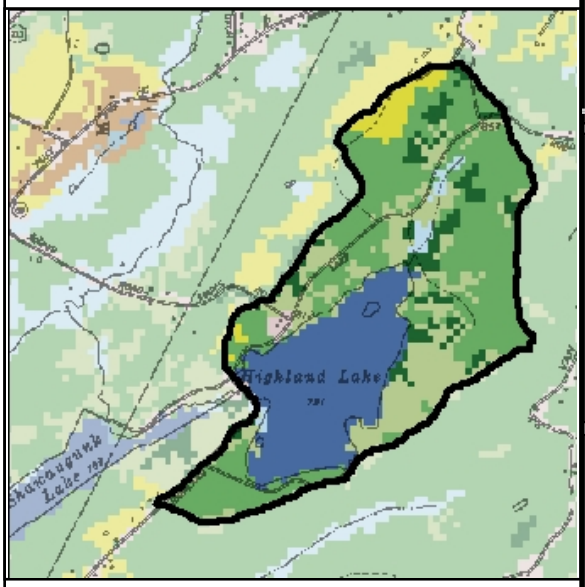
Highland Lake, Orange Co.

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation



Lake Characteristics	Surface Area (ac/ha)	96	39
	Max Depth (ft/m)	19	6
	Mean Depth (ft/m)	15	5
	Retention Time (years)	2.00	
	Water Class	AA	
	Dam Class	B	
Watershed Characteristics	Watershed Area(ac/ha)	459	186
	Watershed/Lake Ratio	5	
	Lake and Wetlands	26.6%	
	Agricultural	4.0%	
	Forests, shrubs, grasses	68.6%	
	Residential	0.8%	
	Urban	0.0%	
CSLAP Participation	Years	2003-2005, 2008-2009	
	Volunteers		

Trophic State	HABs Susceptibility	Invasive Vulnerability	PWL Assessment
Mesoeutrophic	Moderate	Low	Stressed

Open Water Indicators	2017 Sampling Results								Seasonal Change	Long Term Avg.
Chl.a (ug/l)										4.0
BG Chl.a (ug/l)										
Clarity (m)										2.2
pH										7.4
Cond (umho/cm)										102
Surf Temp (degC)										23
Bott Temp (degC)										24
TN (mg/L)										0.390
TP (mg/L)										0.038
Deep TP (mg/L)										0.041
N:P Ratio										

Shoreline bloom and HABs notifications

Date of first listing	Date of last listing	# of weeks on DEC notification list	# of weeks with updates

Shoreline HAB Sample Dates 2017

HAB Indicators	HAB Criteria							
BGA	25 µg/L	NA						
Microcystin	20 µg/L	NA						
Anatoxin-a		NA						

