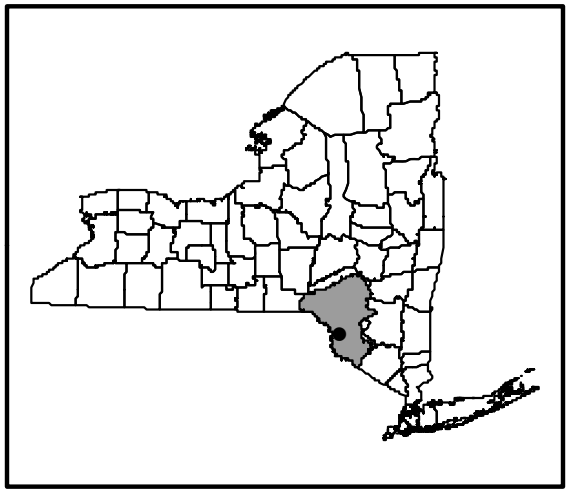
LCI Lake Water Quality Summary

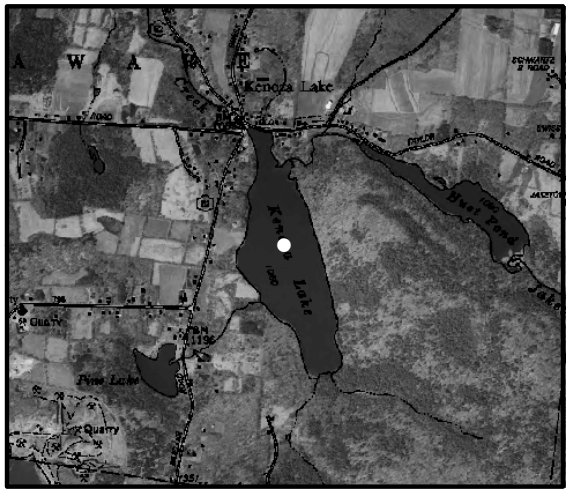
General Information

Lake Name:	**Kenoza Lake**
Location:	Town of Delaware, Sullivan County, NY
Basin:	Delaware River Basin
Size:	33.7 hectares (83.2 acres)
Lake Origins:	natural
Major Tributaries:	Jaketown Creek, a minor unnamed tributary from Pine Lake and another minor tributary
Lake Tributary to?:	East Branch of Callicoon Creek via Jaketown Creek
Water Quality Classification:	B (best intended use: primary contact recreation)
Sounding Depth:	6.8 meters (21 feet)
Sampling Coordinates:	Latitude: 41.72754, Longitude: -74.94654
Sampling Access Point:	private land (Marc Dubrovsky)
Monitoring Program:	Lake Classification and Inventory (LCI) Survey
Sampling Date:	July 29, 2009
Samplers:	David Newman, NYSDEC Division of Water, Albany Steven Finnemore, NYSDEC Division of Water, Albany
Contact Information:	David Newman, NYSDEC Division of Water djnewman@gw.dec.state.ny.us; 518-402-8201

Lake Map

(sampling location marked with a circle)





Background and Lake Assessment

Kenoza Lake is located in western Sullivan County. The majority of the land surrounding the lake is forested. At the time of the survey there were a few homes on large wooded lots on the northwestern shore of the lake, as well as some agricultural land just west of the lake. The lake receives water from Jakestown Creek, which has a largely agricultural watershed. In addition the lake receives water from two minor tributaries to the south and from Pine Lake to the west. The lake currently supports boating and fishing and possibly swimming. A quick internet search showed that there are plans to put up to 15 homes on the eastern shore of Kenoza Lake.

Kenoza Lake was included in NYSDEC Divisions of Water's screening (single sample) Lake Classification and Inventory Survey (LCI) program in the summer of 2009 due to a lack of water quality data in the Division's database. Due to reduced water clarity and elevated phosphorus levels, Kenoza Lake may be a candidate for more intensive monitoring (monthly) during the summer of 2010.

Kenoza Lake can be characterized as a *eutrophic*, or highly productive. The water clarity reading (TSI = 55, typical of *eutrophic* lakes) was similar to that expected given the phosphorus (TSI = 58, typical of *eutrophic* lakes) and chlorophyll *a* (TSI = 53, typical of *eutrophic* lakes) readings. These data indicate that baseline nutrient levels may support algal blooms. At the time of sampling the lake may have been in the initial stages of a bloom with the observation of specks of blue-green algae throughout the water column. Phosphorus was determined to be the limiting nutrient, which is typical for New York State lakes. This means that phosphorus additions to the lake will likely lead to increased primary production in the form of algae, potentially leading to algal blooms.

