VERMONT
ENVIRONMENTAL CONSERVATION

Lewis Creek & Pond Brook

Watershed Description

This bacteria TMDL summary applies to a 12.3-mile reach of Lewis Creek, and a 1.5-mile reach of Pond Brook, a major tributary to Lewis Creek. Lewis Creek is a 33-mile stream draining the northern section of Addison County and the southern section of Chittenden County (ACRWC, 2009). The creek's headwaters originate in the wooded hills of Starksboro (VTF&W). From Starksboro, the stream meanders through agricultural land before reaching Ferrisburgh where it flows into Lake Champlain. The headwaters for Pond Brook originate in Winona Lake in Bristol. The brook flows north through wetlands and farmland before its confluence with Lewis Creek to the east of Silver Street in Hinesburg (LCWQR, 2009).

Lewis Creek's bacteria-impaired segment begins at the footbridge to the west of Rte. 116 in center Starksboro and continues 12.3 miles downstream to the lower covered bridge on Monkton Road in Charlotte. The impaired segment for Pond Brook begins 1.5 miles upstream from the brook's confluence with Lewis Creek, at the Silver Street crossing, near the intersection of Silver Street and Murry Lane in north eastern Monkton. The Lewis Creek watershed (Figure 1) covers 70 square miles, primarily in the towns of Charlotte, Hinesburg, Starksboro, Bristol, and Monkton. Overall, land use in the watershed is 67% forested, 25% agricultural, 1% developed, and 5% wetland, as shown in Figure 2 (based on 2006 Land Cover Analysis by NOAA-CSC). Pond Brook's watershed is included in the greater Lewis Creek watershed. The Pond Brook watershed is 18.3 square miles with dominant land uses of 28% agriculture, 57% forest and 11% wetland (LCW, 2010).

Waterbody Facts (VT03-08)

- **Towns:** Charlotte, Hinesburg, Starksboro, Monkton
- **Lewis Creek Impaired Segment Location:** From lower covered bridge upstream to footbridge
- **Lewis Creek Impaired Segment Length:** 12.3 miles
- **Pond Brook Impaired Segment Location:** From Lewis Creek confluence upstream to Silver Street
- **Pond Brook Impaired Segment Length:** 1.5 miles
- **Classification:** Class B
- **Watershed Area:** 70 square miles
- **Planning Basin:** 3-Otter Creek

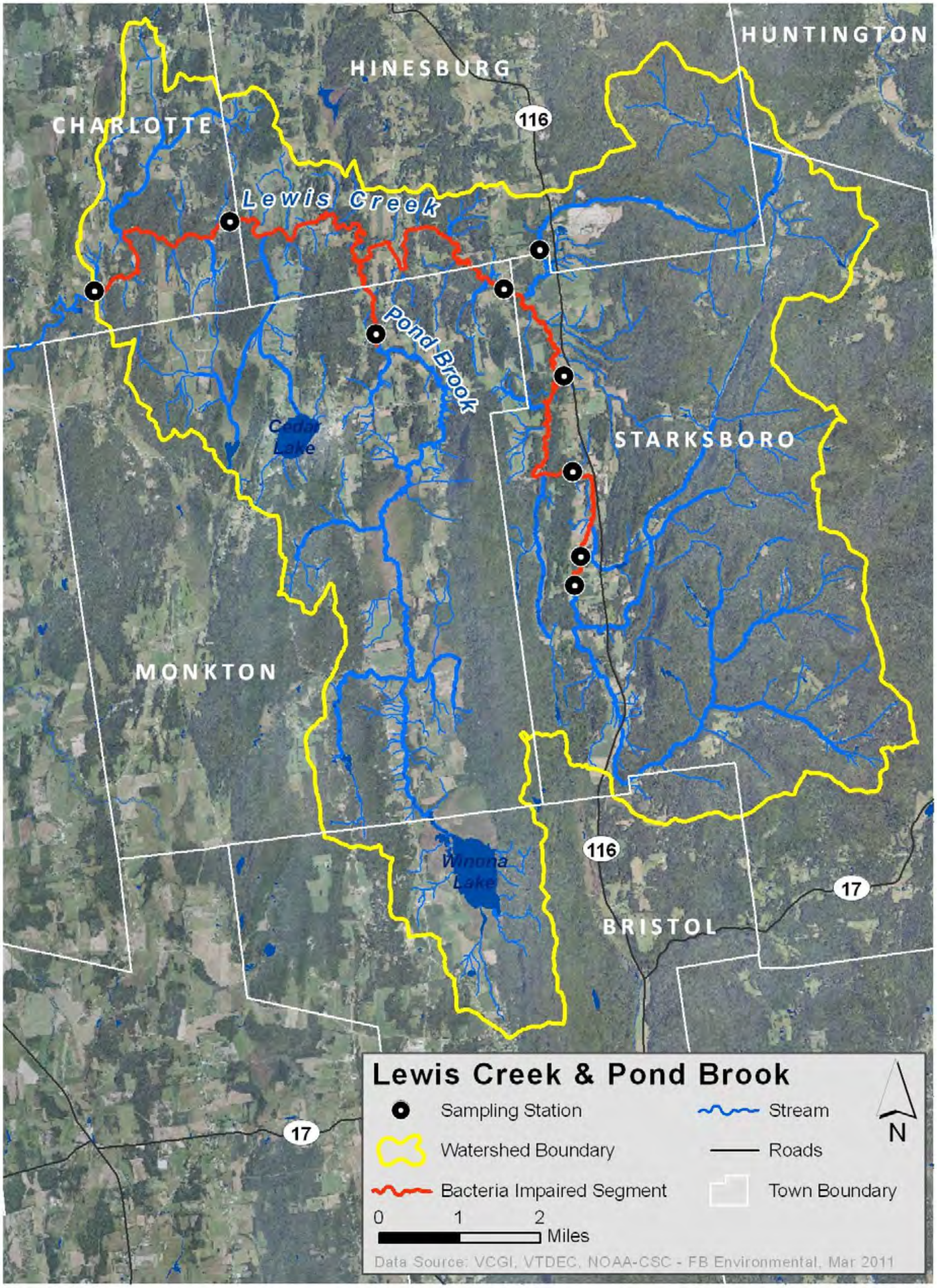

Figure 1: ***Map of Lewis Creek watershed with impaired segment and sampling stations indicated.***

