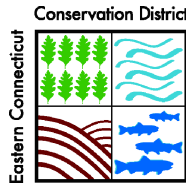


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## **Contract 12-05f French River Watershed-Based Plan and Implementation Action**

**Eastern Connecticut Conservation District  
August 24, 2015**

### **Task 1d – Conduct Water Sampling**



*This project is funded in part by CT DEEP through a US EPA  
Clean Water Act §319 Nonpoint Source Program grant.*

## Introduction

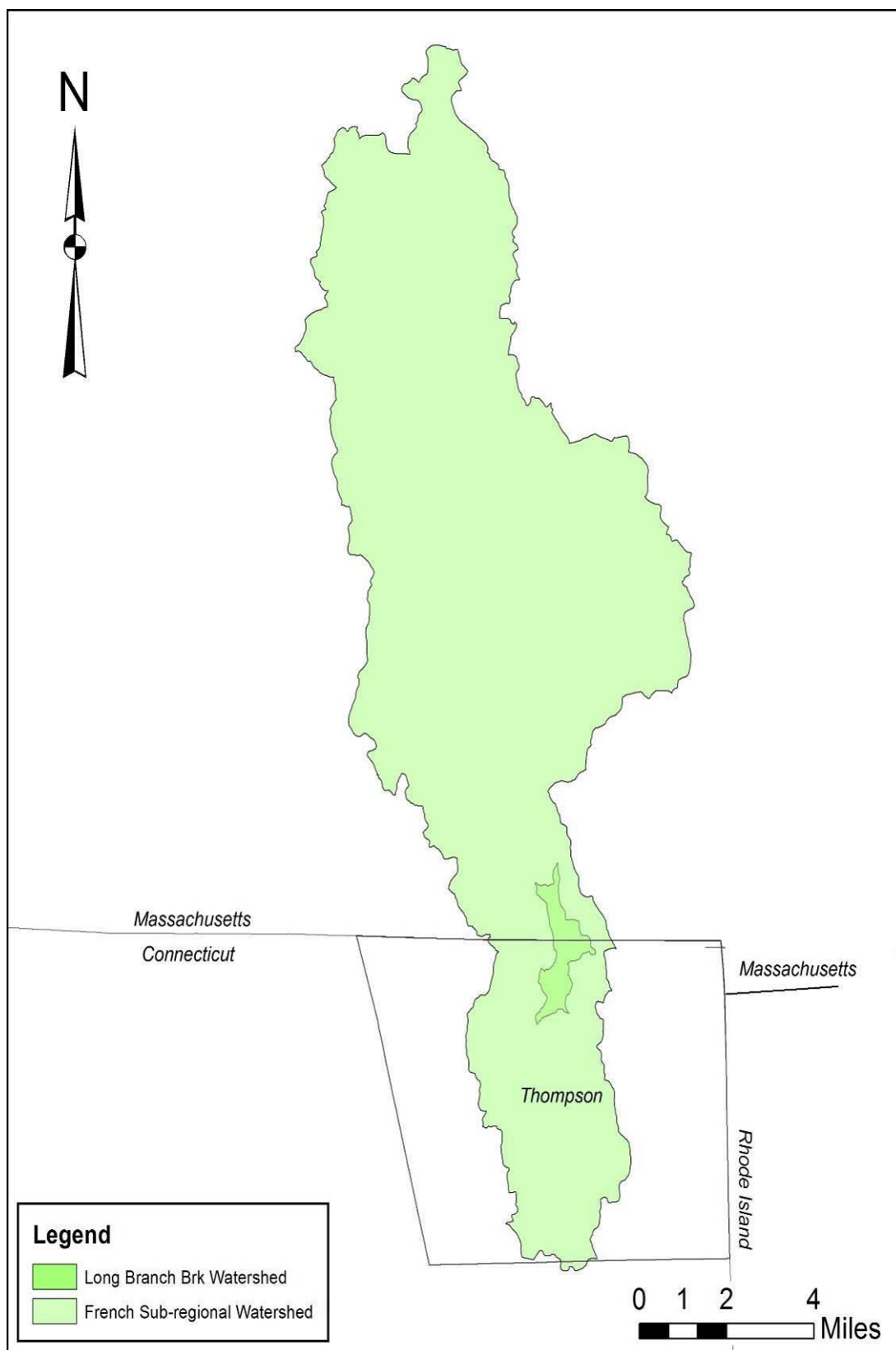
The Eastern Connecticut Conservation District (ECCD) has received funding from CT DEEP through the Clean Water Act Section 319 Nonpoint Source program to conduct water quality sampling in the French River (CT3300-00\_01) and Long Branch Brook (CT3300-02\_01) in Thompson, Connecticut (Fig. 1). The purpose is to identify potential sources of bacteria that have resulted in the periodic inclusion of both waterbodies in the State of Connecticut's Impaired Waters (303d) list. ECCD will use the bacteria data to develop a subwatershed-based plan for the French River watershed.

