Truesdale Lake

Surface water quality classification: Class B

Morphology Summary:

Characteristic	Units	Value	Source
Surface area	hectares	34	Land-Tech 2001
Watershed area	hectares	972*	EcoLogic 2008 (excl lake)
Volume	mgal	99.2	Land-Tech 2001
Elevation	m	153	NYSDEC 2007
Maximum depth	m	3.4	Land-Tech 2001
Average Depth	m	1.1**	EcoLogic 2008

* Approximately 49% of the lake's watershed area lies within the State of Connecticut.
**EcoLogic calculated from Land-Tech data: mean depth = volume divided by area.

Lake Inlet: A perennial watercourse discharges into the northeastern portion of the lake from Pumping Station Swamp, a drinking water wellfield located on the border of New York and Connecticut (Land-Tech 2001). A smaller intermittent water course discharges to a cove in the northeast portion of the lake. The lake level is lowered seasonally to minimize damage from ice and to minimize encroachment of aquatic plants.

Recreational impacts: Recreational assessments degrade through mid summer (coincident with increasing lake productivity and despite decreasing weed densities) and improve slightly during late summer as weed densities drop. (NYSDEC 2007).

Lakeshore Development: Mix of forest and maintained lawns (Land-Tech 2001)

Lake Outlet: The lake discharges at the northern end of the lake through a concrete dam. The dam contains an 18-foot spillway with removable springboards allowing the lake levels to be seasonally managed. A spillway height of 14 inches is maintained during the summer months.

Additional Notes:

- Truesdale Lake is a man-made lake created in 1927 by damming a stream and flooding a small pond and surrounding swamp (Truesdale Lake web site[1])
- Sediments accumulate in the lake at a rate of approximately 0.1-0.3 inches per year (Land-Tech 2001).
- Volunteer monitoring Truesdale Inlet from May to August 31 2007 measured Orthophosphate at average concentration of 63.2 ug/l.

