

## MEMORANDUM

To: Mr. Paul Johnson, Council Member, Town of Southeast  
cc: Mr. John J. Dunford, Supervisor, Town of Southeast  
Ms. Chris Krupka, Princeton Hydro, LLC  
From: Fred S. Lubnow, Ph.D., Princeton Hydro, LLC  
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Subject: Project report on Lake Tonetta stormwater sampling program  
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In 2005 the Town of Southeast, Putnam County, New York was awarded a County grant to develop a stormwater monitoring program that could be used to quantify the non-point source (NPS) pollutant loads entering Lake Tonetta from storm-based surface runoff. This stormwater monitoring program included the following tasks:

- Purchase of an automated stormwater sampling unit (ISCO 3710 Sampling Units) that will allow the community to collect composited stormwater samples throughout the course of a specific storm event, to analyze water quality parameters of concern.
- Train local volunteers to set-up the automated sampling unit prior to a storm event and collect the stormwater samples after a storm event.
- Collect some stormwater samples with the sampling unit and have the samples analyzed for a variety of water quality parameters.

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- Provide an interpretation of the laboratory results of the collected stormwater samples.

This memorandum completes this project by providing an interpretation of the collected stormwater samples and also provides recommendations for future monitoring efforts.

A staff scientist from Princeton Hydro provided training to approximately 12 volunteers from the community surrounding Lake Tonetta. This training session occurred on 6 August 2005 and covered programming the automated sampler, the selection of appropriate sites for its placement and the retrieval of the stormwater samples.

The volunteers collected stormwater samples during three storm events in October, with the first occurring after an extended dry spell (approximately 2 months). Samples were collected with the ISCO sampling unit for nitrate-N, total phosphorus (TP), total suspended solids (TSS) and total petroleum hydrocarbons (TPH). In addition, grab samples were also collected during each sampling event for the analysis of fecal coliform.

Nitrate-N and TP are nutrients that stimulate algal and aquatic plant growth. Therefore, one of the long-term management goals in the protection and preservation of Lake Tonetta is to minimize its watershed-based nutrient loads.

While there are no formal water quality standards for nutrients in New York, there are some guidelines that can be followed. For example, for drinking water nitrate-N concentrations should be less than 10 mg/L, as per both US EPA and NYS DEC guidelines. In addition, in terms of avoiding nuisance algal blooms, it is generally accepted that in-lake nitrate-N concentrations should be less than 1 mg/L.

TP is typically the primary limited nutrient in lakes and ponds within the Mid-Atlantic section of the United States and this is certainly the case for Lake Tonetta. As the primary limiting nutrient, it takes very little phosphorus to stimulate a substantial amount of algae and aquatic plant growth. For example, one pound of phosphorus has the potential to generate up to 1,100 lbs of wet algae biomass. Thus, phosphorus loads entering Lake Tonetta need to be minimized whenever possible.

While there is no NYS DEC established stormwater or in-lake standard for phosphorus, it is generally recognized that TP concentrations greater than 0.03 mg/L can lead to highly productive conditions relative to algal growth. In addition, based on Princeton Hydro's in-house database on Mid-Atlantic waterbodies, TP concentrations greater than 0.06 mg/L typically result in conditions that are perceived by the layperson as being a nuisance or "scummy" relative to recreational use.

TSS is a measure of the amount of particulate material or "dirt" in the water. In general, TSS concentrations greater than 25 mg/L in a lake, under baseline (non-storm event) conditions, are typically perceived as "dirty" or "muddy" by the layperson.

TPH is a total measurement of the variety of petroleum compounds / products that originally come from crude oil. There is no distinct or targeted level for TPH; essentially, less is better due to its potential toxicological impacts on aquatic life.

However, consistently elevated concentrations may identify a local site of contamination that needs to be addressed.

Fecal coliform is a sub-group of coliform bacteria that are able to grow at an elevated temperature of 44.5°C and are commonly found in human and animal wastes. While these bacteria are not harmful themselves, they are indicator organisms for the possible presence of pathogenic (disease-causing) bacteria, viruses and protozoans that also live in human and animal digestive systems. Therefore, elevated fecal coliform counts may indicate sewage or animal waste contamination.

Lake Tonetta is identified as a Class “B” waterbody, where the monthly geometric mean for fecal coliform, from a minimum of five measurements, shall not exceed 200 colonies per 100 mLs. This standard is for standing waters, along a beach where contact recreational activities occur. The beach at Lake Tonetta is monitored through the course of the growing season for fecal coliform to ensure safe conditions for contact use. However, the 200 colonies per 100 mLs will be used as a reference for the collected stormwater samples.

Finally, it should be emphasized that the standards or guidelines described above, pertain to standing, surface waters and not stormwater. While there are no formal standards established for stormwater quality, the long-term goal should be to minimize the magnitude of the pollutant loads entering the lake, so in-lake water quality conditions do not degrade.

The first sampling event occurred on 9 October 2005, after a prolonged dry spell. For the 9 October sampling event, the ISCO sampling unit was located along the north end of the Lakeshore Drive near a huge culvert. This location is targeted for the installation of a stormwater retrofit sometime over the next year. The stormwater samples collected during the 22-23 October storm event were collected from the outflow leaving a Vortech stormwater structure located in the southwest section of the watershed. The 24-25 October storm event sampled a drainage swale off Lakeshore Drive. All data are provided in Table 1 and in Figures 1-5.

