

# MEMORANDUM | EASTERN BRANCH JOHNS RIVER FECAL SOURCE TRACKING



**TO:** Christopher Hall Ph.D., Rachel Bizarro, Town of Bristol  
**FROM:** Forrest Bell, FB Environmental Associates (FBE)  
**SUBJECT:** Memorandum: Eastern Branch Johns River Fecal Source Tracking  
**DATE:** October 4, 2021  
**CC:** Margaret Mills, Maggie Kelly, FB Environmental Associates (FBE)

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FB Environmental worked with the Town of Bristol to develop a plan for fecal source tracking in the Eastern Branch of the Johns River. The Eastern Branch of the Johns River is located across the town boundaries of Bristol and South Bristol, Maine. Under recent reclassification by the Maine Department of Marine Resources (Maine DMR), the Eastern Branch of the Johns River has been assigned to Growing Area “WR”, with a conditionally approved classification area defined in 2018 as “CA2” that is closed seasonally from May 1 through October 31. A smaller prohibited area exists near the outlet below Foster Island and is defined as “P1”. This area has historically been a favorite spot for local commercial and recreational clammers because of the ease of access and productivity of the flats. As shellfishing is an important resource for both the towns of Bristol and South Bristol, the conditional classifications have led the Bristol Shellfish Committee and the Town of Bristol to investigate potential causes of fecal contamination. Four small intermittent tributaries enter this estuary: one in Wilson’s Cove, two in the northern portion of the cove near lots 084 (Hope’s Landing) and 084-A, and a fourth in Gentle Cove.

FBE completed investigative sampling for fecal coliform, mitochondrial DNA for human and Canada Goose markers, and optical brighteners in June 2021 at seven locations within the Eastern Branch Johns River cove (Figure 1). FBE also performed a watershed reconnaissance survey to document land use observations and potential nonpoint source pollution sources. FBE compiled available historical data from DMR and the Maine Department of Environmental Protection to inform these efforts.

This memorandum discusses the results of the fecal source tracking sampling, key observations from the watershed reconnaissance, and suggested recommendations for next steps.

## FECAL SOURCE TRACKING

### METHODOLOGY

FBE conducted water quality sampling on the Eastern Branch of the Johns River on June 21, 2021. Samples were taken at seven sites in the cove where four small tributaries outlet, as well as at DMR stations WR016.00 and WR014.00, and adjacent to Foster’s Island (Figure 1). Samples were taken on the outgoing tide to capture samples and pollutants as the water is leaving the estuary, resulting in as accurate a representation as possible of conditions specific to the estuary caused by runoff and tributary drainages. Samples were taken during dry weather conditions to understand baseline conditions.

Samples were analyzed for fecal coliform (the parameter used by Maine DMR for regulating shellfish flats), optical brighteners (whitening agents commonly found in human wastewater systems which can indicate human contamination), and mitochondrial DNA (mtDNA) for human and Canada Goose markers. Canada Goose was selected because anecdotal information from local clammers suggests this area hosts congregating geese populations. Human markers are important for identifying any fecal contamination resulting from malfunctioning septic systems.

#### *Microbial Source Tracking with mtDNA*

Elevated fecal indicator bacteria are difficult to control, because fecal indicator bacteria can be sourced from wildlife or proliferate on certain substrates within the environment. Microbial source tracking (MST) is a scientific technique that uses mtDNA host-specific markers to determine the source animal of mtDNA found in water samples. The mtDNA analysis was performed at the UNH Microbial Source Identification Laboratory using molecular biomarkers to assess water quality. If absent, the target biomarker was not detected above the limit of detection and is therefore considered absent. Additional sampling, for example during variable flow in dry conditions and during a storm, may provide more data to draw definitive conclusions about the animal source contributor(s) of fecal pollution in surface water. If positive, the source of a present sample is detected within the standard microbial source guidelines.

