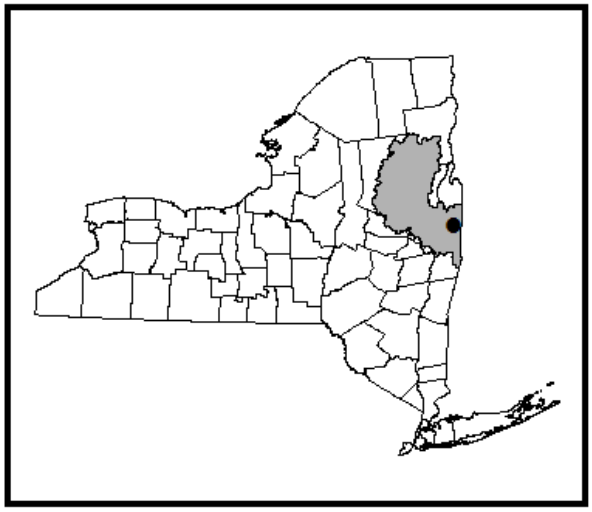
LCI Lake Water Quality Summary

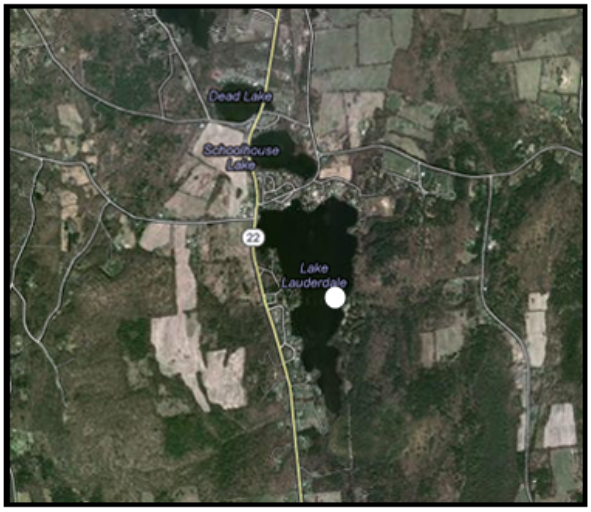
General Information

Lake Name:	**Lake Lauderdale**
Location:	Town of Jackson, Washington County, NY
Basin:	Upper Hudson River Basin
Size:	31 hectares (77 acres)
Lake Origins:	unknown
Major Tributaries:	Schoolhouse Lake
Watershed Area:	1.8 Square Miles
Lake Tributary to:	Hoosic River via the Owl Kill
Water Quality Classification:	B (best intended use: primary contact recreation)
Maximum Sounding Depth:	20 meters (65 feet)
Sampling Coordinates:	43.08912, -73.37308
Sampling Access Point:	Lauderdale Park Beach
Monitoring Program:	Lake Classification and Inventory (LCI) Survey
Sampling Date:	6/7, 7/11, 8/8 & 9/12/2012
Samplers:	David Newman, Brad Wenskoski, & Cliff Callinan NYSDEC Division of Water, Albany Carrie Buetow, NYSDEC Division of Water Schenectady
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

Lake Lauderdale is a 77 acre lake located about 5 miles north of the Village of Cambridge in Washington County, New York. The majority of eastern shoreline of the lake is land owned by the State of New York and leased to Washington County. The county operates a park that offers a swimming beach as well as a place to launch canoes and kayaks. The majority of the state land is forested except for the swimming beach. The remainder of the land surrounding the lake is private with seasonal and year-round residences. Many of the private properties have manicured lawns and/or have an altered shoreline with boat docks or other development. The lake's greater watershed contains a mix of land covers/uses including forested (55%), agricultural land (22%), development (13%) and wetland (9%). Currently the lake supports many uses including swimming, boating, and fishing.

Lake Lauderdale was listed with Schoolhouse Lake (smaller lake just north of Lake Lauderdale) in the 2003 Waterbody Inventory and Priority Waterbodies List for the Upper Hudson River Basin as a waterbody needing verification due to limited recent water quality data being available for the lakes. Specifically, the growth of aquatic macrophytes and periodic algal blooms were cited as possible threats to recreational uses of Lake Lauderdale. The lake was included in the 2012 Lake Classification and Inventory (LCI) intensive monitoring program to obtain water quality data to help make an assessment of the designated uses at the lake. The lake had been sampled through the NY Citizens Statewide Lake Assessment Program (CSLAP) from 1989 to 1993. The CSLAP sampling results did not show any water quality problems, with some recreational impacts associated with excessive weed growth.

