

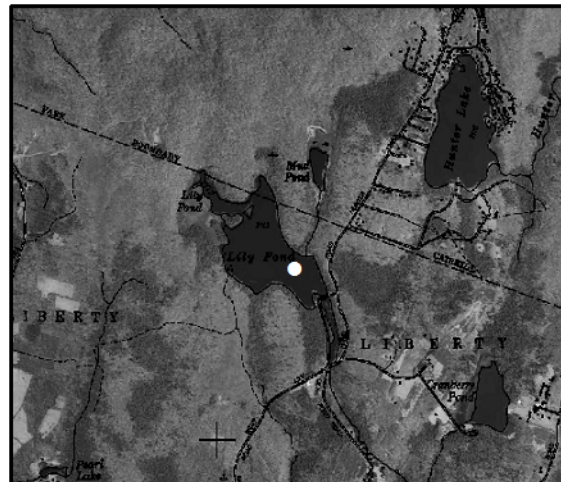
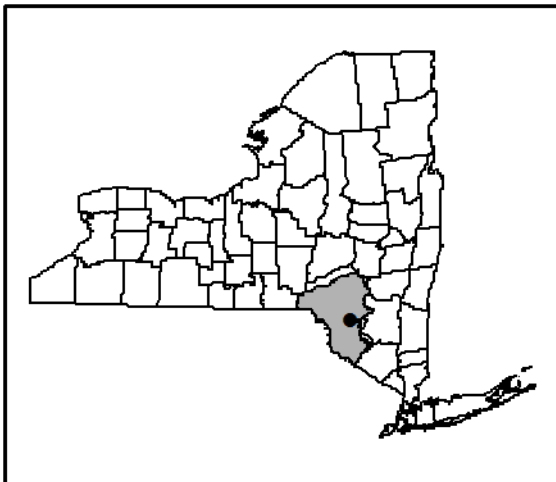
LCI Lake Water Quality Summary

General Information

| | |
|--------------------------------------|--|
| Lake Name: | Lily Pond |
| Location: | Town of Liberty, Sullivan County, NY |
| Basin: | Delaware River Basin |
| Size: | 31.1 hectares (= 77 acres) |
| Lake Origins: | man made |
| Major Tributaries: | minor unnamed tributary from Mud Pond |
| Lake Tributary to?: | Beaver Kill via a minor unnamed tributary |
| Water Quality Classification: | AA (best intended use: potable water) |
| Sounding Depth: | 8.5 meters (= 28 feet) |
| Sampling Coordinates: | Latitude: 41.88513, Longitude: -74.74387 |
| Sampling Access Point: | hand launch off causeway separating basins |
| Monitoring Program: | Lake Classification and Inventory (LCI) Survey |
| Sampling Date: | July 29, 2009 |
| Samplers: | Scott Kishbaugh, NYSDEC Division of Water, Albany Dan Hayes, NYSDEC Division of Water, Albany |
| Contact Information: | Scott Kishbaugh, NYSDEC Division of Water sakishba@gw.dec.state.ny.us ; 518-402-8282 |

Lake Map

(sampling location marked with a circle)



Background and Lake Assessment

Lily Pond is small waterbody north of the City of Liberty in Sullivan County, New York. The pond is used as the source of drinking water for the Village of Liberty, precluding access for other uses. The shoreline and watershed for the pond are almost completely forested and enclosed by fences; a small portion of the northern shoreline of the lake is found within the Catskill Park Blue Line.

Lily Pond was included in the NYSDEC Division of Water's 2009 Lake Classification Inventory (LCI) survey in the Delaware River Basin. Inclusion in the LCI's screening year (single sample) was based on a lack of water quality information from the pond in the Division of Water's database. There were no indications of water quality problems that would require additional sampling during the summer of 2010.

Lily Pond can generally be characterized as *mesoeutrophic*, or moderately to highly productive. The water clarity reading (TSI = 50, typical of *mesoeutrophic* lakes) was lower than expected given the phosphorus reading (TSI = 42, typical of *mesotrophic* lakes), but was in the expected range given the chlorophyll *a* reading (TSI = 50, typical of *mesoeutrophic* lakes). These data suggest that baseline nutrient levels do not support persistent algae blooms, but there may tend to be slightly elevated algae levels in the pond during the summer.

