* must get their nitrogen from sources already in the lake. Nitrogen enters a lake just like phosphorus, from the watershed or from releases from *sediments*, the mud at the bottom of the lake. So, a key part of finding a solution to HABs will be to understand how much nitrogen is in the lake that could be used by non-nitrogen fixing species like *Microcystis*.

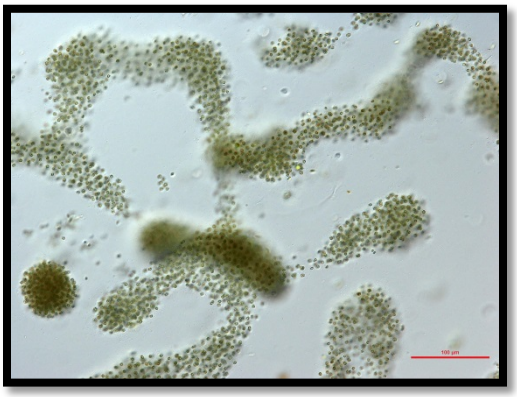


**Figure 3.** *Microcystis* species. Photo credit: J. D. Wehr, Fordham University retrieved from https://www.epa.gov/nutrient-policy-data/cyanobacteriacyanotoxins.

**Different forms of nitrogen and processes that affect their occurrence** There are different *forms*, or types of nitrogen present in the water. Inorganic (without carbon) forms of nitrogen include nitrate ($NO_3^-$) and nitrite ($NO_2^-$). Organic forms of nitrogen include ammonium ($NH_4^+$) and urea. Ammonium is the form of nitrogen that cyanobacteria like *Microcystis* will preferentially consume. When all the ammonium is used up, plankton will then use urea, and then finally turn to nitrite and nitrate, which can be converted in the cell to ammonium. Few monitoring studies measure all these forms of nitrogen, especially the forms like ammonium that are so important for the plankton but are present in very low concentrations.

There are many processes that convert one form of nitrogen to another in the lake. One important process is called *denitrification* (**Figure 4**). This is how a lake naturally loses excess nitrogen, just as the human body releases excess nitrogen as waste. Denitrification is the loss of $N_2$ gas out of the lake and back to the atmosphere. When $N_2$ gas is formed, it reduces the nitrogen available for phytoplankton to use in the lake. If a lake has a low denitrification rate, nitrogen can build up and fuel the occurrence of HABs.

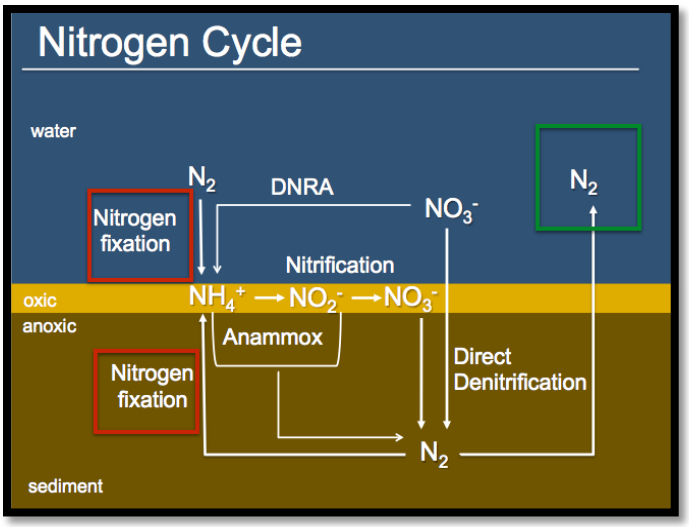



**Figure 4.** The nitrogen cycle is complex. Two key processes are the nitrogen loss mechanism called denitrification, which is how the lake naturally loses excess nitrogen as $N_2$ gas is released back to the atmosphere (green box). Another is nitrogen fixation, which keeps nitrogen in the lake (red boxes). Image modified from S. Newell.

## Collaboration between Finger Lakes Institute and Wright State University to measure nitrogen in Honeoye Lake

Dr. Mark McCarthy and Dr. Silvia Newell at Wright State in Dayton, OH, are two experts in nitrogen biogeochemical cycling and HABs. Facilitated by grants from the Ontario County Water Resources Council (2016, 2017) and the Great Lakes Research Consortium (2017), myself, Dr. Lisa Cleckner, and a team of FLI staff and undergrads have been working with Terry and Dorothy Gronwall to measure different nitrogen forms in the lake on a weekly basis. Samples of nitrogen species in the water have been collected in the *epilimnion* (i.e., surface waters) and *hypolimnion* (i.e., bottom waters) at 4 offshore locations on the lake. Four nearshore sites have also been sampled at the surface only.