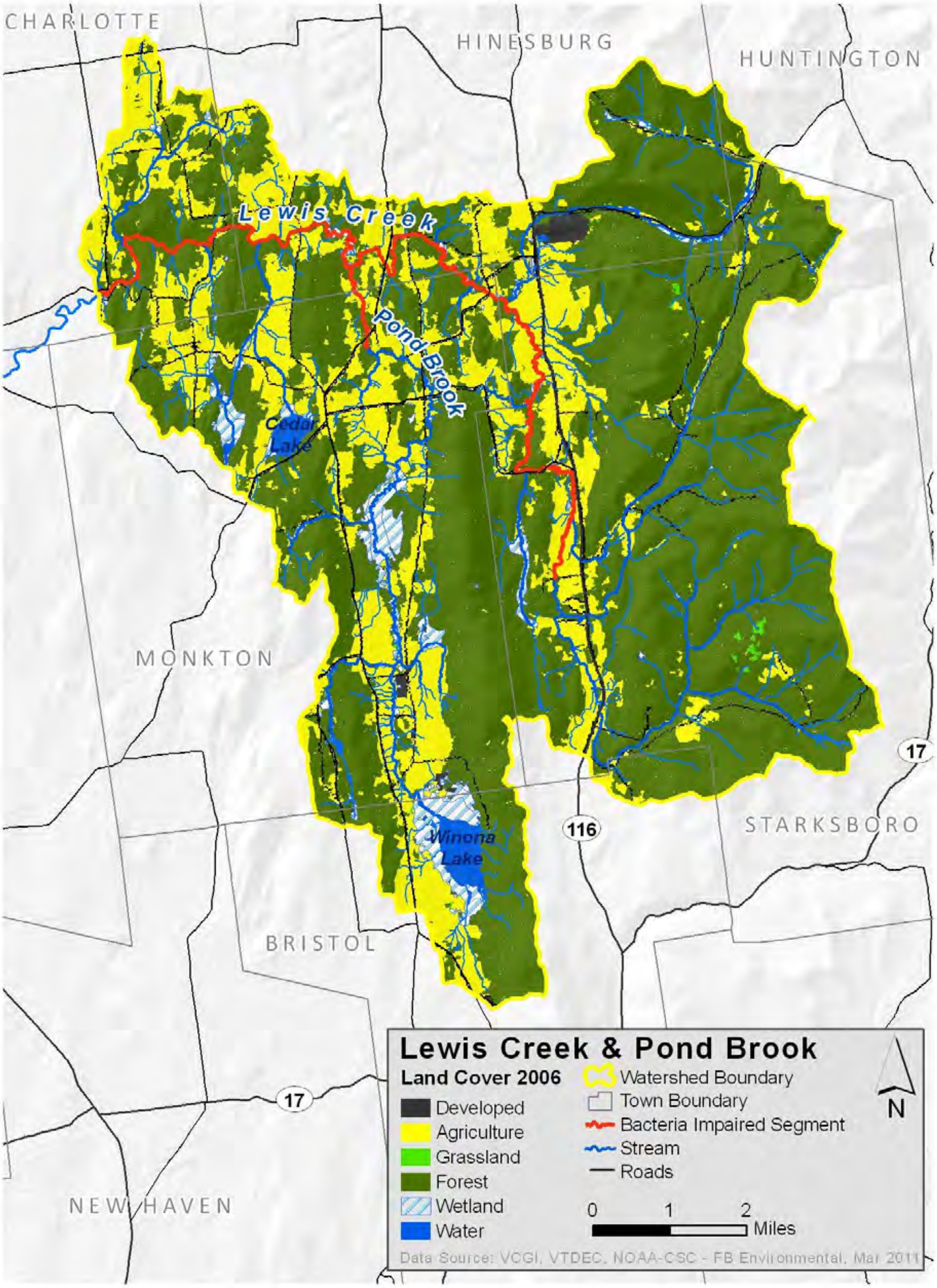

Figure 2: ***Map of Lewis Creek watershed with impaired segment and land cover indicated.***

