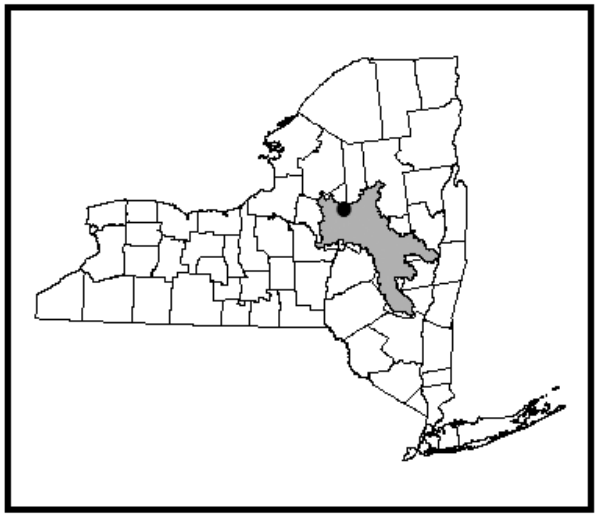
LCI Lake Water Quality Summary

General Information

Lake Name:	**Hinckley Reservoir**
Location:	Hinckley, Oneida & Herkimer Counties, NY
Basin:	Mohawk River Basin
Size:	1150 hectares (2854 acres)
Lake Origins:	Earthen and Concrete dam commissioned in 1915
Major Tributaries:	West Canada Creek & Black Creek
Lake Tributary to:	West Canada Creek
Watershed Area:	~372 Square Miles
Water Quality Classification:	AA(T) (best intended use: potable water supply) (T) waters shall be suitable for trout survival
Sounding Depth:	20 meters (65 feet)
Sampling Coordinates:	43.3112, -75.1074
Sampling Access Point:	New York Power Authority (NYPA) public launch
Monitoring Program:	Lake Classification and Inventory (LCI) Survey
Sampling Date:	6/14, 7/12, 8/11, & 9/13/2011
Samplers:	David Newman, Cliff Callinan, & Brad Wenskoski NYSDEC Division of Water, Albany with assistance from the Mohawk Valley Water Authority (MVWA)
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

Hinckley Reservoir was constructed by the State of New York in the early 1900s. The reservoir provides drinking water to the greater Utica area and also serves as a source of water for the Erie Barge Canal. The reservoir houses a hydropower facility and water released also helps to maintain the prime trout waters of West Canada Creek. While the reservoir was not built to assist with flood management, it can be used to provide flood protection benefits for downstream areas. There is public access to the reservoir, and activities available to the public include boating and personal watercraft access, swimming, and fishing for recreation. Hinckley Reservoir has a very large, mostly forested (> 98%) watershed area with a very small mix of other land uses, including agricultural lands (~1.5%), open water and wetlands (~0.2%), residential housing (< 0.01%), other urban development (~0.01%) and mining lands(< 0.01%).

Hinckley Reservoir was selected for intensive (monthly) sampling through the NYSDEC Division of Water's Lake Classification and Inventory (LCI) program in the summer of 2011, due to department interest. The reservoir is listed in the Waterbody Inventory and Priority Waterbodies List (WI/PWL) as having *minor impacts*. The multiple competing demands for the water from the reservoir cause wide fluctuations in water level and high flushing rates. Demands for the water, as noted above, include serving as a supplement flow for the Erie Barge Canal, the originally intended use, providing a source of drinking water for the greater Utica area, and a source of hydropower and recreation on the reservoir.

Based on data from the sampling from June 2011 to September 2011, Hinckley Reservoir can generally be characterized as *mesotrophic*, or moderately productive. The water clarity reading (TSI = 44, typical of *mesotrophic* lakes) was slightly higher than expected given the phosphorus reading (TSI = 37, typical of *oligotrophic* lakes) and the chlorophyll *a* reading (TSI = 42, typical of *mesotrophic* lakes). These data indicate that baseline nutrient levels may support occasional algal blooms in the reservoir, although the chlorophyll *a* readings indicate they are not likely to occur. The water in the reservoir was recorded as brown and/or tannic during the course of the summer, and "algal greenness" was not reported by the samplers.

The reservoir was observed to have a brownish coloration likely due to weak organic acids (tannic acids) from watershed soils. The overall plant abundance in the southern portion of the reservoir was low, with no plants growing at nuisance levels. A more thorough plants specific survey would need to be conducted to rule out the existence of any invasive plant species.

