VERMONT
ENVIRONMENTAL CONSERVATION

Little Otter Creek: Headwaters

Watershed Description

This bacteria TMDL summary applies to a 1-mile reach of the Little Otter Creek Headwaters (VT03-07), a section of stream approximately 2.5-mile long located southeast of Lake Champlain (Figure 1). The headwaters of Little Otter Creek begin in a small forested area just over the town line in Bristol. The creek flows west into New Haven, where it collects a small tributary flowing down from the north. The creek continues west and the impaired segment ends a half mile west of Sawyer Road in New Haven. Little Otter Creek then continues to flow north west and eventually flows into Lake Champlain in the town of Ferrisburgh. The watershed for the Little Otter Creek Headwaters (Figure 1) covers 4.8 square miles, exclusively in the towns of Bristol and New Haven. Overall, land use in the watershed is 36% forested 55% agricultural, 7% developed, and 2% wetland, as shown in Figure 2 (based on 2006 Land Cover Analysis by NOAA-CSC).

The headwaters of Little Otter Creek are an important natural feature within Bristol and New Haven. The soils along the creek's bank and within its floodplains are ideal for agriculture. Approximately 65% of the land within New Haven is considered either prime agricultural soil (7%) or agricultural soil of statewide or local importance (58%) (New Haven, 2010). Farming dominates the landscape within New Haven and acts as the major economic force within the town.

The creek's impaired segment begins approximately one mile upstream of station LOC14.4 at river mile 15.4. The impaired segment continues for one mile upstream to river mile 16.4. Sampling stations use distances upstream of the mouth of the river, in their title. For example "LOC14.4" is situated 14.4 miles from the mouth of Little Otter Creek in Hawkins Bay on Lake Champlain.

Waterbody Facts (VT03-07)

- **Watershed Towns:** New Haven & Bristol
- **Impaired Segment Location:** River mile 15.4 to river mile 16.4
- **Impaired Segment Length:** 1 miles
- **Classification:** Class B
- **Watershed Area:** 4.8 square miles
- **Planning Basin:** 3-Otter Creek