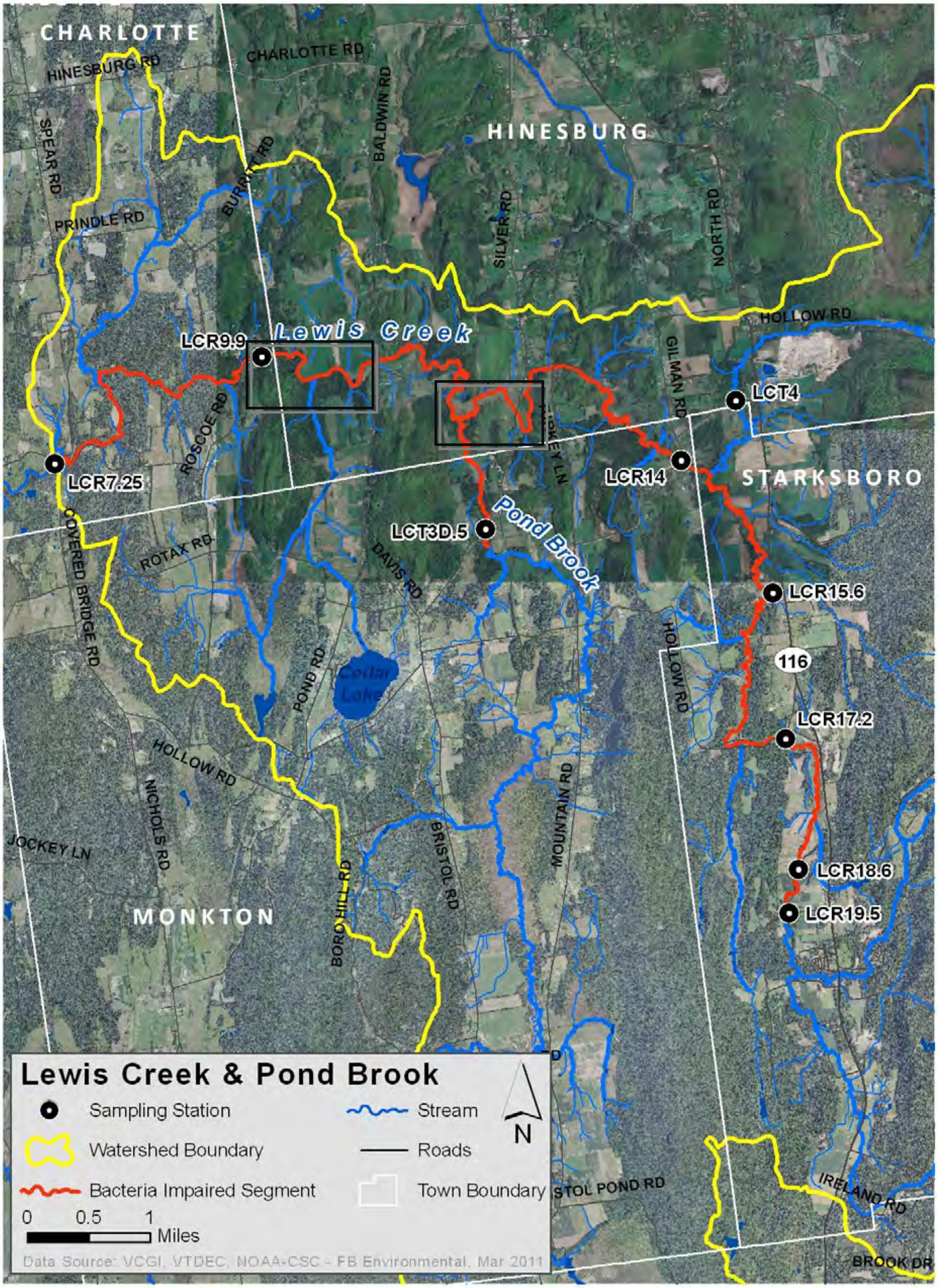

Figure 3: ***Map of downstream reaches of Lewis Creek with impaired segment and sampling locations indicated. Inset areas correspond to Figures 4 and 5 below.***

Figure 4: ***Aerial view of Lewis Creek and confluence with Pond Brook (center-left)(Source: Google Maps).***

Lewis Creek and Pond Brook are important natural features within Chittenden and Addison County. Figure 3 provides a more detailed aerial view of Lewis Creek in the downstream reaches with sampling stations indicated. The impaired segment of Lewis Creek begins at sampling station LCR19.5 (Figure 3). The sampling stations utilize river miles, distances upstream of the mouth of the river, in their title. For example "LCR19.5" is situated 19.5 miles from the mouth of Lewis Creek.

Figure 4 shows the reach from approximately river mile 13 to river mile 11.5. At approximately river mile 12, Pond Brook flows into Lewis Creek. As seen in this aerial image, there are large tracts of agricultural land along the banks of Lewis Creek and Pond Brook. Agriculture is prominent and remains an important cultural and economic resource in Chittenden and Addison County (ACRCP, 2008). Much of the agricultural land surrounding the impaired segment of both Lewis Creek and Pond Brook was once natural wetlands which helped to attenuate floods and excessive runoff. In the past, these areas were deforested and drained to be used for agriculture. It is believed that up to one-third of Addison County's farmland may have once been wetland (ACRPC, 1994).

From the beginning of the impaired segment of Lewis Creek, in central Starksboro, to river mile 7.25, the creek flows through large sections with little or no riparian buffer. Land use has a profound effect on water's movement, storage and ultimately quality (RRPC, 2008). During high flow events, the turbidity of Pond Brook can be very high. This can be an indication of agricultural runoff and stream bank erosion (LCWQR, 2009). Figure 4 also shows how in several locations agricultural activities directly abut the stream bank with minimal to no riparian buffer. Without a buffer to filter and remove sediment and pollutants, Pond Brook's measurements of turbidity and *E.coli* in the brook are generally high (LCW, 2010). The long term health of Lewis Creek and Pond Brook are closely linked to the use of best management practices (BMPs) on agricultural lands aimed at reducing pollutant loads to the creek. Figure 5 provides an aerial view of a reach of Lewis Creek from approximately river mile 11 to the sampling station LCR9.9 on Roscoe Road in Charlotte. This photo also documents the lack of adequate riparian buffer along the northern bank of Lewis Creek. It also displays the large tracts of forest land within the watershed, present here on the creek's southern bank.

Figure 5: ***Aerial view of Lewis Creek from approximately river mile 11 to river mile 10 (Source: Google Maps).***

Why is a TMDL needed?

