LCI Lake Water Quality Summary

General Information

Lake Name: Ilion Reservoir #3

Location: Hinckley, Oneida County & Herkimer Counties, NY
Basin: Mohawk River Basin
Size: 15.3 hectares (37.9 acres)
Lake Origins: Earthen dam built in 1921
Tributaries: Minor tributary to Steele Creek
Lake Tributary to: Steele Creek via a minor tributary
Watershed Area: 350 hectares (864 acres)
Water Quality Classification: A(T) (best intended use: potable water supply)
(T) waters shall be suitable for trout survival

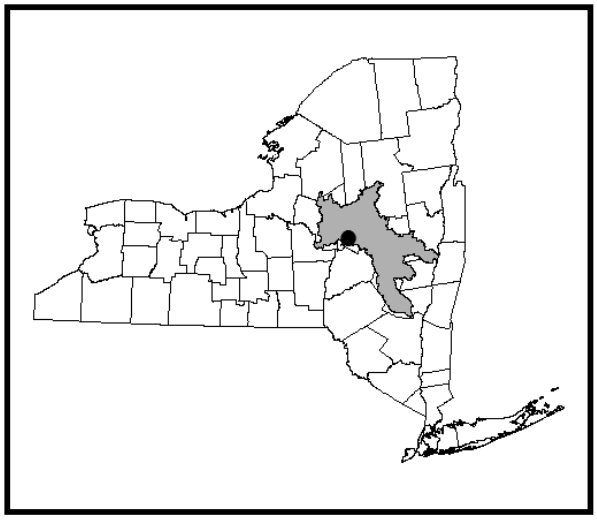
Sounding Depth: 16 meters (50 feet)
Sampling Coordinates: 42.98659896, -75.03135701
Sampling Access Point: Village of Ilion Right of Way

Monitoring Program: Lake Classification and Inventory (LCI) Survey
Sampling Date: 6/14, 7/12, 8/11, & 9/27/2011
Samplers: David Newman, Cliff Callinan, & Brad Wenskoski
NYSDEC Division of Water

Contact Information: David Newman, NYSDEC Division of Water
djnewman@gw.dec.state.ny.us; 518-402-8201

Lake Maps

(sampling location marked with a circle)



Background and Lake Assessment

Ilion Reservoir #3 is located in Herkimer County in the town of German Flatts. The reservoir is used as an emergency source of water for the Ilion water supply system. Within the watershed are rural residences, dairy farms, and farmland. There is no development directly adjacent to the reservoir. There is no public access to the reservoir and fishing is not allowed. A minor tributary to Steele Creek is both the inlet and outlet for the reservoir.

Ilion Reservoir was selected to be sampled monthly in 2011 due to having a *Threatened* listing in the 2010 Mohawk River Basin Waterbody Inventory/Priority Waterbodies List (WI/PWL). This listing was based on a Source Water Assessment conducted by the New York State Department of Health which found that the reservoir had "high susceptibility" to contamination from agricultural lands in the watershed.

Based on data from these sampling events, Ilion Reservoir #3 can generally be characterized as *mesotrophic*, or moderately productive. The water clarity reading (TSI = 38, typical of *oligotrophic* lakes) was higher than expected given the phosphorus reading (TSI = 47, typical of *mesotrophic* lakes) and the chlorophyll *a* reading (TSI = 42, typical of *mesotrophic* lakes). These data indicate that baseline nutrient levels may support algal blooms in the reservoir.

In June, August, and September the lake was observed to have a brownish coloration which may come from weak organic acids (tannic acids) from watershed soils and logging occurring along the north shore of the reservoir. In a quick examination of the plant community of the reservoir *Potomogeton crispus* (curlyleaf pondweed) was found, which is not native to New York State and can form dense stands crowding out native plant species. In addition to curlyleaf pondweed, a few native aquatic plant species were observed, but not identified.

Ilion Reservoir #3 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 in depth. The depth range of the thermocline in the reservoir gradually decreased from three meters in June to seven meters in September. Below this level hypoxic (little oxygen) and anoxic (without oxygen) conditions occurred. The pH readings indicate circumneutral to weakly alkaline waters and conductivity readings indicate intermediate to hard water.

