

# Vermont Family Forest Project Summary

## 2022 Water Quality Monitoring of Isham, Beaver Meadow, and Cold Brooks

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For Addison County River Watch Collaborative

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### Background

Addison County River Watch (ACRWC) began monitoring in the upper New Haven River watershed in 2021 in the town of Lincoln with two sites: one on Isham Brook (NH10.1) and one on Beaver Meadow Brook (NHBM0.1). Analytes measured in 2021 included *E. coli*, chloride, nitrate, total phosphorus, turbidity and temperature. The results of that first year of monitoring were summarized in November 2021. In 2022, ACRWC monitored the same two sites and added a third on Cold Brook, a tributary to Baldwin Creek in the town of Bristol, which drains to the New Haven River.

In 2022, Isham and Beaver Meadow Brooks were grab sampled on four days: June 7, July 5, August 2, and September 6. Cold Brook was grab sampled on the same days with the exception of the September date when the Cold Brook location was dry. Samples were analyzed for concentration of *E. coli*, chloride, nitrate, total phosphorus, and turbidity. The New Haven River USGS gage at Brooksville was used to determine general flow conditions on each sampling date.

The Isham Brook watershed is about 1,500 acres, Beaver Brook's is roughly 6,800 acres, and Cold Brook (at the location of monitoring) is 435 acres. In contrast, the New Haven River (into which all of these tributaries flow) has a drainage area of over 74,500 acres (Figures 1 & 2).