From the data collect during the summer of 2012, Lake Lauderdale can be characterized as *mesotrophic*, or moderately productive. The average water clarity reading (TSI = 37, typical of *oligotrophic* waterbodies) was in the expected range given the total phosphorus reading (TSI = 39, typical of *mesotrophic* waterbodies) and about as clear as expected give the chlorophyll *a* reading (TSI = 47, typical of *mesotrophic* waterbodies). These data indicate that baseline nutrients levels are unlikely to support persistent algal blooms in the lake. These averages and ranges of values for the trophic indicators were similar to those seen in the 1989 to 1993 CSLAP sampling.

The water color was most often described as clear to brown with slight algal greenness noted in July and September. Water clarity averaged close to 5 meters (16 feet) deep, with the highest clarity in June and lowest in September. An assessment of the aquatic plants of the lake revealed the occurrence of two invasive aquatic plants species; curlyleaf pondweed (*Potamogeton crispus*) and Eurasian watermilfoil (*Myriophyllum spicatum*), both species are known to outcompete native plants species and are able to grow to high densities. Lake Lauderdale Improvement Association, a lakeshore homeowner's organization, has used an herbicide (fluridone) and other methods to control invasive plant growth in the lake since at least 1997. Two native plant species were also observed in 2012, but a complete assessment of the plant communities in the lake was not conducted in 2012. A more extensive plant survey conducted in 1990 showed 9 native plant species in addition to Eurasian watermilfoil.

Lake Lauderdale 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 6 meters deep. The thermocline was generally in 3 to 5 meter range throughout the summer.

Anoxic (lack of oxygen) conditions were observed in waters below 7 meters throughout the summer. This is consistent with the results from fisheries surveys conducted in 1997 and 2010. Surface pH readings were slightly alkaline and declined with depth. This was consistent with pH levels observed between 1989 and 1993. Conductivity readings indicate hard water (high ionic strength) with surface readings being much higher than those observed between 1989 and 1993. This apparent rise in conductivity over time suggest anthropogenic inputs to the lake from sources such as road salting, faulty septic systems and/or other runoff associated with developed areas.

Lake Lauderdale appears typical of other hard water, weakly colored, slightly alkaline waterbodies in New York State. A fisheries survey conducted in 2010 indicated that the lake supports at least 8 different fish species: golden shiner, yellow bullhead, rock bass, pumpkinseed, bluegill, largemouth bass, redfin pickerel, and northern pike. In the past, DEC has stocked tiger muskie in lake. This practice was discontinued in 2009, but may be reinstituted in the future. Due to the anoxic conditions in the bottom waters of the lake, the lake is unlikely to support cold water fish species such as trout, except perhaps in springs or in the upper waters of the hypolimnion.

The only water quality parameters of concern that were identified during the 2012 monitoring were related to the anoxic conditions in the bottom waters. These parameters include elevated manganese, ammonia and sulfate in the bottom waters. Manganese levels were above the drinking water standards and would likely cause taste or odor issues with finished water. The chloride levels were below the water quality standard; however, chloride readings were high enough to suspect external inputs from road salting or failing septic systems. Calcium levels in the lake indicate that the lake would support zebra mussels if they were introduced to the lake.

Evaluation of Lake Condition Impacts to Lake Uses

Potable Water (Drinking Water)

Lake Lauderdale is not classified for use as a potable water supply. The data collected through the LCI are not sufficient to fully evaluate potable water use. Manganese levels in the bottom waters may threaten the use of bottom water withdrawals for drinking water due to taste and odor issues.

Contact Recreation (Swimming)

Lake Lauderdale is classified for primary contact recreation- swimming and bathing being the best intended use. Bacteria data are needed to evaluate the safety of Lake Lauderdale for swimming—these are not collected through the LCI. The county is required to conduct bacterial sampling as they operate a swimming beach on the lake. In the absence of this bacteriological data, the only potential *threat* to the lake supporting swimming is the occurrence of dense aquatic plant growth in certain areas of the lake.

Non-Contact Recreation (Boating and Fishing)

The data collected through the LCI indicates that the occurrence of exotic invasive plant species may *stress* the ability of the lake to be used for boating and fishing.

Aquatic Life

Organisms susceptible to high summer temperature may be *stressed* due to a lack of cold oxygen rich water in the lake during the summer. In addition, the occurrence of exotic invasive plant species may *threaten* the aquatic life in the lake by outcompeting native plant species. Additional biological studies would need to be conducted to further evaluate impacts to aquatic life.

Aesthetics

These data indicate *no known impact* to the aesthetics of the lake.