The pond water appeared to have a brownish tint which was typical for other lakes in the area and may come from weak or organic acids (tannins) that enter the lake through the watershed. Several native plant species were observed in the lake and included: *Nuphar sp.* (yellow water lily), *Brasenia schreberi* (water shield), and *Sparganium sp.* (bur-reed). Water lilies and water shield were observed at many of the lakes sampled in the Delaware River Basin, and these plants are typical of slightly colored lakes. A more thorough plants specific survey would be need to completely rule out the existence of invasive plant species.

Lily Pond exhibits thermal stratification, in which depth zones (warm water on top, cold water on the bottom during the summer) are established, as in most NYS lakes great than six meters in depth. The thermocline in the lake was in the three to four meter depth range. The entire hypolimnion (bottom waters) were anoxic (devoid of oxygen) at depths below five meters. This is typical of water bodies with elevated chlorophyll *a* (algae levels) and was common among other lakes sampled in the area. pH readings indicate acidic waters with the surface reading falling below the state's minimum guidance value. Low pH values were typical for waterbodies in the northern part of Sullivan County, and was probably due to acid deposition and the naturally low buffering capacity these waterbodies have due to the thin underlying soil layers. Conductivity readings indicate soft water, which was typical of other lakes sampled in the Delaware River.

Lily Pond appears to be typical of softwater, weakly colored, acidic lakes. Other water bodies with similar water quality characteristics often support warmwater fisheries, although fisheries habitat cannot be fully evaluated through this monitoring program (and the lake is not used for fishing). Coldwater fisheries may not be supported, given the lack of cold water and high oxygen refugia necessary to protect any salmonids or aquatic life susceptible to high summer temperatures.

Total phosphorus levels were low in the surface waters but elevated in the bottom waters. This can be observed in other waterbodies experiencing oxygen deficits in the bottom waters, as the anoxic conditions allow phosphorus bound in the sediments to be released into the water column. Ammonia levels were slightly elevated in the bottom waters which can be indicative of oxygen deficits. The nitrate levels in the bottom waters were below the laboratory detection limit and would not suggest persistent oxygen deficits. Iron levels were also elevated in the bottom waters, and are sufficiently high to exceed the state's drinking water standard and may cause taste or odor problems. Chloride and other ions exhibited low levels, indicating little impacts from road salting or other signs of stormwater runoff through developed areas. This is typical for waterbodies in highly forested watershed.

Evaluation of Lake Condition Impacts to Lake Uses

Potable Water (Drinking Water)

Lily Pond is classified for potable water use and is currently being used for this purpose. LCI data are not sufficient to evaluate potable water use. The data collected through the LCI indicated that pH levels in the surface and bottom water may lead to problems with managing the water supply. In addition, deep water withdraws may also be impacted by the elevated iron levels.

Contact Recreation (Swimming)

Bacteria data are needed to evaluate the safety of Lily Pond for swimming- these are not collected through the LCI but may be collected by the village. While swimming is not allowed on the pond, the data collected through the LCI did not indicate any issues that would prevent the pond from being used for swimming. The water clarity was above the State Department of Health's guidance value of 1.2 meters to protect the safety of swimmers.

Non-Contact Recreation (Boating and Fishing)

Boating and fishing are not permitted on the pond; however, the data collected through the LCI did not indicate any stressors to these uses.

Aquatic Life

Low pH and anoxic conditions may stress some aquatic life, particularly those susceptible to high summer temperatures. Additional biological studies would need to be conducted to fully evaluate impacts to aquatic life.

Aesthetics

These data did not indicate any water quality related issues that would impact the aesthetics of the pond.

Additional Comments

- Periodic surveillance for invasive exotic plant species may help to prevent the establishment and spread of any new invaders, given the escalating problems with exotic aquatic weeds.