The water was observed to be tea colored with the specks of blue green cited above. The tea or tannic color is due to weak organic acids from the watershed and was common among the other lakes sampled in the Delaware River Basin. Three different species of native floating leaf plants were found to occur in the lake: *Brasenia schreberi* (water shield), *Nymphaea sp.* (white water lily), and *Nuphar sp.* (yellow water lily). No exotic invasive species were observed; however, a more thorough plants specific survey would need to be conducted to completely rule out their occurrence in the lake.

Water samples were collected to evaluate the potential presence of harmful algal blooms—cyanobacteria that might trigger the release of algal toxins or taste and odor compounds. The samples from Kenoza Lake were run through a phycocyanin detector and recorded readings of 24 phycocyanin units. Any sampling results below 100 units units are thought to indicate less than 1.0 µg/l of microcystis-LR, corresponding to the World Health Organization (WHO) guidance to protect drinking water supplies. It is not yet known what phycocyanin readings might result in microcystis-LR readings above 5-10 µg/l, the guidance to protect contact recreation. The results from these detectors can be highly variable, and should only be used as an indication of a potential problem.

Kenoza Lake 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 greater than six meters deep. The thermocline in the lake was in the three to four meter range in late July. The

entire hypolimnion (bottom waters) was anoxic (devoid of oxygen) at depths below three meters. pH readings indicate neutral surface water, with the readings dropping off as depth increases. Conductivity readings indicate soft water (low ionic strength). Both indicators are typical of other lakes sampled in the Delaware River Basin. The oxygen reduction potential (ORP) readings were well below zero in the hypolimnion, indicating persistent oxygen deficits.

The lake appears to be typical of softwater, weakly colored, neutral to slightly acidic 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 unlikely to 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. Deepwater fisheries may also be affected by elevated deepwater ammonia and iron readings. It is not known if these coldwater fish have historically been supported in the lake.

Nitrate levels were low in both the surface and bottom waters; however, total phosphorus readings were intermediate to high in both the surface and bottom waters. Ammonia, iron and manganese readings were elevated in the bottom waters, typical of other persistently anoxic lakes. Chloride and other ion levels were in the intermediate range indicating there may be some minor impacts from road salting and/or stormwater runoff.

Aquatic life cannot be fully evaluated though the LCI, however deepwater oxygen and ammonia levels are not supportive of aquatic life, although it is not known if aquatic life would otherwise be found in the deeper waters.

Evaluation of Lake Condition Impacts to Lake Uses

Potable Water (Drinking Water)

Kenoza Lake is not classified for use as a potable water supply. Although the LCI data are not sufficient to evaluate potable water use, these data suggest that the lake water would require substantial treatment to serve as a potable water supply. Deepwater intake quality would be compromised by elevated ammonia, iron and manganese levels.

Contact Recreation (Swimming)

Kenoza Lake is classified for contact recreation- swimming and bathing. It is believed that this use may currently be supported. Bacteria data are needed to evaluate the safety to Kenoza Lake for swimming, however these data are not collected though the LCI. The data collected through the LCI do indicate that the water clarity is just above the NYS Department of Health's guidance value of 1.2 meters to protect the safety of swimmers. If algae levels were to increase this would decrease the water clarity in the lake at which time the water clarity reading may fall below the guidance value. Future use of the lake for contact recreation may require management of nutrient sources and algae levels to provide safe and aesthetically acceptable swimming conditions.

Some species of cyanobacteria can produce toxins, such as microcystis-LR, and others can be implicated in taste and odor problems. So while the presence of cyanobacteria does not necessarily indicate water quality problems or the presence of harmful algal blooms, it may warrant additional investigation. If Kenoza Lake is sampled in 2010 through the LCI program,

any blooms or suspicious conditions that are observed additional sampling will be conducted as part of a long-term study by the NYS Department of Health and the NYS Department of Environmental Conservation funded by the Centers for Disease Control, to evaluate the presence and persistence of harmful algal blooms in New York State.

Non-Contact Recreation (Boating and Fishing)

Boating is presently supported on the lake. High densities of floating leaf plants may make boating difficult in certain areas of the lake; however, the majority of the lake is suitable for this use. Warmwater fisheries should be supported on the lake, although coldwater fisheries are unlikely to be supported. The LCI is not set up to fully evaluate fisheries and fishing.