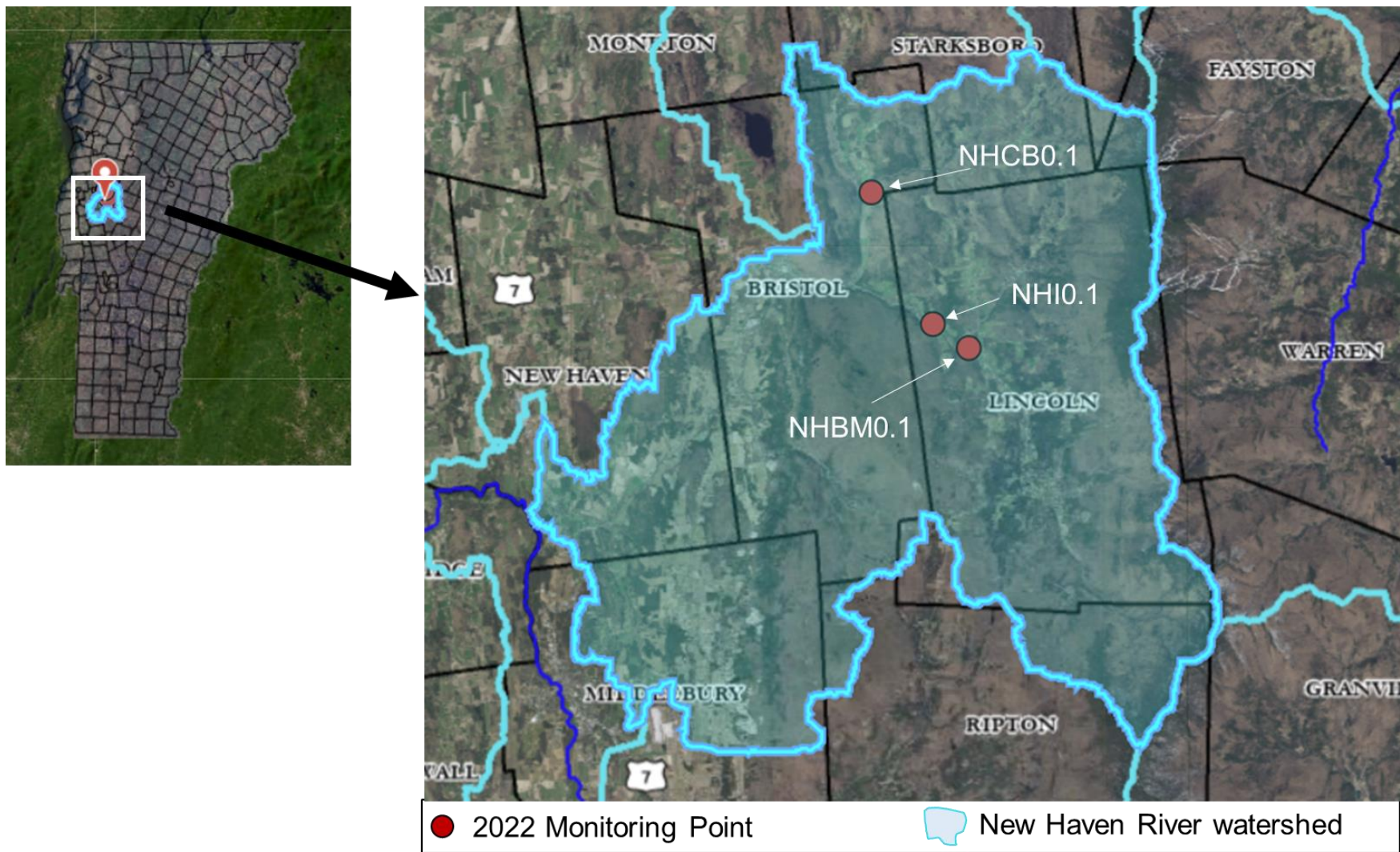


Figure 1. Map of New Haven River Watershed and 2022 monitoring locations



Figure 2. Maps of 2022 monitoring locations in detail.

## Monitoring Data

Raw water quality data collected in 2022 are displayed in Table 1.

Table 1. Complete raw dataset

Date	Site Name	Site ID	E.coli (MPN)	Chloride (mg/L)	Nitrate (mg/L)	TP (mg/L)	Turbidity (NTU)	Water Temp F	
6/7/2022	Isham	NHIO.1	1	<5	0.34	<0.011	<.5	54	
7/5/2022	Isham	NHIO.1	4.1	<5	0.48	<0.011	<.5	56	
8/2/2022	Isham	NHIO.1	14	<5	0.6	<0.011	<0.50	62	
9/6/2022	Isham	NHIO.1	120	1.5	0.33	<0.011	0.76	57	
6/7/2022	Beaver Meadow	NHBM0.1	20	<5	<.2	<0.011	<.5	61	
7/5/2022	Beaver Meadow	NHBM0.1	36	<5	0.23	<0.011	<.5	61	
8/2/2022	Beaver Meadow	NHBM0.1	16	<5	0.25	<0.011	0.58	69	
9/6/2022	Beaver Meadow	NHBM0.1	730	2	0.13	<0.011	2.4	60	
6/7/2022	Cold Brook	NHCB0.1	<1	<5	<.2	<0.011	<.5	68	
7/5/2022	Cold Brook	NHCB0.1	<1	<5	0.32	<0.011	<.5	63	
8/2/2022	Cold Brook	NHCB0.1	1	<5	0.4	<0.011	0.9	72	
9/6/2022	Cold Brook	NHCB0.1	Dry						

Flow conditions in the New Haven River and the timing of sampling events in the tributaries are displayed in Figure 3. The low median monthly flow (LMM) for the New Haven River is shown as a red line at 65 cfs. This flow statistic is relevant for evaluating testing parameters in terms of Vermont Water Quality Standards. Total phosphorus (TP) standards are based on sample collected when flows are below the LMM while nitrate-nitrogen levels are evaluated when flows exceed the LMM. In 2022, one sampling day corresponded with a flow higher than the LMM (relevant for evaluating nitrate values in context with state standards) while three sampling events corresponded with flows at or below the LMM (relevant for evaluating TP values in context with state standards).