## RESULTS AND ANALYSIS

Results are displayed in Table 1 and Figure 1. None of the sites had elevated fecal coliform bacteria results during the June 21 sampling event. Fecal coliform is a fecal indicator bacteria, and as such, it is highly variable and can proliferate or degrade in the environment depending on conditions such as temperature, sunlight, flow, salinity, and other factors. Historical DMR water quality monitoring has indicated levels of fecal coliform that cause the East Branch of the Johns River to be conditionally approved. The absence of fecal coliform bacteria during the dry weather sampling conditions on June 21 indicates that pollution may be entering the estuary in variable weather conditions and further sampling may help indicate what conditions are causing elevated bacteria levels.

Two of the seven sites had positive results for human and Canada Goose at low threshold concentrations. Sites JR-4 and JR-5 had low threshold concentrations of both markers, indicating that there is presence of fecal contamination from human and Canada Goose, but it is at low levels and resampling during both wet and dry weather conditions is recommended to get a stronger signal and understanding of the presence.

One site had a positive result for optical brighteners, site JR-4. Optical brighteners are commonly used for wastewater detection. Optical brighteners are not naturally occurring and are typically added to laundry soaps, detergents, cleaning agents, and toilet papers to aid in the brightening of fabrics and/or surfaces. Testing positive for optical brighteners in groundwater strongly suggests greywater from leach fields is entering the groundwater without adequate filtration. This indicates that there is a wastewater problem entering the estuary, potentially upstream of site JR-4.

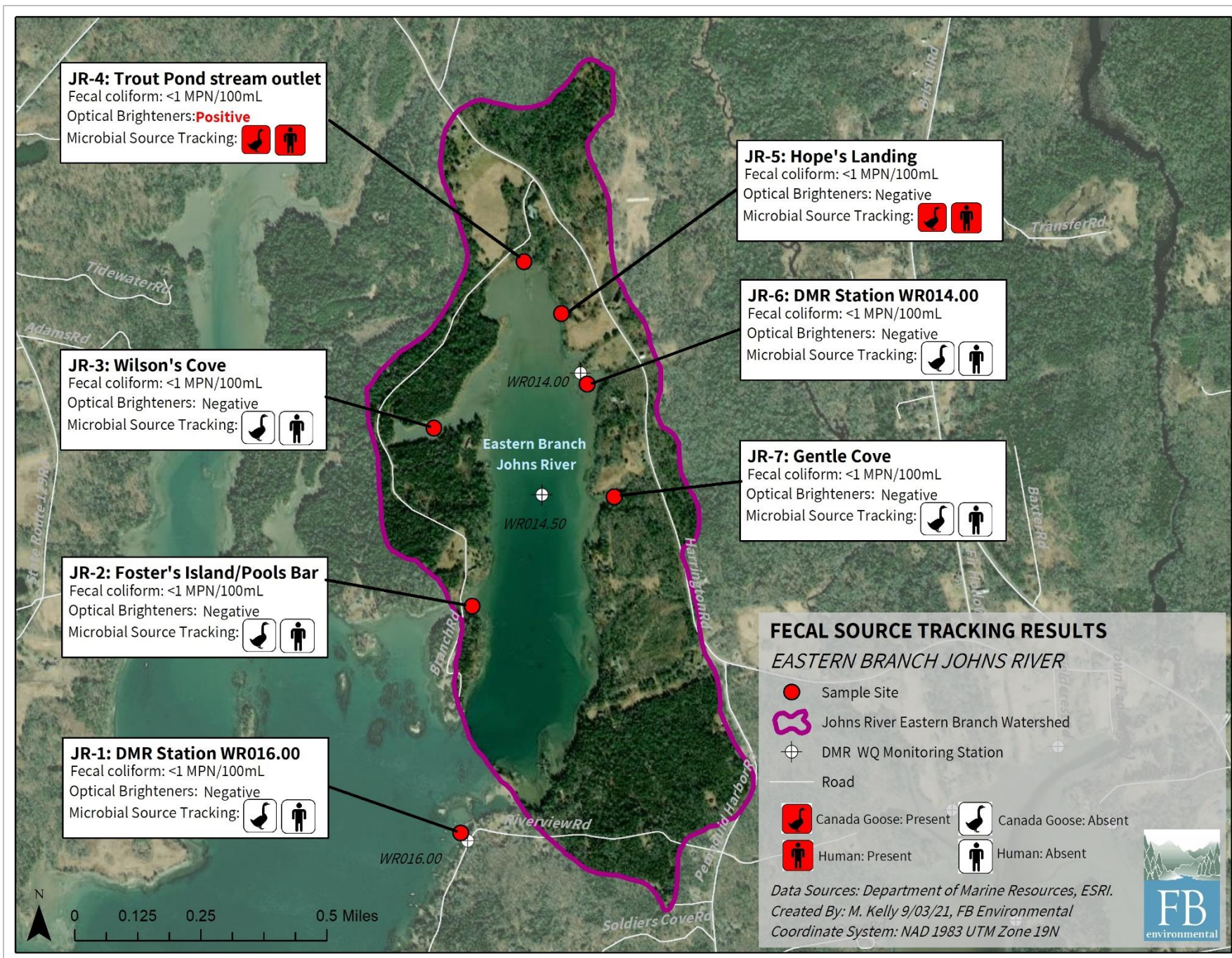
Recommendations are discussed at the end of this memorandum.