Aquatic Plant IDs

Exotic Plants:

None

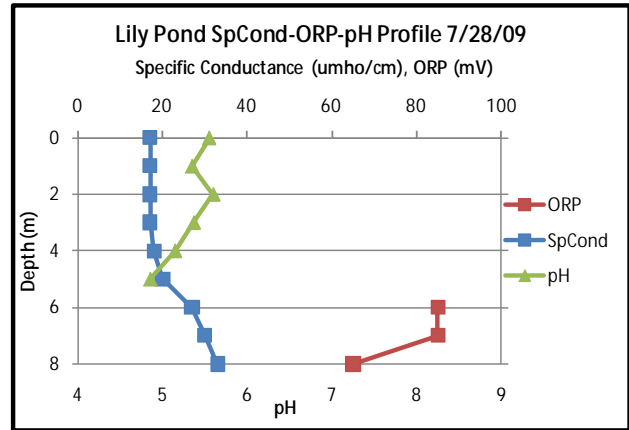
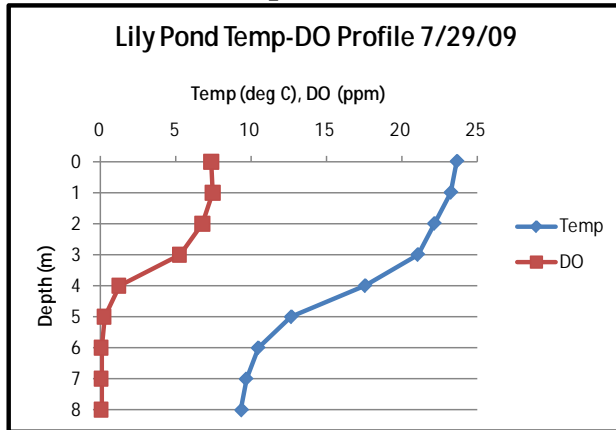
Native Plants:

Nuphar sp. (yellow water lily)

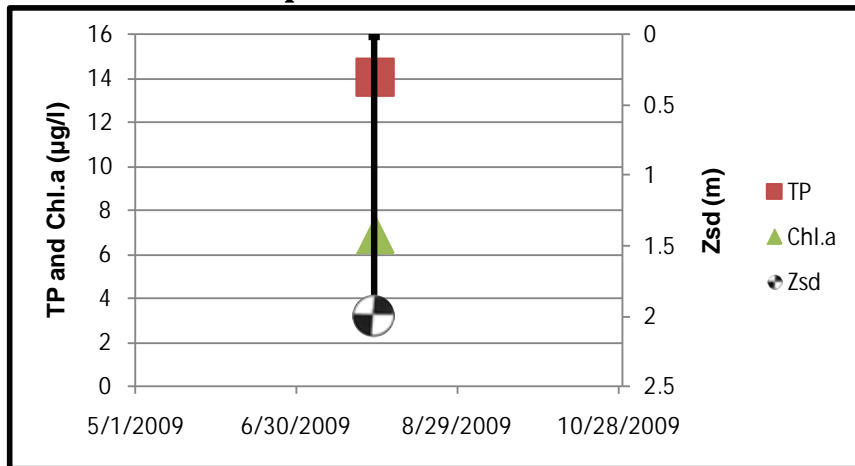
Brasenia schreberi (water shield)

Sparganium sp. (bur-reed)