[1] Truesdale Lake web site <http://www.truesdalelake.com/>

Figure 1
Truesdale Lake Aquatic Vegetation Survey
Bathymetry Map
July 7, 2005

0 260 520 1,040 1,560 2,080
Feet

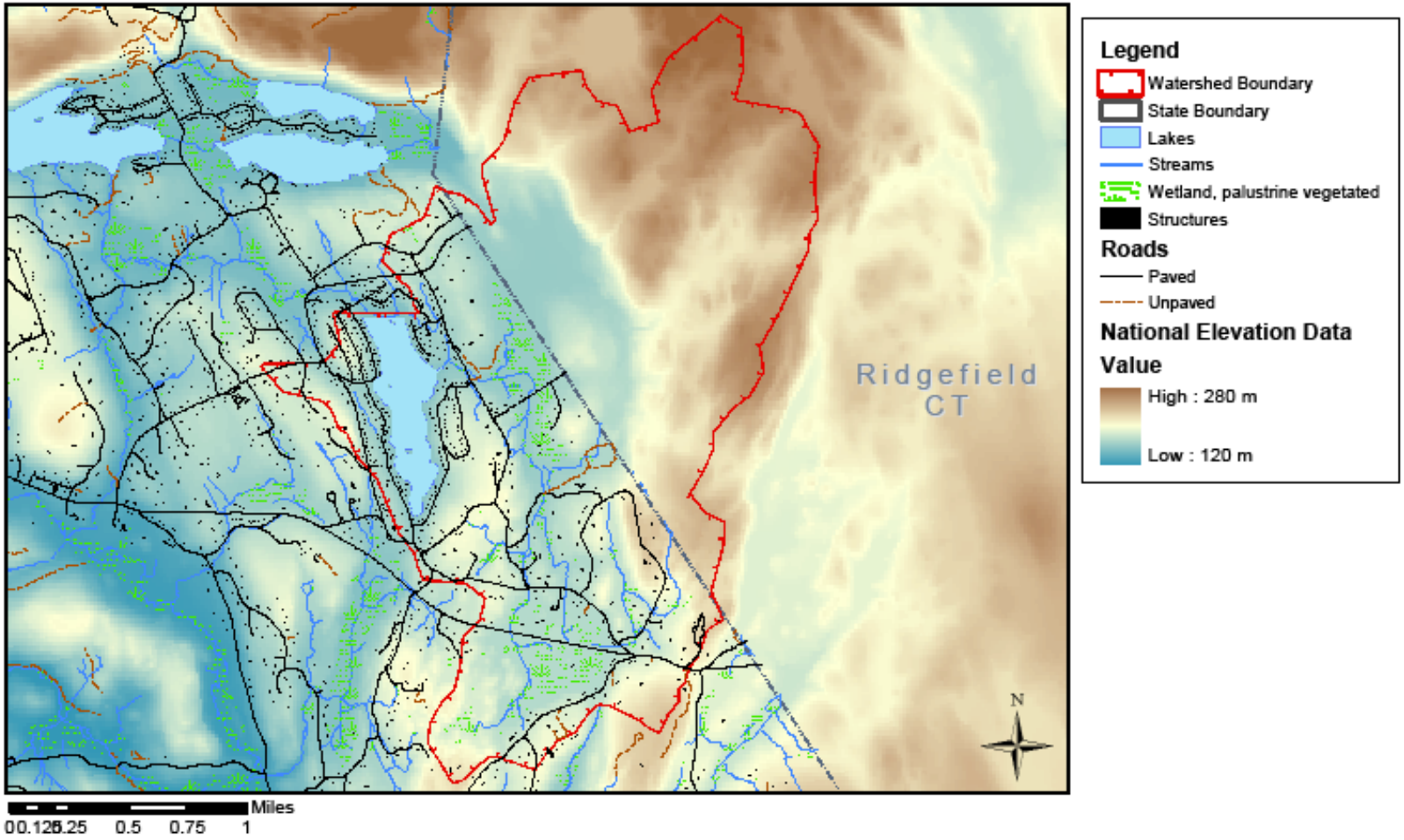
Legend

- Water Depth in feet

N

Allied Biological

Figure 2
Truesdale Lake
Topographic and Human Features



Sources:
Lakes, Streams, Wetlands, Roads and Structures - On-line at Westchester County web site http://giswww.westchestergov.com/. Municipal planimetric datasets were photogrammetrically derived from the county's 2004 base map project and meet National Map Accuracy Standards at 1"=100'.
National Elevation Dataset - U.S. Geological Survey (USGS), EROS Data Center, 1999. On-line at http://gisdata.usgs.net/ned/.
Geographic coordinate system. Horizontal datum of NAD83. Vertical datum of NAVD88.

Historical water quality data summary: Data were collected under the Citizens Statewide Lake Assessment Program (CSLAP), at depths ranging from 1.0 to 1.5 meters (upper waters only). Table A below summarizes samples collected between January and December of each year. Table B below summarizes samples collected during the summer, defined as the period between June 15 and September 15 each year.

A. Representing samples collected between January and December each year.

Parameter (units)	Time Period	Number of Samples	Minimum	Maximum	Average
Calcium (mg/l)	2003-2007	7	21.4	30	25.4
Chlorophyll-α (ug/l)	1999-2007	69	0.24	116	27.3
Color (platinum color units)	1999-2007	69	11	88	31.5
Conductivity (umhos/cm; 25°C)	1999-2007	70	110	322	263
Dissolved Nitrogen (mg/l)	2002-2007	45	0.005	1.52	0.66
Nitrate Nitrogen (mg/l)	1999-2007	71	0.0015	0.14	0.023
Ammonia Nitrogen (mg/l)	2002-2007	47	0.005	0.20	0.038
Phosphorus (mg/l)	1999-2007	78	0.018	0.125	0.057
Nitrogen:Phosphorus Ratio	2002-2007	44	0.20	61	13.6
pH (std units)	1999-2007	68	7.02	9.17	8.02
Secchi depth (m)	1999-2007	72	0.53	2.7	1.23
Temperature (°C)	1999-2007	72	17	31	24

B. Representing samples collected between June 15 and September 15 each year.

Parameter (units)	Time Period	Number of Samples	Minimum	Maximum	Average
Chlorophyll-α (ug/l)	1999-2007	69	1.9	116	30.21
Dissolved Nitrogen (mg/l)	2002-2007	35	0.147	1.52	0.70
Nitrate N (mg/l)	1999-2007	55	0.0015	0.14	0.023
Ammonia N (mg/l)	2002-2007	36	0.005	0.155	0.035
Phosphorus (mg/l)	1999-2007	62	0.018	0.125	0.059
Nitrogen:Phosphorus Ratio	2002-2007	35	1.86	61	13.26
Secchi depth (m)	1999-2007	56	0.53	2.48	1.09

EcoLogic August 2008 water quality data summary:

A. Analytical Results 08/12/2008

Parameter (units)	Surface (0 m)	Depth (3.3 m)
Secchi Transparency (m)	0.75	na
Chlorophyll-a (mg/l)	0.12	na
Alkalinity (mg/l)	80	na
Phosphorus:		
Total Phosphorus (mg/l)	0.092	0.096
Soluble Reactive Phosphorus (mg/l)	0.0070[a]	0.021[a]
Nitrogen:		
Nitrate + Nitrite as N (mg/l)	0.065[a]	0.092[a]
Total Kjeldahl Nitrogen (mg/l)	1.3[a]	1.6[a]
Total Nitrogen (mg/l)	1.4	1.7

na – not analyzed
[a]The result of the laboratory control sample was greater than the established limit.

B. Field Profiles

Depth ft (m)	Temperature (°C)	pH	Conductivity (us)	DO (mg/l)	DO (% sat)
1 (0.305)	23.8	7.7	308	7.1	83.9
2 (0.61)	23.9		308	7.0	81.9
3 (0.915)	23.8		308	6.9	81.6
4 (1.22)	23.8		308	6.8	81.1
5 (1.525)	23.7		309	6.6	78.5
6 (1.83)	23.7		309	6.7	79.1
7 (2.135)	23.6		309	6.4	74.0
8 (2.44)	23.3		308	6.3	74.4
9 (2.745)	23.1		305	5.6	67.0
10 (3.05)	21.8		275	4.2	48.3

Sediment data summary:

- Composite samples collected May 2001 (Land-Tech, 2001):

Parameter (units)	Result
Phosphorus (mg/kg)	410
Copper (mg/kg)	34

- Composite samples collected August 12, 2008 (EcoLogic, 2008):

Parameter	Analytical Method	Result-1 (mg/kg dry wt)	Result-2 (mg/kg dry wt)
Pesticides/PCBs	EPA 8081/8082	ND	ND
TCL Volatiles	EPA 8260B	ND	ND
TCL Semi-Volatiles	EPA 8270	ND	ND
RCRA Total Metals	EPA 6010		
Arsenic		ND	ND
Barium		19	26
Cadmium		0.23	0.32
Chromium		3.3	4.7

Parameter	Analytical Method	Result-1 (mg/kg dry wt)	Result-2 (mg/kg dry wt)
Copper		240	210
Lead		7.8	8.2
Selenium		ND	ND
Silver		ND	ND
RCRA Mercury	EPA 7471	ND	ND
Total Organic Carbon	EPA 9060	132000	39300
Total Solids	SM 18-20 2540B	9.2%	26%

ND – non-detect. Analytes reported as less than the method detection limit.

