

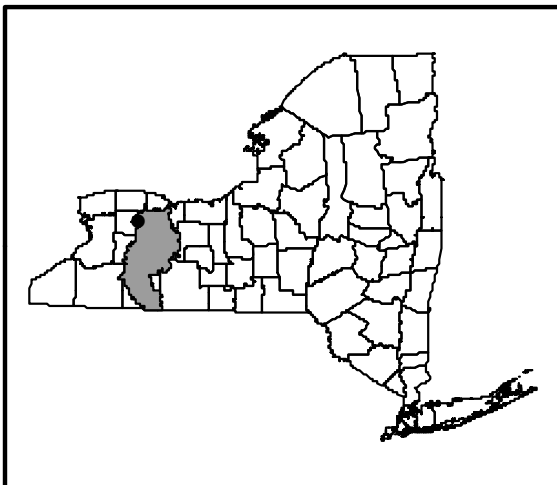
# LCI Lake Water Quality Summary

## General Information

<b>Lake Name:</b>	<b>Horseshoe Lake</b>
<b>Location:</b>	Town of Stafford, Genesee County, NY
<b>Basin:</b>	Genesee River Basin
<b>Size:</b>	7.8 hectares (19.3 acres)
<b>Lake Origins:</b>	natural
<b>Major Tributaries:</b>	Seven Springs Pond and Chaplin Pond via Bigelow Creek and an unnamed tributary
<b>Lake Tributary to:</b>	Bigelow Creek
<b>Water Quality Classification:</b>	B (best intended use: primary contact recreation)
<b>Sounding Depth:</b>	4.3 meters (14 feet)
<b>Sampling Coordinates:</b>	Latitude: 43.00556, Longitude: -78.12039
<b>Sampling Access Point:</b>	Horseshoe Lake Private Beach
<b>Monitoring Program:</b>	Lake Classification and Inventory (LCI) Survey
<b>Sampling Date:</b>	August 3, 2009
<b>Samplers:</b>	David Newman, NYSDEC Division of Water, Albany Steven Finnemore, NYSDEC Division of Water, Albany
<b>Contact Information:</b>	David Newman, NYSDEC Division of Water <a href="mailto:djnewman@gw.dec.state.ny.us">djnewman@gw.dec.state.ny.us</a> ; 518-402-8201

## Lake Map

(sampling location marked with a circle)



## Background and Lake Assessment

Horseshoe Lake is a small privately owned lake in central Genesee County. The lake is owned and managed by the Horseshoe Lake Corporation. Homes line the shore of the northern two thirds of the lake with the southern third dominated by forests and wetlands. The Horseshoe Lake Corporation operates a small beach for local residents and many of the homes around the lake have small boat docks. There are several different land uses within the lake's watershed, these include: wetland and forested areas along Seven Springs Pond, Chaplin Pond and Bigelow Creek, a golf course to the west of the lake, gravel and sand mining to the southwest of the lake and agricultural land to the southeast of the lake.

The lake was among the largest lakes in the Genesee River drainage basin not previously sampled through the New York State DEC Division of Water's Lake Classification and Inventory Survey (LCI), and thus was included in the 2009 LCI screening program. At this time there are no perceived water quality issues that would make this lake a candidate for more intensive sampling during the 2010 survey of the basin.

Horseshoe Lake can be characterized as *mesotrophic*, or moderately productive. The chlorophyll *a* reading (TSI = 46, typical of *mesotrophic* lakes) was slightly higher than expected given the water clarity reading (TSI = 43, typical of *mesotrophic* lakes) and the phosphorus reading (TSI = 41, typical of lakes that border between *oligotrophic* and *mesotrophic*) in the collected water sample. This means that while there is a moderate level of chlorophyll *a* (algae) in the water column, it is not having drastic effects on the water clarity and that phosphorous levels do not support persistent algal blooms.

During the early August sampling event the lake had a slight yellow/green color, with the water clarity reading being greater than 10 feet. The yellow/green may in part be due to chlorophyll in the water column, but may be more due to light reflection from the bottom sediments, as the water sample that was collected had little to no coloration. There were several native plant species found in the shallow area of the lake southeast of the beach area. These included: the submergent plants *Myriophyllum verticillatum* (whorl-leaf milfoil), *Ceratophyllum demersum* (coontail), *Utricularia vulgaris* (common bladderwort), *Stuckenia pectinatus* (Sago pondweed), and the floating leaf plant *Nuphar sp.* (yellow water lily). No exotic invasive species were observed; however, a more thorough plant specific survey would need to be conducted to completely rule out the presence of exotic plants.