Time Series: Depth Profiles



Time Series: Trophic Indicators



WQ Sampling Results

Surface Samples

| | UNITS | Reading | Scientific Classification | Regulatory Comments |
|------------|--------|---------|-----------------------------------|--|
| SECCHI | meters | 2 | Mesotrophic | Readings does not violate DOH guidance value |
| TSI-Secchi | | 50.0 | Eutrophic | No pertinent water quality standards |
| TP | mg/l | 0.0141 | Mesotrophic | Readings does not violate DEC guidance values |
| TSI-TP | | 42.3 | Mesotrophic | No pertinent water quality standards |
| TSP | mg/l | 0.0037 | Little available phosphorus | No pertinent water quality standards |
| NOx | mg/l | ND | Low nitrate | Readings violate guidance |
| NH4 | mg/l | 0.026 | Low ammonia | Reading does not violate guidance |
| TKN | mg/l | 0.29 | Low organic nitrogen | No pertinent water quality standards |
| TN/TP | mg/l | 44.94 | Phosphorus Limited | No pertinent water quality standards |
| CHLA | ug/l | 6.9 | Mesotrophic | No pertinent water quality standards |
| TSI-CHLA | | 49.5 | Mesotrophic | No pertinent water quality standards |
| Alkalinity | mg/l | <2 | Poorly Buffered | No pertinent water quality standards |
| TCOLOR | ptu | 35 | Highly Colored | No pertinent water quality standards |
| TOC | mg/l | 6 | | No pertinent water quality standards |
| Ca | mg/l | 1.76 | Does Not Support Zebra Mussels | No pertinent water quality standards |
| Fe | mg/l | 0.169 | | Reading does not violate water quality standards |
| Mn | mg/l | 0.0498 | | Reading does not violate water quality standards |
| Mg | mg/l | 0.27 | | Reading does not violate water quality standards |
| K | mg/l | 0.126 | | No pertinent water quality standards |
| Na | mg/l | 1.03 | | Reading does not violate water quality standards |
| Cl | mg/l | 2 | Little impact from road salt | Reading does not violate water quality standards |
| SO4 | mg/l | 3.3 | | Reading does not violate water quality standards |

Bottom Samples

| | UNITS | Reading | Scientific Classification | Regulatory Comments |
|---------------|-------|---------|-----------------------------------|---|
| TP-bottom | mg/l | 0.0348 | Elevated deepwater phosphorus | No pertinent water quality standards |
| TSP-bottom | mg/l | 0.0082 | Little available phosphorus | No pertinent water quality standards |
| NOx-bottom | mg/l | ND | No evidence of DO depletion | Reading does not violate water quality standards |
| NH4-bottom | mg/l | 0.291 | Evidence of DO depletion | Readings does not violate water quality standards |
| TKN-bottom | mg/l | 0.65 | | No pertinent water quality standards |
| Alk-bottom | mg/l | 4.8 | Poorly Buffered | No pertinent water quality standards |
| TCOLOR-bottom | ptu | 80 | Highly Colored | No pertinent water quality standards |
| TOC-bottom | mg/l | 7.2 | | No pertinent water quality standards |
| Ca-bottom | mg/l | 2.29 | Does Not Support Zebra Mussels | No pertinent water quality standards |
| Fe-bottom | mg/l | 2.48 | Taste or odor likely | Reading violates water quality standards |

Bottom Samples (continued)

| | UNITS | Reading | Scientific Classification | Regulatory Comments |
|------------|-------|---------|---------------------------|---|
| Mn-bottom | mg/l | 0.123 | | Reading does not violate water quality standards |
| Mg-bottom | mg/l | 0.305 | | Reading does not violate water quality standards |
| K-bottom | mg/l | 0.201 | | |
| Na-bottom | mg/l | 1.16 | | Reading does not violate water quality standards |
| Cl-bottom | mg/l | 2.2 | | Readings does not violate water quality standards |
| SO4-bottom | mg/l | 2.1 | | Readings does not violate water quality standards |

Lake Perception

| | UNITS | Reading | Scientific Classification | Regulatory Comments |
|-------------------------|-------------|---------|------------------------------|--------------------------------------|
| WQ Assessment | 1-5, 1 best | 3 | Definite Algal Greenness | No pertinent water quality standards |
| Weed Assessment | 1-5, 1 best | 2 | Plants Visible Below Surface | No pertinent water quality standards |
| Recreational Assessment | 1-5, 1 best | 2 | Excellent for Most Uses | No pertinent water quality standards |

Legend Information

General Legend Information

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|-----------------|--|
| Surface Samples | = integrated sample collected in the first 2 meters of surface water |
| Bottom Samples | = grab sample collected from a depth of approximately 1 meter from the lake bottom |
| SECCHI | = Secchi disk water transparency or clarity - measured in meters (m) |
| TSI-SECCHI | = Trophic State Index calculated from Secchi, = $60 - 14.41 * \ln(\text{Secchi})$ |