Lewis Creek is a Class B, cold water fishery with designated uses including swimming, fishing and boating (VTDEC, 2008). The Addison County River Water Collaborative (ACRWC) has been collecting samples from Lewis Creek for analysis of *E.coli* since 1992 (ACRWC, 2009). Each summer, samples are collected from the sampling stations shown in Figure 3. Bacteria data from sampling locations LCR19.5 down to station LCR7.25 have consistently exceeded Vermont's water quality criteria for *E.coli* bacteria. Table 1 below provides bacteria data collected at these sampling locations from 2000 to 2007. Table 2 below provides bacteria data collected from sampling station LCT3D.5 on Pond brook from 2003 to 2007. Both tables provide 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 at the stations on Lewis Creek and the station on Pond Brook. For Lewis Creek, the current water quality criterion was exceeded in nearly three-quarters of the sampling events. For Pond Brook, Vermont's current water quality criterion was exceeded in nearly three-quarters of the sampling events. During the 2010 sampling season ACRWC only sampled at two locations, LCR14 and LCR 3.7. During 2010, single sample *E.coli* levels at these stations exceeded Vermont's water quality criteria on all four sample dates (ACRWC, 2011).

Due to the elevated bacteria measurements presented in Table 1, Lewis Creek from the station at river mile 7.25 up to the station at river mile 19.5 did not meet Vermont's water quality standards, was identified as impaired and was placed on the 303(d) list. Due to the elevated bacteria measurements presented in Table 2, Pond Brook, from its confluence with Lewis Creek to 1.5 miles upstream, did not meet Vermont's water quality standards, was identified as impaired and was also placed on the 303(d) list (VTDEC, 2008). The 303(d) listing states that use of Lewis Creek and Pond Brook for contact recreation (i.e., swimming) are 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

Failing on-site septic systems and agricultural runoff washing manure and other wastes into the creek are likely sources of bacteria to Lewis Creek and Pond Brook. Most of the residents within the Lewis Creek watershed are not serviced by waste water treatment facilities and therefore rely on on-site septic systems to treat waste. Only 22% of residents within Addison County have are serviced by waste water treatment facilities (ACRPC, 2008). Most of the residents within Chittenden also rely on septic waste disposal. Only Hinesburg has access to a wastewater treatment facility within the watershed. Nearly all of the connections to a wastewater treatment facility within Hinesburg are in the central portion of town that is out of the Lewis Creek Watershed (CCRPC, 2006). Therefore, nearly all of the residents within the Lewis Creek watershed residing in Hinesburg, also rely on septic waste disposal.

Over two-thirds of the soils within Chittenden County are not properly suited for septic disposal including areas of the county within the Lewis Creek watershed (CCRPC, 2006). 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). When these systems malfunction or fail, they can release untreated human waste into surface waters, such as Lewis Creek and Pond Brook.

Given the high proportion of agriculture uses within the watershed, the proximity of these activities to Lewis Creek and Pond Brook, and the general lack of riparian buffers along the creek, agricultural activities are likely to contribute to bacterial contamination in the streams. Agricultural activities on Lewis Creek, particularly between Parsonage Road (LCR19.5) and Tyler Bridge Road (LCR14) likely impact the sanitary quality of water, as shown by high *E.coli* concentrations in samples over the last two decades (ACRWC, 2009).

Agricultural activities along the banks of Pond Brook have also played a role in high *E.coli* and turbidity readings. Turbidity increases when excess sediments are washed into or stirred up by the brook. In Pond Brook, high turbidity is most likely caused by agricultural activities encroaching on the brook without adequate riparian buffers (LCWQR, 2009). Sediments are not the only pollutant carried off of agricultural fields. Manure is often applied to cropland, and grazing animals deposit their waste directly onto the fields adjacent to the brook. When heavy rains increase the sediment load to Pond Brook, increasing turbidity, bacteria and other potentially harmful pathogens are washed into the brook as well. Geomorphic assessments have identified crop and pasture land uses as the likely sources of increased runoff to Lewis Creek and Pond Brook (LCW, 2010).

Long term on-site improvement and restoration projects are being undertaken to help reduce agriculture runoff to Lewis Creek (VTDEC, 2010). The Natural Resources Conservation Service, USEPA, and other agencies provided technical assistance and partial funding to support these projects (ACRWC, 2005). These improvements include actions such as extending riparian buffers which can reduce erosion and polluted runoff to streams while increasing water filtration on the land. The Lewis Creek Association has assisted in the past with native stream buffer plantings in Hinesburg and Starksboro (ACRWC, 2005). Following current trends, it appears likely that agricultural runoff of fecal bacteria will continue to be a problem in the watershed due to the presence of narrow riparian buffers and adjacent large-scale farming activities. There is no evidence of measurable improvement in the sanitary quality of the waters in Lewis Creek since ACRWC began sampling for *E.coli* in 1992 (LCWQR, 2009).

Recommended Next Steps

The Addison County River Watch Collaborative (ACRWC) is working with the VT DEC on developing and implementing an education and outreach program for several rivers including Lewis Creek. ACRWC and the Lewis Creek Association (LCA) are also developing a comprehensive assessment of Lewis Creek with funds from a Clean and Clear Watershed Planning Assistance grant. In addition, The Lewis Creek Stark Valley Corridor Planning Project is currently underway within the watershed (VTDEC, 2010). The LCA, ACRWC, municipalities surrounding the impaired segment, and other community and watershed 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). Protection and restoration of Lewis Creek is important, but protecting the tributaries to Lewis Creek, especially Pond Brook, are an essential component of the overall watershed goals of mitigating bacterial contamination (LCW, 2010).