Ilion Reservoir #3 appears to be typical of intermediately hard water, moderately colored, circumneutral pH lakes. Other lakes with similar water quality characteristics often support both warm and coldwater fisheries, although fisheries habitat cannot be fully evaluated through this monitoring program. Coldwater fisheries may be *stressed* due to anoxic conditions in the bottom layer or hypolimnion of the reservoir.

Total phosphorus levels were above the state's guidance value in the surface samples during the August and September sampling events, with a high percent of the total phosphorus being soluble (available for primary production in the form of algae). This is common among lakes experiencing oxygen deficiencies, which allows the phosphorus bond in the sediments to be released into the water column. Manganese levels in the surface waters violated the class 'A' water quality standards in July. This is also typical of lakes experiencing persistent oxygen deficiencies. Elevated manganese levels may result in odor or taste problems in untreated water.

Chloride levels were in the moderate to high range and may indicated impacts from road salting or storm water inputs. Iron, manganese and sodium readings in the bottom waters violated water quality standards during at least one sampling event. Arsenic levels were above the laboratory's detection limit for all three samples that were analyzed, although they were well below state and federal criteria for protecting potable water use. Detectable arsenic levels are typically seen in waterbodies with elevated iron and/or manganese levels in the hypolimnion. All of the other parameters fell below the state's water quality standards and guidance values.

Evaluation of Lake Condition Impacts to Lake Uses

Potable Water (Drinking Water)

Ilion Reservoir #3 is classified for use as a potable water supply and it is currently used for this purpose. LCI data are not sufficient to fully evaluate potable water use; however, the data collected indicate that surface water withdrawals are *threatened* by elevated iron and manganese levels and bottom water withdrawals are *impaired* by high iron levels, are *stressed* by high manganese levels, and are possibly *stressed* by high arsenic levels.

Contact Recreation (Swimming)

Class 'A' waters should be suitable for contact and non-contact recreation. Due to restricted access to the reservoir, people are unlikely to swim in the reservoir. Bacteria data are needed to evaluate the safety of the reservoir for swimming; these are not collected through the LCI, but the Village of Ilion may collect these data. Water clarity readings were sufficiently high to support swimming; however, total phosphorus levels *threaten* the ability of the reservoir to be used for swimming.

Non-Contact Recreation (Boating and Fishing)

Due to restricted access to the reservoir it is unlikely that people boat or fish on the reservoir. The LCI data collected in 2011 indicate that non-contact recreational use of the reservoir may be *threatened* by the occurrence of curlyleaf pondweed.

Aquatic Life

Reduced dissolved oxygen levels below the thermocline may *stress* some aquatic life, especially organisms (such as trout or other salmonids) susceptible to high summer water temperatures. The occurrence of the invasive species curlyleaf pondweed may *threaten* the biological communities of the reservoir. Additional biological studies would need to be conducted to fully evaluate impacts to aquatic life.

Aesthetics

Based on field observations there is *no known impact* to the aesthetics of the reservoir.

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 in New York State.

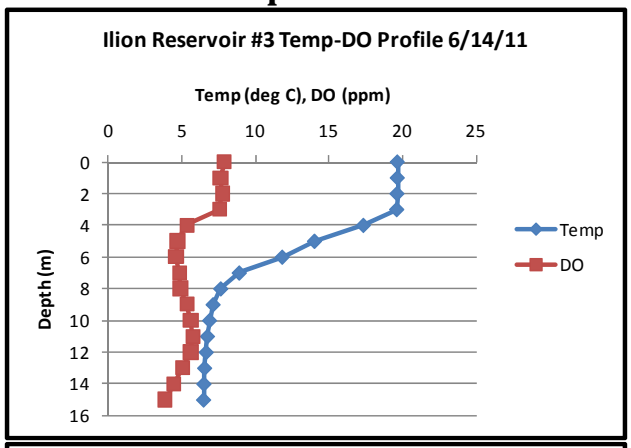
- Ensuring that farms within the watershed are using best management practices including forested stream buffers and excluding livestock from streams.