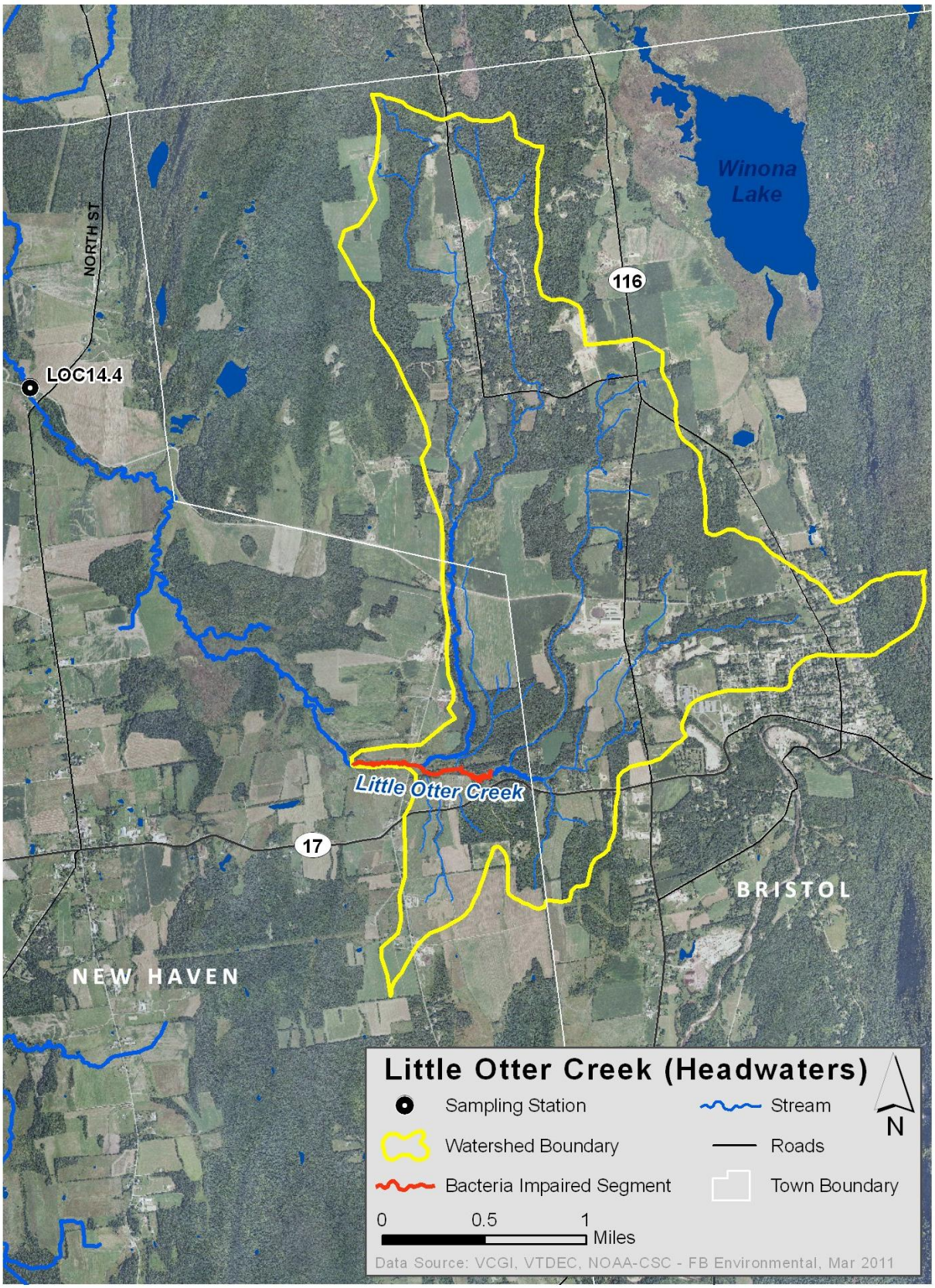

Figure 1: ***Map of Little Otter Creek Headwaters watershed with impaired segment and sampling stations indicated.***