Like most shallow lakes, Horseshoe Lake is not thermally stratified, where depth zones (warm water on top, cold water on the bottom during the summer) are established. Temperature and dissolved oxygen readings were comparable throughout the water column. pH readings indicate alkaline water, and conductivity readings indicate hard water (high ionic strength).

Horseshoe Lake appears to be typical of hardwater, clear, alkaline lakes. Other lakes with similar water quality characteristics often support warmwater fisheries, although fisheries habitat cannot be fully evaluated through this monitoring program. Coldwater fisheries are probably not supported, given the lack of cold water during the summer.

Total phosphorus levels were low, indicating that most of the phosphorus is already tied up in primary production. It is likely that phosphorus limits algae growth, as in most NYS lakes, and additions of phosphorus to the lake may cause increases in algal production. Chloride levels were on the high side and may indicate impacts from road salting or stormwater runoff through developed areas. None of the other water quality indicators measured through this program indicate water quality problems.

## **Evaluation of Lake Condition Impacts to Lake Uses**

### **Potable Water (Drinking Water)**

Horseshoe Lake is not classified for use as a potable water supply. Although the LCI data are not sufficient to evaluate potable water use, the data collected through the LCI did not show any stressors to this use.

### **Contact Recreation (Swimming)**

Horseshoe Lake is classified for primary contact recreation and currently supports this use. Bacteria data are needed to evaluate the safety of Horseshoe Lake for swimming; however, these data are not collected through the LCI. The data collected through the LCI indicate that swimming should be supported by the existing water quality conditions, as the water clarity reading was above the NYS Department of Health's guidance value of 1.2 meters for safe swimming.

### **Non-Contact Recreation (Boating and Fishing)**

The data collected through the LCI show that boating and fishing should continue to be supported uses.

### **Aquatic Life**

Additional biological studies would need to be conducted to fully evaluate aquatic life; however, no stressors to aquatic life were observed during the LCI survey.

### **Aesthetics**

These data indicate that aesthetics should be fully supported, due to the lack of problems with excessive algae, poor water clarity, or weeds in at least most of the lake.

## **Additional Comments**

1. 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:

*Myriophyllum verticillatum* (whorl-leaf milfoil)

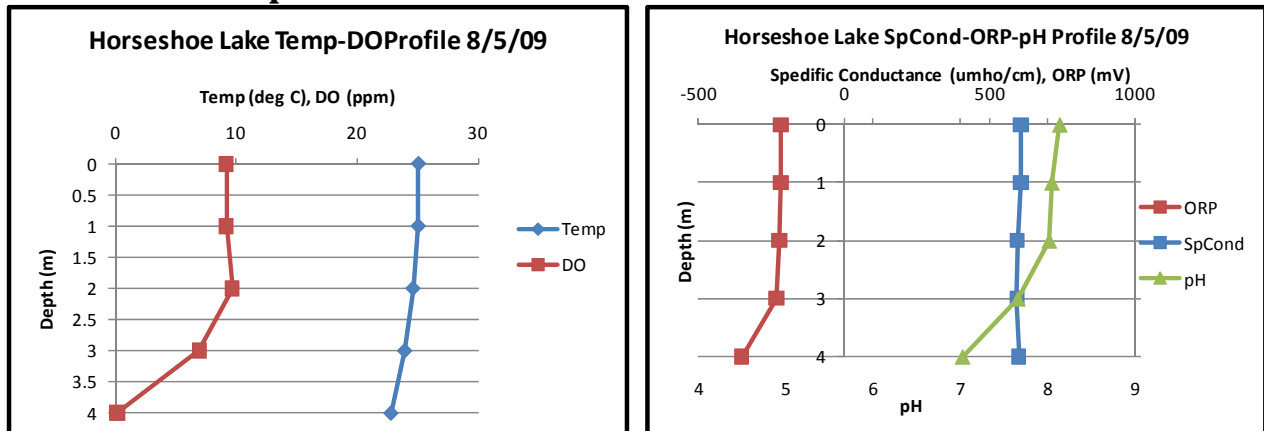
*Ceratophyllum demersum* (coontail)