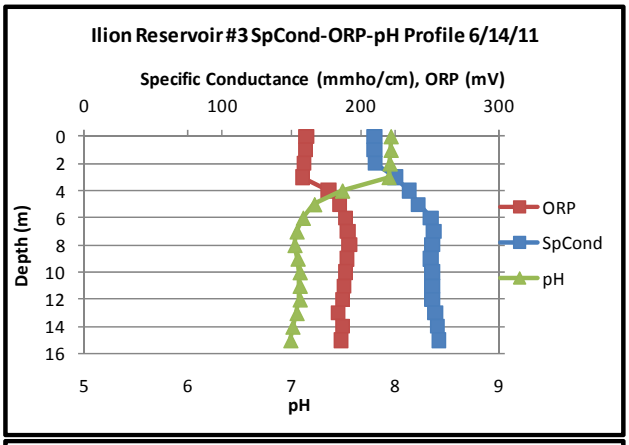
Aquatic Plant IDs

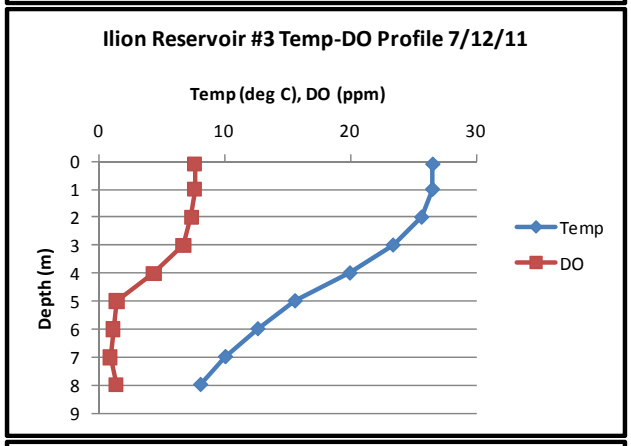
Exotic Plants: ***Potamogeton crispus* (Curlyleaf pondweed)**

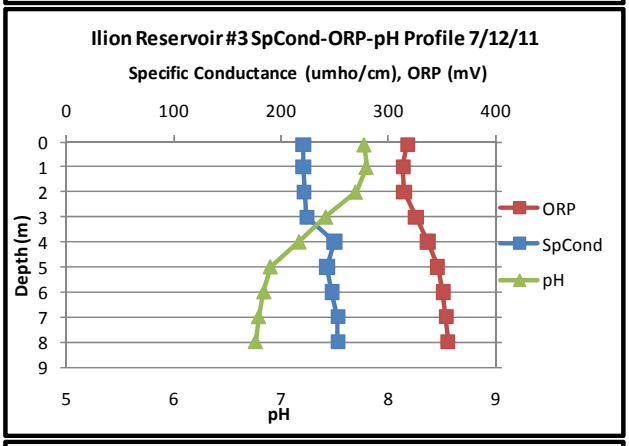
Native Plants: Native aquatic plants were observed but not identified.