Sediment Contaminant Analysis: Interest has been expressed in exploring the feasibility of dredging. A composite sediment sample was collected on August 13, 2008 (EcoLogic, 2008) to determine if any threshold screening values that might preclude dredging were exceeded. Results are summarized in Table C, in the context of NYSDEC Screening levels. A complete set of results is attached to the end of this report. (Attachment 2 - 2008 Water Quality and Sediment Sampling Locations and Laboratory Analysis Reports)**.** The NYSDEC screening levels are separated into three Classes: A, B, and C:

- **Class A - No Appreciable Contamination (No Toxicity to aquatic life).**
  If sediment chemistry is found to be at or below the chemical concentrations which define this class, dredging and in-water or riparian placement, at approved locations, can generally proceed.

- **Class B - Moderate Contamination (Chronic Toxicity to aquatic life).**
  Dredging and riparian placement may be conducted with several restrictions. These restrictions may be applied based upon site-specific concerns and knowledge coupled with sediment evaluation.

- **Class C - High Contamination (Acute Toxicity to aquatic life).**
  Class C dredged material is expected to be acutely toxic to aquatic biota and therefore, dredging and disposal requirements may be stringent. When the contaminant levels exceed Class C, it is the responsibility of the applicant to ensure that the dredged material is not a regulated hazardous material as defined in 6NYCRR Part 371. This TOGS does not apply to dredged materials determined to be hazardous.

Table C. Truesdale Lake sediment analytical results for two samples, with NYSDEC Sediment Quality Threshold Values for Dredging, Riparian or In-water Placement. Threshold values are based on known and presumed impacts on aquatic organisms/ecosystem. Results that fall into Class C (high contamination) are highlighted.

Compound	Required Method Detection Limit	Threshold Values			Truesdale Results	Threshold Class
		Class A	Class B	Class C		
Metals (mg/kg dry wt) – EPA Method 6010B						
Arsenic	1.0	< 14	14 – 53	> 53	ND; ND	A
Cadmium	0.5	< 1.2	1.2 - 9.5	> 9.5	0.23; 0.32	A
Copper*	2.5	< 33	33 – 207	> 207	240; 210	C
Lead	5.0	< 33	33 – 166	> 166	7.8; 8.2	A
Mercury+	0.2	< 0.17	0.17 - 1.6	> 1.6	ND; ND	A
PAHs and Petroleum-Related Compounds (mg/kg dry wt) – EPA Methods 8020, 8021, 8260 and 8270						
Benzene	0.002	< 0.59	0.59 - 2.16	> 2.16	ND; ND	A
Total BTEX*	0.002	< 0.96	0.96 - 5.9	> 5.9	ND; ND	A
Total PAH[1]	0.33	< 4	4 - 35	> 35	ND; ND	A
Pesticides (mg/kg dry wt) – EPA Methods 8081						
Sum of DDT+DDD+DDE+	0.029	< 0.003	0.003 - 0.03	> 0.03	ND; ND	A
Mirex*+	0.189	< 0.0014	0.0014 - 0.014	> 0.014	na	--
Chlordane*+	0.031	< 0.003	0.003 - 0.036	> 0.036	ND; ND	A
Dieldrin	0.019	< 0.11	0.11 -0. 48	> 0.48	ND; ND	A
Chlorinated Hydrocarbons (mg/kg dry wt) – EPA Methods 8082 and 1613B						
PCBs (sum of aroclors)[2]	0.025	< 0.1	0.1 - 1	> 1	ND; ND	A
2,3,7,8-TCDD*[3](sum of toxic equivalency)	0.000002	< 0.0000045	0.0000045 - 0.00005	> 0.00005	na	--

na – not analyzed; "<" – indicates result was not detected above the level reported.

+Threshold values lower than the Method Detection Limit are superseded by the Method Detection Limit.

* Indicates case-specific parameter. The analysis and evaluation of these case specific analytes is recommended for those waters known or suspected to have sediment contamination caused by those chemicals. These determinations are made at the discretion of Division staff.

[1]For Sum of PAH, see Appendix E of TOGS 5.1.9. For Truesdale Lake, each of the 18 PAH compounds in two samples were reported as non-detect (<0.8 and <1 mg/kg).

