Lake Sunnyside Septic NPS Monitoring 2019 Report

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Introduction

SUNY Adirondack encourages participation in undergraduate research by community college students under the mentorship of college faculty. In 2019, SUNY Adirondack partnered with the Lake Sunnyside of Queensbury, NY, and the Warren County Soil and Water Conservation District (WCSWCD) to investigate whether residential/commercial septic systems could be a contributing factor to nonpoint source (NPS) pollution of Lake Sunnyside

The US Environmental Protection Agency defines nonpoint source pollution (NPS) to mean, "any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act." That definition states:

> "The term "point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture."

The EPA also notes that, "nonpoint source pollution is the leading remaining cause of water quality problems. The effects of nonpoint source pollutants on specific waters vary and may not always be fully assessed. However, we know that these pollutants have harmful effects on drinking water supplies, recreation, fisheries and wildlife." (https://www.epa.gov/nps)

Generally, NPS pollution of surface or ground water is due to rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made chemical compounds, such as nitrogen and phosphorus, which are then deposited into lakes, wetlands, rivers, coastal waters and ground waters. On residential lakes, septic systems are often the primary source of NPS pollutants and constitute an environmental concern.

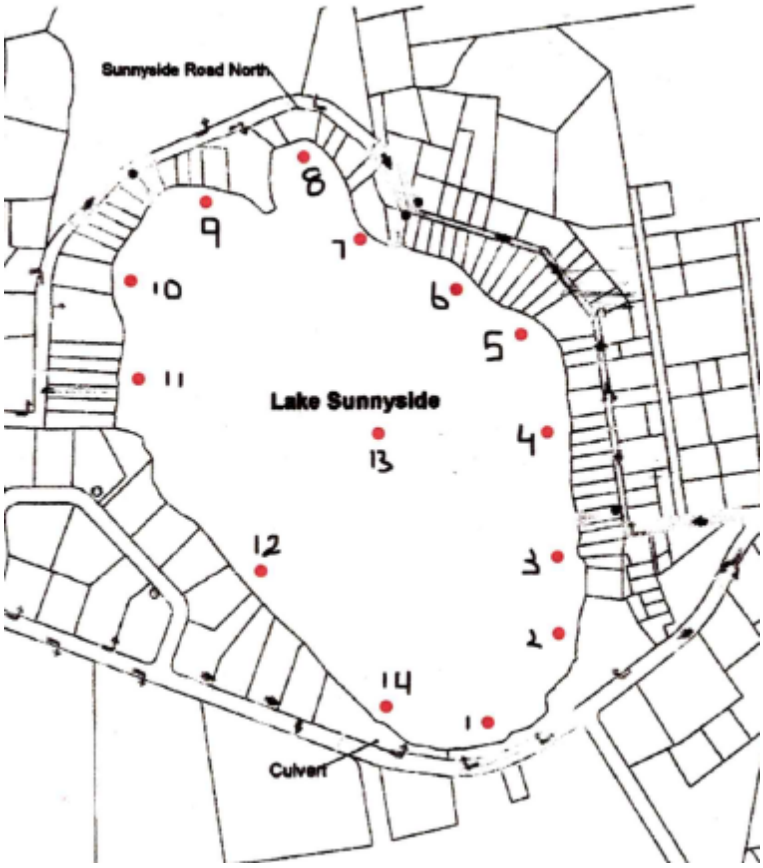
In general, the impact of NPS on small lakes is to disrupt the natural ecosystem, which encourages the growth of invasive microbial, plant, and animal species and diminish the usability of the lake as a water supply or for recreational purposes. In the long term, this type of disruption leads to eutrophication if not addressed.

Previous research conducted at SUNY Adirondack has shown that concurrent detection of (1) hypochlorite ion or hypochlorous acid (HOCl), which are chlorine compounds in bleach and cleaning products that are not found naturally in aquatic environments; and (2) fecally-derived bacteria, specifically *Escherichia coli* (EC) can serve as a reliable indicator for septic system-associated NPS.

Method

Testing was conducted at selected sites around the lake (see Figure 1) once a month between June and October 2019. Rainfall data for this period was accessed from the National Climatic Data Center (www.ncdc.noaa.gov). Each sampling location was identified using visual and GPS coordinates.

Figure 1: Locations of sampling sites on Lake Sunnyside



At each site, a "grab" sample was obtained approximately 10-20 cm below the surface of the water in sterile 250 ml Naglene bottles. All samples were stored in a cooler with ice and transferred to the Microbiology Research Laboratory at SUNY Adirondack where they were processed within 2 hours of collection. Each sample was tested for the presence of *Escherichia coli* (a fecal coliform bacteria) using the IDEXX Colilert testing system according to manufacturer

specifications. The samples were also tested for free chlorine (hypochlorous acid and hypochlorite) using a Hach DR/800 colorimeter and HACH reagents according to manufacturer recommendations. For this study, we used the lower limit of detection (0.02 mg/L) of the assay as the positive cutoff value.

Results and Discussion

The highest number of positive sites occurred in June, when 71% of the sites tested positive for both indicators (Table 1). The testing date was one week after the conclusion of the Memorial Day holiday weekend. As shown in Table 1, the increase in overall positive sites showed little correlation with monthly rainfall totals for the previous month.

Table 1: Results of NPS Indicator Testing on Lake Sunnyside, 2019.

Site #	June 3	July 3	Aug. 5	Sept. 18	Oct. 16	Site +	%
1	+	--	+	+	+	4	80%
2	--	--	--	--	--	0	0
3	+	--	+	+	+	4	80%
4	+	+	--	--	--	2	40%
5	+	--	+	--	--	2	40%
6	+	--	(+/-)	--	--	2	40%
7	--	--	--	+	--	1	20%
8	+	--	+	--	--	2	40%
9	+	--	+	--	+	3	60%
10	+	--	--	--	--	1	20%
11	+	--	--	--	+	2	40%
12	+	--	--	--	+	2	40%
13	--	--	--	--	--	0	0
14	--	+	+	--	+	3	60%
Date +	10	2	6	3	6		
%	71%	14%	43%	21%	43%		
Rain (in.)	4.52	4.48	2.19	2.79	1.78		

Key to abbreviations: **+** = HOCl and *E. coli* were BOTH detected; **(-/+)** = Very weak reaction for HOCl with positive EC: **(+/-)** = positive HOCl with weakly positive EC.

Of interest is the longitudinal data for Site 4, where replacement of a septic system occurred at one of the residential properties in July. Before July, the site was positive for NPS, but after the septic system replacement NPS indicators were not detected for the remainder of the study period.

The cumulative data suggests that Lake Sunnyside receives NPS pollution from septic systems that is carried into the lake as a result of snowmelt and runoff. NPS detection increases during periods associated with increased seasonal use of lakefront properties. The ecological impact of NPS on Lake Sunnyside was not assessed in this study.