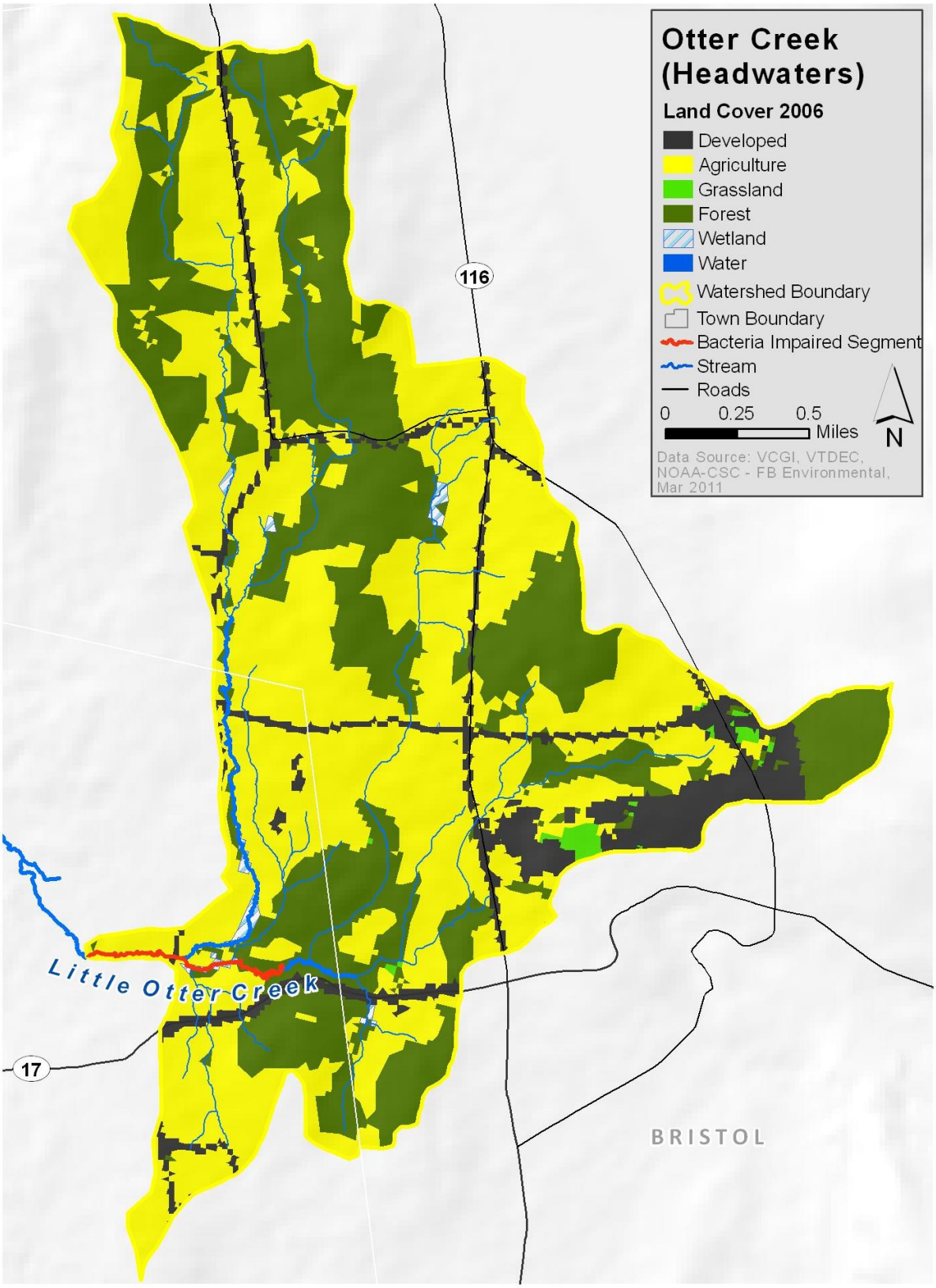

Figure 2: ***Map of Little Otter Creek Headwaters watershed with impaired segment and land cover indicated.***