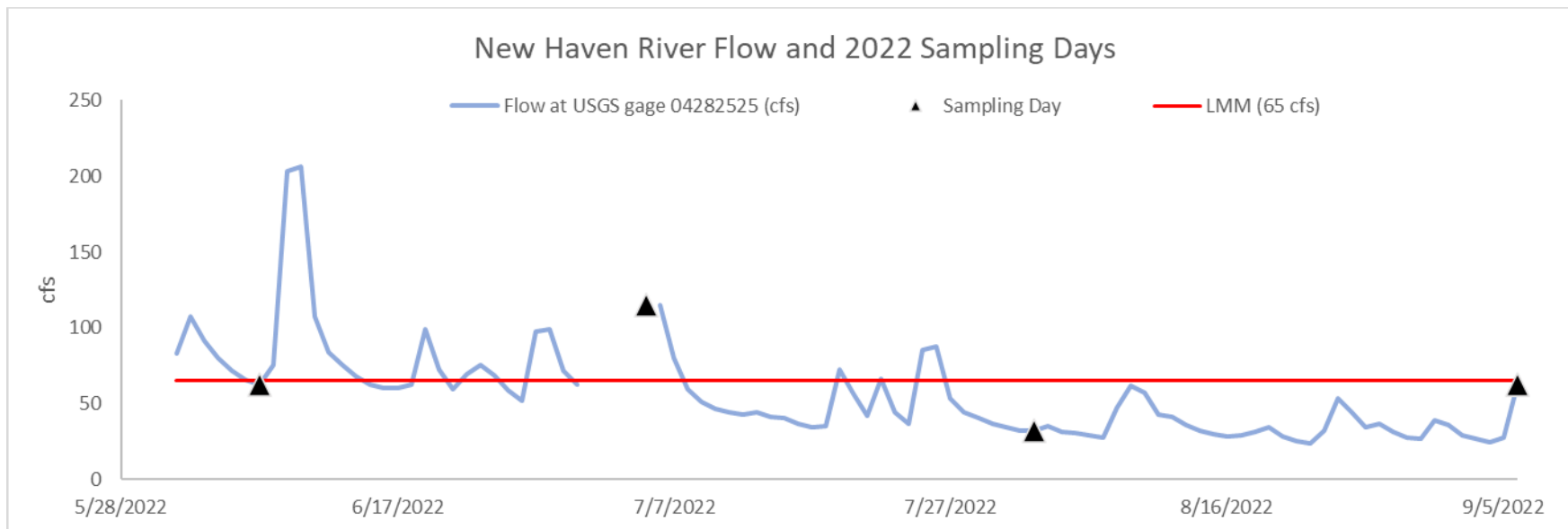


Figure 3. Flow conditions in the New Haven River at the downstream USGS gage and the corresponding timing of grab sampling events at upstream tributaries.

Total phosphorus concentrations were below the laboratory detection limit of 1 µg/L on every sampling day in 2022. The Vermont Water Quality Standard for TP in Class B warm-water medium gradient (WWMG) wadable stream ecotypes is 27 µg/L (0.027 mg/L) when flows are at or below LMM discharge. Similarly, nitrate samples ranged in concentration from <0.2 – 0.6 mg/L. The Class B cold water fishery VT Water Quality Standard for nitrogen as nitrate is 5 mg/L when flows exceed LMM flow. Neither TP nor nitrate approached the applicable water quality standard on any of the sampling days.

The Vermont Water Quality Standard for chloride is not associated with a flow level. The standard indicates a chronic and acute threshold of chloride not to exceed of 230 mg/L as a 4-day average and 860 mg/L as a one-hour average (respectively) in a three-year period. Chloride values at these monitored sites were less than 5 mg/L – well below the chronic standard.

The turbidity standard for Class B cold-water streams is 10 NTU at low flow conditions. Samples at all locations in 2022 ranged from <0.5-2.4 NTU. The highest value (2.4 NTU) was measured on September 6 at the Beaver Meadow site.

Vermont Water Quality Criteria (October 2016) states that *E.coli* is not to exceed a geometric mean of 126 organisms (MPN)/100 mL obtained over a representative period of 60 days, and no more than 10% of samples should be above 235 organisms/100 mL. The 235 MPN/ 100 mL standard was exceeded at site NHBM0.1 on Beaver Meadow Brook when *E. coli* values reached 730 MPN/ 100 mL on September 6. The Isham Brook site (NH10.1) neared the geomean standard of 126 MPN/ 100 mL that same day with a measured *E. coli* concentration of 120 MPN/ 100 mL. The site on Cold Brook was not sampled on this day due to lack of water, but on all other sampling days, *E. coli* concentrations were very low in Cold Brook (Figure 4).

Spot checks of stream temperature indicate the highest values were recorded on August 2 and Cold Brook recorded the highest temperature on all monitoring dates and Isham Brook measured the lowest temperatures (Figure 5).