**Table 1. Results from laboratory analysis and microbial source tracking analysis. Positive results are highlighted in red.**

Site	Location Description	Fecal Coliform (MPN/100 mL)	Microbial Source Tracking		Optical Brighteners (Positive/Negative)
			Human (DNA result)	Canada Goose (DNA result)	
JR-1	DMR Station WR016.00	<1	Absent	Absent	Negative
JR-2	Foster's Island/Pools Bar	<1	Absent	Absent	Negative
JR-3	Wilson's Cove	<1	Absent	Absent	Negative
JR-4	Trout Pond stream outlet	<1	Present*	Present*	Positive
JR-5	Hope's Landing	<1	Present*	Present*	Negative
JR-6	DMR Station WR014.00	<1	Absent	Absent	Negative
JR-7	Gentle Cove	<1	Absent	Absent	Negative

*\*mtDNA results were present but at low concentrations; resampling during spring wet season recommended.*





**Figure 1.** Results of fecal source tracking in the Eastern Branch Johns River.



## WATERSHED RECONNAISSANCE

FBE visited the Eastern Branch Johns River Watershed on May 27, 2021 to perform a watershed reconnaissance survey and document observations about land use, watercourses, stream crossings, pets and livestock, and wildlife gathering areas. FBE drove all public roads within the watershed and evaluated sites that posed a threat to downstream waterbodies. FBE identified three sites of potential nonpoint source pollution that may pose a threat to the estuary. The observed problems and recommendations are discussed below.

### (1) Harrington Cemetery

**OBSERVED POTENTIAL PROBLEMS:** The cemetery lawn is sloped to the edge of the cove, allowing runoff and possibly pollutants to enter the estuary. The shoreline lacks a vegetated buffer for approximately 105 feet along the water. The shoreline has been armored with boulders, presumably to stop an ongoing erosion problem. The shoreline edge above the stones is eroding into the water. An infiltration trench also leads directly to the water, which may slow and infiltrate some runoff.

The slope of the cemetery lawn and lack of buffer along the shoreline may allow pet waste, fertilizer, or waterfowl waste to enter the estuary. Although there were no signs of Canada Geese during the survey in June 2021, local clammers have noted significant congregations of geese at the cemetery.

**RECOMMENDATIONS:** We recommend installing an extensive vegetated buffer (25 of width where possible) along the bare 100 feet of shoreline. FB Environmental can help Bristol design and implement this buffer. This buffer will slow runoff and filter pollutants before they enter the water. Vegetation and tall grass will also discourage geese from landing on the lawn next to the water, reducing potential risk of waterfowl waste. We also recommend installing signage and/or waste bags to encourage pet owners to clean up pet waste. Lastly, installing stairs on the point of the cemetery where people climb down the bank to the water could reduce erosion through providing a clear access point.



