NPS Monitoring Program
Glen Lake, 2019-2021

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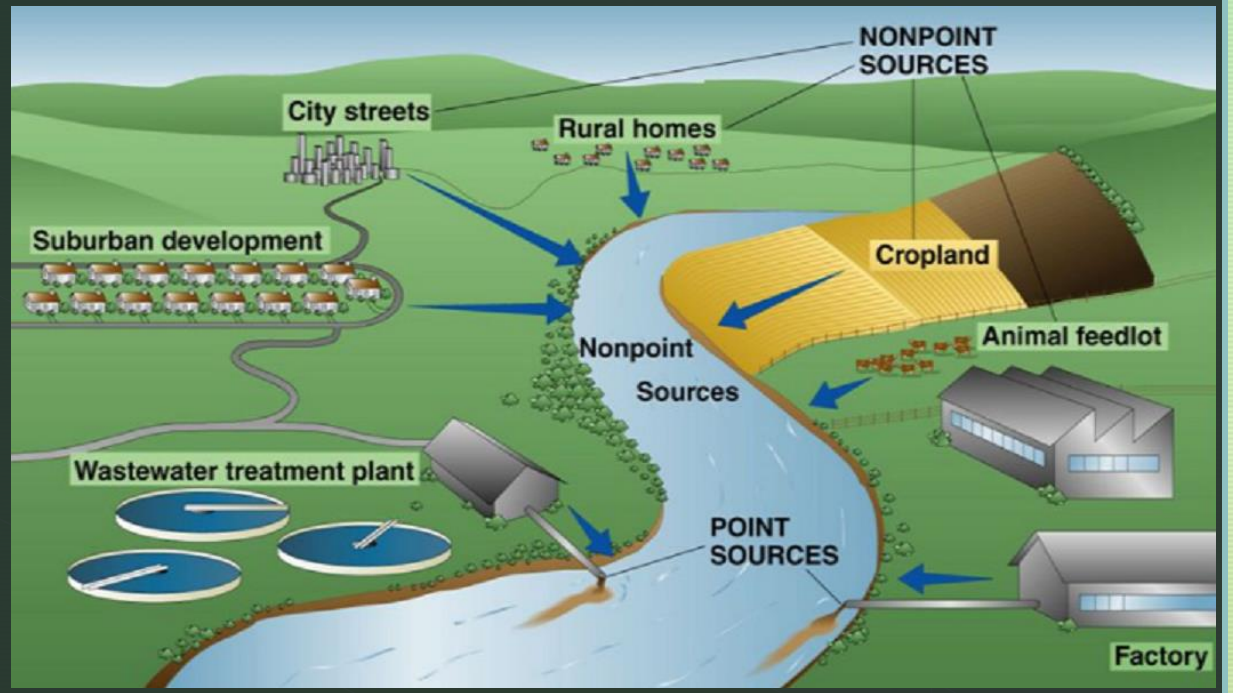
Point vs. Nonpoint Source Pollution