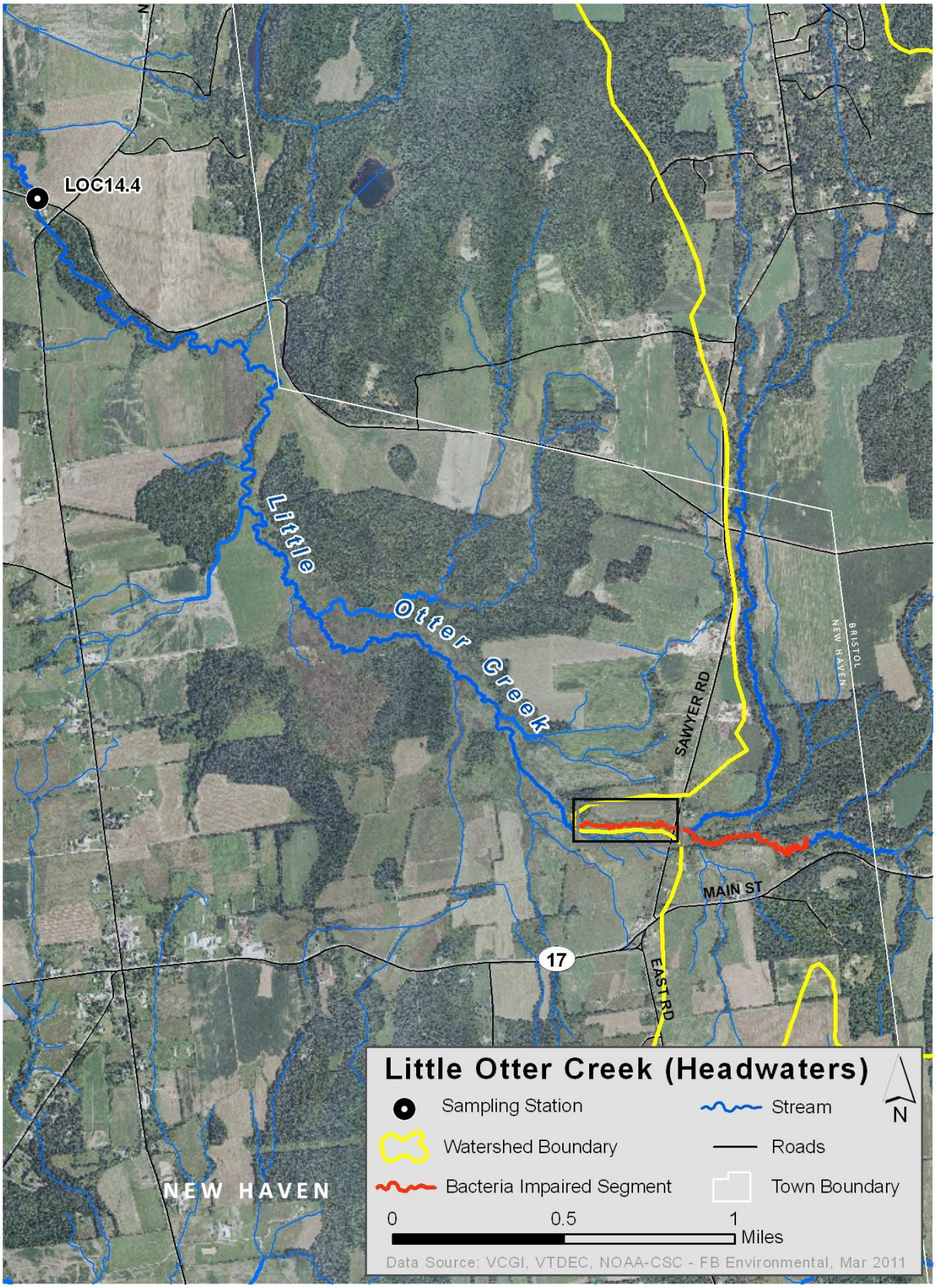

Figure 3: ***Map of downstream reaches of Little Otter Creek Headwaters with impaired segment and sampling locations indicated. Inset area corresponds to Figure 4 below.***

Figure 4: ***Aerial view of Little Otter Creek Headwaters from approximately river mile 15.4 to river mile 16 (Source: Google Maps).***

Figure 4 shows the reach from approximately river mile 15.4, the beginning of the impaired segment (middle left hand side), to river mile 16 in New Haven. As seen in this aerial image, there are large tracts of agricultural land along the creek's banks with minimal riparian buffer. Agriculture remains an important cultural and economic resource in Addison County (ACRPC, 2008). This impaired segment of Little Otter Creek Headwaters is completely within the town of New Haven, where agriculture is the dominant land use and an essential part of the local economy (New Haven, 2010). A 2007 agricultural census found that there are 73 farming operations within the town of New Haven, several of which reside in the small watershed around the impaired segment of Little Otter Creek's headwaters. The types of farms present are primarily dairy, poultry, fruit and vegetable farms, and horse stables (New Haven, 2010). Given the large percentage of its watershed dedicated to agricultural land uses, Little Otter Creek Headwaters is considered an agricultural stream (Medalie, 2007). Much of the agricultural land surrounding the impaired segment and in the creek's course beyond this segment was once wetland. Up to one-third of Addison County's farmland may have once been wetland (ACRPC, 1994).

From the top of the impaired segment at river mile 16.4 down to the end of the impaired segment one mile upstream from sampling station LOC14.4, the stream flows very close to agricultural lands. Land use has a profound effect on waters movement, storage and ultimately its water quality (RRPC, 2008). The long term health of Little Otter Creek Headwaters is closely linked to the use of best management practices (BMPs) on agricultural lands, aimed at reducing pollutant loads, particularly bacteria, to the creek. Figure 4 shows the need for wider riparian buffers along the creek's course.

Why is a TMDL needed?

Little Otter Creek Headwaters is a Class B, cold water fishery with designated uses including swimming, fishing and boating (VTDEC, 2008). The Addison County River Water Collaborative has been collecting samples from Little Otter Creek for analysis of *E.coli* since 1997 (ACRWC, 2009). Each summer, samples are collected from the sampling station shown in Figure 3. Bacteria samples, over the course of ACRWC's history sampling Little Otter Creek and its tributaries, have exceeded the state standard on many sample dates at station 14.4 (LOC, 2009). Table 1 below provides bacteria data collected in the downstream sampling station 14.4 from 2000 to 2007. Table 1 provides the water quality criteria for *E.coli* bacteria along with the individual sampling event bacteria results and geometric mean concentration statistics for each sampling season. Vermont's current single sample water quality criterion was exceeded more than half of the time at LOC14.4. During the 2010 sampling season the *E.coli* levels at station 14.4 were well above the Vermont standard on three of the four sampling dates (ACRWC, 2011).

Due to the elevated bacteria a measurement presented in Table 1, Little Otter Creek Headwaters from river mile 15.4 to river mile 16.4, did not meet Vermont's water quality standards, was identified as impaired and was placed on the 303(d) list (VTDEC, 2008). The 303(d) listing states that use of Little Otter Creek Headwaters for contact recreation (i.e., swimming) is impaired. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies is to comply with state water quality standards.