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 recent years there have been some conflicts between various stakeholders on allowing public access to the lake and fish stocking policies. Issues like these are common at similar sized waterbodies. A chapter in the book *Diet for a Small Lake* discusses User Conflicts. This chapter can be accessed via the DEC's public website at http://www.dec.ny.gov/docs/water_pdf/dietlakech8.pdf

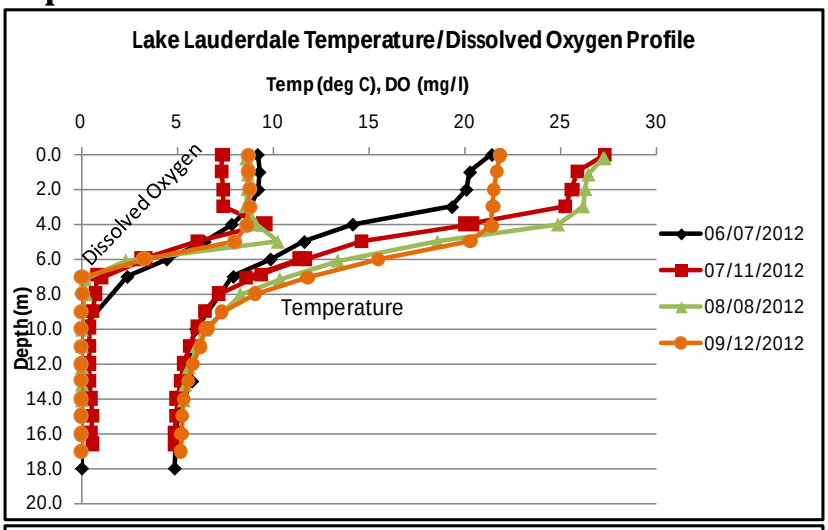
2012 Aquatic Plant IDs

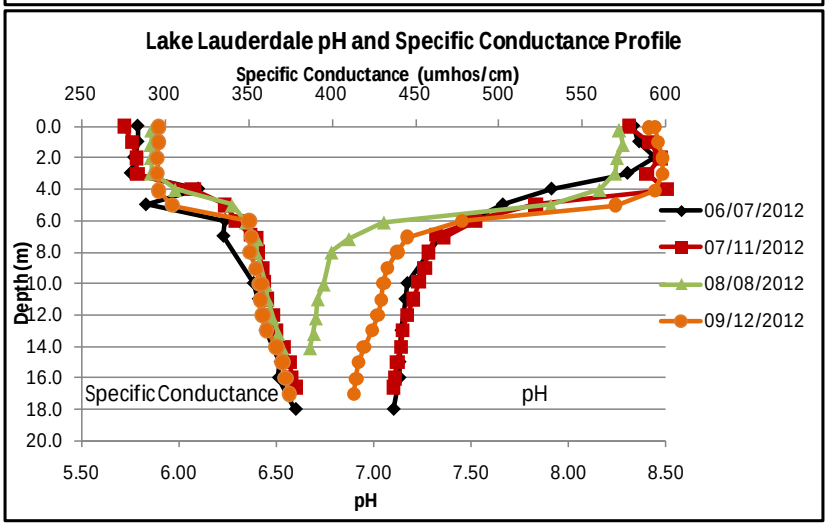
Exotic Plants:	*Myriophyllum spicatum* (Eurasian watermilfoil)
	Potamogeton crispus (curlyleaf pondweed)
Native Plants:	*Elodea canadensis* (common waterweed)
	Potamogeton sp. (unidentified broad-leafed pondweed)

1990 Aquatic Plant IDs

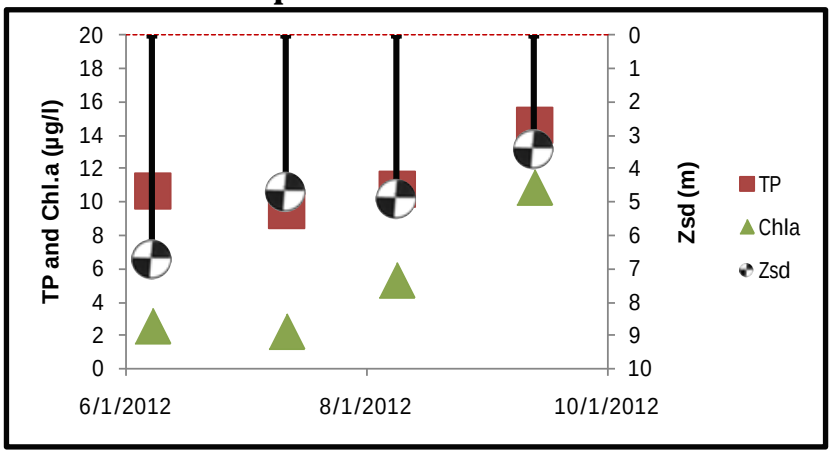
Exotic Plants:	*Myriophyllum spicatum* (Eurasian watermilfoil)
Native Plants:	*Ceratophyllum demersum* (coontail)
	Elodea canadensis (common waterweed)
	Nuphar advena (yellow waterlily)
	Potamogeton amplifolius (largeleaf pondweed)
	Potamogeton illinoensis (Illinois pondweed)
	Potamogeton perfoliatus (redhead pondweed)
	Potamogeton robbinsii (Robbins pondweed)
	Stuckenia pectinatus (sago pondweed)
	Vallisneria americanum (eel grass)