The data presented in Table 1 indicate that bacteria concentrations are highest at stations LCR14 and LCR15.6. Stations LCR9.9 and LCR7.25, downstream from station LCR14 as well as stations LCR17.2, LCR18.6 and LCR19.5, upstream of LCR15.6, have samples that exceed the water quality criteria for *E.coli* on multiple occasions. However, the water quality criteria is exceeded at stations LCR14 and LCR15.6 at the highest rate. This suggest that along the 3.2 mile reach of Lewis Creek between LCR17.2 and LCR14 bacteria are entering the creek in sufficient quantity to cause the water quality criteria the be exceeded at stations LCR14 and LCR15.6.

An aerial analysis of this 3.2 mile reach reveals a high concentration of active agricultural land with narrow or nonexistent riparian buffers. While the land use around three stations upstream of LCR15.6 is mostly agricultural, the riparian zone around Lewis Creek in much of the reach is still intact. It is recommended that LCA focus education and outreach efforts on landowners abutting the 3.2 mile reach between LCR17.2 and LCR14. Field reconnaissance surveys focused on stream buffers, stormwater runoff, and other source identification would be beneficial along this reach. While there are apparent problems throughout Lewis Creek's impaired segment, it is recommended that efforts focus on the areas exhibiting the most exceedances. Landowners along this reach should be notified or reminded that organizations such as NRCS, USGS, the VT Department of Agriculture, and the Otter Creek Conservation District which provide assistance with the installation of BMPs helping to reduce bacteria, nutrients, and suspended sediment loads to Lewis Creek and its tributaries.

There are also multiple smaller tributaries entering Lewis Creek along the 3.2 mile reach. It is recommended that LCA expand bacteria sampling to stations near the outlet of these smaller tributaries. Such data would indicate if there are sources releasing bacteria into the tributaries, ultimately reaching Lewis Creek. Additional bacteria data collection throughout the watershed would also be beneficial to support identification of potential sources in other areas.. For example, sampling upstream and downstream of potential on-site septic and agricultural sources (a practice known as "bracket sampling") may be beneficial for 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.

Previous investigations (ACRPC, 1994; CCRPC, 2006; LCW, 2010; VTDEC, 2010) have recommended the following actions to support water quality goals in Lewis Creek:

- <u>On-Site Septic System Management</u> – Conduct a sanitary survey of domestic wastewater, work with Vermont environmental enforcement officers and local health officials to identify and replace failing systems.
- <u>Agricultural</u> - Work with the USDA, NRCS and other agencies to assess the extent of agricultural waste application and potentially reduce applications through improved nutrient management planning. Restore the land to health where damage to natural resources has already occurred due to poor land use. Evaluate riparian buffer and identify opportunities to remove areas near the river from production.
- <u>Land Use Protection</u> - Preserve undeveloped portions of the watershed and institute controls on development near Lewis Creek. Encourage communities to develop plans and regulations that afford greater protection of wetlands that do not appear on the "Vermont Significant Wetlands Inventory."
- <u>Riparian Corridor</u> – Encourage communities to install regulations addressing setbacks, buffers, and other tools that protect shoreline and/or riparian areas. Continue riparian corridor projects and seek 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 Lewis Creek and Pond Brook.

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.

Lewis Creek, from Lower Covered Bridge upstream to footbridge (12.3 miles)

WB ID**:** VT03-08

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: Proposed Water Quality Criteria 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: **87%**

Data: 2000 – 2007, Addison County River Watch Collaborative

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

Station Name	Station Location	Date	Result	Geometric Mean **
LCR7.25	Lower Covered Bridge (Quinlan)	8/7/2002	104	NA
LCR7.25	Lower Covered Bridge (Quinlan)	7/27/2002	89	
LCR7.25	Lower Covered Bridge (Quinlan)	6/29/2002	107	
LCR7.25	Lower Covered Bridge (Quinlan)	8/11/2001	99	48
LCR7.25	Lower Covered Bridge (Quinlan)	7/25/2001	17	
LCR7.25	Lower Covered Bridge (Quinlan)	7/14/2001	105	
LCR7.25	Lower Covered Bridge (Quinlan)	6/27/2001	31	
LCR7.25	Lower Covered Bridge (Quinlan)	8/12/2000	201	78
LCR7.25	Lower Covered Bridge (Quinlan)	7/26/2000	74	
LCR7.25	Lower Covered Bridge (Quinlan)	7/15/2000	45	
LCR7.25	Lower Covered Bridge (Quinlan)	6/28/2000	56	
LCR9.9	Upper Covered Bridge (Rule)	8/22/2007	56	184
LCR9.9	Upper Covered Bridge (Rule)	8/8/2007	96	
LCR9.9	Upper Covered Bridge (Rule)	7/25/2007	96	
LCR9.9	Upper Covered Bridge (Rule)	7/11/2007	2420	
LCR9.9	Upper Covered Bridge (Rule)	6/27/2007	167	
LCR9.9	Upper Covered Bridge (Rule)	8/23/2006	365	319
LCR9.9	Upper Covered Bridge (Rule)	8/2/2006	687	
LCR9.9	Upper Covered Bridge (Rule)	7/19/2006	133	
LCR9.9	Upper Covered Bridge (Rule)	7/5/2006	114	
LCR9.9	Upper Covered Bridge (Rule)	6/21/2006	866	

*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/00 mL) Data for Leis Creek (2000-2007) and Geometric Mean (organisms/100mL) for each Station based on Calendar Year (continued).

