

LCI Lake Water Quality Summary

General Information

Lake Name: West Mud Lake

Location: Town of Arkwright & Villenova, Chautauqua County, NY

Basin: Allegheny River Basin

Size: 6 hectares (15 acres)

Lake Origins: unknown

Major Tributaries: West Branch Conewango Creek

Watershed Area: 3.3 Square Miles

Lake Tributary to: West Branch Conewango Creek

Water Quality Classification: C (best intended use: secondary contact recreation)

Sounding Depth: 7 meters (23 feet)

Sampling Coordinates: 42.40199, -79.1779

Sampling Access Point: Private land

Monitoring Program: Lake Classification and Inventory (LCI) Survey

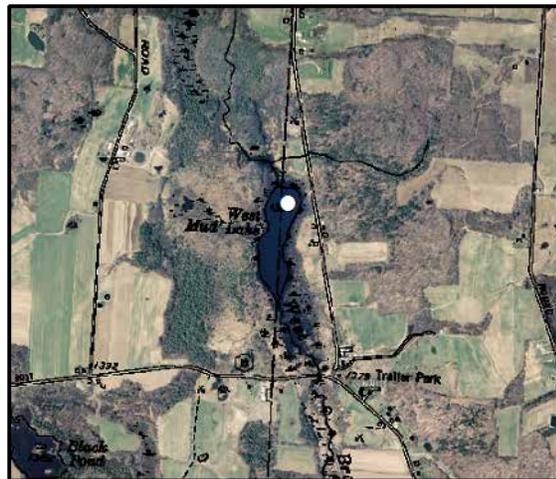
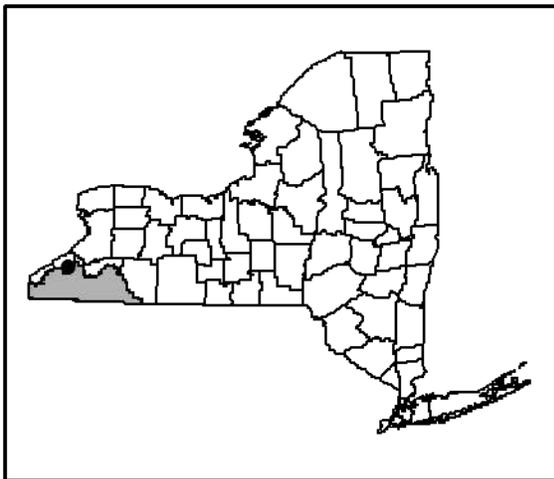
Sampling Date: 8/3/2011, 6/25, 7/31, 8/28 & 9/25/2012

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Lake Map

(sampling location marked with a circle)



Background and Lake Assessment

West Mud Lake is a 15 acre lake located between the towns of Arkwright and Villanova in Chautauqua County. The majority of the near shore area of the lake is either forested or wetland, with only a few private access points to the lake. The entire shoreline of the lake is privately owned with no public access points. The greater watershed for the lake is a mix of forested lands, wetlands and agricultural lands, both crop lands and dairy farms. It is unknown what current or past recreational uses the lake supports, although it is likely that at least some fishing may occur on the lake.

The NYSDEC Division of Water's lake water quality database had no previous data for the lake, and thus the lake was included in the 2011 Lake Classification and Inventory (LCI) screening program. Due to potential water quality impairments related to excess nutrients, additional monitoring of the lake during the summer of 2012.

West Mud Lake can be characterized as *eutrophic*, or moderately to highly productive. The average water clarity reading for the samples taken between 2011 and 2012 (TSI = 51, typical of *eutrophic* waterbodies) was in the expected range given the total phosphorus reading (TSI = 53, typical of *eutrophic* waterbodies) and clearer than expected given the chlorophyll *a* reading (TSI = 58, typical of *eutrophic* waterbodies). These data indicate that baseline nutrients may support algal blooms in the lake.