Water is withdrawn from Hinckley Reservoir from the bottom third of the 75 foot high dam. Removing cold water from low in the reservoir reduces the reservoir's ability to maintain thermally stratified layers. In June, the water level was near the top of the dam and the reservoir exhibited week thermal stratification with hypoxic (low oxygen) conditions near the bottom of the reservoir. In July, the water levels remained near the top of the dam; however, there was a loss of thermal stratification found in June. Dissolved oxygen levels remained above the trout survival threshold of 5 mg/l in the top 36 feet of the reservoir. In August, the water level was down ~9 feet below the top of the dam with little change in water temperature from the surface to the bottom. Dissolved oxygen levels were less than 5 mg/l below 13 feet. In September, the water level had returned to the top of the dam. The reservoir was not stratified in September. Temperature and dissolved oxygen levels dropped slowly between the surface and bottom of the

reservoir. Conductivity readings throughout the summer indicate soft water, and pH readings indicate weakly acidic waters.

Two of the bottom water (hypolimnion) samples had iron levels above the water quality standard. Elevated iron levels are often found in the hypolimnion of waterbodies experiencing oxygen deficits the bottom waters. None of the other indicators evaluated through the LCI in Hinckley Reservoir exceeded state criteria or water quality standards.

Evaluation of Lake Condition Impacts to Lake Uses

Potable Water (Drinking Water)

Hinckley Reservoir is classified for use as a potable water supply and it is currently used for this purpose. LCI data are not sufficient to evaluate potable water use; however, the data collected indicate that bottom water withdrawals may be *stressed* by elevated levels of iron and *threatened* by elevated levels of manganese, both of which may lead to taste and/or odor problems with finished water. In August of 2011, some MVWA customers reported a discoloration of their water. MVWA later determined that manganese levels in the raw water from the reservoir were higher than normal. Subsequently they added an additional water treatment chemical to their filtration process that was able to reduce manganese levels in the finished water (Clukey 2011). The LCI manganese sample taken from the hypolimnion in August had manganese levels twice as high as those from June and July.

Contact Recreation (Swimming)

Class "A" waters should also be suitable for contact and non-contact recreation. Bacteria data are needed to evaluate the safety of the reservoir for swimming. However, these are not collected through the LCI, but may be collected by other state or local monitoring programs. Based on the data collected through the LCI, there is *no known impact* to swimming in the reservoir.

Non-Contact Recreation (Boating and Fishing)

Based on the data collected through the LCI there is *no known impact* to boating and fishing on the reservoir. However The Hinckley Working Group (2008) indicates that the reservoir does not currently support a "good" fishery.

Aquatic Life

LCI data indicate that aquatic life may be *stressed* by low dissolved oxygen levels in the bottom waters of the reservoir. The oxygen deficit in the bottom waters is not consistently seen throughout the summer and is related to water level in the reservoir and water withdrawals. Like many reservoirs, Hinckley experiences large changes in water level throughout the year which may also *stress* aquatic life.