*Utricularia vulgaris* (common bladderwort)

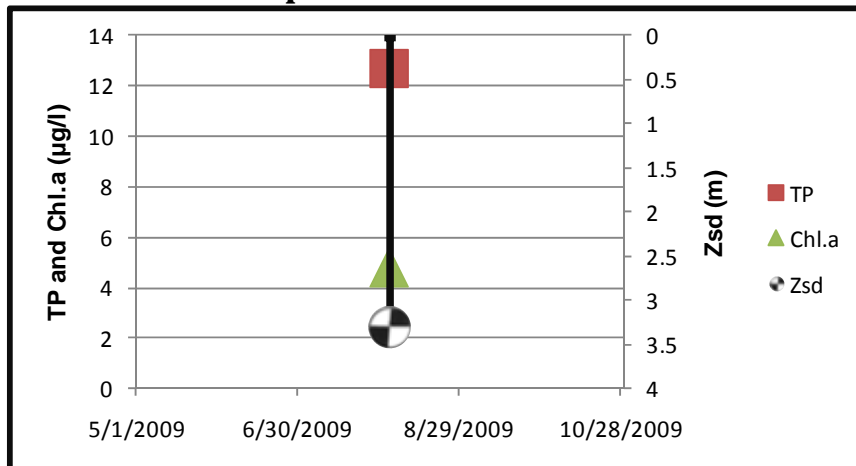
*Stuckenia pectinatus* (Sago pondweed)

*Nuphar sp.* (yellow water lily)

## Time Series: Depth Profiles



## Time Series: Trophic Indicators



## WQ Sampling Results

### Surface Samples

	UNITS	Reading	Scientific Classification	Regulatory Comments
SECCHI	meters	3.3	Mesotrophic	Reading does not violate DOH guidance value
TSI-Secchi		42.8	Mesotrophic	No pertinent water quality standards
TP	mg/l	0.0127	Mesotrophic	Reading does not violate DEC guidance values
TSI-TP		40.8	Mesotrophic	No pertinent water quality standards
TSP	mg/l	0.0045	Little available phosphorus	No pertinent water quality standards
NOx	mg/l	0.009	Low nitrate	Reading does not violate guidance
NH4	mg/l	0.018	Low ammonia	Reading does not violate guidance
TKN	mg/l	0.52	Intermediate organic nitrogen	No pertinent water quality standards
TN/TP	mg/l	91.64	Phosphorus Limited	No pertinent water quality standards
CHLA	ug/l	4.8	Mesotrophic	No pertinent water quality standards
TSI-CHLA		46.0	Mesotrophic	No pertinent water quality standards
Alkalinity	mg/l	189	Moderately Buffered	No pertinent water quality standards
TCOLOR	ptu	10	Uncolored	No pertinent water quality standards
TOC	mg/l	4.5		No pertinent water quality standards
Ca	mg/l	47.9	Strongly Supports Zebra Mussels	No pertinent water quality standards
Fe	mg/l	0.0355		Reading does not violate water quality standards
Mn	mg/l	0.017		Reading does not violate water quality standards
Mg	mg/l	27.5		Reading does not violate water quality standards
K	mg/l	2.25		No pertinent water quality standards
Na	mg/l	52		Reading violates water quality standards
Cl	mg/l	99.2	Significant road salt runoff	Reading does not violate water quality standards
SO4	mg/l	25.4		Reading 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	4	Dense Plant Growth at Lake Surface	No pertinent water quality standards
Recreational Assessment	1-5, 1 best	3	Slightly Impaired	No pertinent water quality standards

## Legend Information

### General Legend Information

Surface Samples	= integrated sample collected in the first 2 meters of surface water
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	= <b>water quality assessment</b> , 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	= <b>weed coverage/density assessment</b> , 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	= <b>swimming/aesthetic assessment</b> , 5 point scale; 1 = could not be nicer, 2 = excellent, 3= slightly impaired, 4 = substantially impaired, 5 = lake not usable