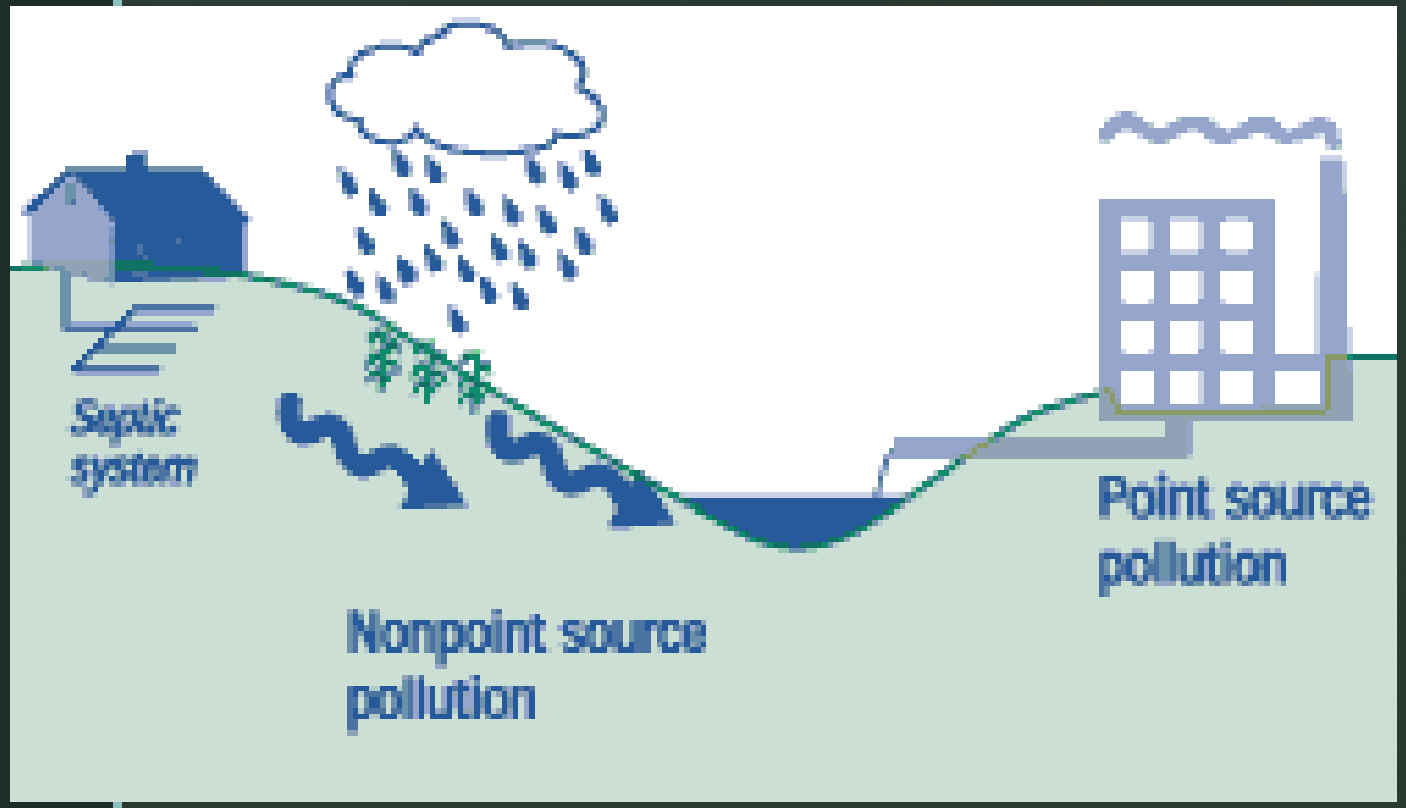
Point Source: "…any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.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



(https://www.epa.gov/nps)

Nonpoint Source Pollution

Nonpoint Source: "Any source of water pollution that does not meet the legal definition of "point source."



"NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters."

(https://www.epa.gov/nps)

