Sebago Lake Watershed Monitoring Programs
Tributary Monitoring - 2025

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Introduction

Sebago Lake is the primary drinking water supply for the greater Portland area. The Portland Water District (PWD) treats and delivers drinking water to over 200,000 people in 11 communities. PWD has a waiver from the filtration requirements of the federal Safe Drinking Water Act. There are many criteria for obtaining and keeping the waiver, but one of the largest factors is the continued excellent water quality of Sebago Lake and PWD's watershed protection efforts. This waiver agreement requires ongoing monitoring of lake water quality.

PWD monitors Sebago Lake and the rivers and streams that drain to it through more than 10 monitoring and surveillance programs. In general, more samples are collected and tested for more parameters the closer one moves to the intake pipes, located in Lower Bay.

The water quality of Sebago Lake is influenced by many factors, one of which is the condition of the watershed. A watershed is the land area that drains to a water body. In the case of Sebago Lake, the watershed includes part or all of 24 towns from Standish to Bethel. The majority of the watershed is forested, and because forests act as a natural filter, the water quality of the lake is excellent.

The tributary monitoring program was created to be an indicator of conditions in the watershed. If water pollution problems exist on the land that drains to the lake, one would expect to see water quality declines in the tributaries first.

This report covers the Tributary Monitoring Program which includes 11 tributaries that drain to Sebago Lake. The Tributary Monitoring Program began in 1977 with the purpose of monitoring the health of the watershed.

Methods

Eleven tributaries to Sebago Lake are sampled at one location each for three parameters: total phosphorus, turbidity, and *Escherichia coli (E. coli)* bacteria (Figure 1). The tributaries include: 1952 Brook, Panther Run, Crooked River (site name: State Park), Songo River, Muddy River, Northwest River, Rich Mill, Smith Mill, Sticky River, Standish Brook, and an un-named stream near St. Joseph's College (site name: St. Joe's). The State Park site is located on the Crooked River and is also part of the Crooked River Monitoring Program. Results for that site are discussed in PWD's Crooked River monitoring report. The other ten tributaries will be discussed here.

Tributary sampling occurs monthly with a hand grab or by using a "dipper" that lowers sample bottles into the water, usually from a bridge over the tributary. *E. coli* and turbidity samples are collected monthly in sterile sample bottles. Total phosphorus samples are collected four times per year (April,

June, August, and October) in acid-washed glass flasks. In instances where the tributary is frozen, there is not enough flow to collect a sample, flow does not go to the lake, or the site is unsafe, a sample will not be collected.

Total phosphorous samples are analyzed using the ascorbic acid method and a spectrophotometer in the Portland Water District's Water Quality Lab. Turbidity is analyzed using a laboratory benchtop Hach TU5200 Turbidimeter. *E. coli* samples are analyzed using the IDEXX Colilert method and are incubated at 35 degrees Celsius for 24 hours.