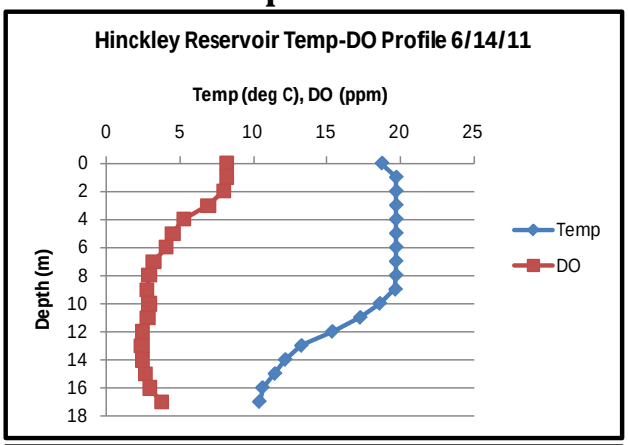
Aesthetics

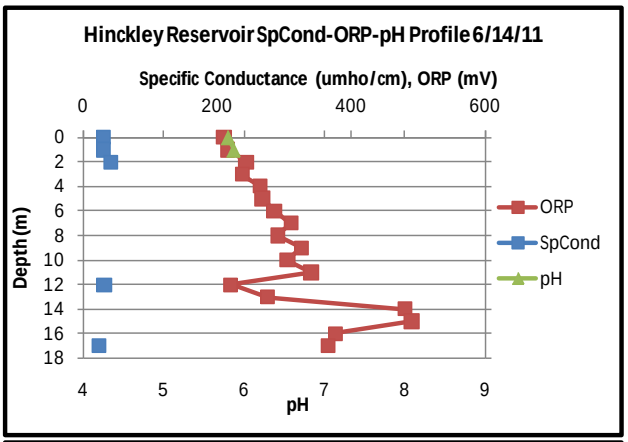
An assessment of the aesthetics of the reservoir indicated *no known impact*.

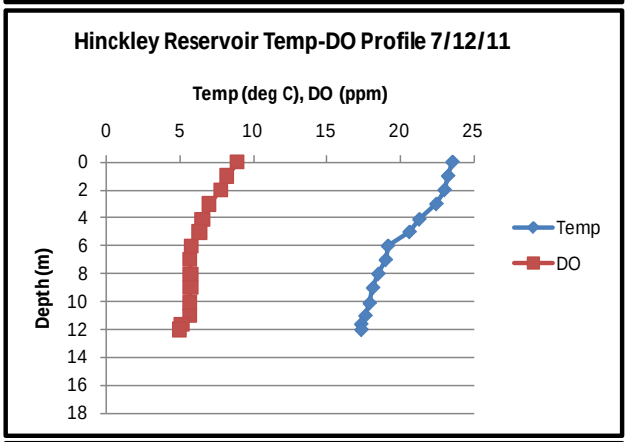
Additional Comments

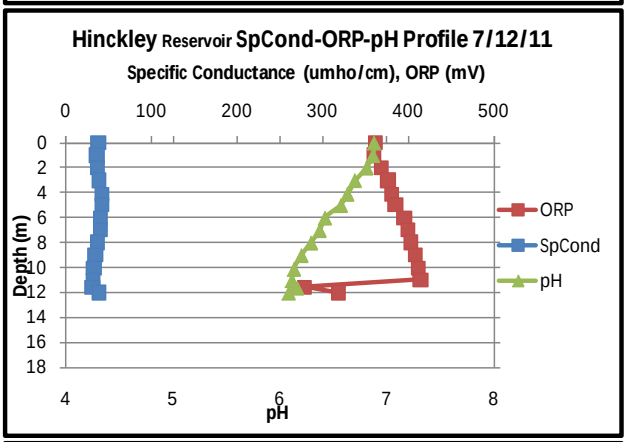
- Periodic surveillance for invasive exotic plant species may help to prevent the establishment and spread of any new invaders, given the escalating problems with exotic aquatic weeds in New York State.