In early August, the lake's surface water had a slight algal greenness, with the water clarity reading of 2.1 meters (~7 feet). An assessment of the aquatic plants of the lake showed several native submergent and floating leaf plants. A few of the floating leaf plants were noted as occurring at high densities in a few small areas around the lake. No invasive aquatic plant species were seen in the lake; however, a complete survey of the aquatic plant community of the lake was not conducted. Efforts should be made to prevent the introduction and spread of any invasive species

West Mud 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 6 meters deep. The thermocline was generally in 3 to 5 meter range from late June through late August. The lake had de-stratified or mixed by the end of September. Anoxic (lack of oxygen) conditions were observed in waters below 4 meters of depth while the lake was stratified with a re-oxygenation of the lower portion of the water column occurring when the lake mixed in September. Surface pH readings were slightly alkaline. Conductivity readings indicated hard water (high ionic strength) and were consistent over depth and time. All of the above parameters were similar to those seen at East Mud Lake in 2011, with the exception of the dissolved oxygen level (more indicative of *hypoxic*, or oxygen-poor conditions) in East Mud Lake. East Mud Lake was not sampled in 2012.

West Mud Lake appears typical of hard water, weakly colored, slightly alkaline waterbodies. Other water bodies with similar water quality characteristics support warmwater fish species, although the lack of cold oxygen rich water may not be supportive of coldwater fish species. However, fisheries habitat cannot be fully evaluated by the LCI. A fisheries survey would need to be conducted to further evaluate the fisheries in the lake.

The phosphorus levels found in the surface waters were above the state's guidance value on all sampling dates and may indicate unnatural nutrient inputs to the lake from the watershed. The other parameters of concern were high chlorophyll *a* (indicative of elevated algae levels), low deepwater dissolved oxygen readings, and elevated iron and manganese levels in the bottom waters. The elevated iron and manganese are typically seen in waterbodies that experience anoxic conditions, which allows iron and manganese bound in the sediment to be released to the water column.

Evaluation of Lake Condition Impacts to Lake Uses

Potable Water (Drinking Water)

West Mud 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 elevated levels of phosphorus, algae (chlorophyll *a*) and iron may *threaten* surface potable water use. The levels of iron and manganese in the bottom waters may cause taste or odor issues with finished water.

Contact Recreation (Swimming)

West Mud Lake is not classified for primary contact recreation- swimming and bathing being the best intended use. Bacteria data are needed to evaluate the safety of West Mud Lake for swimming—these are not collected through the LCI. The data collected through the LCI showed the water clarity was above the State Department of Health's guidance value of 1.2 meters to protect swimmers. The high algae and phosphorus levels may create conditions that would *stress* the ability of the lake to be safely used for swimming.

Non-Contact Recreation (Boating and Fishing)

The data collected through the LCI indicates that high densities of floating leaf aquatic plants may *threaten* the ability of the lake to be used for boating and fishing.

