

Seneca Lake Water Quality Overview

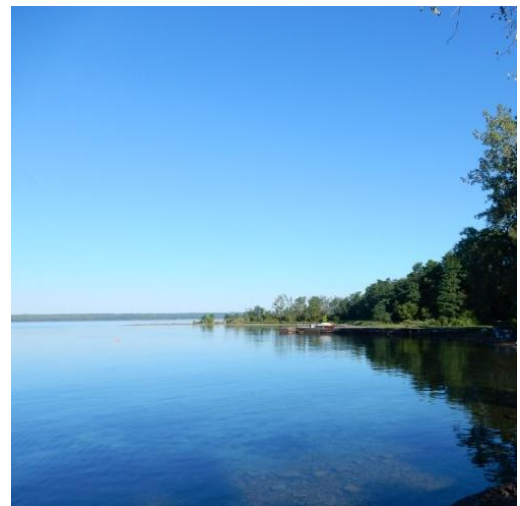
Updated October 2017 by Kelly Coughlin and David Youst

FIRST, THE BAD NEWS

- Seneca Lake has too much phosphorus--both in its tributary streams and in the main body of the lake. The best stream had unacceptable levels 73% of the time; the worst had unacceptable levels 100% of the time. When there is too much phosphorus in the water, it can cause algal overgrowth and create conditions where there is not enough oxygen for fish and other aquatic life.
- Seneca Lake has high bacteria in its streams, which often do not comply with State swimming standards. The best stream had unacceptable bacteria concentrations 44% of the time; the worst had unacceptable concentrations 100% of the time.
- Harmful Algal Blooms (HABs) are occurring more often and causing increased concerns.

NOW, THE GOOD NEWS

- Despite growing concern over contamination sources, Seneca Lake is still rated oligotrophic (the best category for lake water quality, with abundant oxygen for aquatic life) along with Keuka, Canandaigua, and Skaneateles Lakes.
- Among the eight lakes evaluated by the Finger Lakes Institute, Seneca Lake is ranked fourth in water quality, (behind the three lakes mentioned above, and has better quality than Cayuga, Owasco, Otisco, and Honeoye Lakes.
- Water clarity, nitrogen, chlorophyll, dissolved oxygen, and stream macro-invertebrates are at acceptable levels.
- Salt levels are continuing to decline in Seneca Lake.
- A new program called Finger Lakes HUB has been launched by the New York Department of Environmental Conservation (DEC) and is staffed by four water quality professionals. They will be carrying out additional water quality studies and concentrating on the causes of HABs.
- Reeder Creek was declared an “impaired Waterway” by DEC following a Seneca Lake Pure Waters Association (SLPWA) request. This means that the DEC is looking for the sources of extremely high phosphorus and will be responsible for initiatives to improve water quality.



IMPLICATIONS FOR SENECA LAKE

SLPWA’s stream monitoring activities should continue to target the sources of excess phosphorus and bacteria. Pilot remediation programs should be developed with other concerned agencies and municipal organizations using SLPWA measurements as the baseline for improvements. HABs monitoring and warning programs should continue.

SENECA LAKE WATER QUALITY UPDATE, 2017



The purpose of this summary is to help area residents:

- Understand recent research on water quality in Seneca Lake
- Identify significant threats to the lake
- Provide links to the best sources of current research so those interested can continue learning in greater depth.

Three primary sources have provided most of the data reviewed: The **Finger Lakes Institute (FLI)** at Hobart and William Smith Colleges, Geneva, New York; The **Seneca County Soil and Water Conservation District**, Seneca Falls, New York; and the **Seneca Lake Pure Waters Association (SLPWA)** in partnership with the **Community Sciences Institute (SCI)**. Links to all current research archives follow this summary.

Good News: Seneca Lake Rated Oligotrophic in 2016

The table below describes Seneca Lake as oligotrophic (blue cells in the table), the best of three designations for overall water quality. Four lakes fall into this category -- Skaneateles, Canandaigua, Keuka, and Seneca in order of water quality.