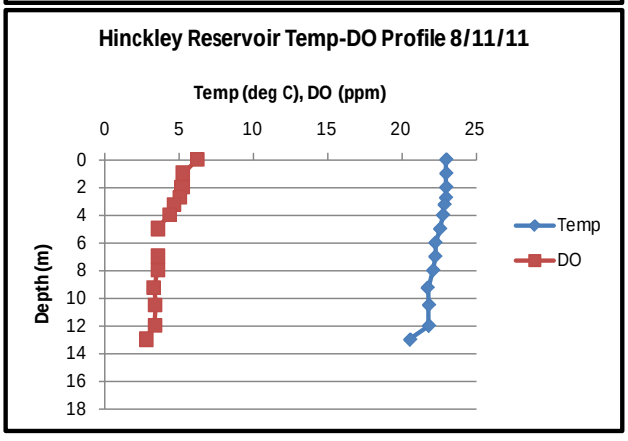
Time Series: Depth Profiles

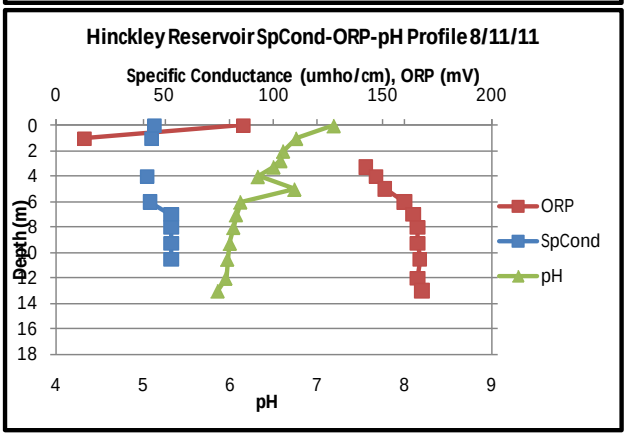


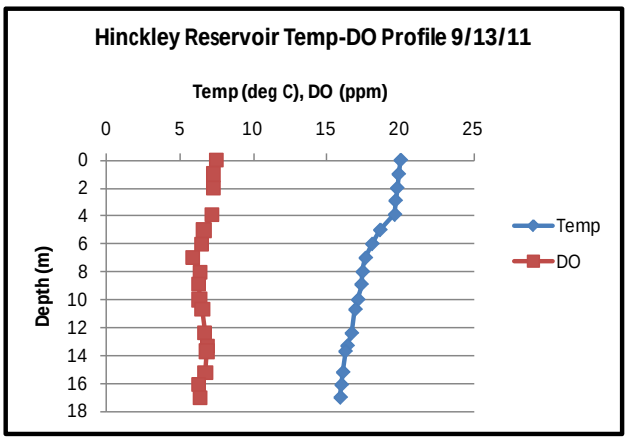


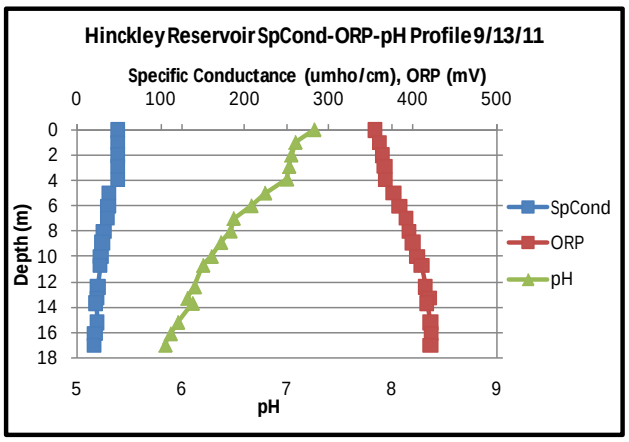




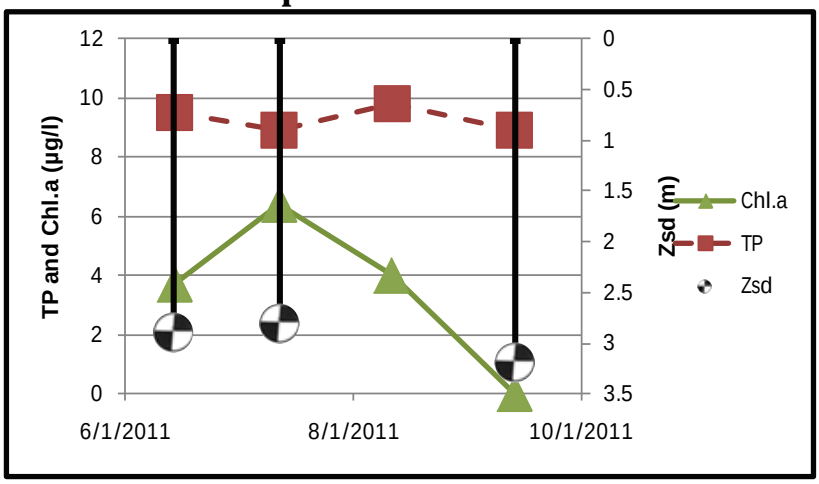








Time Series: Trophic Indicators



WQ Sampling Results

Surface Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
SECCHI	meters	3	2.8	2.97	3.2	Mesotrophic	No readings violate DOH guidance value
TSI-Secchi			45.2	44.3	43.2	Mesotrophic	No pertinent water quality standards
TP	mg/l	4	0.0089	0.01	0.0098	Mesotrophic	No readings violate water quality standards
TSI-TP			35.7	37.3	37.0	Oligotrophic	No pertinent water quality standards
TSP	mg/l	4	0.0057	0.0398	0.0773	High % soluble Phosphorus	No pertinent water quality standards
NOx	mg/l	4	0.0357	0.077275	0.156	Potentially high nitrate	No readings violate water quality standards
NH4	mg/l	4	ND	0.024	0.039	Low ammonia	No readings violate water quality standards
TKN	mg/l	4	0.23	0.34	0.4	Low organic nitrogen	No pertinent water quality standards
TN/TP	mg/l	4	71.59	97.58	110.69	Phosphorus Limited	No pertinent water quality standards
CHLA	ug/l	4	ND	3.78	6.4	Mesotrophic	No pertinent water quality standards
TSI-CHLA			ND	41.8	48.8	Mesotrophic	No pertinent water quality standards
Alkalinity	mg/l	4	8	12.1	15.3	Poorly Buffered	No pertinent water quality standards
TCOLOR	ptu	4	33	37.3	42	Highly Colored	No pertinent water quality standards
TOC	mg/l	4	4.4	5.3	5.9		No pertinent water quality standards
Ca	mg/l	4	4.13	5.5	6.88	Does Not Support Zebra Mussels	No pertinent water quality standards
Fe	mg/l	4	0.111	0.155	0.2		No readings violate water quality standards
Mn	mg/l	4	0.0057	0.015	0.0257		No readings violate water quality standards
Mg	mg/l	4	0.668	0.81	1		No readings violate water quality standards
K	mg/l	4	0.256	0.28	0.315		No pertinent water quality standards
Na	mg/l	4	1.78	2.06	2.31		No readings violate water quality standards
Cl	mg/l	4	ND	0.4	3.2	Minor road salt runoff	No readings violate water quality standards
SO4	mg/l	4	2.4	2.73	3.2		No readings violate water quality standards

Bottom Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
TP-bottom	mg/l	3	0.0092	0.0098	0.011		No pertinent water quality standards
TSP-bottom	mg/l	3	0.0038	0.0844	0.243	High % soluble phosphorus	No pertinent water quality standards