Depth Profiles





Time Series: Trophic Indicators



Water Quality Sampling Results

Surface Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
SECCHI	meters	4	3.4	4.925	6.7	Mesotrophic	No readings violate DOH guidance value
TSI-Secchi			42.4	37.0	32.6	Oligotrophic	No pertinent water quality standards
TP	mg/l	4	0.0095	0.0114	0.0146	Mesotrophic	No readings violate water quality standards
TSI-TP			36.6	39.2	42.8	Oligotrophic	No pertinent water quality standards
TSP	mg/l	2	0.0041	0.00515	0.0062	High % soluble Phosphorus	No pertinent water quality standards
NOx	mg/l	4	ND	0.0073	0.025	Low nitrate	No readings violate water quality standards
NH4	mg/l	4	ND	ND	ND	Low ammonia	No readings violate water quality standards
TKN	mg/l	4	0.25	0.3175	0.4	Low organic nitrogen	No pertinent water quality standards
TN/TP	mg/l		56.54	63.22	70.19	Phosphorus Limited	No pertinent water quality standards
CHLA	ug/l	4	2.21	5.2375	10.9	Mesotrophic	No pertinent water quality standards
TSI-CHLA			38.4	46.8	54.0	Mesotrophic	No pertinent water quality standards
Alkalinity	mg/l	4	86.4	91.925	99.6	Moderately Buffered	No pertinent water quality standards
TCOLOR	ptu	4	13	16	21	Weakly Colored	No pertinent water quality standards
TOC	mg/l	4	3.9	3.95	4		No pertinent water quality standards
Ca	mg/l	4	28.3	30	31.4	**Minimally Supports Zebra Mussels**	No pertinent water quality standards
Fe	mg/l	4	0.0215	0.0288	0.0335		No readings violate water quality standards
Mn	mg/l	4	0.0152	0.0177	0.0236		No readings violate water quality standards
Mg	mg/l	4	6.4	6.55	6.71		No readings violate water quality standards
K	mg/l	4	1.13	1.275	1.39		No pertinent water quality standards
Na	mg/l	4	14.7	15.33	16.1		No readings violate water quality standards
Cl	mg/l	4	26.4	27.475	28.1	Moderate road salt runoff	No readings violate water quality standards
SO4	mg/l	4	9	9.95	11.2		No readings violate water quality standards
Si	mg/l	4	0.792	1.241	1.65		No pertinent water quality standards

Bottom Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
TP-bottom	mg/l	4	0.0425	0.1396	0.182		No pertinent water quality standards
TSP-bottom	mg/l	3	0.0051	0.1137	0.207	High % soluble phosphorus	No pertinent water quality standards
NOx-bottom	mg/l	4	0.0034	0.007	0.0114	No evidence of DO depletion	No readings violate water quality standards
NH4-bottom	mg/l	4	0.453	0.697	0.833	**Evidence of DO depletion**	No readings violate water quality standards
TKN-bottom	mg/l	4	0.84	1.02	1.1		No pertinent water quality standards
Alk-bottom	mg/l	4	117	121.8	127	Moderately Buffered	No pertinent water quality standards
TCOLOR-bottom	ptu	4	16	18.5	23	Weakly Colored	No pertinent water quality standards
TOC-bottom	mg/l	4	3.1	3.3	3.6		No pertinent water quality standards
Ca-bottom	mg/l	4	40.6	41.7	42.4	**Strongly Supports Zebra Mussels**	No pertinent water quality standards
Fe-bottom	mg/l	4	0.009	0.017	0.0228		No readings violate water quality standards
Mn-bottom	mg/l	4	0.8	0.972	1.22	**Taste or odor likely**	**100% of readings violate class 'A' water quality standards**
Mg-bottom	mg/l	4	7.55	7.8	8.14		No readings violate water quality standards
K-bottom	mg/l	4	1.43	1.48	1.55		No pertinent water quality standards
Na-bottom	mg/l	4	16.8	17.7	18.7		No readings violate water quality standards
Cl-bottom	mg/l	4	31.8	33.03	33.9		No readings violate water quality standards
SO4-bottom	mg/l	4	10.9	12.2	13.5	**May have rotten egg odor**	No readings violate water quality standards
Si-bottom	mg/l	4	5.99	6.27	6.53		No pertinent water quality standards