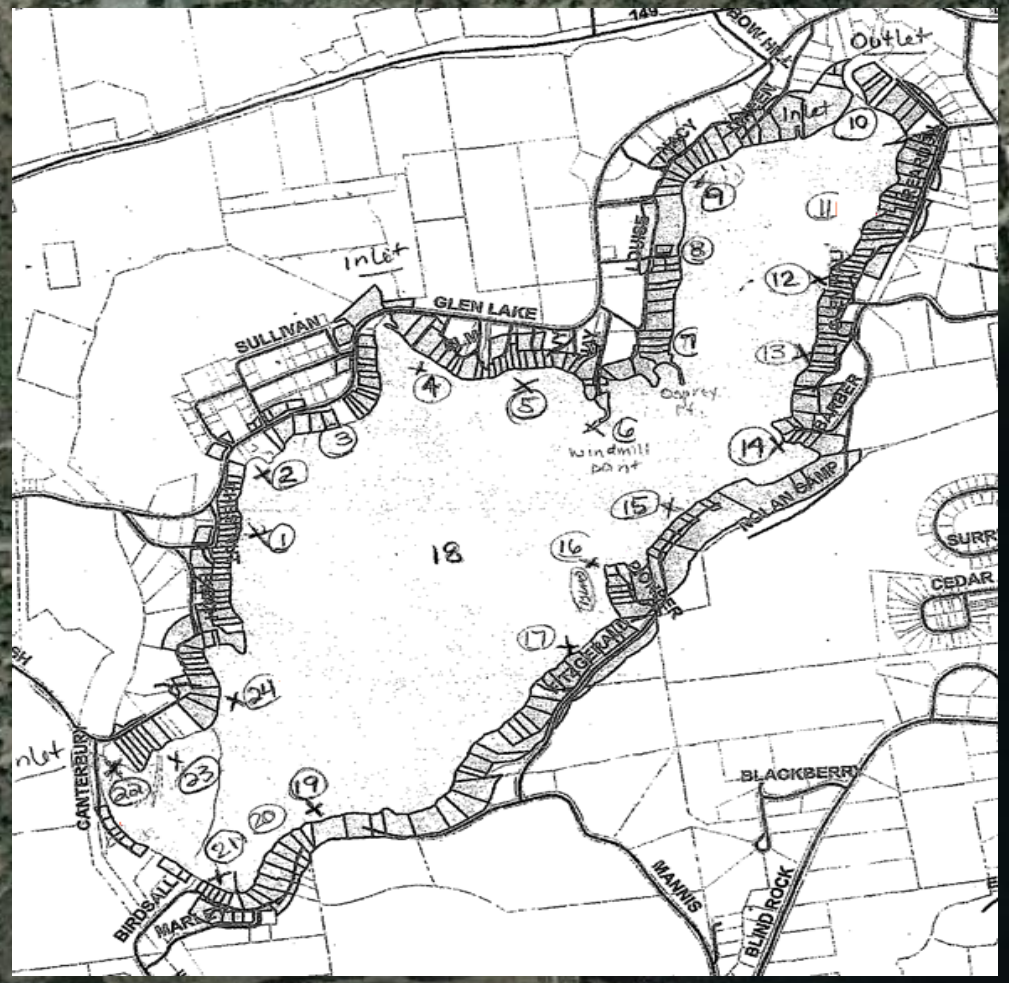
Nonpoint source pollution can include:

- Excess fertilizers, herbicides and insecticides from agricultural lands and residential areas
- Oil, grease and other ***chemicals in runoff***
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks
- ***Bacteria*** and nutrients from livestock, pet wastes and ***faulty septic systems***