In addition to measuring the different forms of nitrogen, McCarthy and Newell and their graduate student, Justin Myers, have conducted controlled lab experiments on sediments from Honeoye Lake to measure the rates of transformation between the different nitrogen forms. These findings will lead to a better understanding of how quickly nitrogen is lost (via denitrification) or gained (via nitrogen fixation) in the lake sediments and water column.

## Findings to date:

Analysis of the large amount of data collected in the last two summers on Honeoye Lake is still ongoing. However, the preliminary findings below are helping us better understand the role of nitrogen in contributing to HAB events in the lake.

### Finding #1. Sediments are a source of bioavailable nitrogen and phosphorus to Honeoye Lake

Concentrations of nutrients that can easily be used by cyanobacteria including the biologically preferred organic forms of nitrogen - urea and ammonium - and soluble reactive phosphorus, were released in high concentrations from sediments. This shows that Honeoye Lake's HABs can be fueled from the nutrients that are already available in the lake.

### Finding #2. Significant differences in nutrient concentrations occur between non-*Microcystis* and *Microcystis* dominated blooms in 2016

In 2016, surface water phosphorus (soluble reactive phosphorus, SRP) and bottom water urea concentrations were significantly different between the non-*Microcystis* (i.e., *Anabaena*) and *Microcystis* dominated bloom periods. A large rain storm occurred between these periods resulting in a mixing of the water column and a release of nutrients that had been building up in the bottom waters of the lake from the sediments into surface waters. This increase in both the bioavailable forms of phosphorus and nitrogen is contributing to the blooms of non-nitrogen fixing *Microcystis* on Honeoye Lake.

### Finding #3. Natural nitrogen removal from Honeoye Lake sediments is low

Experimental results showed that there is not enough nitrate in Honeoye Lake sediments for denitrification to occur, which limits the natural removal mechanism of nitrogen from Honeoye Lake). Adding to this, calculations of the gains of nitrogen into the sediments (i.e., nitrogen fixation rates) were also high. This means that the conditions in Honeoye Lake sediments facilitate more nitrogen formation that can be used by cyanobacteria that form HABs, ultimately resulting in a buildup of nitrogen in the sediments.

## Next Steps

Water column sampling and sediment core incubations will occur in 2018. These are necessary to understand the impact of different weather events including spring and summer rain, summer temperatures, and wind events on the occurrence of HAB events and the types of cyanobacteria that comprise the blooms.

Future work may also include the incubation of sediment cores with water collected from streams entering Honeoye Lake and with other external nutrient sources.

## Water Quality Improvement Grants (WQIP) in the Honeoye Lake Watershed

*Ditch plug and pothole wetland installed at the Honeoye Inlet Restoration Project site facing east from CR 36. Photograph: Megan Webster.*

2017 enhancement work at the Honeoye Inlet Restoration Project has been completed with the installation of ditch plugs and wetland features.

The work is intended to intercept the flow of stormwater from drainage ditches running from the roadsides to the Honeoye Inlet. By blocking the drainage ditches, stormwater is slowed and spread out over a larger surface area, allowing for sediment and associated nutrients to drop out of the water.

Pothole wetlands, small areas of ponding water below the ditch plugs, help to control large volumes of stormwater and aid in meeting the overall project objectives: to slow down the stormwater, increase treatment areas and provided enhanced habitat for wildlife.

The Nature Conservancy has been conducting ongoing water quality and species diversity monitoring throughout the past year. We look forward to observing the positive impacts from this project in the years to come.

*Photograph By Megan Webster: Sediment trap installed in steep roadside ditch:*

This photo from Cayuga County shows an example of a pre-fabricated concrete sediment trap. These traps allow easy maintenance for cleaning out accumulated material from drainage ditches and prevent culverts from clogging.

A number projects in the Honeoye Lake Watershed, funded through WQIP grants, are on track for installation in 2018. Pre-fabricated sediment traps (see photo above) are planned for multiple locations along County Road 36 to aid in maintaining drainage. Debris guards are planned for Cratsley Gully culverts upstream of County Road 36 that should aid in stopping large debris from blocking culverts and ultimately leading to flooding. Ontario County will be partnering with Finger Lake Community College and NYS DEC to provide a workshop on forestry BMPs along with installation of a few highlighted BMPs to aid in sediment and nutrient reduction.

## **SAVE THE DATE**

**April 17th 2018, 6-8:30PM, FLCC Muller Field Station (6455 County Road 36 Honeoye, NY 14471)**

**A Workshop on Best Management Practices to Manage Your Forest.**

- Thinking about having your timber harvested?
- Wondering what you can do to protect your driveway and forest road from eroding?
- Concerned about invasive species like Hemlock Woolly Adelgid, Emerald Ash Borer and Oak Wilt?
- Come join us to learn more about Forestry Best Management Practices and what is happening in the Honeoye Lake Watershed.