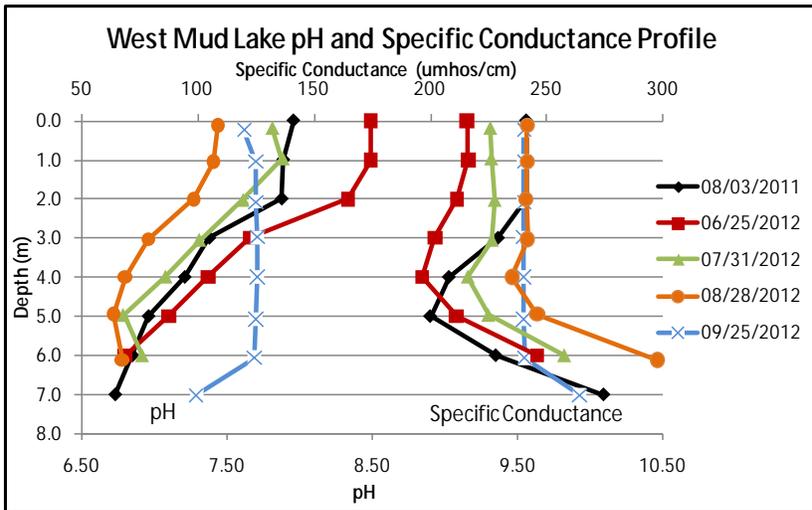
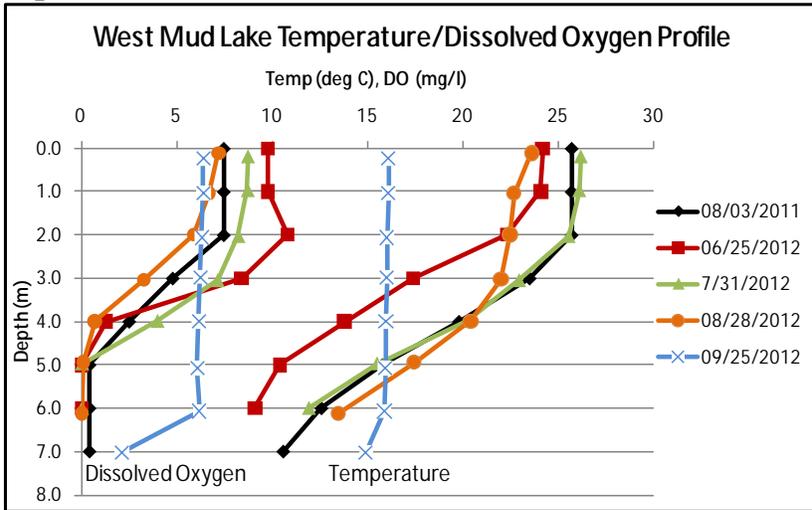
Aquatic Life

Organisms susceptible to high summer temperature may be *stressed* due to a lack of cold oxygen rich water in the pond during the summer. Additional biological studies would need to be conducted to further evaluate impacts to aquatic life.

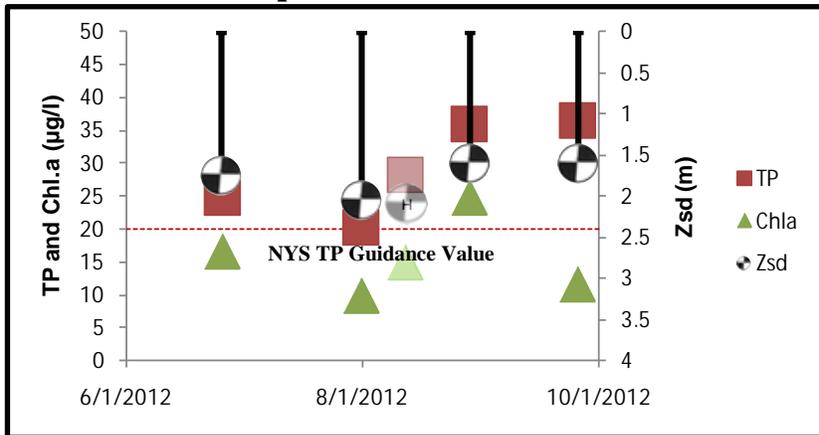
Aesthetics

These data indicate that aesthetics may be *stressed* by high densities of aquatic macrophytes and algal greenness.