NOx-bottom	mg/l	3	0.0735	0.1258	0.2	No evidence of DO depletion	No readings violate water quality standards
NH4-bottom	mg/l	3	0.044	0.086	0.143	No evidence of DO depletion	No readings violate water quality standards
TKN-bottom	mg/l	3	0.21	0.34	0.45		No pertinent water quality standards
Alk-bottom	mg/l	3	6.3	8.5	12.1	Poorly Buffered	No pertinent water quality standards
TCOLOR-bottom	ptu	3	40	43.7	47	Highly Colored	No pertinent water quality standards
TOC-bottom	mg/l	3	5	5.8	6.7		No pertinent water quality standards
Ca-bottom	mg/l	3	3.45	4	4.84	Does Not Support Zebra Mussels	No pertinent water quality standards
Fe-bottom	mg/l	3	0.212	0.4117	0.715	Taste or odor likely	67% of readings violate water quality standards
Mn-bottom	mg/l	3	0.074	0.1315	0.236		No readings violate water quality standards
Mg-bottom	mg/l	3	0.516	0.6	0.727		No readings violate water quality standards
K-bottom	mg/l	3	0.167	0.23	0.258		No pertinent water quality standards
Na-bottom	mg/l	3	1.26	1.5	1.75		No readings violate water quality standards
Cl-bottom	mg/l	3	ND	ND	ND		No readings violate water quality standards
SO4-bottom	mg/l	3	2.2	2.5	3		No readings violate water quality standards
As-bottom	mg/l	2	ND	ND	ND	No evidence of potable water threats	No readings violate guidance values

Lake Perception

	UNITS	N	MIN	AVG	MAX	Scientific Classification
WQ Assessment	1-5, 1 best	4	2	2	2	Not Quite Crystal Clear
Weed Assessment	1-5, 1 best	4	1	1.25	2	Plants Usually Not Visible
Recreational Assessment	1-5, 1 best	4	2	2	2	Excellent for Most Uses

References

Clukey, K. 2011. Water Authority: Manganese increase in Hinckley Reservoir possible cause of discoloration. Utica Observer-Dispatch. 15 Aug 2011. Accessed at http://www.uticaod.com/news/x386659860/Residents-ask-for-answers-as-water-problem-continues.

Hinckley Reservoir Working Group. 2008. Report to the Governor. Accessible at http://www.health.ny.gov/environmental/investigations/hinckley_reservoir/docs/2008-04-30_report_to_the_governor.pdf

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 for class A waters 1.0 mg/l for class B & C waters
Mn	= manganese, mg/l Detection limit = 0.01 mg/l; NYS standard = 0.3 mg/l for class A waters 1.0 mg/l for class B & C 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 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