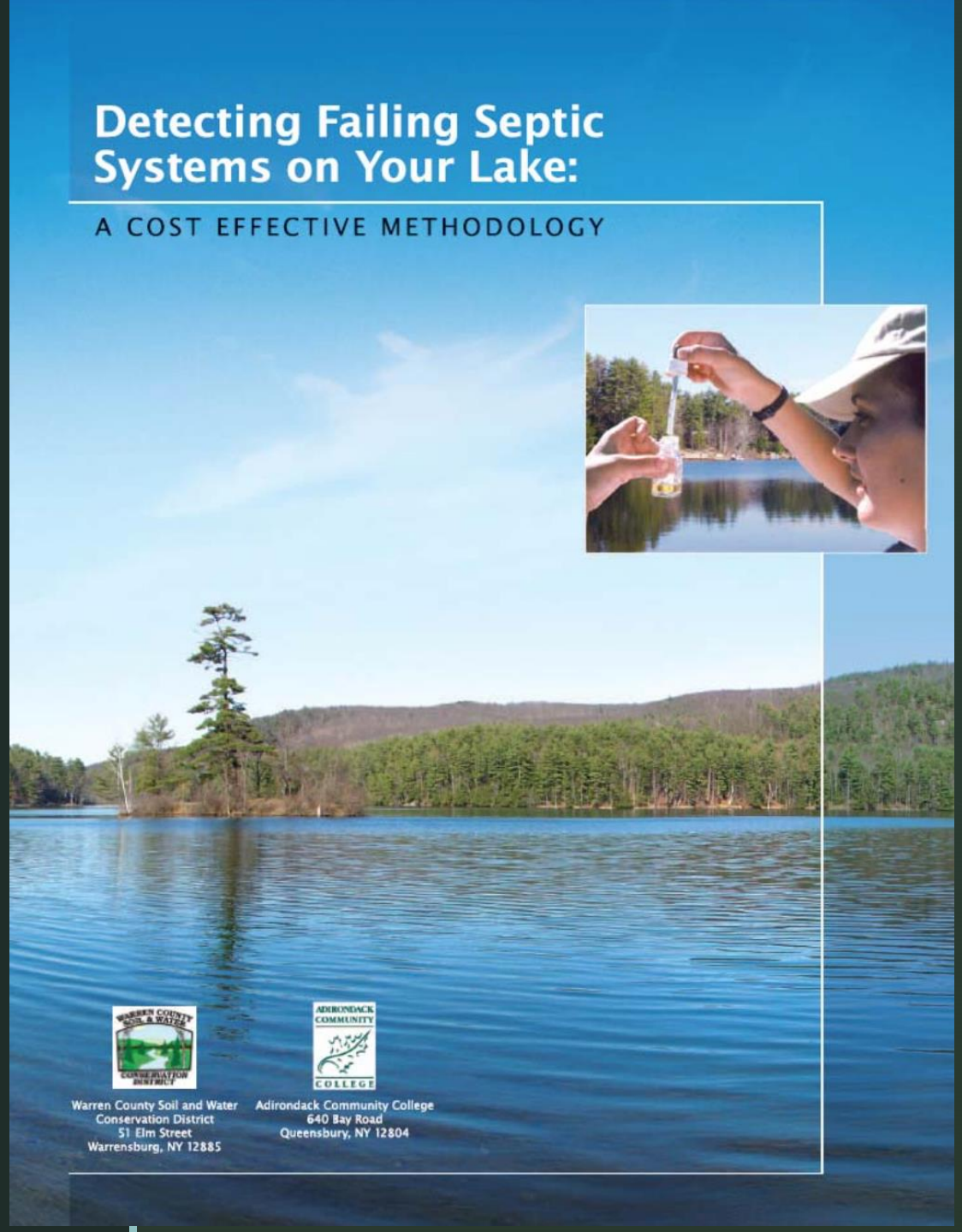
"States report that nonpoint source pollution is the leading remaining cause of water quality problems. The effects of nonpoint source pollutants on specific waters vary and may not always be fully assessed. However, we know that these pollutants have harmful effects on drinking water supplies, recreation, fisheries and wildlife."

(https://www.epa.gov/nps)

Glen Lake Sampling:



- Maps and land use information was obtained from WCSWCD
- Patterns of lake usage were discussed with year-round lakefront residents
- Evenly distributed sites around the lake were identified; 24 sampling locations were selected based on funding and feedback from lake residents
- Water samples (250 mL) were collected monthly by boat from the lake, within 1 – 6 feet of shoreline
  - In 2017 and 2018, not all sites were tested every month.
  - In 2019, 2020, and 2021 all 24 sites were sampled once per month.
- Samples were stored in a cooler and transported to the Microbiology lab at SUNY Adirondack for processing, within 2 hours of collection



Monitoring Method for NPS

TWO indicators of septic system-derived NPS are measured; detection of BOTH indicates potential septic-derived NPS:

1. Free chlorine (hypochlorous acid or hypochlorite ion)
   - Form of chlorine found in bleach and household cleaners, municipal water supplies, and treated well water
   - ***No natural sources of HOCl***

2. E*scherichia coli (E. coli)*
   - Coliform bacteria associated with human and animal fecal material
   - ***E. coli from animal sources may occur***

Hach DPD Reagent and Pocket Colorimeter to detect HOCl

Mix powder with water; read in colorimeter

Chlorine-containing samples are reacted with N, N-diethyl-p-phenylenediamine sulfate, which reacts with chlorine to produce a pink color.

Colilert (IDEXX) to detect fecal coliforms and *E. coli*

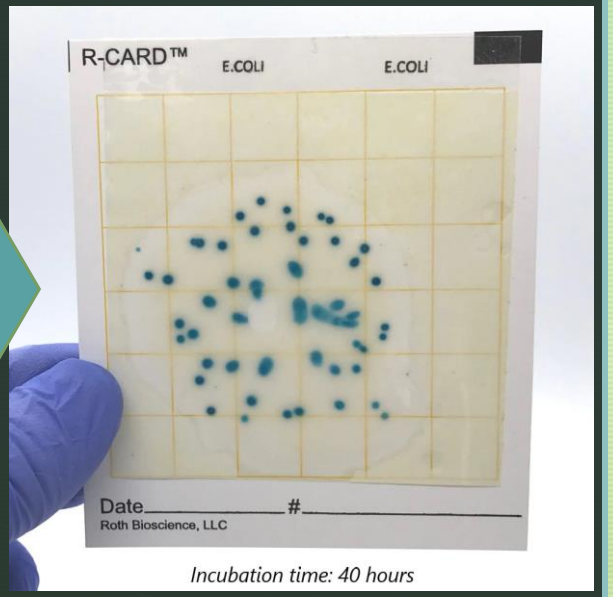
Add Colilert to sample and shake to dissolve

Incubate at 35°C for 18 – 24 hours

Roth BioScience E-card to quantify *E. coli* cells per mL

Pipette 1 mL of sample on E-CARD

Incubate at 35°C for 18 – 24 hours



Incubation time: 40 hours

Colilert vs. E-CARD

- Both methods detect *E. coli*; Colilert also detects coliforms
- Qualitative vs. quantitative
- E-CARD provides the actual number of *E. coli* cells that were present when the sample was taken
- E-CARDs cost less, and are easier to dispose of

	A	B	C	D	E	F	G	H	I	J
1	NPS Project 2021 Glen Lake									
2	Tuesday October 12, 2021						NPS Peritive Lake Sites: 8/24 - 33%			
3	Lake pH 8.3 - 8.6						NPS Peritive Fen sites: 3/5 - 60%			
4	Water temp 18.1 - 18.5									
5	Lake activity - average									
6										
7				Roth						
8	Site #	HOCl	Colilert	cfu/ml	NPS					
9	1	0	0	1	0					
10	2	0	0	0	0					
11	3	0	0	1	0					
12	4	0	0	1	0					
13	5	0	0	0	0					
14	6	0	1	9	0					
15	7	0	0	9	0					
16	8	1	1	17	1					
17	9	1	0	12	0					
18	10	0	1	5	0					
19	11	1	1	10	1					
20	12	1	1	14	1					
21	13	1	1	51	1					
22	14	0	1	16	0					
23	15	0	1	15	0					
24	16	1	1	16	1					
25	17	1	1	20	1					
26	18	0	0	1	0					
27	19	0	1	1	0					
28	20	0	1	26	0					
29	21	1	1	55	1					
30	22	0	1	2	0					
31	23	1	1	2	1					
32	24	0	1	9	0					