HAB Status

2017 Open Water Algae Samples

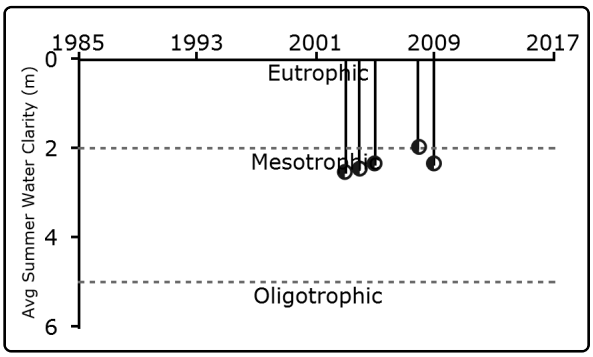
2017 Shoreline Algae Samples

2017 Open Water Toxin Levels

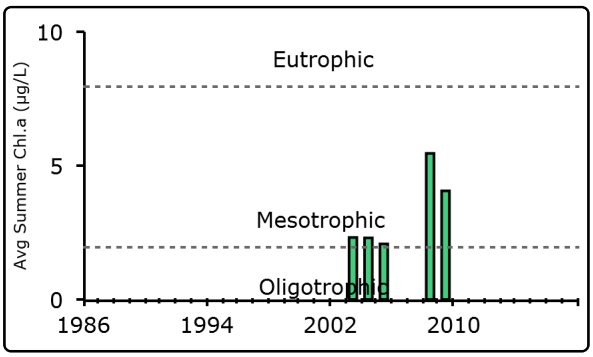
2017 Shoreline Toxin Levels

Highland Lake Long Term Trend Analysis

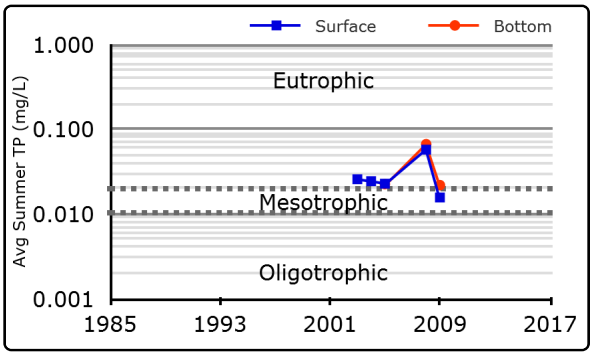
Clarity



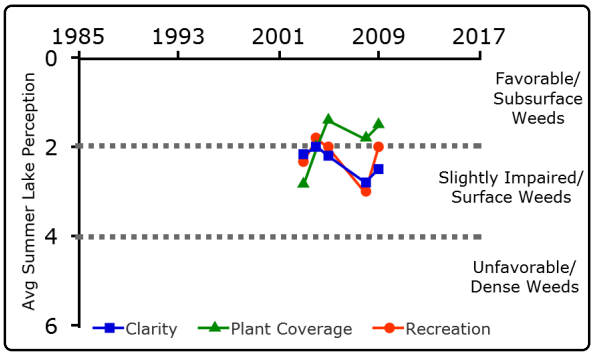
Chlorophyll a



Surface and Deep Phosphorus

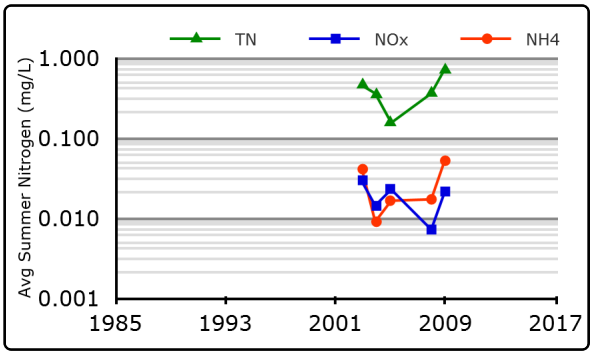


Lake Perception

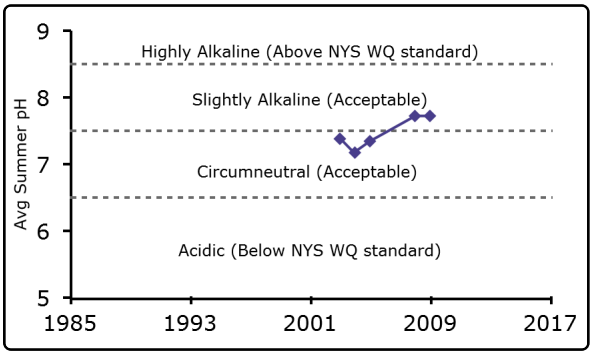


Highland Lake Long Term Trend Analysis

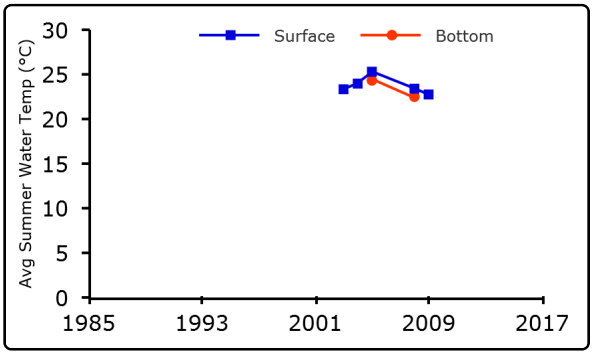
Nitrogen



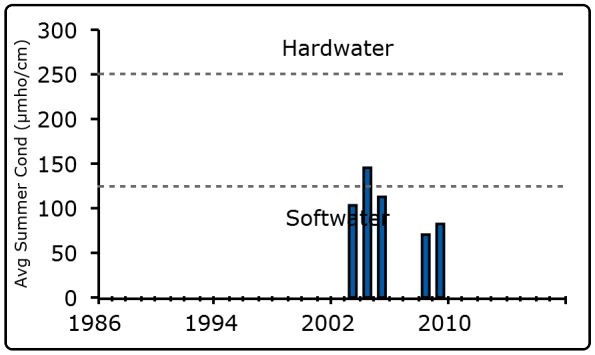
pH



Temperature



Specific Conductance



Highland Lake In-Season Analysis

In Season Temperature

In Season Water Clarity

Scorecard

Lake Use

	PWL	Average Year	2017	Primary Issue
Potable Water	●	◆	□	**Algae levels**
Swimming	●	●	□	**No impacts**
Recreation	◆	◆	□	**High nutrients**
Aquatic Life	□	●	□	**No impacts**
Aesthetics	□	◆	□	**High nutrients**
Habitat	□	●	□	**No impacts**
Fish Consumption	□	□	□	**Not applicable**