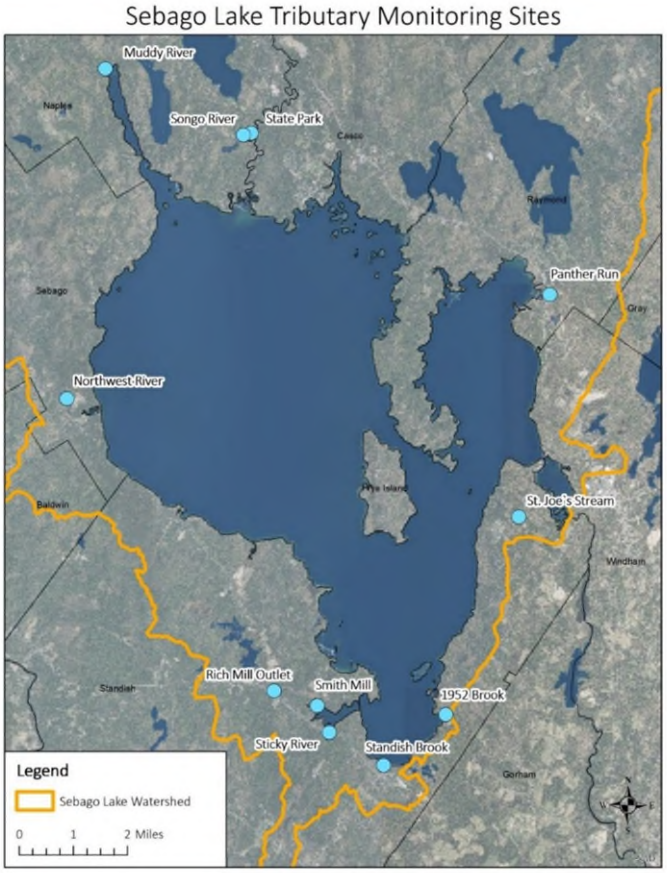

Figure 1: Tributary sampling sites location map for 2025.

Results and Discussion

Total Phosphorus

PWD measures phosphorus in the tributaries because it is an important nutrient for plant growth. In lakes, the amount of phosphorus in the water often limits the growth of algae. Increases in phosphorus levels can lead to more algae growth and declines in water quality of a lake. Phosphorus levels tend to be higher in the tributaries but become diluted once the tributary waters reach Sebago Lake.

There are many forms of phosphorus in the environment. PWD measures total phosphorus, which includes both phosphates attached to sediment and dissolved forms of phosphorus. It is measured in parts per billion (ppb). A result of 35 ppb is the action level established by PWD. For St. Joe's Stream, the action level is 60 ppb based on past data indicating that the typical range of total

phosphorus is higher in this tributary. Sampling events that result in total phosphorus levels at or above these action levels are reviewed and appropriate corrective measures are taken, if possible.

In 2025, three sampling events produced total phosphorus results that were above the PWD established action levels (Table 1). To determine if these are normal results, the mean (M) and standard deviation (SD) are calculated for each tributaries' historical data set. A value that is within two standard deviations of the mean is considered normal, and those beyond are outside of the normal range.

Table 1. Total phosphorus (ppb) results for 2025. Results at or above the action level (35 ppb or 60 ppb) are in bold text and those exceeding the action level which are outside of the normal range are in red text.

	1952 Brook	St. Joe's Stream	Panther Run	Songo River	Muddy River	Northwest River	Rich Mill	Smith Mill	Sticky River	Standish Brook
4/14/25	14.1	12.2	10.4	9.1	8.4	9.5	17.7	16.5		10.8
6/9/25	**37.1**	30.5	12.5	9.1	14.7	16.6	26.8	26.7	**35.1**	21.5
8/25/25				7.2		11.4	19.8	25.0	**45.0**	
10/27/25			5.4	5.2	5.7	6.2	19.5	15.0	25.5	

The 1952 Brook high result of 37.1 ppb in June is within the normal range (M=24.7, +2SD=50.2) for data collected from 1995-2024. The Sticky River high result of 35.1 ppb in June is also within the normal range (M=23.9, +2SD=50.3) for data collected from 1977-2024. The likely cause of the high total phosphorus result for these samples in June is the 0.86-inch rain event two days preceding the sampling event.

The Sticky River high result of 45.0 ppb in August is within the normal range (M=23.9, +2SD=50.3) for data collected from 1977-2024. A possible cause of the high total phosphorus result for the Sticky River sample in August is the trace amount (less than 0.0005") of rain that occurred on the day of sampling.

Turbidity

Turbidity is the amount of suspended particulate matter in the water. In streams, the three major types of suspended particulates that contribute to turbidity are algae, detritus (dead organic material), and silt (inorganic or mineral suspended sediment). High turbidity decreases light penetration and facilitates eutrophication of lakes. Particulates also provide attachment sites for heavy metals such as cadmium, mercury and lead, many toxic organic contaminants such as PCBs, and many pesticides.