Aquatic Life

The anoxic conditions and elevated ammonia levels observed will stress some aquatic life. Additional biological studies would be needed to evaluate any other aquatic life impacts.

Aesthetics

Elevated levels of algae may detract from the aesthetics of the lake, although this wasn't apparent in the single 2009 sampling session.

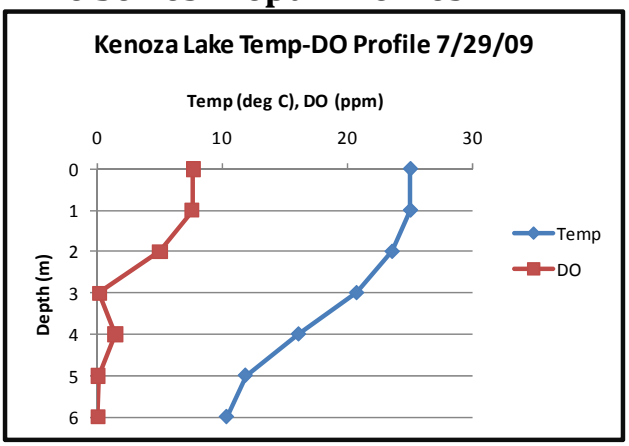
Additional Comments

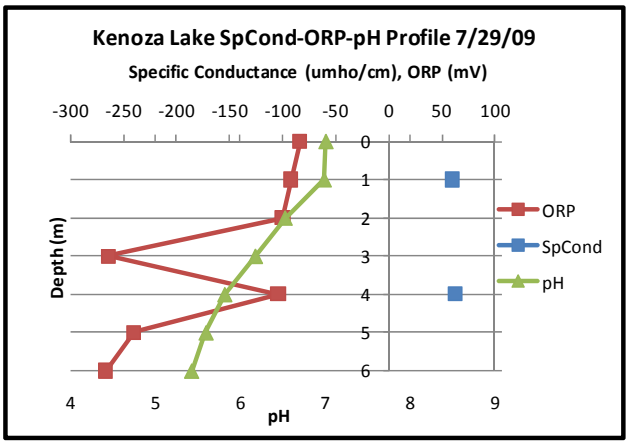
- Periodic surveillance for invasive exotic plant species may help to prevent the establishment and spread of any new invaders, given the escalating problems with exotic aquatic weeds.
- Algae identification would determine if the lake may suffer from harmful algal blooms (HABs) and/or the production of algal toxins. Additional sampling will be conducted in 2010 as part of a long-term study by the NYS Department of Health and the NYS Department of Environmental Conservation funded by the Centers for Disease Control, to evaluate the presence and persistence of harmful algal blooms in New York State.
- Development around the lake has the possibility of negatively impacting the water quality of the lake. Developers should adhere to proper erosion and sediment control standards during land clearing and building. Maintaining a forested buffer around the lake will help decrease runoff from the steep slopes that surround the lake. Limiting the use of fertilizers and ensuring that septic systems are properly maintained will help limit nutrient inputs to the lake.

Aquatic Plant IDs

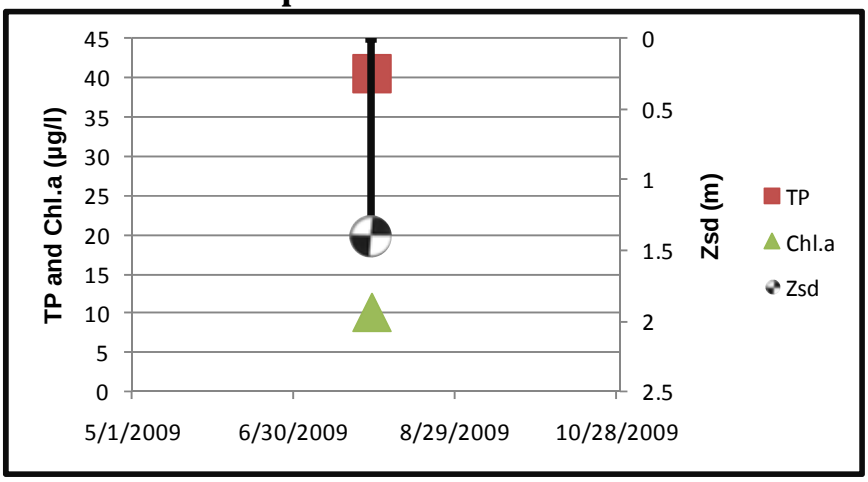
Exotic Plants:	None
Native Plants:	*Brasenia schreberi* (water shield)
	Nymphaea sp. (white water lily)
	Nuphar sp. (yellow water lily)