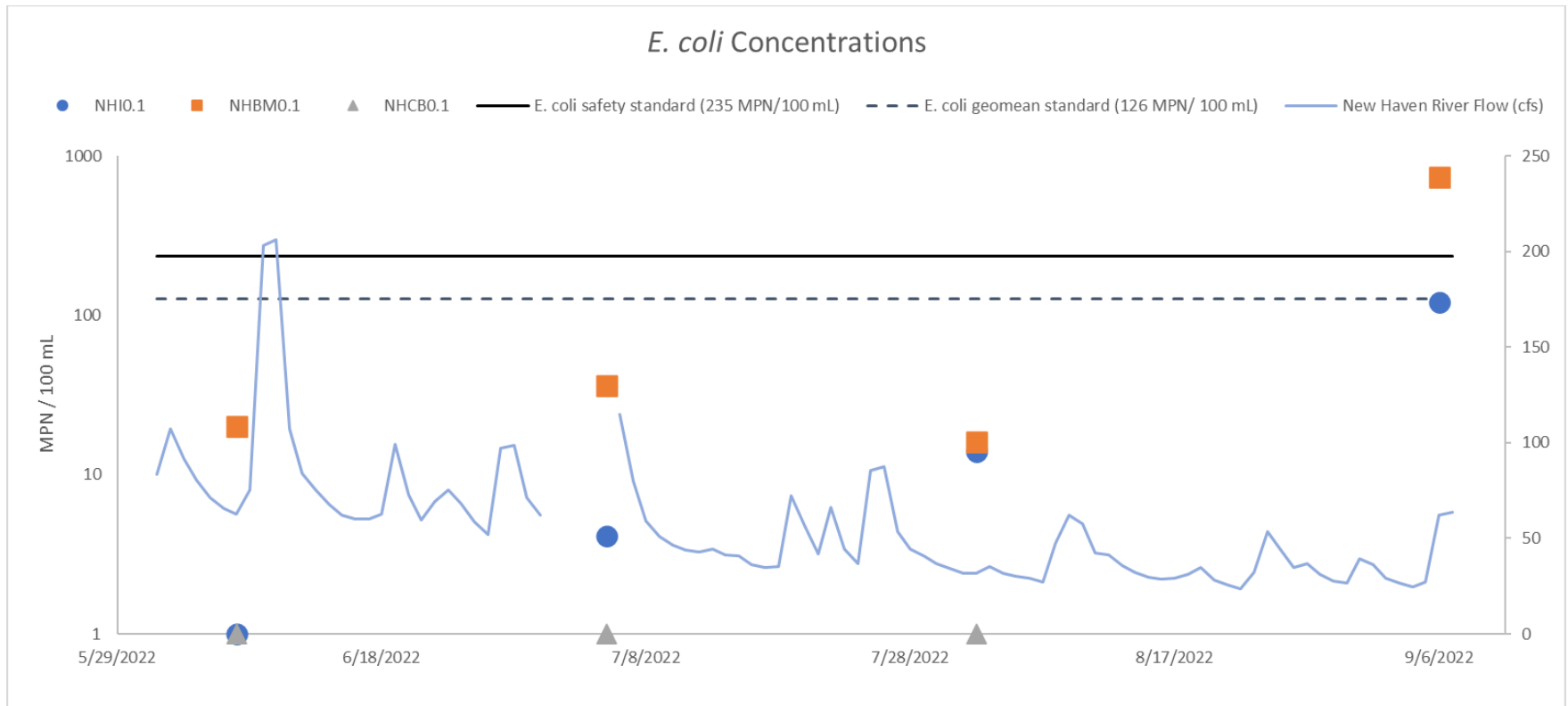


Figure 4. E. coli concentrations at three monitoring points in the Upper New Haven River watershed. The y-axis is presented in a logarithmic scale. High E. coli values do not appear to coincide with high stream flow, an indicator that the source of E. coli may not be diffuse non-point source stormwater runoff and may be associated with a point discharge or septic failure.