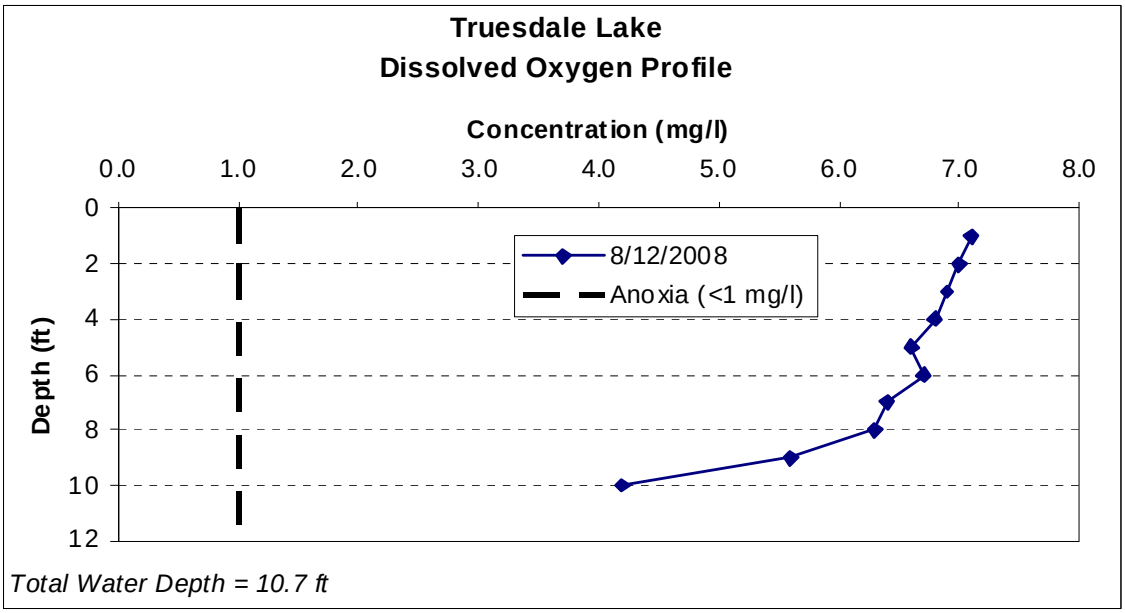
[2]For the sum of the 22 PCB congeners required by the USACE NYD or EPA Region 2, the sum must be multiplied by two to determine the total PCB concentration. For Truesdale Lake, seven Aroclors were each reported as <0.2 mg/kg; this value is reported above.

[3]TEQ calculation as per the NATO - 1988 method (see Appendix D of TOGS 5.1.9).

Note: The proposed list of analytes can be augmented with additional site specific parameters of concern. Any additional analytes suggested will require Division approved sediment quality threshold values for the A, B and C classifications.

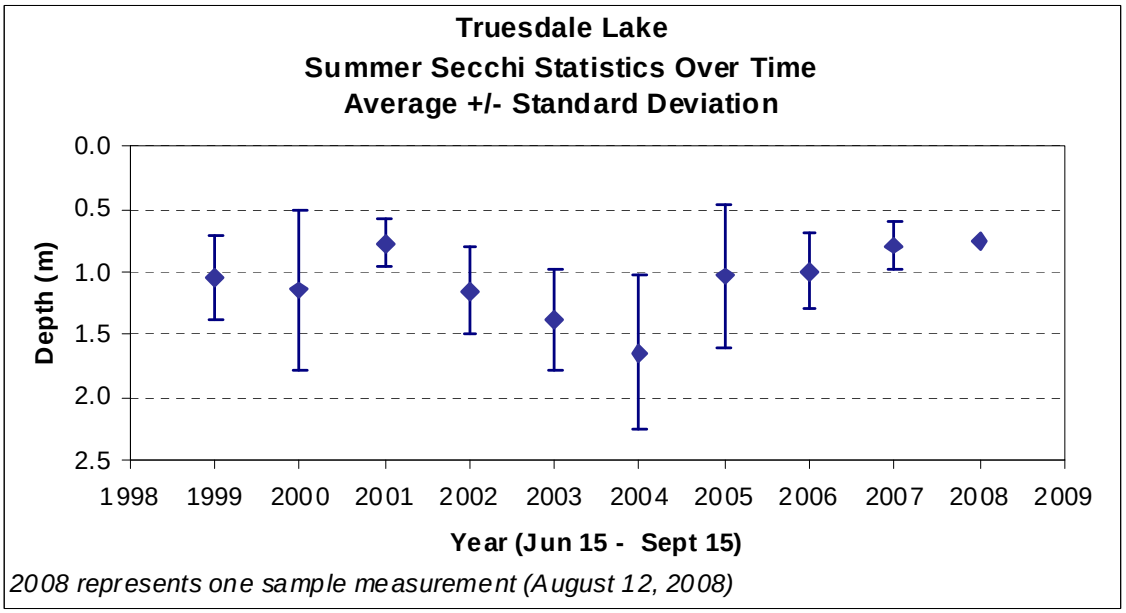
Source: Table 2, NYSDEC Division of Water, Technical & Operational Guidance Series (TOGS) 5.1.9, "In-Water and Riparian Management of Sediment and Dredged Material", Nov. 2004

Anoxia: Based on the dissolved oxygen profile collected on August 12, 2008, oxygen levels were depleted in the lower waters, but anoxic conditions (concentrations less than 1 mg/l) were not observed in the lake.