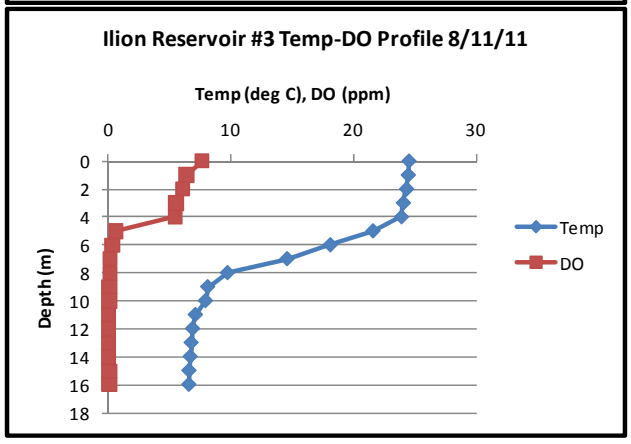
Time Series: Depth Profiles

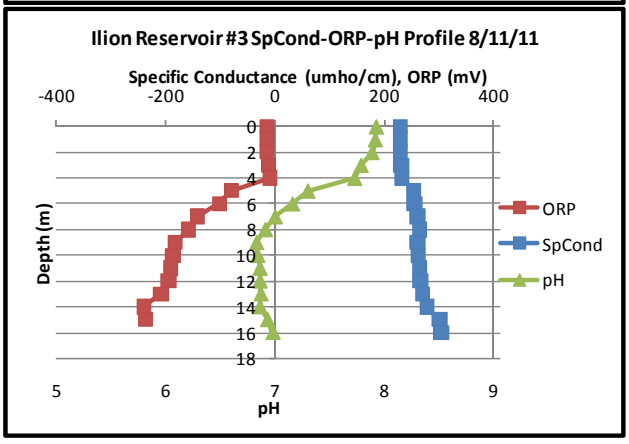


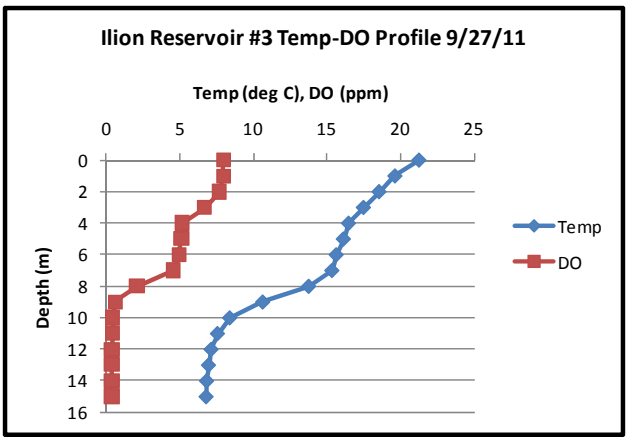


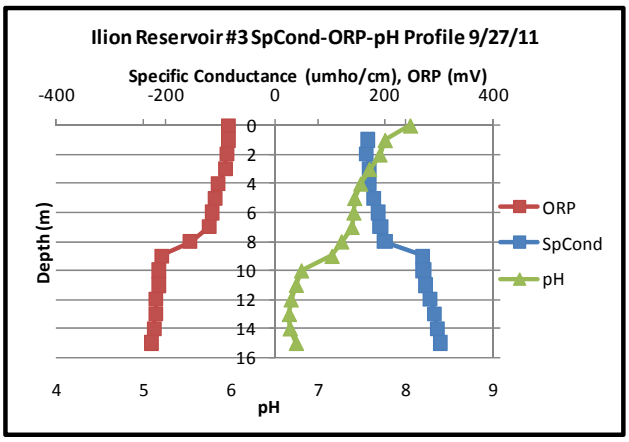




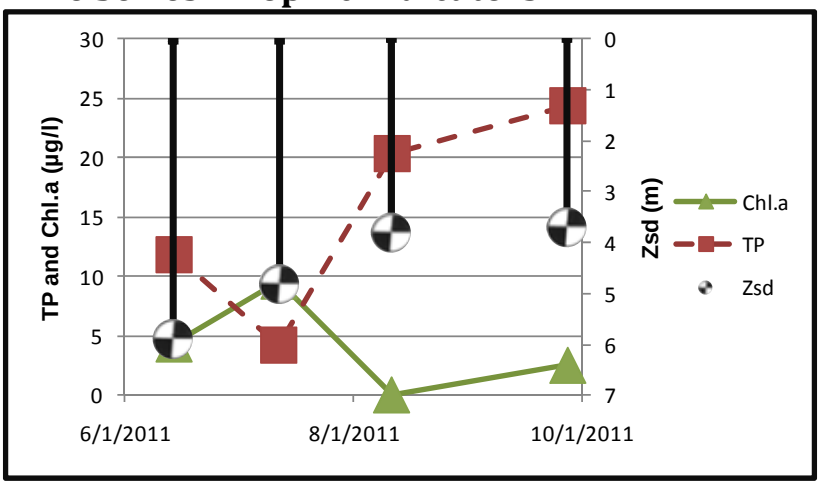








Time Series: Trophic Indicators



WQ Sampling Results

Surface Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
SECCHI	meters	4	3.7	4.55	5.9	Mesotrophic	No readings violate DOH guidance value
TSI-Secchi			41.1	38.2	34.4	Oligotrophic	No pertinent water quality standards
TP	mg/l	4	0.0042	0.02	0.0243	Mesotrophic	50% of readings violate water quality guidance value
TSI-TP			24.8	47.3	50.1	Mesotrophic	No pertinent water quality standards
TSP	mg/l	4	0.0082	0.0306	0.0973	High % soluble Phosphorus	No pertinent water quality standards
NOx	mg/l	4	0.0073	0.01355	0.0242	Low nitrate	No readings violate water quality standards
NH4	mg/l	4	0.013	0.018	0.028	Low ammonia	No readings violate water quality standards
TKN	mg/l	4	0.32	0.35	0.36	Low organic nitrogen	No pertinent water quality standards
TN/TP	mg/l	4	33.88	79.33	174.85	Phosphorus Limited	No pertinent water quality standards
CHLA	ug/l	4	ND	4.35	9.6	Mesotrophic	No pertinent water quality standards
TSI-CHLA			ND	42.0	52.8	Mesotrophic	No pertinent water quality standards
Alkalinity	mg/l	4	63.1	69	75.6	Moderately Buffered	No pertinent water quality standards
TCOLOR	ptu	4	16	23	37	Weakly Colored	No pertinent water quality standards
TOC	mg/l	4	4.8	9.2	19.6		No pertinent water quality standards
Ca	mg/l	4	20	21.4	23.2	Minimally Supports Zebra Mussels	No pertinent water quality standards
Fe	mg/l	4	0.0301	0.117	0.173		No readings violate water quality standards
Mn	mg/l	4	0.0172	0.2695	0.951	May have some taste/odor	25% of readings violate class 'A' water quality standards
Mg	mg/l	4	0.0196	2.99	4.35		No readings violate water quality standards