Lake Perception

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
Water Clarity Assessment	1-5, 1 best	4	1	2.25	3	Not Quite Crystal Clear	No pertinent water quality standards
Weed Assessment	1-5, 1 best	4	2	2.25	3	Plants Visible Below Surface	No pertinent water quality standards
Recreational Assessment	1-5, 1 best	4	2	2.25	3	Excellent for Most Uses	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
Si	= Dissolved silica, mg/l Detection limit = 0.01 mg/l; no NYS standard or guidance value

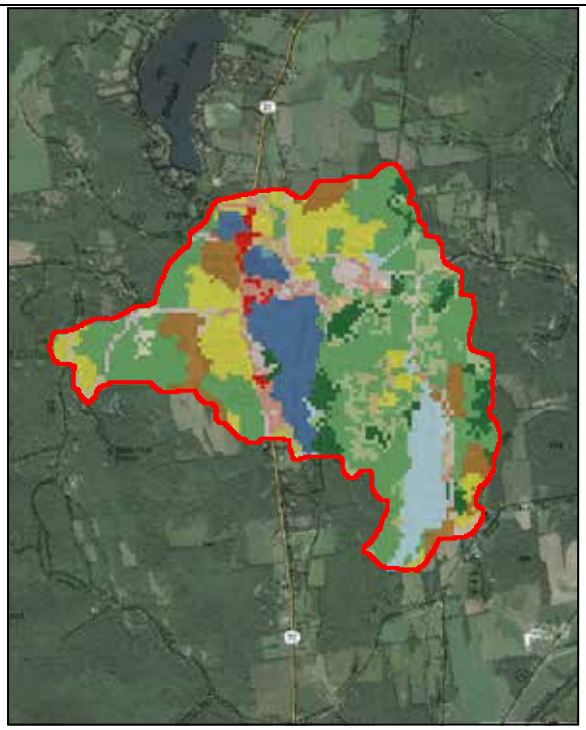
Field Parameters

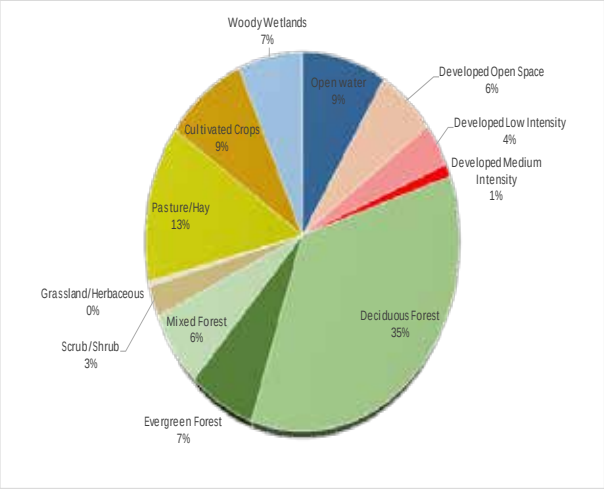
Depth	= water depth, meters
Temp	= water temperature, degrees Celsius
D.O.	= dissolved oxygen, in milligrams per liter (mg/l) or parts per million (ppm) NYS standard = 4 mg/l; 5 mg/l for salmonids
pH	= powers of hydrogen, standard pH units (S.U.) Detection limit = 1 S.U.; NYS standard = 6.5 and 8.5
SpCond	= 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

Lake Lauderdale Watershed (Washington County, NY) 2011 Land Cover





Landcover Category	Acers	Hectares	Percent
Open water	103.59	41.94	8.9%
Developed Open Space	70.91	28.71	6.1%
Developed Low Intensity	44.02	17.82	3.8%
Developed Medium Intensity	12.67	5.13	1.1%
Deciduous Forest	409.03	165.6	35.2%
Evergreen Forest	76.92	31.14	6.6%
Mixed Forest	73.80	29.88	6.4%
Scrub/Shrub	30.46	12.33	2.6%
Grassland/Herbaceous	4.89	1.98	0.4%
Pasture/Hay	156.72	63.45	13.5%
Cultivated Crops	99.59	40.32	8.6%
Woody Wetlands	78.03	31.59	6.7%
Emergent Herbaceous Wetland	1.56	0.63	0.1%