While all three stormwater nitrate-N concentrations were above the level to stimulate high rates of algal / aquatic plant growth, none were above the threshold for safe drinking water (Figure 1).

TP concentrations during the first two storm events were high; both being > 0.25 mg/L. The extremely high TP concentration of 0.31 mg/L measured during the 9 October sampling event may have been due to the prolonged dry spell. In the absence of rain, phosphorus from various sources (i.e. fertilizers, disturbed soils, pet wastes and wildlife droppings) accumulates in the watershed and the first substantial storm can wash this material into a receiving waterbody within a relatively short period of time. This “first flush” typically contains the highest pollutant concentrations relative to surface runoff generated during later portions of the storm. Thus, even though the ISOC sampling unit collected composited samples over the course of 24 hours, the particularly prolonged dry period, coupled with how the storm progressed, may have extended the first flush over the majority of the sampling period. In any event, such conditions at least partially

account for the elevated TP, and other pollutants, concentrations measured during the 9 October storm event.

In contrast to the first two storm events, the TP concentration measured during the third storm event was less than the nuisance bloom threshold of 0.06 mg/L (Figure 2). The swale the stormwater flowed through may have contributed toward reducing these pollutant loads prior to it entering the lake.

TSS concentrations during the three storm events were below the 25 mg/L threshold, with the 9 October storm event having the highest concentration (Figure 3). Again, this was attributed to the prolonged dry spell preceding the storm event. The Vortechincs structure is designed to remove particulates (TSS) and floatable debris / material from stormwater and based on the stormwater leaving the structure (22-23 October storm event), it has the capacity to remove a substantial amount of solids. The TSS concentration from the 22-23 October storm event was less than 5 mg/L.

The Vortechincs structure also appears to be relatively effective at removing TPH, since its concentration in the outflow stormwater was less than 2 mg/L (Figure 4). In contrast, during the 24-25 October storm event, the TPH concentration was slightly greater than 26 mg/L.

Two of the three storm events had fecal coliform counts in excess of the 200 colonies per 100 mL threshold (Figure 5; Table 1). Again, the extremely high fecal coliform measurement for the 9 October 2005 more than likely reflected the prolonged dry period prior to the storm event. Stormwater leaving the Vortechincs unit also had high fecal coliform counts. The Vortechincs retrofit is not designed to reduce fecal coliform, so substantial reductions of this pollutant were not expected.

### ***Conclusions and Recommendations***

- There was an extreme amount of variability in the magnitude of storm runoff pollution entering lake from various locations throughout the watershed.
- The north end storm event sampling location (9 October) had the highest TP, TSS and fecal coliform concentrations. A stormwater retrofit is scheduled to be installed at this site sometime over the next year, which will aid in reducing the TP and TSS loads entering Lake Tonetta. Thus, this location should be re-sampled after the retrofit is installed to evaluate its efficiency.
- Based on stormwater data collected on 22-23 October, the Vortechincs unit appears to be effective at minimizing the TSS and TPH loads entering the lake. In contrast, nitrate-N, TP and fecal coliform concentrations were high in the outflow leaving the Vortechincs. This stormwater retrofit is not designed to reduce nitrate-N and fecal coliform concentrations, however, it can provide a certain degree of TP removal if a large portion of the TP is adsorbed onto sediment particles. It is possible that a large part of the phosphorus moving through the Vortechincs unit was in a dissolved state (i.e. fall lawn fertilizers).

- For 2006 stormwater monitoring efforts of the Vortechincs unit, stormwater should be collected before it enters the retrofit. The ISCO sampler should still be installed at its outflow, but a few discrete samples should be manually collected and composited to assess the magnitude of the pollutants entering the Vortechincs unit. This will allow for a direct comparison between inflow and outflow concentrations to calculate percent removal rates for each pollutant.
- The drainage swale sampled during the 24-25 October storm event had consistently low pollutant concentrations, with the exception of TPH. An on-site survey should be conducted to determine if parking lot runoff flows through this swale. The swale should also be re-sampled next year to determine if the slightly elevated TPH is a sustained problem that needs to be addressed.
- Between 4 and 6 storm events should be sampled with the ISCO sampler in 2006. If four storm events are to be sampled, they should occur in the spring (2) and fall (2). If six storm events are to be sampled, the two additional events should be in the summer (2). A more detailed stormwater database will provide a means of determining if the magnitude of the pollutant loads varies with season.
- Any sampling of the Vortechinc units, or any stormwater retrofit, should include the collection of samples above and below the structure. This will provide a means of assessing the rates of pollutant removal.
- In general, overall stormwater loads entering Lake Tonetta during the October 2005 sampling events were not consistently high throughout the watershed. Based on these data, the pollutants of primary concern should be TP and fecal coliform, while the pollutants of secondary concern should be TSS and TPH. Nitrate-N concentration in the stormwater was not particularly high. Thus, based on existing budgetary constraints, nitrate-N should be considered an optional pollutant for laboratory analysis.

If you have any questions or comments on this report, please feel free to contact either me or Ms. Chris Krupka at our Ringoes office at 908-237-5660. A proposal for 2006 consulting services will be emailed to you shortly. Thank you for your time and for selecting Princeton Hydro for your environmental needs.