Finger Lakes Water Quality by Carlson Trophic Index*

2016	Secchi Depth	Total Phosphorus	Chlorophyll	Dissolved Oxygen	Designation
Honeoye	2.3	41	22.7	10 - 80	Eutrophic
Canandaigua	7.7	18	1.8	>80	Oligotrophic
Keuka	5.9	12.5	1.5	>80	Oligotrophic
Seneca	4.3	15.1	2.7	>80	Oligotrophic
Cayuga	3.5	16.5	3	>80	Mesotrophic
Owasco	5.6	14.1	3.5	10 - 80	Mesotrophic
Skaneateles	9.7	13.7	1.0	>80	Oligotrophic
Otisco	3.2	16.1	3.0	>10	Mesotrophic

*Oligotrophic conditions appear in blue, Mesotrophic in beige and Eutrophic in red. Finger Lakes Institute, 2017.






Bad News: Too Much Phosphorus is a Concern at Seneca Lake

While water clarity, chlorophyll, and dissolved oxygen levels in Seneca Lake are relatively good, phosphorus concentrations are at levels of concern. Elevated levels of phosphorus can be improved by reducing amounts entering the lake each year via residential, agricultural and municipal runoff. This reduction will limit the growth of living material in the lake and help to maintain good water quality. The table above also tells us that each one of the Finger Lakes evaluated by FLI has too much phosphorus. While phosphorus is not harmful to people, it is the primary nutrient causing excessive growth of algae and other aquatic plants in the lakes. Excessive growth of algae can lead to unsightly or harmful algal blooms (HABs) and a reduction in dissolved oxygen needed by fish and other aquatic animals.

Bad News: 2016 SLPWA Stream Results for Phosphorus are Unacceptably High

All five streams have elevated phosphorus concentrations, though concentrations can vary significantly from the head of the stream to the mouth, likely due to the proximity of sources to sampling sites--sources such as wastewater treatment discharge outfalls or agricultural runoff, for example.

Percent of samples meeting phosphorus guideline by stream, 2014-2016

	Keuka Outlet	Catharine Creek	Big Stream	Reeder Creek	Kashong Creek
					
Samples meeting guideline*	7%	25%	27%	0%	0%
Samples failing to meet guideline	93%	75%	73%	100%	100%

*Water quality guideline for total phosphorus in a healthy lake is <20 ug/L.






Reeder Creek is often singled out because of its extremely high phosphorus levels. In fact, some experts suspect that the ground water in that area is contaminated with white phosphorus due to years of burning old ammunition at the Seneca Army Depot. Fortunately Reeder Creek is dry much of the year, so it is not the largest source of Seneca Lake’s phosphorus problems. Of all the streams monitored by SLPWA, Keuka Outlet and the Queen Catherine Creek contribute about 2/3 of the phosphorus flowing into Seneca Lake. Sampling results also indicate that concentrations are much higher during storm events. This suggests that the total amount of phosphorus being added to the lake every year is likely underestimated.

SLPWA began its extensive stream sampling program in partnership with The Community Sciences Institute (CSI) in 2014. SLPWA volunteers collect water samples during warm weather months from multiple locations in five major streams feeding into Seneca Lake. Each stream is sampled at a minimum of three different locations on at least four separate occasions each year. Samples are processed at CSI, a SLPWA partner that operates a New York State certified laboratory and has had extensive sampling experience at Cayuga and other lakes in the area.

Bad News: SLPWA Stream Results Indicate Bacterial Contamination

All five streams have had elevated *E. coli* bacteria during the swimming season. *E. coli* is used to indicate the presence of disease-causing bacteria and viruses in recreational waters. These results are inconsistent with bacteria concentrations reported in the main body of Seneca Lake, which are generally much lower and less of a concern. Streams are more directly affected by sources of contamination and have smaller volumes of water to dilute them--these sources include improperly maintained septic systems, wastewater treatment plant discharges, illegal sewer connections, wild and domestic animal waste, and stormwater runoff.