PWD measures turbidity using a turbidimeter, an instrument that passes a beam of light through a water sample and measures the light output on the other side. The greater the amount of suspended particulate matter in the water, the more the light beam is refracted and blocked, and the higher the turbidity reading. Turbidity is measured in NTU (nephelometric turbidity units). Generally, readings below 1 NTU indicate water that appears "clear" to the naked eye. Readings greater than 4 NTU indicate water that would appear cloudy or murky.

A reading of 4 NTU or greater is the action level established by PWD. Values that exceed 4 NTU are reviewed and appropriate corrective measures taken, if possible.

In 2025, one sampling event produced turbidity results above the PWD established action level (Table 2). To determine if these are normal results, the mean (M) and standard deviation (SD) are

calculated for each tributaries' historical data set. A value that is within two standard deviations of the mean is considered normal, and those beyond are outside of the normal range.

Table 2. Turbidity (NTU) results for 2025. Results at or above the action level (4 NTU) are in bold text and those and those exceeding the action level which are outside of the normal range are in red text.

	1952 Brook	St. Joe's Stream	Panther Run	Songo River	Muddy River	Northwest River	Rich Mill	Smith Mill	Sticky River	Standish Brook
1/27/2025		0.4	1.6	1.2		0.5	1.4			
2/10/2025				0.82		0.71	1.57			
3/31/2025	0.37	0.35	0.83	0.56	0.32	0.3	0.6	0.72	0.39	0.49
4/14/2025	0.69	0.33	0.76	1.17	0.32	0.34	0.53	0.97		0.54
5/12/2025	1.19	0.42	0.77	0.55	0.36	0.39	0.73	0.6	0.68	0.72
6/9/2025	3.15	1.3	1.13	0.79	0.72	1.87	0.84	1.44	1.59	1.68
7/23/2025	**34.3**	0.25	1.19	0.5	0.44	0.57	0.7	1.32		
8/25/2025				0.68		0.31	1.03	2.38	1.61	
9/24/2025			2.67	0.48	0.21	0.24	0.86		1.73	
10/27/2025			1.67	0.7	0.56	0.51	0.51	0.99	2.01	
11/18/2025	0.38	0.35	0.96	0.87	0.44	0.42	0.43	0.61	0.79	0.61
12/22/2025	0.89	0.61		0.74	0.59	0.72	0.6	2.68	0.68	0.57

The turbidity was high in 1952 Brook in the July sampling event. The July result is outside the normal range (M=5.8, +2SD=23.9) for data collected from 1995-2024. For this sampling event, it was noted by the sampler that high iron bacteria were present in the tributary, which is the likely cause of this high turbidity result.

Escherichia coli Bacteria

E. coli is a type of fecal coliform bacteria that is found in the guts of warm-blooded animals and is used by water utilities as an indicator of possible contamination and pathogens in the water. *E. coli* is used as an indicator organism because it has been shown to be a reliable indicator of contamination, and it is not practical to test every sample for all the pathogens that could be present in water.

E. coli levels tend to be higher in the tributaries than the lake, but the levels become diluted once the tributary water enters the lake. Natural occurrences can cause elevated *E. coli* levels. Examples include significant precipitation events that wash pollution (i.e., animal feces) and eroded soils into the tributaries. A small percentage of fecal bacteria is associated with soil.

PWD's action level for *E. coli* is 235 Most Probable Number (MPN) per 100mL in accordance with the recommended level for beach closure under the Maine Healthy Beaches Program. Sampling events that result in *E. coli* levels above 235 MPN/100mL are reviewed or re-sampled if the cause is unknown.

In 2025, ten sampling events and five resampling events produced *E. coli* results that were above the PWD established action level (Table 3). To determine if these are normal results, the mean (M) and standard deviation (SD) are calculated for each tributaries' historical data set. A value that is within two standard deviations of the mean is considered normal, and those beyond are outside of the normal range.

Table 3. *E. coli (MPN/100mL)* results for 2025. Results at or above the action level (235 MPN/100 mL) are in bold text and those exceeding the action level which are outside of the normal range are in red text.