Laboratory Parameters

| | |
|--------|---|
| ND | = Non-Detect, the level of the analyte in question is at or below the laboratory's detection limit |
| TP | = total phosphorus- milligrams per liter (mg/l) Detection limit = 0.003 mg/l; NYS Guidance Value = 0.020 mg/l |
| TSI-TP | = Trophic State Index calculated from TP, = $14.42 * \ln(\text{TP} * 1000) + 4.15$ |
| TSP | = total soluble phosphorus, mg/l Detection limit = 0.003 mg/l; no NYS standard or guidance value |
| NOx | = nitrate + nitrite nitrogen, mg/l Detection limit = 0.01 mg/l; NYS WQ standard = 10 mg/l |
| NH4 | = total ammonia, mg/l Detection limit = 0.01 mg/l; NYS WQ standard = 2 mg/l |
| TKN | = total Kjeldahl nitrogen (= organic nitrogen + ammonia), mg/l Detection limit = 0.01 mg/l; no NYS standard or guidance value |
| TN/TP | = Nitrogen to Phosphorus ratio (molar ratio), = $(\text{TKN} + \text{NOx}) * 2.2 / \text{TP}$ > 30 suggests phosphorus limitation, < 10 suggests nitrogen limitation |
| CHLA | = chlorophyll <i>a</i> , micrograms per liter ($\mu\text{g/l}$) or parts per billion (ppb) Detection limit = 2 $\mu\text{g/l}$; no NYS standard or guidance value |

| | |
|------------|--|
| TSI-CHLA | = Trophic State Index calculated from CHLA, = $9.81 * \ln(\text{CHLA}) + 30.6$ |
| ALKALINITY | = total alkalinity in mg/l as calcium carbonate Detection limit = 10 mg/l; no NYS standard or guidance value |
| TCOLOR | = true (filtered or centrifuged) color, platinum color units (ptu) Detection limit = 5 ptu; no NYS standard or guidance value |
| TOC | = total organic carbon, mg/l Detection limit = 1 mg/l; no NYS standard or guidance value |
| Ca | = calcium, mg/l Detection limit = 1 mg/l; no NYS standard or guidance value |
| Fe | = iron, mg/l Detection limit = 0.1 mg/l; NYS standard = 0.3 mg/l |
| Mn | = manganese, mg/l Detection limit = 0.01 mg/l; NYS standard = 0.3 mg/l |
| Mg | = magnesium, mg/l Detection limit = 2 mg/l; NYS standard = 35 mg/l |
| K | = potassium, mg/l Detection limit = 2 mg/l; no NYS standard or guidance value |
| Na | = sodium, mg/l Detection limit = 2 mg/l; NYS standard = 20 mg/l |
| Cl | = chloride, mg/l Detection limit = 2 mg/l; NYS standard = 250 mg/l |
| SO4 | = sulfate, mg/l Detection limit = 2 mg/l; NYS standard = 250 mg/l |

Field Parameters

| | |
|--------|---|
| Depth | = water depth, meters |
| Temp | = water temperature, degrees Celsius |
| D.O. | = dissolved oxygen, in milligrams per liter (mg/l) or parts per million (ppm) NYS standard = 4 mg/l; 5 mg/l for salmonids |
| pH | = powers of hydrogen, standard pH units (S.U.) Detection limit = 1 S.U.; NYS standard = 6.5 and 8.5 |
| SpCond | = specific conductance, corrected to 25°C, micromho per centimeter ($\mu\text{mho/cm}$) Detection limit = 1 $\mu\text{mho/cm}$; no NYS standard or guidance value |
| ORP | = Oxygen Reduction Potential, millivolts (MV) Detection limit = -250 mV; no NYS standard or guidance value |

Lake Assessment

| | |
|-------------------------|--|
| WQ Assessment | = water quality assessment , 5 point scale, 1= crystal clear, 2 = not quite crystal clear, 3 = definite algae greenness, 4 = high algae levels, 5 = severely high algae levels |
| Weed Assessment | = weed coverage/density assessment , 5 point scale, 1 = no plants visible, 2 = plants below surface, 3 = plants at surface, 4 = plants dense at surface, 5 = plants cover surface |
| Recreational Assessment | = swimming/aesthetic assessment , 5 point scale; 1 = could not be nicer, 2 = excellent, 3= slightly impaired, 4 = substantially impaired, 5 = lake not usable |