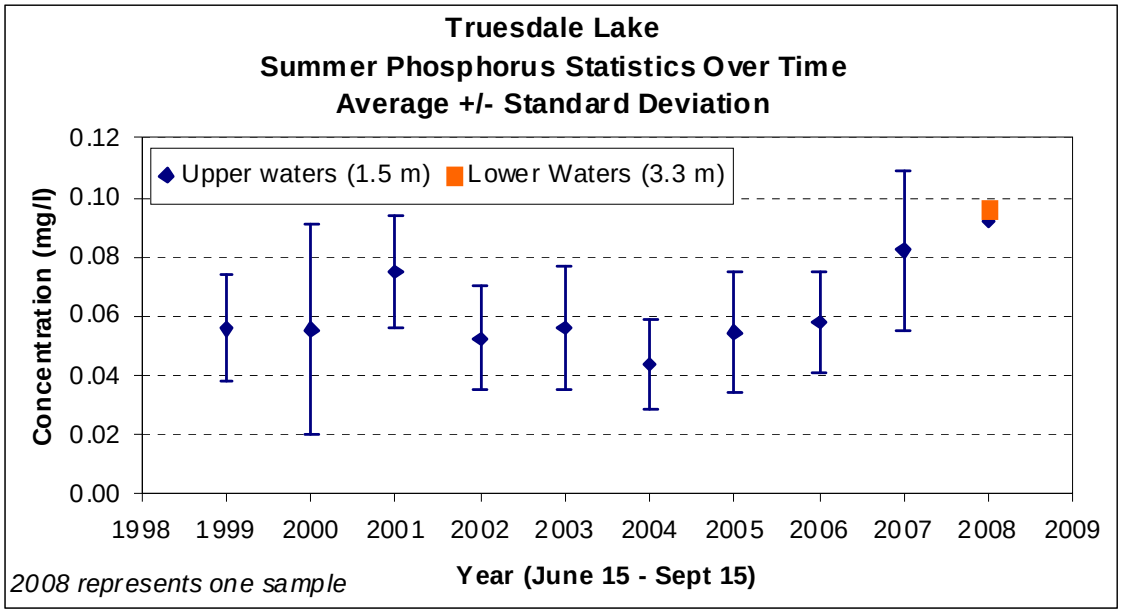
Total Water Depth = 10.7 ft

Water Clarity: Averages over time are generally less than 2 meters. The historical variability around the mean is about half a meter.

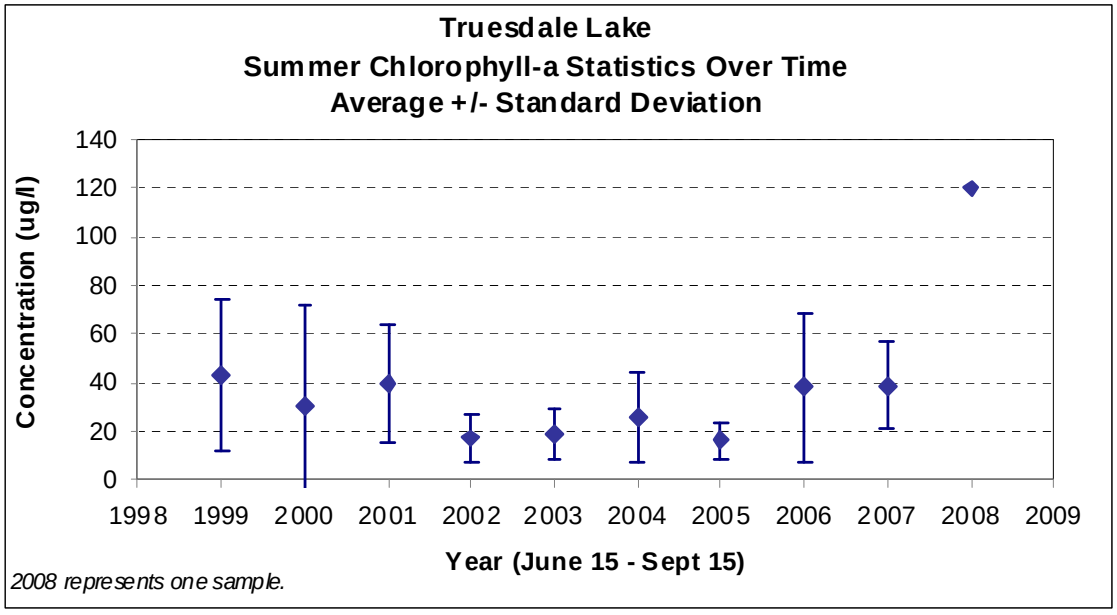


2008 represents one sample measurement (August 12, 2008)

Phosphorus Concentrations: Phosphorus concentrations in upper waters have been fairly stable since 1999. There are no phosphorus data for lower waters prior to 2008. In 2008, lower and upper waters phosphorus concentrations are similar.



Chlorophyll-α: Chlorophyll-α concentrations are generally lower for the 2002 through 2005 time period than for the 1999 through 2001 period. The concentrations in 2006 and 2007 are comparable to the 1999 through 2001 period. The standard deviations show considerable variability over time.



Trophic Status:

Parameter	Trophic State (shading indicates match to Lake)				Truesdale Lake*
	Oligotrophic	Mesotrophic	Eutrophic	Hypereutrophic	
Summer average Total Phosphorus, upper waters (µg/l)	<10	10-35	35 -100	>100	59
Summer chlorophyll-a, upper waters (µg/l)	<2.5	2.5 - 8	8 - 25	>25	30
Peak chlorophyll-a (µg/l)	<8	8-25	25-75	>75	116
Average Secchi disk transparency, m	>6	6-3	3-1.5	<1.5	1.09
Minimum Secchi disk transparency, meters	>3	3-1.5	1.5-0.7	<0.7	0.53
Dissolved oxygen in lower waters (% saturation)	80 - 100	10-80	Less than 10	Zero	48.3

*Data shown represent the period 1999-2007, except for dissolved oxygen, which was collected at a depth of 10 feet by EcoLogic on 08/12/2008.