Station Name	Station Location	Date	Result	Geometric Mean **
LCR9.9	Upper Covered Bridge (Rule)	8/17/2005	73	441
LCR9.9	Upper Covered Bridge (Rule)	8/3/2005	1120	
LCR9.9	Upper Covered Bridge (Rule)	7/20/2005	110	
LCR9.9	Upper Covered Bridge (Rule)	7/6/2005	2420	
LCR9.9	Upper Covered Bridge (Rule)	6/22/2005	770	
LCR9.9	Upper Covered Bridge (Rule)	8/18/2004	365	683
LCR9.9	Upper Covered Bridge (Rule)	8/4/2004	2420	
LCR9.9	Upper Covered Bridge (Rule)	7/21/2004	727	
LCR9.9	Upper Covered Bridge (Rule)	7/7/2004	134	
LCR9.9	Upper Covered Bridge (Rule)	6/23/2004	1733	
LCR9.9	Upper Covered Bridge (Rule)	8/6/2003	361	222
LCR9.9	Upper Covered Bridge (Rule)	7/23/2003	1410	
LCR9.9	Upper Covered Bridge (Rule)	7/9/2003	38	
LCR9.9	Upper Covered Bridge (Rule)	6/25/2003	125	
LCR9.9	Upper Covered Bridge (Rule)	8/7/2002	144	NA
LCR9.9	Upper Covered Bridge (Rule)	7/27/2002	109	
LCR9.9	Upper Covered Bridge (Rule)	6/29/2002	127	
LCR9.9	Upper Covered Bridge (Rule)	8/11/2001	118	99
LCR9.9	Upper Covered Bridge (Rule)	7/25/2001	82	
LCR9.9	Upper Covered Bridge (Rule)	7/14/2001	140	
LCR9.9	Upper Covered Bridge (Rule)	6/27/2001	72	
LCR9.9	Upper Covered Bridge (Rule)	8/12/2000	2420	256
LCR9.9	Upper Covered Bridge (Rule)	7/26/2000	102	
LCR9.9	Upper Covered Bridge (Rule)	7/15/2000	86	
LCR9.9	Upper Covered Bridge (Rule)	6/28/2000	201	
LCR14	Tyler Bridge	8/22/2007	1120	798
LCR14	Tyler Bridge	8/8/2007	387	
LCR14	Tyler Bridge	7/25/2007	276	
LCR14	Tyler Bridge	7/11/2007	2420	
LCR14	Tyler Bridge	6/27/2007	1120	
LCR14	Tyler Bridge	8/23/2006	248	403
LCR14	Tyler Bridge	8/2/2006	308	
LCR14	Tyler Bridge	7/19/2006	365	
LCR14	Tyler Bridge	7/5/2006	192	
LCR14	Tyler Bridge	6/21/2006	1990	
LCR14	Tyler Bridge	8/17/2005	548	987
LCR14	Tyler Bridge	8/3/2005	816	
LCR14	Tyler Bridge	7/20/2005	435	
LCR14	Tyler Bridge	7/6/2005	2420	
LCR14	Tyler Bridge	6/22/2005	1990	

*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.

Station Name	Station Location	Date	Result	Geometric Mean **
LCR14	Tyler Bridge	8/18/2004	116	770
LCR14	Tyler Bridge	8/4/2004	2420	
LCR14	Tyler Bridge	7/21/2004	488	
LCR14	Tyler Bridge	7/7/2004	816	
LCR14	Tyler Bridge	6/23/2004	2420	
LCR14	Tyler Bridge	8/6/2003	2420	640
LCR14	Tyler Bridge	7/23/2003	548	
LCR14	Tyler Bridge	7/9/2003	488	
LCR14	Tyler Bridge	6/25/2003	260	
LCR14	Tyler Bridge	8/7/2002	1300	325
LCR14	Tyler Bridge	7/27/2002	201	
LCR14	Tyler Bridge	7/10/2002	387	
LCR14	Tyler Bridge	6/29/2002	110	
LCR14	Tyler Bridge	8/11/2001	328	586
LCR14	Tyler Bridge	7/25/2001	361	
LCR14	Tyler Bridge	7/14/2001	2420	
LCR14	Tyler Bridge	6/27/2001	411	
LCR14	Tyler Bridge	8/12/2000	2420	827
LCR14	Tyler Bridge	7/26/2000	980	
LCR14	Tyler Bridge	7/15/2000	980	
LCR14	Tyler Bridge	6/28/2000	201	
LCR15.6	Kelly Farm	8/17/2005	727	797
LCR15.6	Kelly Farm	8/3/2005	770	
LCR15.6	Kelly Farm	7/20/2005	411	
LCR15.6	Kelly Farm	7/6/2005	2420	
LCR15.6	Kelly Farm	6/22/2005	579	
LCR15.6	Kelly Farm	8/18/2004	201	665
LCR15.6	Kelly Farm	8/4/2004	2420	
LCR15.6	Kelly Farm	7/21/2004	276	
LCR15.6	Kelly Farm	7/7/2004	687	
LCR15.6	Kelly Farm	6/23/2004	1414	
LCR15.6	Kelly Farm	8/6/2003	461	335
LCR15.6	Kelly Farm	7/23/2003	687	
LCR15.6	Kelly Farm	7/9/2003	261	
LCR15.6	Kelly Farm	6/25/2003	153	
LCR17.2	Ballpark	8/22/2007	80	261
LCR17.2	Ballpark	8/8/2007	517	
LCR17.2	Ballpark	7/25/2007	116	
LCR17.2	Ballpark	7/11/2007	2420	
LCR17.2	Ballpark	6/27/2007	105	

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

*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 Lewis Creek (2000-2007) and Geometric Mean (organisms/100mL) for each Station based on Calendar Year (continued).