K	mg/l	4	0.931	1.89	4.15		No pertinent water quality standards
Na	mg/l	4	9.64	13.99	15.9		No readings violate water quality standards
Cl	mg/l	4	12.2	20	23.6	Moderate road salt runoff	No readings violate water quality standards
SO4	mg/l	4	2.9	3.38	4.3		No readings violate water quality standards

Bottom Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
TP-bottom	mg/l	4	0.0232	0.0996	0.301	Elevated deepwater phosphorus	No pertinent water quality standards
TSP-bottom	mg/l	4	0.0233	0.1037	0.23	High % soluble phosphorus	No pertinent water quality standards
NOx-bottom	mg/l	4	0.0209	0.051525	0.0908	No evidence of DO depletion	No readings violate water quality standards
NH4-bottom	mg/l	4	0.039	0.2855	0.759	Evidence of DO depletion	No readings violate water quality standards
TKN-bottom	mg/l	4	0.31	0.63	1.3		No pertinent water quality standards
Alk-bottom	mg/l	4	64.9	74.5	85.8	Moderately Buffered	No pertinent water quality standards
TCOLOR-bottom	ptu	4	13	49.8	114	Highly Colored	No pertinent water quality standards
TOC-bottom	mg/l	4	3.8	5.3	7.1		No pertinent water quality standards
Ca-bottom	mg/l	4	20	24	26.9	Minimally Supports Zebra Mussels	No pertinent water quality standards
Fe-bottom	mg/l	4	0.15	1.7	5.94	Taste or odor likely	50% of readings violate water quality standards
Mn-bottom	mg/l	4	0.0669	0.673	2.1	Taste or odor likely	25% of readings violate class 'A' water quality standards
Mg-bottom	mg/l	4	3.46	4.1	4.36		No readings violate water quality standards
K-bottom	mg/l	4	1.03	1.18	1.41		No pertinent water quality standards
Na-bottom	mg/l	4	9.61	16.9	20.2		25% of readings violate water guidance values
Cl-bottom	mg/l	4	11.8	27.83	35.4		No readings violate water quality standards
SO4-bottom	mg/l	4	2.3	3.88	5.1		No readings violate water quality standards
As-bottom	mg/l	3	0.256	2.197	5.6	Threat to deep potable water intakes	No readings violate guidance values