Depth Profiles



Time Series: Trophic Indicators



* Transparent markers represent the 8/3/2011 sampling

Water Quality Sampling Results

Surface Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
SECCHI	meters	5	1.6	1.82	2.1	Eutrophic	No readings violate DOH guidance value
TSI-Secchi			53.2	51.4	49.3	Eutrophic	No pertinent water quality standards
TP	mg/l	5	0.0204	0.0292	0.0366	Eutrophic	100% of readings violate water quality guidance value
TSI-TP			47.6	52.8	56.0	Eutrophic	No pertinent water quality standards
TSP	mg/l	5	0.0056	0.01052	0.0187	High % soluble Phosphorus	No pertinent water quality standards
NOx	mg/l	5	0.0049	0.01306	0.0279	Low nitrate	No readings violate water quality standards
NH4	mg/l	5	ND	0.052	0.213	Low ammonia	No readings violate water quality standards
TKN	mg/l	5	0.43	0.542	0.64	Intermediate organic nitrogen	No pertinent water quality standards
TN/TP	mg/l		38.42	42.61	53.61	Phosphorus Limited	No pertinent water quality standards
CHLA	ug/l	5	9.77	15.494	24.7	Eutrophic	Readings indicate <i>stressed</i> conditions
TSI-CHLA			53.0	57.5	62.1	Eutrophic	No pertinent water quality standards
Alkalinity	mg/l	5	97.1	107.22	115	Moderately Buffered	No pertinent water quality standards
TCOLOR	ptu	5	22	29.6	39	Weakly Colored	No pertinent water quality standards
TOC	mg/l	5	5.9	6.14	6.3		No pertinent water quality standards
Ca	mg/l	5	31.1	34.62	36.8	Strongly Supports Zebra Mussels	No pertinent water quality standards
Fe	mg/l	5	0.0974	0.2207	0.572	May have some taste/odor	20% of readings violate water quality standards
Mn	mg/l	5	0.0232	0.07302	0.203		No readings violate water quality standards
Mg	mg/l	5	6.76	7.22	7.45		No readings violate water quality standards
K	mg/l	5	0.636	0.774	1.04		No pertinent water quality standards
Na	mg/l	5	3.43	3.88	4.3		No readings violate water quality standards
Cl	mg/l	5	4.3	5.3	5.9	Minor road salt runoff	No readings violate water quality standards
SO4	mg/l	5	3.9	4.6	5.5		No readings violate water quality standards
Si	mg/l	5	3.77	5.232	5.87		No pertinent water quality standards

Bottom Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
TP-bottom	mg/l	3	0.0286	0.1312	0.231		No pertinent water quality standards
TSP-bottom	mg/l	3	0.0126	0.0601	0.119	High % soluble phosphorus	No pertinent water quality standards
NOx-bottom	mg/l	3	0.0073	0.0172	0.0313	No evidence of DO depletion	No readings violate water quality standards
NH4-bottom	mg/l	3	0.028	0.382	0.801	Evidence of DO depletion	No readings violate water quality standards
TKN-bottom	mg/l	3	0.4	0.98	1.69		No pertinent water quality standards
Alk-bottom	mg/l	3	63.4	90.7	120	Moderately Buffered	No pertinent water quality standards
TCOLOR-bottom	ptu	3	32	44.7	60	Highly Colored	No pertinent water quality standards
TOC-bottom	mg/l	3	4.7	5.8	6.9		No pertinent water quality standards
Ca-bottom	mg/l	3	28.3	32.9	35.2	Strongly Supports Zebra Mussels	No pertinent water quality standards
Fe-bottom	mg/l	3	0.242	1.491	2.82	Taste or odor likely	67% of readings violate class 'A' water quality standards (not applicable to West Mud Lake)
Mn-bottom	mg/l	3	0.203	1.168	2.08	Taste or odor likely	67% of readings violate class 'A' water quality standards (not applicable to West Mud Lake)
Mg-bottom	mg/l	3	5.92	6.5	6.96		No readings violate water quality standards
K-bottom	mg/l	3	0.745	0.83	0.918		No pertinent water quality standards
Na-bottom	mg/l	3	3.12	3.4	3.72		No readings violate water quality standards
Cl-bottom	mg/l	3	4.5	4.93	5.3		No readings violate water quality standards
SO4-bottom	mg/l	3	2.2	3.5	4.2		No readings violate water quality standards
Si-bottom	mg/l	3	3.96	6.81	9.03		No pertinent water quality standards

Lake Perception

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
Water Clarity Assessment	1-5, 1 best	5	3	3	3	Definite Algal Greenness	No pertinent water quality standards
Weed Assessment	1-5, 1 best	5	2	2.6	3	Plants Grow to Lake Surface	No pertinent water quality standards
Recreational Assessment	1-5, 1 best	5	2	2.8	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, = $60 - 14.41 * \ln(\text{Secchi})$

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 *a*, 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

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 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 = **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