Aquatic Habitat:

- The lake lacks habitat diversity; it is shallow with gentle slopes offering little variation in depth for fish habitat. (Land-Tech 2001)

- Aquatic vascular plants and algae are a major problem in Lake Truesdale. The physical removal of weeds goes back to 1950 using weed cutters and harvesting. Chemical treatment was initiated in 1957 under the direction of Cornell University's State School of Agriculture, Conservation Department. (Land-Tech 2001).

- Vegetation survey was conducted on July 7, 2005 (Allied Biological):

    - Truesdale Lake was treated with an aquatic herbicide ten days before the vegetation survey (June 27, 2005). The target macrophytes were Curly-leaf pondweed (*P. crispus*) and Leafy pondweed (*P. foliosus*). Since neither of these pondweeds were observed during the July 7th survey, that treatment can be considered a success.

    - Benthic filamentous algae was scattered throughout the lake, as was stonewort. Southern Naiad was observed mostly in the northern half of the lake but almost exclusively in trace amounts. As Southern Naiad is a late season annual, the July 7th survey is probably not an accurate representation of its true distribution later in the season. Common Waterweed was only observed at three sample locations in Lake Truesdale.

    - List of Aquatic Plants identified in 2005:

Scientific Name	Common Name
Miscellaneous	Benthic filamentous algae
Nitella spp.	Stonewort, Nitella
Najas guadalupensis	Southern naiad, southern water nymph, bushy pondweed
Elodea canadensis.	Elodea, common water weed

Invasive Species: Early Detection List for eight regions in New York State, published by the Invasive Species Plant Council of New York State. Obtained on-line (11/29/07). Lower Hudson region list:

Scientific Name	Common Name
Heracleum mantegazzianum	Giant Hogweed
Wisteria floribunda	Japanese Wisteria, Wisteria
Digitalis grandiflora (D. pupurea)	Yellow Foxglove, Foxglove
Geranium thunbergii	Thunberg's Geranium
Miscanthus sinensis	Chinese Silver Grass, Eulalia
Myriophyllum aquaticum	Parrot-feather, Waterfeather, Brazilian Watermilfoil.
Pinus thunbergiana (P. thunbergii)	Japanese Black Pine
Prunus padus	European Bird Cherry
Veronica beccabunga	European Speedwell

Endangered Species:

- US Fish and Wildlife Service

Scientific Name	Common Name	Federal Status
Reptiles		
Clemmys muhlenbergii	Bog Turtle	Threatened, Westchester Co.
Birds		
Haliaeefus leucocephalus	Bald Eagle	Threatened, entire state
Mammals		
Myotis sodalist	Indiana Bat	Endangered, entire state
Felix concolor couguar	Eastern Cougar	Endangered, entire state (probably extinct)
Plants		
Isotria medeoloides	Small Whorled Pogonia	Threatened, entire state
Platanthera leucophea	Eastern Prairie Orchid	Threatened, not relocated in NY
Scirpus ancistrochaetus	Northeastern Bulrush	Endangered, not relocated in NY

- New York Natural Heritage Program – Town of Lewisboro

Scientific Name	Common Name	NY Legal Status
Reptiles		
Glyptemys muhlenbergii (formerly Clemmys muhlenbergii)	Bog Turtle	Endangered
Birds		
Oporornis formosus	Kentucky Warbler	Protected
Butterflies and Skippers		
Satyrium favonius ontario	Northern Oak Hairstreak	Unlisted
Dragonflies and Damselflies		
Enallagma laterale	New England Bluet	Unlisted
Plants		
Asclepias purpurascens	Purple Milkweed	Unlisted
Eleocharis quadrangulata	Angled Spikerush	Endangered

Water Balance:

USGS Mean Annual (inches/year)		Volume (acre-ft/year)
Precipitation (P)	48	336
Evaporation (ET)	22	154
Runoff (R)	26	5,206

Water Budget:	
Inflow to Lake [R+(P-ET)]	1,756 mgal/year
Lake Volume	180 mgal
Flushing Rate	10 times/year
Residence Time	0.10 years

Phosphorus Budget:

(A) Watershed Land Cover: 2001 National Land Cover Data Set (MRLC). Includes phosphorus export coefficient (kg/ha/year) and estimated phosphorus export.

Description	Watershed (acres)	Cover (%)	Phosphorus Export Coeff	Estim P Export kg/year	Estim P Export Percent
Open water (all)	90	3.5	0.30	11	9.0
Developed, open space	380	15	0.20	31	25
Developed, low intensity	6.3	0.25	0.30	0.77	0.63
Developed, moderate intensity	2.5	0.10	0.50	0.52	0.42
Deciduous forest	1,569	61	0.07	44	36
Evergreen forest	105	4.1	0.20	8.5	6.9
Mixed forest	36	1.4	0.09	1.3	1.1
Shrub/scrub	3.8	0.15	0.28	0.43	0.35
Grassland/herbaceous	2.2	0.09	0.28	0.25	0.21
Pasture/hay	106	4.1	0.30	13	11
Cultivated crops	2.0	0.08	2.10	1.7	1.4
Woody wetlands	264	10	0.09	9.6	7.9
Total Acres*	**2,567**	**100**		**122**	**100**

*Watershed area includes the area located in the State of Connecticut.

(B) Septic: Assumes that communities around the lake are on septic systems.

Estimated population on septic by soil suitability class with US 2000 Census household size for 100-meter buffer of surface water.