	1952 Brook	St. Joe's Stream	Panther Run	Songo River	Muddy River	Northwest River	Rich Mill	Smith Mill	Sticky River	Standish Brook
1/27/25		3	87	2		8	29			`
2/10/25				1		9	7			
3/31/25	13	228	9	0	15	11	26	24	12	201
4/14/25	6	41	7	0	8	8	12	36		38
5/12/25	26	161	14	5	14	27	47	115	71	56
6/9/25	138	185	161	54	130	108	78	74	185	**345**
Resample										**345**
7/23/25	96	31	**249**	66	4	44	**291**	**248**		
Resample			32				**308**	133		
8/25/25				65		42	157	**687**	3	
Resample								**276**		
Resample								**248**		
9/24/25			86	17	51	35	**461**		**387**	
Resample							**687**		47	
10/27/25			15	14	9	13	101	75	33	
11/18/25	4	5	43	3	20	10	68	19	25	28
12/22/25	88	6		1	**435**	219	29	62	**345**	**1414**

The *E. coli* level was high in Standish Brook during the June sampling event. The result is within the normal range (M=234, +2SD=1159) for data collected from 2009-2024. Microbial source tracking tests, which use PCR DNA analysis, indicate potential sources of contamination includes birds, dogs, and mammals.

During the July sampling event, the *E. coli* level was high in Panther Run, Rich Mill, and Smith Mill. The initial high results are all within each site's normal range (Panther Run: M=106.9, +2SD=535; Rich Mill: M=68.8, +2SD=518; Smith Mill: M=100.8, +2SD=559) for the historical data sets. Resampling yielded results that were below the action level for Panther Run and Smith Mill. At Rich Mill, it was noted by the sampler that the beginning of a beaver dam was directly upstream of the sampling location, which is the likely cause of the high result. Since Rich Mill flows to Lower Bay, efforts to conduct beaver removal were initiated. Additionally, precipitation events in days prior to the initial sample collection likely contributed to the high results.

The *E. coli* level was high in Smith Mill during the August sampling event. The result is outside the normal range (M=100.8, +2SD=559) for data collected from 2009-2024. Resamples did not yield results below the action level. Low water levels, warm temperatures, and stagnant water (very little flushing of the bog with the drought) were determined to be contributing factors to the high results.

During the September sampling event, the *E. coli* level was high in Rich Mill and Sticky River. The initial high result for Rich Mill is within the normal range, but the resample result is outside the normal range (M=68.8, +2SD=518) for data collected from 2009-2024. The initial result in Sticky River is outside the normal range (M=28.1, +2SD=170) for data collected from 2009-2024.The resample fell below the action level. The likely cause of the initial high *E. coli* result is the 0.02-inch rain event the day of sampling and 0.13 inches of rain the day before the sampling event.

During the December sampling event, the *E. coli* level was high in Muddy River, Sticky River, and Standish Brook. These results are all outside each site's normal range (Muddy River: M=44.9, +2SD=275; Sticky River: M=28.1, +2SD=170; Standish Brook: M=234, +2SD=1159). We were unable to resample in December, but early January 2026 samples were all below action level.

Conclusion

This sampling program provides a “snapshot” determination of the health of the major tributaries to Sebago Lake. Samples that exceed established action limits are investigated and re-sampled if necessary. Because sampling occurs on a monthly basis under various weather conditions, it is difficult to determine a continuous water quality trend from the data. Rather, this program reflects the variability of water quality in response to both environmental and human factors.

In 2025, we experienced 12 consecutive rainy spring weekends followed by extreme drought conditions through late fall. Despite this swing between extreme conditions, water quality in the tributaries remains high. Weather and other environmental factors were the most likely causes of exceedances of action levels in the tributaries. Continued monitoring of the tributaries is necessary. The tributaries empty directly into Sebago Lake, and reductions in water quality in these streams could affect the health of the lake.