- ● Supported/Good
- ▲ Threatened/Fair
- ◆ Stressed/Poor
- ■ Impaired
- □ Not Known

Summary

2017 compared to prior years: Highland Lake has not been sampled by the DEC since the late 2000s. That sampling showed Highland Lake to be a *mesoeutrophic* lake, based on elevated nutrient (phosphorus) levels and intermediate water clarity and chlorophyll a readings. pH is slightly alkaline, and the lake water has intermediate hardness and dissolved color. These indicate a threat to production of disinfection-by-products when the water is chlorinated, although DBP formation potential, UV254 or other precursors to DBPs have not been sampled through CSLAP in Highland Lake. Aquatic plants generally do not reach the surface, but water quality and recreational assessments are favorable.

Compared to nearby lakes: Highland Lake has water clarity, algae levels and nutrient readings that are similar to those in other Lower Hudson River basin lakes. pH and conductivity are also similar to those in other nearby lakes, but surface plant coverage may occur less frequently than in these other lakes. Water quality conditions are comparable in Highland, Shawangunk and Highland Lakes, although algae levels were slightly lower in Highland Lake in the late 2000s.

Trends: With the exception of a slight increase in algae levels and pH, none of the CSLAP water quality indicators exhibited clear long term trends in Highland Lake during the 2000s. This is typical of other lakes sampled over a short timeframe.

Algal blooms and HABS: Water quality conditions indicated a moderate susceptibility to blooms. While shoreline blooms were not documented through CSLAP during the time of Highland Lake sampling, it has been reported that blooms occur at least periodically and threaten the water supply.

Aquatic invasive species: No AIS species have been reported in Highland Lake, although many AIS, including Eurasian watermilfoil, Brazilian elodea, and fanwort, have been found in nearby lakes. It is not known if excessive weed growth affects potable water use of the lake.

Indicated Actions: The City of Middletown manages these lakes and at least a portion of their watershed. For other nearby land owners, Individual stewardship activities such as pumping your septic system, growing a buffer of native plants next to the water bodies, and reducing erosion from shoreline properties and runoff into the lake will help to improve lake health by reducing nutrient and sediment loading to the lake. Visiting boats should be inspected to reduce the risk of new invasive species, since nearby lakes harbor several invasive plants not presently found in this lake. Continued monitoring for invasive species is warranted. Continued algae bloom education and monitoring for HABs is recommended, given the increasing frequency in bloom reports in New York state lakes and the potential to affect potable water use of Highland Lake.

How to Read the Report

This guide provides a description of the CSLAP report by section and a glossary. The sampling site is indicated in the header for lakes with more than one routine sampling site.

Physical Characteristics influence lake quality:

- Surface area is the lake's surface in acres and hectares.
- Max depth is the water depth measured at the deepest part of the lake in feet and meters.
- Mean depth is either known from lake bathymetry or is 0.46 of the maximum depth.
- Retention time is the time it takes for water to pass through a lake in years. This indicates the influence of the watershed on lake conditions.
- Lake classification describes the "best uses" for this lake. Class AA, AAspec, and A lakes may be used as sources of potable water. Class B lakes are suitable for contact recreational activities, like swimming. Class C lakes are suitable for non-contact recreational activities, including fishing, although they may still support swimming. The addition of a T or TS to any of these classes indicates the ability of a lake to support trout populations and/or trout spawning.
- Dam classification defines the hazard class of a dam. Class A, B, C, and D dams are defined as low, intermediate, high, or negligible/no hazard dams in that order. "0" indicates that no class has been assigned to a particular dam, or that no dam exists.

Watershed characteristics influence lake water quality:

- Watershed area in acres and hectares
- Land use data come from the most recent (2011) US Geological Survey National Land Use Cover dataset

CSLAP Participation lists the sampling years and the current year volunteers.