Class	N Structures	Average Household	Estimated Population*
Not limited	9	3	27
Somewhat limited	198	3	594
Very limited	96	3	288
Total	**303**		**909**

*Population estimate does not include the area of the watershed located in the State of Connecticut; a Structures file was not available to conduct the analysis.

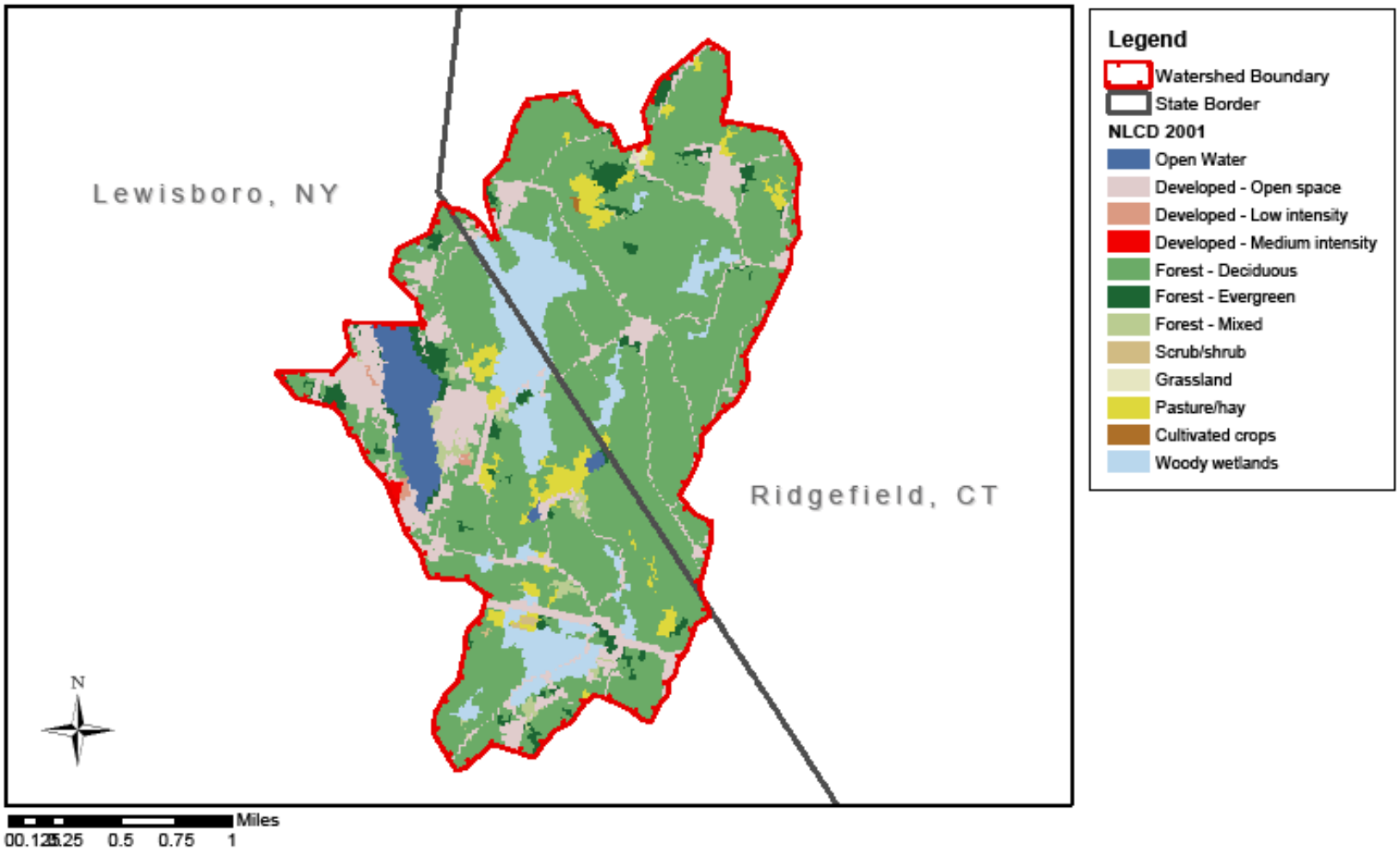
Estimated Phosphorus export by Soil Suitability class for 100-meter buffer of surface water, with failure rate of 5%.

Class	Population*	P per cap	Transport	kg/year
Not limited	26	0.6	10%	1.5
Somewhat limited	564	0.6	30%	102
Very limited	274	0.6	60%	98
Failed systems (5%)	45	0.6	100%	27
Total	**909**			**229**

*Population estimate does not include the area located in the State of Connecticut; a Structures file was not available for this area.