Lake Perception

	UNITS	N	MIN	AVG	MAX	Scientific Classification
WQ Assessment	1-5, 1 best	4	2	2.5	3	Definite Algal Greenness
Weed Assessment	1-5, 1 best	4	2	2.75	3	Plants Grow to Lake Surface
Recreational Assessment	1-5, 1 best	4	2	2.25	3	Excellent for Most Uses

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(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 for class A waters
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 Guidance Value = 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

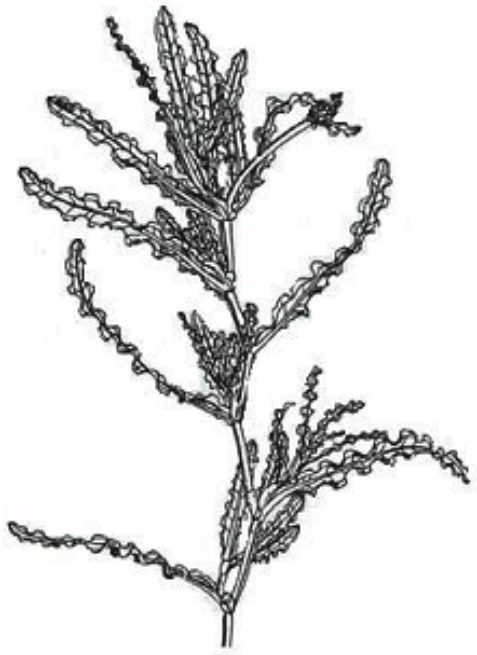
Lake Assessment

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

SPECIES NAME: *Potamogeton crispus*

COMMON NAME: curlyleaf pondweed

ECOLOGICAL VALUE: While this is not a native plant to New York state, it has become well established in many lakes and does not disrupt the aquatic ecosystem as do other (recently-introduced) exotics, although it still can out-compete native species and dominate a macrophyte community, particularly in late spring and early summer (before the peak growing season for other native and non-native macrophytes).



DISTRIBUTION IN UNITED STATES: In hard or brackish, often polluted waters, naturalized from Europe and common in New England, western Massachusetts, with a range extending from Quebec west to Minnesota, south to Alabama and Texas, and scattered throughout the western states

DISTRIBUTION IN NEW YORK: widespread and often abundant along the Hudson River and Finger Lakes basins, with some occurrences in far western New York

DEGREE OF NUISANCE: *Potamogeton crispus* may establish easily and grow abundantly, reaching nuisance levels, although the extent of coverage and nuisance conditions is limited by the growing season (winter through early-mid summer)

COMMENTS: *Potamogeton* is a highly variable genus within the pondweed family. Species within the genus often are characterized by two leaf types- firm floating leaves and thin emersed leaves. Many mature species have flowers borne in spikes (for wind pollination), conspicuous in early summer. Identification of the individual species can be extremely difficult, particularly among the narrow-leaved pondweeds. The *Potamogeton* are distinguished from the other genus within the pondweed family by having alternate leaves (unlike the *Zanichellia* and *Najas*), and by their presence in fresh or estuarine waters (unlike the *Zostera*). There are nearly 30 species found within New York State, some quite rare and others extremely common. *P. crispus* is one of the four major non-native exotic plant species in New York state, and has served as the impetus for several lake restoration and plant management programs. However, it naturally dies out in many lakes by early to mid summer, often to be replaced by other monocultures. It is characterized by finely-toothed leaf margins and a 'lasagna'-like leaf appearance.

Line drawing- Crowe, G.E. and C.B. Hellquist. Aquatic and wetlands plants of northeastern North America. 2000