Result of 2021 NPS testing on Glen Lake

- 1 = both indicators detected
- 0 = no indicators or one indicator detected

Site	10-May	8-Jun	6-Jul	10-Aug	14-Sep	12-Oct	Site Pos	%
				LAKE				
1	0	1	0	0	0	0	1	0.17
2	1	1	1	1	1	0	5	**0.83**
3	1	1	1	0	1	0	4	**0.67**
4	0	0	1	0	1	0	2	0.33
5	0	1	0	0	0	0	1	0.17
6	0	0	1	0	0	0	1	0.17
7	0	1	1	0	0	0	2	0.33
8	1	0	1	1	1	1	5	**0.83**
9	1	1	0	0	0	0	2	0.33
10	0	0	1	1	0	0	2	0.33
11	0	0	1	1	1	1	4	**0.67**
12	0	0	1	1	0	1	3	0.50
13	0	1	1	0	0	1	3	0.50
14	0	0	0	0	1	0	1	0.17
15	0	0	1	0	0	0	1	0.17
16	0	0	0	0	0	1	1	0.17
17	0	0	1	0	1	1	3	0.50
18	0	0	1	0	0	0	1	0.17
19	0	0	1	0	1	0	2	0.33
20	1	0	0	0	0	0	1	0.17
21	0	0	0	0	0	1	1	0.17
22	0	0	1	1	0	0	2	0.33
23	1	0	0	0	0	1	2	0.33
24	1	0	0	0	0	0	1	0.17
	7	7	15	6	8	8		
	29%	29%	63%	25%	33%	33%		

Glen Lake NPS Data, 2019 - 2021

Site #	2019						2020						2021							
	16-May	10-Jun	8-Jul	12-Aug	10-Sep	8-Oct	13-May	10-Jun	6-Jul	18-Aug	14-Sep	12-Oct	10-May	8-Jun	6-Jul	10-Aug	14-Sep	12-Oct	3 Yr Total	% Pos
1	0	0	1	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	5	31.25
2	1	0	0	0	1	0	0	0	1	0	1	0	1	1	1	1	1	0	9	56.25
3	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	6	37.5
4	0	0	1	0	1	0	0	1	0	0	1	0	0	0	1	0	1	0	6	37.5
5	0	0	1	0	1	0	0	0	0	1	1	1	0	1	0	0	0	0	6	37.5
6	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	3	18.75
7	0	0	1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	0	8	50
8	0	0	1	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1	13	81.25
9	0	0	1	0	1	0	0	1	1	1	1	1	1	1	0	0	0	0	9	56.25
10	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	5	31.25
11	0	1	1	0	1	0	0	1	0	1	1	1	0	0	1	1	1	1	11	68.75
12	0	0	0	0	0	0	0	1	1	1	1	0	0	0	1	1	0	1	7	43.75
13	0	0	1	0	1	1	0	1	0	1	0	0	0	1	1	0	0	1	8	50
14	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0	0	1	0	5	31.25
15	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	4	25
16	0	0	1	0	1	0	1	1	0	0	0	1	0	0	0	0	0	1	6	37.5
17	0	0	1	1	0	1	0	1	0	0	0	1	0	0	1	0	1	1	8	50
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	1	0	0	1	0	1	1	0	0	0	1	1	0	0	1	0	1	0	8	50
20	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	4	25
21	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	3	18.75
22	0	0	1	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	5	31.25
23	0	1	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	6	37.5
24	0	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	4	25

Project Take-Aways

- Cumulative data supports the validity of this approach for highlighting areas at risk of NPS input via runoff
  - Consistency of NPS positive sites
  - Conversion from NPS (+) to NPS (-) following septic system upgrades
  - Opportunity to verify detection method during Lake George waste treatment facility spill in 2018 (positive control)
- Sampling for septic-derived NPS using this approach is a cost-effective way for small lakes to assess water quality issues, particular when used in conjunction with CSLAP.
- Provides actionable information with regard to faulty or failing septic systems on lake properties

Glen Lake, NY

Carl E. Heilman II