Figure 3

Truesdale Lake
National Land Cover Dataset 2001

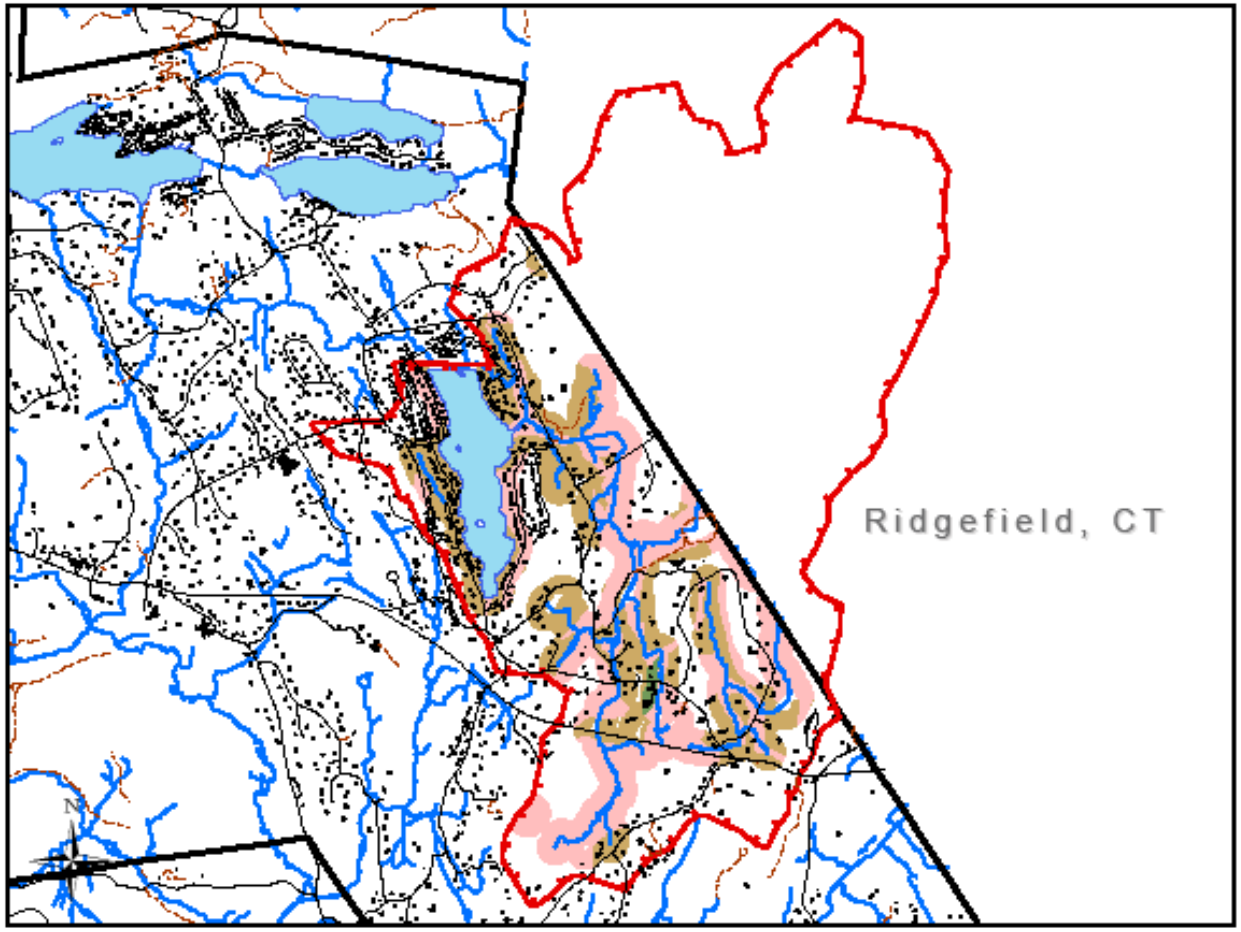


Source:
National Land Cover Database zone 65 Land Cover Layer. On-line at http://www.mrlc.gov
The National Land Cover Database 2001 land cover layer for mapping zone 65 was produced through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium. Minimum mapping unit = 1 acre. Geo-referenced to Albers Conical Equal Area, with a spheroid of GRS 1980, and Datum of NAD83.

Figure 4

Truesdale Lake

Soil Septic Suitability, 100-Meter Stream Buffer Within the Watershed



Legend

- Watershed Boundary
- Town Border
- Lakes
- Streams
- Structures

Roads

- Paved
- Unpaved

Septic Suitability

- Not limited
- Somewhat limited
- Very limited

Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect septic absorption fields:

"Not limited" - the soil has features that are very favorable. Good performance and very low maintenance can be expected.

"Somewhat limited" - the soil has features that are moderately favorable. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

"Very limited" - the soil has one or more features that are unfavorable. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Sources:

Lakes, Streams, Wetlands, Roads and Structures - On-line at Westchester County web site http://giswww.westchestergov.com/. Municipal planimetric datasets were photogrammetrically derived from the county's 2004 base map project and meet National Map Accuracy Standards at 1"=100'.

Soil Survey of Westchester County - Compiled by Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. On-line at http://soildatamart.nrcs.usda.gov/. Accessed November 28, 2007. *"Septic tank absorption fields" are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches or between a depth of 24 inches and a restrictive layer is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health.*

EcoLogic

(C) Point Sources: There are no known point sources of phosphorus to Truesdale Lake.

(D) Summary of Phosphorus Input to the Lake:

Source	Input (kg/year)
Watershed Land Cover	122
Point Sources	0
Septic within 100m of surface water	229
Internal loading (sediments)	0
Total	**351**

Phosphorus Mass Balance: Empirical estimates of net loss from system based on mean depth and water residence time.

$$p = W'/10+H\rho$$

where:

p = summer average in-lake TP concentration, ug/l
W′ = areal loading rate, g/m^2/year
H = mean depth, m
ρ = flushes per year

Parameter	Units	Result
W′	g/m^2/year	1,032
H	m	2.0
ρ	flushes per year	0.10
p	**ug/l**	**101**
Summer (Jun 15 – Sept 15) average TP 1999-2007, upper waters:		**54 ug/l**

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