Key lake status indicators summarize lake conditions:

- Trophic state of a lake refers to its nutrient loading and productivity, measured by phosphorus, algae, and clarity. An oligotrophic lake has low nutrient and algae levels (low productivity) and high clarity while a eutrophic lake has high nutrient and algae levels (high productivity) and low clarity. Mesotrophic lakes fall in the middle.
- Harmful algal bloom susceptibility summarizes the available historical HAB data and indicates the potential for future HAB events.
- Invasive vulnerability indicates whether aquatic invasive species are found in this lake or in nearby lakes, indicating the potential for further introductions.
- Priority waterbody list (PWL) assessment is based on the assessment of use categories and summarized as fully supported, threatened, stressed,

impaired, or precluded. Aesthetics and habitat are evaluated as good, fair, or poor. The cited PWL assessment reflects the "worst" assessment for the lake. The full PWL assessment can be found at http://www.dec.ny.gov/chemical/36730.html#WIPWL.

Current year sampling results

- Results for each of the sampling sessions in the year are in tabular form. The seasonal change graphically shows the current year results. Red shading indicates eutrophic readings.
- HAB notification periods on the DEC website, updated weekly http://www.dec.ny.gov/chemical/83310.html
- Shoreline HAB sample dates and results. Samples are collected from the area that appears to have the worst bloom. Red shading indicates a confirmed HAB.
- HAB sample algae analysis. Algae types typically change during the season. These charts show the amount of the different types of algae found in each mid-lake or shoreline sample. Samples with high levels of BGA are HABs. The second set of charts show the level of toxins found in open water and shoreline samples compared to the World Health Organization (WHO) guidelines.
- If there are more than ten shoreline bloom samples collected in a year, bloom sample information is instead summarized by month (May-Oct.) as minimum, average, and maximum values for blue-green algae and microcystin.

Long Term Trend Analysis puts the current year findings in context. Summer averages (mid-June thru mid-September) for each of the CSLAP years show trends in key water quality indicators. The graphs include relevant criteria (trophic categories, water quality standards, etc.) and boundaries separating these criteria.

In-Season Analysis shows water temperature and water clarity during the sampling season. These indicate seasonal changes and show the sample year results compared to the typical historical readings for those dates.

The Lake Use Scorecard presents the results of the existing Priority Waterbody List assessment for this lake in a graphical form and compares it to information from the current year and average values from CSLAP data and other lake information. Primary issues that could impact specific use categories are identified, although more issues could also affect each designated use.

The Lake Summary reviews and encapsulates the data in the lake report, and provides suggested actions for lake management.

Glossary of water quality and HAB indicators

Clarity (m): The depth to which a Secchi disk lowered into the water is visible, measured in meters. Water clarity is one of the trophic indicators for each lake.

TP (mg/L): Total phosphorus, measured in milligrams per liter at the lake surface (1.5 meters below the surface). TP includes all dissolved and particulate forms of phosphorus.

Deep TP: Total phosphorus measured in milligrams per liter at depth (1-2 meters above the lake bottom at the deepest part of the lake)

TN: Total nitrogen, measured in milligrams per liter at the lake surface. TN includes all forms of nitrogen, including **NOx** (nitrite and nitrate) and **NH_4** (ammonia).

N:P Ratio: The ratio of total nitrogen to total phosphorus, unitless (mass ratio). This ratio helps determine if a lake is phosphorous or nitrogen limited.

Chl.a (µg/L): Chlorophyll a, measured in micrograms per liter. Indicates the amount of algae in the water column.

pH: A range from 0 to 14, with 0 being the most acidic and 14 being the most basic or alkaline. A healthy lake generally ranges between 6.5 and 8.5.

Cond (µmho/cm): Specific conductance is a measure of the conductivity of water. A higher value indicates the presence of more dissolved ions. High ion concentrations indicate hardwater, and low show softwater.

Upper Temp (°C): Surface temperature, measured in degrees Celsius

Deep Temp (°C): Bottom temperature, measured in degrees Celsius

BG Chl.a (µg/L): Chlorophyll a from blue-green algae, measured in micrograms per liter

HABs: Harmful Algal Blooms. Algal blooms that have the appearance of cyanobacteria (BGA)

BGA: Blue-green algae, also known as cyanobacteria

Microcystin (µg/L): The most common HAB liver toxin; total microcystin above 20 micrograms per liter indicates a “high toxin” bloom. However, ALL BGA blooms should be avoided, even if toxin levels are low.

Anatoxin-a (µg/L): A toxin that may be produced in a HAB which targets the central nervous system. Neither EPA nor NYS has developed a risk threshold for anatoxin-a, although readings above 4 micrograms per liter are believed to represent an elevated risk.