Notes from Dr. Gilmans report 9/14/2010

Formed at the end of the Ice Age, Honeoye Lake sits at the bottom of a much larger glacially scoured valley.

At just over four miles in length and ¾ mile in width, Honeoye Lake has the second smallest surface area of the eleven Finger Lakes.

With a maximum depth of 30 feet, Honeoye Lake is the shallowest of the Finger Lakes and contains the smallest volume of water.

On average, water molecules move through the lake and down the outlet in 300 days. This is by far the fastest flushing rate of all the Finger Lakes, and it is not affected by the outlet weir blade which simply stabilizes the lake level.

In late July 2010, water bodies across our region experienced successive blooms of cyanobacteria. These included all major Lake Ontario Bays especially Sodus Bay that was featured in several news releases, Waneta and Lamoka Lakes, Conesus Lake, Cayuga Lake, Canandaigua Lake, and Hemlock Lake.

These cyanobacteria species appeared in Honeoye Lake this summer.

- First, *Gleotrichia*
- Second, *Microcystis*
- Third, *Anabaena* (we also had a significant shoreline mat of the green alga, *Hydrodyction reticulatum*)

What are cyanobacteria? And why be concerned about them?

Why have cyanobacteria become more common across our region? One contributing factor may involve this invasive species. Zebra mussels, first detected in Honeoye Lake on May 30, 1998 by me, selectively feed on the "tasty" algae and regurgitate the distasteful cyanobacteria as a pseudo-fecal pellet back into the water. Since 1998, cyanobacteria have made up a larger and larger percentage of the phytoplankton community. If environmental conditions are right, cyanobacteria populations can "bloom" and have huge densities in the surface water. (By 2002, zebra mussels already had a littoral zone density of 1547/m², based on four sites and three depths at each site)

What influences the growth of cyanobacteria? In the simplest sense, these organisms respond to warm water (hot summer days), sun light, the nutrient phosphorus and calm, stagnant water conditions.

Honeoye Lake temperatures peaked at 87□C in late July, we had many cloudless summer days, phosphorus was added to the water in runoff associated with several intense storm

events, and these were followed by several long intervals of calm stagnant water conditions.

Weather data from the Honeoye Wastewater Treatment Plant demonstrates the unusual climatic conditions during the summer of 2010. Monthly temperatures exceeded the long-term average, rainfall exceeded the long-term average, and storm intensity was localized and torrential. On the late afternoon of July 13, a storm at the southern end of the Honeoye Lake watershed delivered over 4 inches of rain in just 30 minutes! The north end of the lake only received ¼ of an inch during this same event.

When storm intensities exceed the ability of the soil to absorb the rainfall, runoff results. Even land cover that is regarded as desirable in terms of erosion prevention will be subject to high runoff rates. Soil particles, organic matter and soluble nutrients will enter streams and flow to the lake.

I'll finish my presentation by introducing the phosphorus cycle for Honeoye Lake.

To manage the nutrient budget of Honeoye Lake, we have to consider all the ways that nutrients enter the lake, and try to control those ways, as well as consider activities that we can undertake to remove or inactivate phosphorus that is already in the lake. The lake has a nutrient cycle similar to your home vegetable garden. There is a large supply of nutrient already present in the soil, or in the lake's case, in the bottom substrate. I completed a bottom coring research study a few years ago that scientifically documented the total phosphorus, and the portion of it that is readily available, in 33 different locations along the lake bottom. We collectively call this phosphorus the "legacy phosphorus".

Our cores were deep enough to reach back in time 300 years. There is a large amount of nutrient stored in the deep lake sediment that will return to the water when the dissolved oxygen levels near the bottom are low. We call this part of the nutrient cycle the internal loading because it originates within the lake. The alum application was designed to reduce the amount of internal loading.

Returning to the vegetable garden analogy, if we find poor plant growth in our garden, we may choose to enhance our crop growth by adding fertilizer to the soil. Similarly, we know that certain watershed activities will enhance the delivery of nutrients to Honeoye Lake, whether it comes through a flowing tributary stream or directly across the landscape. We call this portion of the nutrient cycle the external loading.

The intensity of storm events, combined with the total rainfall in the event, influences greatly how much runoff occurs and the quantities of eroded soil and nutrients moving to the lake. The impacts of human activities in the watershed are also important. We have completely mapped all of the human land use patterns and natural land cover features in the watershed, and these have been used to predict the potential for nutrient pollution to

the lake. What is difficult to predict is the frequency of severe storms. We have also sampled tributary streams during periods of storm runoff and our now working on a State sponsored inventory of the streams to identify locations where stream banks need to be stabilized.

Managing the nutrient budget of any lake is complex; everyone needs to be involved and supportive of the multiple measures that are required. Gut reactions, exaggeration of situations and untruths about management activities will distract us from our common goal of restoring lake health. As a scientist, I realize that there are still many things that we need to learn about the functioning of Honeoye Lake. There will be no "silver bullet", no quick and simple cure for the lake conditions we often see in the late summer. But through multiple techniques, like removing nutrients from the lake in the form of mechanically harvested weeds, chemically binding nutrients in the deep sediment, improving stormwater management, and encouraging people to use only phosphorus-free fertilizers on their lawns, we may effectively begin to manage the nutrient budget.

Harmful algal blooms are complex, multi-faceted problems which are inherently difficult to understand, predict or solve. They are not a recent phenomena in Honeoye Lake…