*Harrington Cemetery slopes towards the shoreline. Approximately 105 feet along the shoreline is unbuffered (left), allowing pollutants to enter the water. The armoring along the water is eroded at the top of the bank (right), indicated that runoff enters the water here, potentially carrying bacteria or other pollutants.*

## (2) Pond adjacent to East Branch Road (“Trout Pond”)

**OBSERVED POTENTIAL PROBLEMS:** The manmade pond, termed the “Trout Pond” located on the corner of East Branch Road and Harrington Road has altered natural stream conditions. The pond is located approximately 500 feet upstream of the north tip the estuary. The water in the pond is stagnant, which may allow bacteria growth to occur and wash downstream. The inlet to the pond comes from a clogged culvert that crosses under Harrington Road. The outlet of the pond appears to be several large, black drainage pipes that come from the pond into the ravine, which then flows directly into the estuary (note: the land is private land, as such, FBE only viewed the pond and outlet from East Branch Road).

**RECOMMENDATIONS:** We recommend working with the pond’s owner to see when and how the pond outlets into the stream that leads to the cove. Future sampling below the pond may help determine if there are any pollutants of concern entering the stream from the pond. In addition, we recommend ensuring that there is an extensive buffer along the pond to discourage geese or other waterfowl from landing and entering the pond.



*Manmade pond at the corner of Harrington Road and East branch Road and East Branch Road.*



*Black drainage pipes, circled in red, coming out of pond and into the ravine that leads to the estuary.*

## (3) Ravine/drainage to Cove on East Branch Road

**OBSERVED POTENTIAL PROBLEMS:** The culvert that crosses under East Branch Road at the top of the estuary allows a small tributary to outlet into the stream that enters the northern tip of the Eastern Branch Johns River estuary. The culvert is misaligned, and the inlet of the culvert is perched, which appears to allow ponding to happen behind the culvert inlet. The culvert outlet is also extremely perched.

**RECOMMENDATIONS:** Replace or reinstall this culvert at grade to fix the perched inlet and outlet.



*Ponding is occurring below/behind the culvert inlet, causing the inlet to be perched and not drain properly.*



### Additional Observations during Watershed Reconnaissance

FBE observed that along the eastern side of the cove along Harrington Road, there are several large lawns and fields that have limited to no buffer along the shoreline. This is a point of concern because it increases the risk of pollutant or fertilizer runoff into the estuary. This problem is exacerbated by the landscape of the watershed. The land is heavily sloped towards the estuary, particularly along Harrington Road.

In addition, FBE observed that several of the homes along the shoreline, especially along Riverview Road just outside of the cove entrance, are older homes in very close proximity to the water. This presents a risk of septic system malfunction or failure which could allow pollutants to enter the estuary. An overboard discharge previously occurred along Riverview Road at the DMR water quality station WR16.00, causing this area to be prohibited to shellfishing until the problem is resolved.

The west side of the estuary is mostly forested. The road is well maintained and there were no observed potential problems.

### RECOMMENDATIONS

Based on the watershed reconnaissance and results of the fecal source tracking performed in 2021, we have the following recommendations:

- We recommend further microbial source sampling for human and Canada goose markers at sites JR-4 and JR-5 in the spring as snow is melting and during a precipitation event. John Bucci of the UNH Microbial Source Identification Laboratory recommends sampling during a rain event at higher flow and as the weather warms up, bacteria will be mobilized and provide a stronger signal. Further sampling could be done directly at the tributary outlets and upstream.
- Based on the positive results for optical brighteners above site JR-4 and for the human marker, we recommend investigating possible septic system malfunctions. To assist with this, we recommend performing bracket sampling on the intermittent stream at the top of estuary, referred to as the “Trout Pond” stream, during a wet weather event. This stream splits into two tributaries directly above the outlet to the estuary. Bracket sampling is a technique that assists in pinpointing sources of bacteria entering a tributary, done by sampling upgradient and downgradient of potential sources to isolate pollutant source locations.
- We recommend working with the agency in charge of Harrington Cemetery to improve the buffer along the shoreline. We recommend a 25 foot wide buffer (where possible) of shrubs and plants to capture pollutants before entering the water and infiltrate stormwater. It will also discourage geese from landing on the grass and entering the water.
- We recommend working with the landowner of the Trout Pond to enhance the buffer along the edge of the pond to discourage geese from landing and entering the water. In addition, we recommend discussing with the landowner how the pond outlets.

FB Environmental Associates is available to help Bristol implement these recommendations. We would be happy to provide an estimate of time and materials at the request of the Town.