Percent of samples meeting bacteria limits by stream, 2014-2016

	Keuka Outlet	Catharine Creek	Big Stream	Reeder Creek	Kashong Creek
					
Samples meeting limit*	32%	56%	14%	20%	0%
Samples failing to meet limit	68%	44%	86%	80%	100%

**E. coli* limit for safe swimming is <235 colonies/100 mL.

Good News: Sampling Along the Length of a Creek Guides Corrective Actions

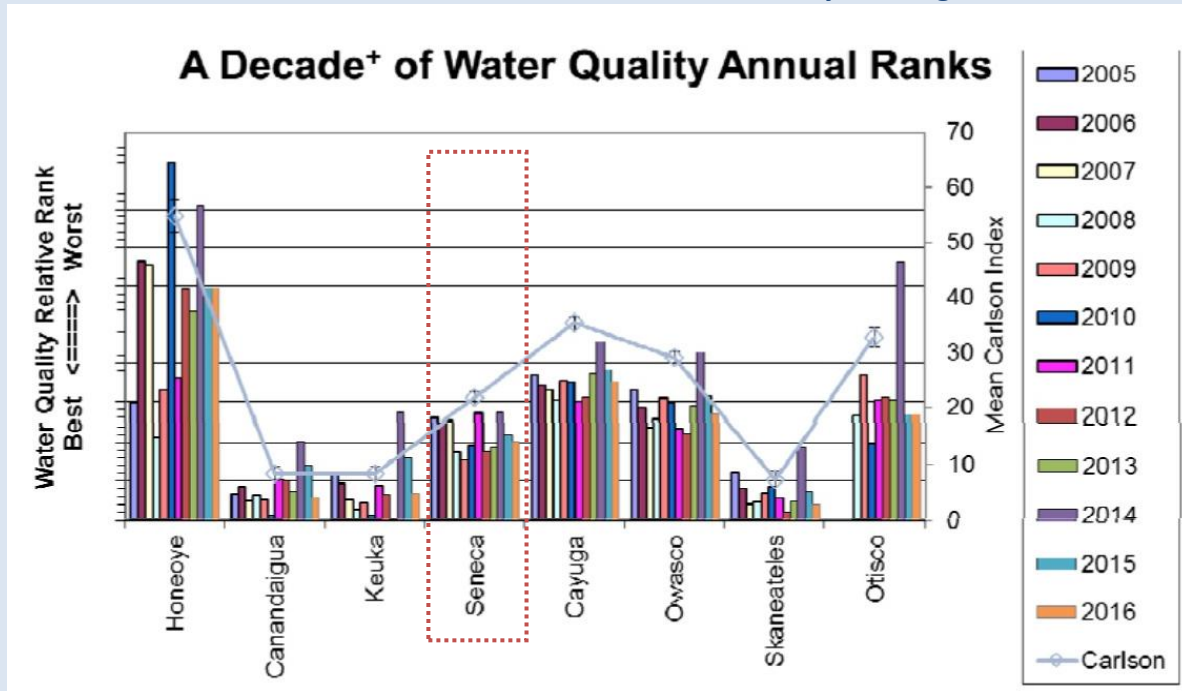
Researchers use stream sampling data to look for specific locations where excess bacteria and nutrients are discharged into the lake watershed. The SLPWA 2016 Stream Sampling report identifies several positive outcomes associated with working with partner organizations and agencies to initiate corrective actions.

- In 2016 Reeder Creek was designated an “impaired waterway” by DEC following a SLPWA request. This means that additional studies are being undertaken by the DEC to identify sources of contamination near the former Seneca Army Depot.
- The Village of Dundee is completing an engineering evaluation of possible wastewater treatment plant upgrades, based partially on data from the SLPWA/CSI Big Stream sampling program.
- SLPWA/CSI data confirmed the need for the new regional Watkins Glen/Montour Falls wastewater treatment facility, which will be operational in two years. High bacterial levels in Catherine Creek will be significantly reduced when the new facility comes online.
- A new DEC program called The Finger Lakes Watershed HUB began in 2017 to evaluate and improve water quality throughout the Finger Lakes. In cooperation with SLPWA/CSI the four HUB staff members are carrying out additional water quality studies on Seneca Lake and investigating the reasons that Harmful Algal Blooms (HABs) form. SLPWA actively monitors HABs and alerts area residents when blooms are confirmed.