Station Name	Station Location	Date	Result	Geometric Mean **
LCR17.2	Ballpark	8/23/2006	153	178
LCR17.2	Ballpark	8/2/2006	185	
LCR17.2	Ballpark	7/19/2006	148	
LCR17.2	Ballpark	7/5/2006	62	
LCR17.2	Ballpark	6/21/2006	687	
LCR17.2	Ballpark	8/17/2005	172	621
LCR17.2	Ballpark	8/3/2005	548	
LCR17.2	Ballpark	7/20/2005	261	
LCR17.2	Ballpark	7/6/2005	2420	
LCR17.2	Ballpark	6/22/2005	1550	
LCR17.2	Ballpark	8/18/2004	110	532
LCR17.2	Ballpark	8/4/2004	1733	
LCR17.2	Ballpark	7/21/2004	579	
LCR17.2	Ballpark	7/7/2004	345	
LCR17.2	Ballpark	6/23/2004	1120	
LCR17.2	Ballpark	8/6/2003	2420	382
LCR17.2	Ballpark	7/23/2003	345	
LCR17.2	Ballpark	7/9/2003	186	
LCR17.2	Ballpark	6/25/2003	137	
LCR17.2	Ballpark	8/7/2002	151	219
LCR17.2	Ballpark	7/27/2002	109	
LCR17.2	Ballpark	7/10/2002	160	
LCR17.2	Ballpark	6/29/2002	866	
LCR17.2	Ballpark	8/11/2001	129	186
LCR17.2	Ballpark	7/25/2001	272	
LCR17.2	Ballpark	7/14/2001	111	
LCR17.2	Ballpark	6/27/2001	308	
LCR17.2	Ballpark	8/12/2000	272	159
LCR17.2	Ballpark	7/26/2000	87	
LCR17.2	Ballpark	7/15/2000	162	
LCR17.2	Ballpark	6/28/2000	165	
LCR18.6	Lewis Ck. Farm Footbridge	8/7/2002	2420	259
LCR18.6	Lewis Ck. Farm Footbridge	7/27/2002	145	
LCR18.6	Lewis Ck. Farm Footbridge	7/10/2002	172	
LCR18.6	Lewis Ck. Farm Footbridge	6/29/2002	74	
LCR18.6	Lewis Ck. Farm Footbridge	8/11/2001	291	193
LCR18.6	Lewis Ck. Farm Footbridge	7/25/2001	101	
LCR18.6	Lewis Ck. Farm Footbridge	7/14/2001	435	
LCR18.6	Lewis Ck. Farm Footbridge	6/27/2001	108	

*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 Lewis Creek (2000-2007) and Geometric Mean (organisms/100mL) for each Station based on Calendar Year (continued).

Station Name	Station Location	Date	Result	Geometric Mean **
LCR18.6	Lewis Ck. Farm Footbridge	8/12/2000	206	155
LCR18.6	Lewis Ck. Farm Footbridge	7/26/2000	201	
LCR18.6	Lewis Ck. Farm Footbridge	7/15/2000	95	
LCR18.6	Lewis Ck. Farm Footbridge	6/28/2000	145	
LCR19.5	Parsonage Rd. Bridge	8/22/2007	29	127
LCR19.5	Parsonage Rd. Bridge	8/8/2007	108	
LCR19.5	Parsonage Rd. Bridge	7/25/2007	47	
LCR19.5	Parsonage Rd. Bridge	7/11/2007	2420	
LCR19.5	Parsonage Rd. Bridge	6/27/2007	91	
LCR19.5	Parsonage Rd. Bridge	8/23/2006	219	200
LCR19.5	Parsonage Rd. Bridge	8/2/2006	345	
LCR19.5	Parsonage Rd. Bridge	7/19/2006	91	
LCR19.5	Parsonage Rd. Bridge	7/5/2006	61	
LCR19.5	Parsonage Rd. Bridge	6/21/2006	770	
LCR19.5	Parsonage Rd. Bridge	8/17/2005	68	330
LCR19.5	Parsonage Rd. Bridge	8/3/2005	344	
LCR19.5	Parsonage Rd. Bridge	7/20/2005	71	
LCR19.5	Parsonage Rd. Bridge	7/6/2005	980	
LCR19.5	Parsonage Rd. Bridge	6/22/2005	2420	
LCR19.5	Parsonage Rd. Bridge	8/18/2004	66	392
LCR19.5	Parsonage Rd. Bridge	8/4/2004	1733	
LCR19.5	Parsonage Rd. Bridge	7/21/2004	261	
LCR19.5	Parsonage Rd. Bridge	7/7/2004	238	
LCR19.5	Parsonage Rd. Bridge	6/23/2004	1300	
LCR19.5	Parsonage Rd. Bridge	8/6/2003	649	198
LCR19.5	Parsonage Rd. Bridge	7/23/2003	310	
LCR19.5	Parsonage Rd. Bridge	7/9/2003	104	
LCR19.5	Parsonage Rd. Bridge	6/25/2003	74	
LCR19.5	Parsonage Rd. Bridge	8/7/2002	2420	229
LCR19.5	Parsonage Rd. Bridge	7/27/2002	109	
LCR19.5	Parsonage Rd. Bridge	7/10/2002	179	
LCR19.5	Parsonage Rd. Bridge	6/29/2002	58	
LCR19.5	Parsonage Rd. Bridge	8/11/2001	82	143
LCR19.5	Parsonage Rd. Bridge	7/25/2001	66	
LCR19.5	Parsonage Rd. Bridge	7/14/2001	435	
LCR19.5	Parsonage Rd. Bridge	6/27/2001	178	
LCR19.5	Parsonage Rd. Bridge	8/12/2000	133	78
LCR19.5	Parsonage Rd. Bridge	7/26/2000	43	
LCR19.5	Parsonage Rd. Bridge	7/15/2000	89	
LCR19.5	Parsonage Rd. Bridge	6/28/2000	74	

*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.