Time Series: Depth Profiles





Time Series: Trophic Indicators



WQ Sampling Results

Surface Samples

	UNITS	Reading	Scientific Classification	Regulatory Comments
SECCHI	meters	1.4	Eutrophic	Readings does not violate DOH guidance value
TSI-Secchi		55.2	Eutrophic	No pertinent water quality standards
TP	mg/l	0.0406	Eutrophic	Sample exceeds guidance value
TSI-TP		57.5	Eutrophic	No pertinent water quality standards
TSP	mg/l	0.0125	High % soluble Phosphorus	No pertinent water quality standards
NOx	mg/l	0.0077	Low nitrate	Reading does not violate guidance
NH4	mg/l	0.021	Low ammonia	Reading does not violate guidance
TKN	mg/l	0.66	Intermediate organic nitrogen	No pertinent water quality standards
TN/TP	mg/l	36.18	Phosphorus Limited	No pertinent water quality standards
CHLA	ug/l	10.2	Eutrophic	No pertinent water quality standards
TSI-CHLA		53.4	Eutrophic	No pertinent water quality standards
Alkalinity	mg/l	13.8	Poorly Buffered	No pertinent water quality standards
TCOLOR	ptu	35	Highly Colored	No pertinent water quality standards
TOC	mg/l	8.1		No pertinent water quality standards
Ca	mg/l	5.41	Does Not Support Zebra Mussels	No pertinent water quality standards
Fe	mg/l	0.377	Taste or odor likely	Reading violates water quality standards
Mn	mg/l	0.0553		Reading does not violate water quality standards
Mg	mg/l	1.42		Reading does not violate water quality standards
K	mg/l	1.28		No pertinent water quality standards
Na	mg/l	6.28		Reading does not violate water quality standards
Cl	mg/l	9.4	Minor road salt runoff	Reading does not violate water quality standards
SO4	mg/l	4		Reading does not violate water quality standards

Bottom Samples

	UNITS	Reading	Scientific Classification	Regulatory Comments
TP-bottom	mg/l	0.27	Elevated deepwater phosphorus	No pertinent water quality standards
TSP-bottom	mg/l	0.18	High % soluble phosphorus	No pertinent water quality standards
NOx-bottom	mg/l	0.0058	No evidence of DO depletion	Reading does not violate water quality standards
NH4-bottom	mg/l	0.623	Evidence of DO depletion	Reading does not violate water quality standards
TKN-bottom	mg/l	1.31		No pertinent water quality standards
Alk-bottom	mg/l	16.2	Poorly Buffered	No pertinent water quality standards
TCOLOR-bottom	ptu	60	Highly Colored	No pertinent water quality standards
TOC-bottom	mg/l	6.9		No pertinent water quality standards
Ca-bottom	mg/l	5.8	Does Not Support Zebra Mussels	No pertinent water quality standards
Fe-bottom	mg/l	4.12	Taste or odor likely	Reading violates water quality standards

Bottom Samples (continued)

	UNITS	Reading	Scientific Classification	Regulatory Comments
Mn-bottom	mg/l	1.71	Taste or odor likely	Reading violates water quality standards
Mg-bottom	mg/l	1.38		Reading does not violate water quality standards
K-bottom	mg/l	1.58		No pertinent water quality standards
Na-bottom	mg/l	6.78		Reading does not violate water quality standards
Cl-bottom	mg/l	10.8		Reading does not violate water quality standards
SO4-bottom	mg/l	3.3	May have rotten egg odor	Reading does not violate water quality standards
As-bottom	mg/l	ND	No evidence of potable water threats	No reading violate guidance values

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	3	Plants Grow to 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
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(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(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), = (TKN + NOx)*2.2/TP
> 30 suggests phosphorus limitation, < 10 suggests nitrogen limitation

CHLA	= chlorophyll *a*, micrograms per liter (µg/l) or parts per billion (ppb) Detection limit = 2 µg/l; no NYS standard or guidance value
TSI-CHLA	= Trophic State Index calculated from CHLA, = 9.81*ln(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
As	=arsenic, mg/l Detection limit = 3.2 mg/l; NYS standard = 10 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 25ºC, micromho per centimeter (µmho/cm) Detection limit = 1 µmho/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