Potential Bacteria Sources

Given the high proportion of agriculture uses within the watershed, the proximity of these activities to the creek, and the general lack of riparian buffers along the creek, agricultural activities are likely the major source of bacterial contamination to Little Otter Creek Headwaters. Long term on-site improvement and restoration projects are being undertaken to help reduce agriculture runoff and educate municipalities of the issues with agricultural runoff to Little Otter Creek (VTDEC, 2010). The Natural Resources Conservation Service, USGS, and other agencies provided technical assistance and partial funding to support these projects (USGS, 2007). Since ACRWC began monitoring for *E.coli* on Little Otter Creek in 1997 there has been no evidence of improvement in the sanitary quality of the water in the creek (LOC, 2009). This suggests there is still much to be done in the watershed to address the threat of agricultural runoff.

Another potential source of bacteria to Little Otter Creek Headwaters is malfunctioning or failing septic (on-site) waste disposal systems. Much of the watershed consists of a high water table, heavy clay or hydric soils, as well as steep slopes that make septic waste disposal difficult (New Haven, 2010). Every resident within New Haven relies on septic disposal, and there are only 34 connections to the sanitary sewer in Bristol, many of which are outside of the watershed (Bristol, 2010). There are multiple instances

where dwellings are directly adjacent to the creek. If a system failed at this proximity to the headwaters of the creek, raw sewage could be transferred to the creek, contaminating it with bacteria. The combination of relatively old septic systems and a relatively high water table with poorly suited soils increases the probability of septic systems failing (ACRPC, 2008).

Recommended Next Steps

The Addison County River Watch Collaborative (ACRWC) is collaborating with the VT DEC on developing and implementing an education and outreach program for several rivers including Little Otter Creek. ACRWC is also developing a comprehensive assessment of Little Otter Creek with funds from a Clean and Clear Watershed Planning Assistance grant (VTDEC, 2010). ACRWC, New Haven and Bristol, and other community and watershed based groups are encouraged to continue implementing education and outreach programs, restoration programs, and the identification of land use activities that might be influencing *E. coli* levels (ACRWC, 2005).

Since much of the watershed is in agricultural land use, it would be beneficial to notify landowners of the programs available from NRCS, USGS, the Vermont Department of Agriculture, as well as the Otter Creek Conservation District. These programs can provide landowners with assistance in the installation of BMPs that help to reduce bacteria loads.

The only sampling station (LOC14.4) for the Little Otter Creek headwaters is over a mile downstream of the bottom of the impaired segment , making it difficult to identify sources of bacteria entering the Little Otter Creek headwaters. There are multiple smaller tributaries that enter the headwaters above and along the impaired segment. It is recommended that ACRWC expand bacteria sampling to stations near the outlet of these smaller tributaries. It would be beneficial to have sampling stations at both the upper and lower ends of the impaired reach, as well as at least one or two locations in-between.

Collecting additional samples upstream and downstream of potential on-site septic and agricultural sources (a practice known as “bracket sampling”) is a good way of identifying and quantifying sources. Sampling activities focused on capturing bacteria data under different weather conditions (e.g., wet and dry) may also be beneficial in support of source identification. Field reconnaissance surveys focused on stream buffers, stormwater runoff, and other source identification may also be beneficial.

Previous investigations (LOC, 2009; ACRPC, 1994; New Haven, 2010) have recommended the following actions to support water quality goals in Little Otter Creek Headwaters:

- On-Site Septic System Management – Encourage upgrading of old or inadequate septic systems paying special attention to areas near surface water.
- Agricultural - Work with the USDA, NRCS, USGS and other agencies to improve nutrient management planning, reduce livestock access to surface water, and increase riparian buffer width. Evaluate riparian buffers and identify opportunities to remove areas near the river from production.

- Land Use Protection - Preserve undeveloped portions of the watershed and institute controls on development near Little Otter Creek. Encourage communities to develop plans and regulations that afford greater protection of wetlands.
- Riparian Corridor – Install regulations addressing setbacks, buffers, and other tools that protect shoreline and/or riparian areas. Encourage landowners to enhance buffers through a combination of buffer plantings, land conservation, and improved agricultural practices.

Several of the steps outlined above are ongoing and should be continued and enhanced to focus on the goals of bacteria TMDL implementation. If implemented, these actions will provide a strong basis toward the goal of mitigating bacteria sources and meeting water quality standards in Little Otter Creek Headwaters.