Good News: Seneca Lake Ranking Has Been Consistent

The results of twelve years of annual rankings of Finger Lakes in the figure below show Seneca Lake water quality has been fairly consistent from year to year. Seneca Lake has ranked higher in water quality than Cayuga, Owasco, Otisco, and Honeoye Lakes but not as highly as Skaneateles, Canandaigua, and Keuka Lakes.

More Than a Decade of Annual Water Quality Rankings



Annual water quality ranking, 2005-2016. Scales offset for clarity (FLI/Halfman 2017).

Bad News: Harmful Algal Blooms are a Growing Concern

Harmful algal blooms, or HABs, are increasingly recognized as a problem in freshwater lakes. According to the New York State Department of Environmental Conservation, lake users should avoid contact with algal blooms because they can contain chemical toxins that can be harmful to swimmers and pets.

Lake users should:

1. Know how to identify HABs
2. Know how to provide information to SLPWA and DEC
3. Know how to inform family members and visitors without alarming them excessively.

Additional Measures of Lake Water Quality Include Benthic Analysis

Scientists measure the biological conditions in streams by evaluating the species of very small, bottom-dwelling aquatic animals living in what is known as the benthic zone--rocks, vegetation and bottom sand or sediments. When conducting "stream biomonitoring" or benthic analysis, the number and types of macroinvertebrates found along the stream bottom are identified. Through experience, scientists have learned that healthy streams contain certain patterns and relative abundance of macroinvertebrate species. These patterns are used as a tool to rank stream health and track improvements or declines in stream health over time. The most recent evaluations have not indicated any major problems.

Scientists also check for a variety of other indicators including: invasive species, algae species that cause harmful algal blooms, excessive erosion and polluted run-off, heavy metals such as mercury, air quality over the watershed, silicates, salt concentrations, water temperatures at various depths, seasonal changes at various depths, viruses that infect aquatic animals such as game fish, and many others.

Good News: Salt Levels Are Declining in Seneca Lake

Seneca Lake and Cayuga Lakes have had relatively high salt concentrations for many years, likely originating from groundwater sources--with sodium, chloride, and sulfate ion concentrations more than double the concentrations of other Finger Lakes. Concentrations are elevated enough that infants, people on low sodium diets and pregnant women are advised to find other sources for their daily drinking water. Salt levels in Seneca Lake have been declining for more than 15 years, but the causes of excessive salt in the lake are not well understood. For more information, refer to the [2014 review](#) by Dr. John Halfman at FLI.

More Ongoing Research Efforts Are Needed

Water quality protection in our lakes is particularly challenging because there are many "unknown unknowns"--there is not always enough information to identify a water quality threat to public health or to the long-term health of the lake. For example, counties surrounding the lake have very little information regarding possible seepage from residential septic systems. Seasonal cottage users and year-round homeowners who draw drinking water directly from the lake do not test their systems regularly, so the quality and safety of residential drinking water is unknown.

Excellent water quality is one of the most important things we can pass on to future generations. Water quality monitoring improves our ability to recognize issues and support solutions. This requires the efforts of dedicated volunteers and further funding for organizations that provide and sponsor research.

You Can Join, Contribute, Volunteer and Find Additional Information Here:

1. Seneca Lake Pure Waters Association: www.senecalake.org
2. Community Sciences Institute www.communityscience.org
3. Finger Lakes Institute: www.hws.edu/fli
4. Seneca County Soil and Water Conservation District: www.senecacountyswcd.org
5. Water quality data sources and documents cited in this report are available at SLPWA's website: www.senecalake.org/water-quality-documents

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