Pond Brook, from Lewis Creek Confluence upstream (1.5 miles).

***WB ID*:** VT03-08

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: **49%**

Data: 2003 – 2007, Addison County River Watch Collaborative

Table 2: *E.coli* (organisms/100 mL) Data for Pond Brook (2003-2007) and Geometric Mean (organisms/100mL) for each Station based on Calendar Year (continued).

Station Name	Station Location	Date	Result	Geometric Mean
LCT3D.5	Silver Street Crossing over Pond Brook	8/22/2007	27	107
LCT3D.5	Silver Street Crossing over Pond Brook	8/8/2007	99	
LCT3D.5	Silver Street Crossing over Pond Brook	7/25/2007	58	
LCT3D.5	Silver Street Crossing over Pond Brook	7/11/2007	345	
LCT3D.5	Silver Street Crossing over Pond Brook	6/27/2007	260	
LCT3D.5	Silver Street Crossing over Pond Brook	8/23/2006	88	64
LCT3D.5	Silver Street Crossing over Pond Brook	8/2/2006	42	
LCT3D.5	Silver Street Crossing over Pond Brook	7/19/2006	67	
LCT3D.5	Silver Street Crossing over Pond Brook	7/5/2006	37	
LCT3D.5	Silver Street Crossing over Pond Brook	6/21/2006	114	
LCT3D.5	Silver Street Crossing over Pond Brook	8/17/2005	119	247
LCT3D.5	Silver Street Crossing over Pond Brook	8/3/2005	179	
LCT3D.5	Silver Street Crossing over Pond Brook	7/20/2005	80	
LCT3D.5	Silver Street Crossing over Pond Brook	7/6/2005	1300	
LCT3D.5	Silver Street Crossing over Pond Brook	6/22/2005	411	
LCT3D.5	Silver Street Crossing over Pond Brook	8/18/2004	86	196
LCT3D.5	Silver Street Crossing over Pond Brook	8/4/2004	2420	
LCT3D.5	Silver Street Crossing over Pond Brook	7/21/2004	51	
LCT3D.5	Silver Street Crossing over Pond Brook	7/7/2004	158	
LCT3D.5	Silver Street Crossing over Pond Brook	6/23/2004	172	
LCT3D.5	Silver Street Crossing over Pond Brook	8/6/2003	162	330
LCT3D.5	Silver Street Crossing over Pond Brook	7/23/2003	613	
LCT3D.5	Silver Street Crossing over Pond Brook	7/9/2003	770	
LCT3D.5	Silver Street Crossing over Pond Brook	6/25/2003	155	

*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.

References

ACRPC (1994). Addison County Regional Planning Commission, Addison County Regional Plan: Section 4: Natural Resources. Last updated April 13, 1994 (website) www.acrpc.org/pages/publications/Reg_Plan/NR_TOC.htm, accessed online on February 10, 2011

ACRPC (2008). Addison County Regional Planning Commission, Addison County Regional Plan: Section 7: Utilities, Facilities and Services. Last updated May 14, 2008

ACRWC (2005). Addison County River Watch Collaborative. 2005 Stream-Monitoring Report. Lewis Creek

ACRWC (2009). 2009 Watershed Outreach Brochure: Lewis Creek. Addison County River Watch Collaborative

ACRWC (2011). Summary Report: 2010 Sampling Results, Addison County River Watch Collaborative, February 25, 2011. Prepared for: Jim Kellogg, VTDEC Water Quality Division. Prepared by: Kristen Underwood, South Mountain Research & Consulting and ACRWC.

CCRPC (2006). Chittenden County Regional Planning Commission. Chittenden County Regional Plan, adopted August, 2006. Available online at: www.ccrpcvt.org/index.asp?Type=B_BASIC&SEC={378E3EB1-84D3-48AD-B30C-26A22DA69B8C}, accessed online on February 14, 2011

LCW (2010). Lewis Creek Watershed: River Corridor Conservation and management Plan. (Addison & Chittenden Counties, Vermont). Starksboro, Monkton, Hinesburg, Charlotte, Ferrisburgh. March, 2010. Prepared for: Lewis Creek Association, Prepared by: South Mountain Research & Consulting

LCWQR (2009). Lewis Creek Water Quality Report (Interpretation and Conclusions based on Results: 1992-2008), Addison County River Watch Collaborative, April, 2009

RRPC (2008). Rutland Regional Planning Commission, Rutland Regional Plan; Chapter 14: Water Quality. Plan Adopted in 2008. Available online at: www.rutlandrpc.org/Plan08/14_Water_Quality.pdf, accessed online on February 10, 2011

VTDEC (2010). Progress Report on River Basin Water Quality Management Planning During 2009. A Report for: House and Senate Committees on Agricultural and Natural Resources and Energy. Prepared by: Vermont Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division, Waterbury, VT. January, 2010

VTDEC (2008). State of Vermont, 2008, 303(d) List of Waters, Part A – Impaired Surface Waters in Need of TMDL, October 2008 (Approved by USEPA September 24, 2008). Prepared by: Vermont Department of Environmental Conservation, Water Quality Division, Waterbury, VT.

VTF&W (undated). Lewis Creek Wildlife Management Area. Vermont Fish & Wildlife Department Available online at: www.vtfishandwildlife.com/library/maps/Wildlife Management Areas/Essex District/Lewis Creek WMA.pdf, accessed online on February 14, 2011