Bacteria Data

Vermont's current criteria for bacteria are more conservative than those recommended by EPA. For Class B waters, VTDEC currently utilizes an E. coli single sample criterion of 77 organisms/100ml. Although, Vermont is in the process of revising their bacteria WQS to better align with the National Recommended Water Quality Criteria (NRWQC) of a geometric mean of 126 organisms/100ml, and a single sample of 235 organisms/100ml. Therefore, in Table 1 below, bacteria data were compared to both the current VTWQS and the NRWQC for informational purposes.

Little Otter Creek Headwaters, river mile 15.4 to 16.4

***WB ID*:** VT03-07

Characteristics: Class B

Impairment: *E. coli* (organisms/100mL)

Current Water Quality Criteria for E. coli:

Single sample: 77 organisms/100 mL

NRWQC for E. coli:

Single sample: 235 organisms/100 mL

Geometric mean: 126 organisms/100 mL

Percent Reduction to meet TMDL (Current):

Single Sample: **97%**

Percent Reduction to meet NRWQC:

Single sample: **90%**

Geometric mean: **59%**

Data: 2000 – 2007, Addison County River Watch Collaborative

Table 1: *E.coli* (organisms/100 mL) Data for Little Otter Creek Headwaters (2000-2007) and Geometric Mean (organisms/100mL) for each Station based on Calendar Year.

Station Name	Station Location	Date	Result	Geometric Mean**
LOC 14.4	Plank Rd.	8/22/2007	73	230
LOC 14.4	Plank Rd.	8/8/2007	261	
LOC 14.4	Plank Rd.	7/25/2007	56	
LOC 14.4	Plank Rd.	7/11/2007	2420	
LOC 14.4	Plank Rd.	6/27/2007	248	
LOC 14.4	Plank Rd.	8/23/2006	104	304
LOC 14.4	Plank Rd.	8/2/2006	308	
LOC 14.4	Plank Rd.	7/19/2006	1990	
LOC 14.4	Plank Rd.	7/5/2006	119	
LOC 14.4	Plank Rd.	6/21/2006	345	
LOC 14.4	Plank Rd.	8/17/2005	95	271
LOC 14.4	Plank Rd.	8/3/2005	687	
LOC 14.4	Plank Rd.	7/20/2005	111	
LOC 14.4	Plank Rd.	7/6/2005	365	
LOC 14.4	Plank Rd.	6/22/2005	548	
LOC 14.4	Plank Rd.	8/18/2004	115	88
LOC 14.4	Plank Rd.	8/4/2004	249	
LOC 14.4	Plank Rd.	7/21/2004	59	
LOC 14.4	Plank Rd.	7/7/2004	46	
LOC 14.4	Plank Rd.	6/23/2004	68	

*Shaded cells indicate single sample and geometric mean used to calculate percent reduction.

**Only geometric mean values calculated with 5 data points or more are used to determine percent reduction.

Table 1: *E.coli* (organisms/100 mL) Data for Little Otter Creek Headwaters (2000-2007) and Geometric Mean (organisms/100mL) for each Station based on Calendar Year (continued).

Station Name	Station Location	Date	Result	Geometric Mean**
LOC 14.4	Plank Rd.	8/6/2003	50	92
LOC 14.4	Plank Rd.	7/23/2003	687	
LOC 14.4	Plank Rd.	7/9/2003	61	
LOC 14.4	Plank Rd.	6/25/2003	34	
LOC 14.4	Plank Rd.	8/7/2002	64	80
LOC 14.4	Plank Rd.	7/27/2002	121	
LOC 14.4	Plank Rd.	7/10/2002	154	
LOC 14.4	Plank Rd.	6/29/2002	35	
LOC 14.4	Plank Rd.	8/11/2001	488	121
LOC 14.4	Plank Rd.	7/25/2001	52	
LOC 14.4	Plank Rd.	7/14/2001	119	
LOC 14.4	Plank Rd.	6/27/2001	71	
LOC 14.4	Plank Rd.	8/12/2000	548	513
LOC 14.4	Plank Rd.	7/26/2000	260	
LOC 14.4	Plank Rd.	7/15/2000	2420	
LOC 14.4	Plank Rd.	6/28/2000	201	

*Shaded cells indicate single sample and geometric mean used to calculate percent reduction.

**Only geometric mean values calculated with 5 data points or more are used to determine percent reduction.

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