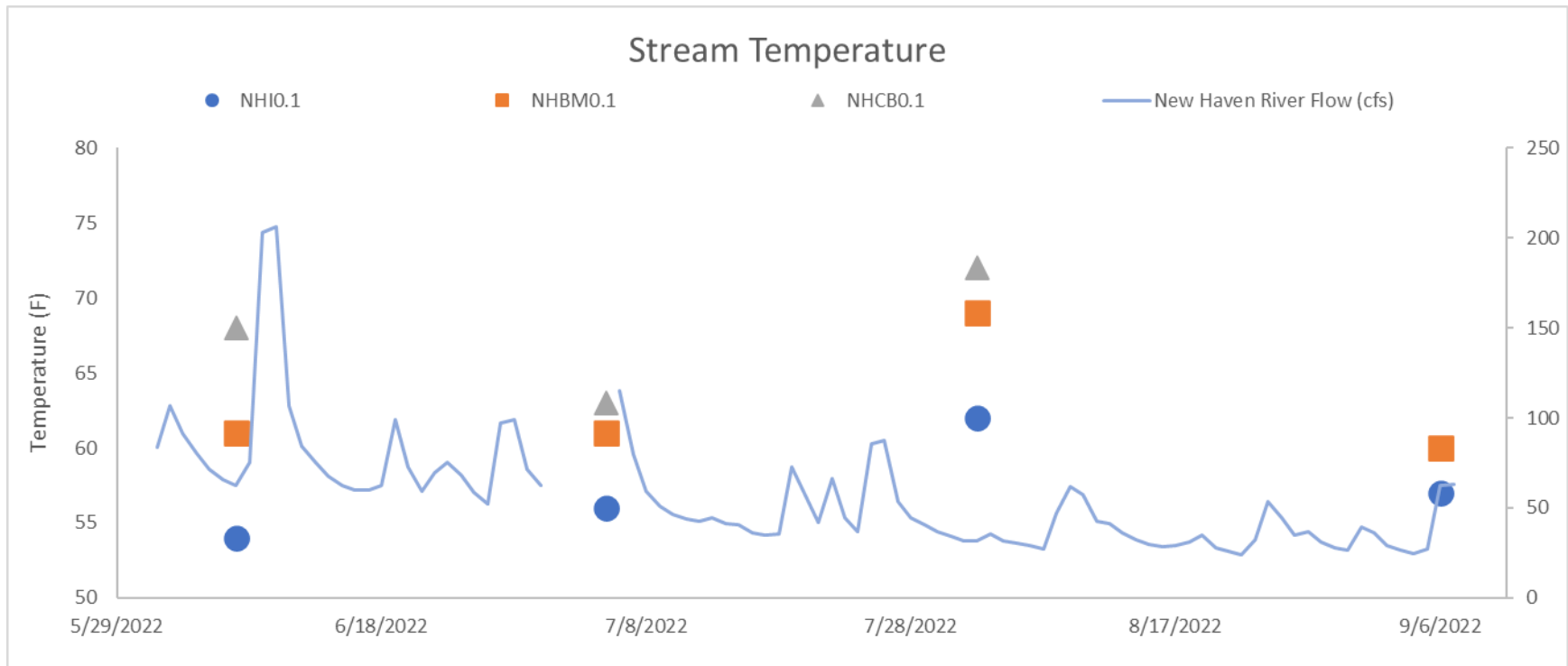


Figure 5. Water temperature in the monitored streams in 2022. Temperatures ranged from 54° to 59° F in Isham and Beaver Brooks and 63° and 72° F in Cold Brook.



## Discussion

Concentrations of nutrients, turbidity and chloride measured at all three sites were quite low – consistent with patterns characterized in 2021.

Chloride levels at all monitoring points are very low. If continued monitoring of chloride is of interest at these sites to track change over time, a handheld conductivity meter would allow more sampling at a lower cost. VT Agency of Natural Resources developed a linear regression equation relating conductivity to chloride which allows easy conversion from one to the other.

*E. coli* levels at two sites were elevated on a late season sampling day (September 6). The 2022 values exceeded 2021 concentrations and do not appear to be coincident with high flow levels, indicating that the *E. coli* source may not be from diffuse stormwater inputs but could be a point discharge or due to a failing septic system or agricultural inputs (for instance). Additional sampling at a variety of flow conditions as well as geographic assessment to identify potential sources may aid in determining next steps to address the input.

Stream temperatures ranged from 54° to 59° F in Isham and Beaver Brooks and from 63° to 72° F in Cold Brook. As a comparison, stream temperatures in Isham and Beaver Brook ranged from 54° to 61° F in the 2021 field season. The average temperature in Isham and Beaver Brooks was 58° in 2021 and 60° in 2022 – a 2-degree increase. Cold Brook has the smallest watershed of all monitored sites, its drainage area is dominated by forest, and it has an extensive vegetated buffer. Elevated temperatures in this stream may be related to its comparatively low flow rate rather than solar radiation from a lack of stream buffers. Isham Brook crosses a couple of roadways and originates in open agricultural land where stream buffers are not present which may influence stream temperatures due to runoff and excess solar radiation. Beaver Meadow Brook, with the largest drainage areas of the monitored streams, winds through a range of land use types that include unbuffered open meadows, several roadways, residential areas, and mature forest.

One goal of the monitoring in these streams is to determine the influence of buffer plantings and other improvements in the watersheds on the temperature in the streams. Based on these data, the streams were warmer in 2022. However, single point temperature measurements do not provide all of the information necessary to determine average stream temperature over a season. In addition to solar radiation, air temperature and flow conditions also influence stream temperature which may not be accurately captured with individual temperature measurements on four days. More frequent water and air temperature measurements could help to clarify the driving factors influencing changes in water temperature between seasons, including the influence of stream shading from buffer planting.