Segment 01 of the French River (CT3300-00\_01), located from the confluence of the French River with the Quinebaug River upstream to the outlet dam of North Grosvenordale Pond, has been listed in multiple cycles of the Connecticut Department of Energy and Environmental Protection's Integrated Water Quality Report to Congress, most recently in 2010, as impaired for recreation due to periodic high levels of the pathogen indicator bacteria *Escherichia coli* (*E. coli*). No specific pathogen sources have been identified. The French River, which has its headwaters in the central Massachusetts town of Leicester, also has several impaired segments in Massachusetts. These segments, including two just across the Connecticut-Massachusetts state line in Dudley and Webster, are impaired for recreation due to the presence of *E. coli*.

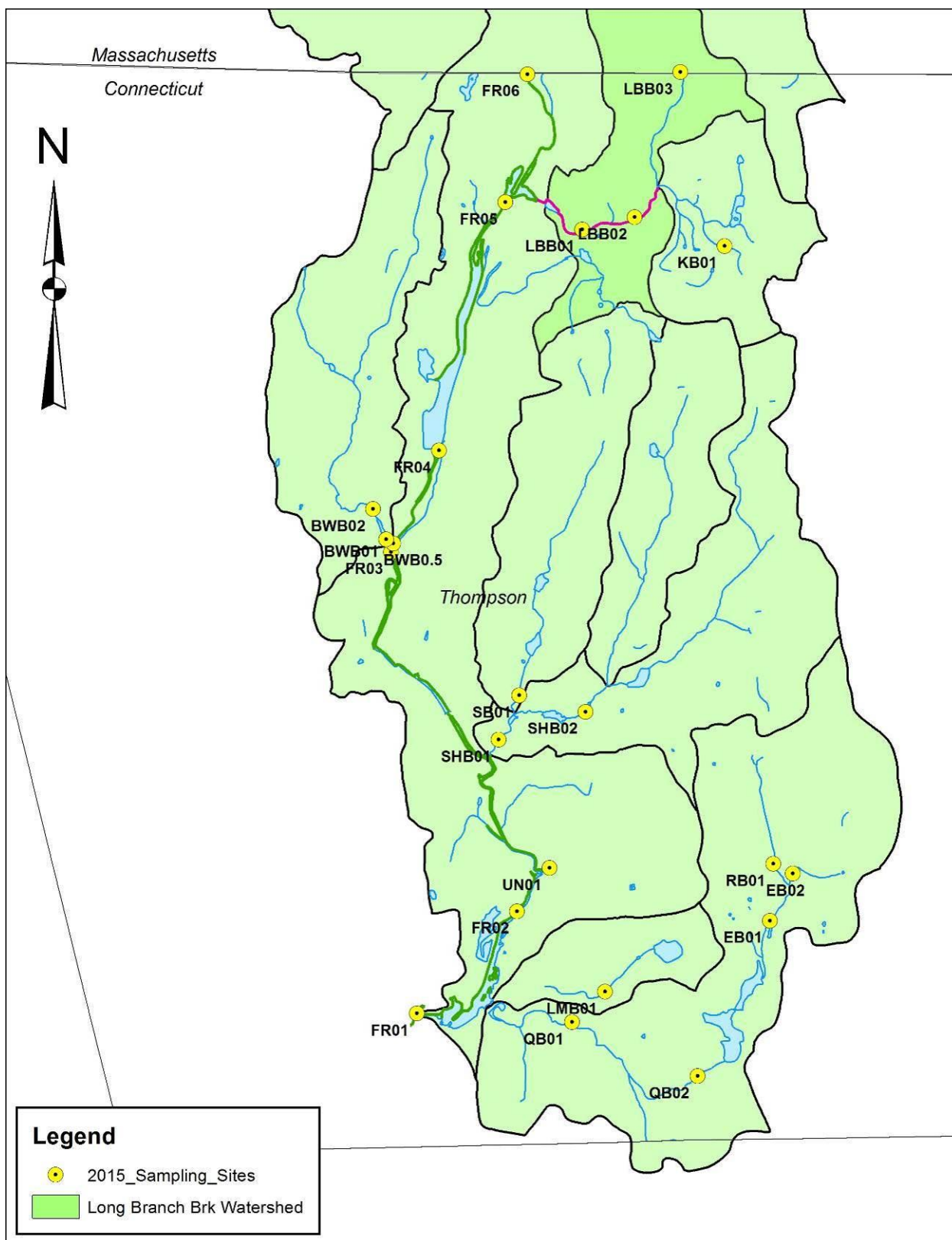
Long Branch Brook (CT3300-02\_01), is a Class A stream that is a tributary to the French River. Long Branch Brook, like the French River, has its headwaters in Massachusetts, in nearby Webster, MA. Long Branch Brook is listed as impaired for recreation due the presence of *Escherichia coli* (*E. coli*). Potential pathogen sources include permitted and non-permitted stormwater, insufficient septic systems, agricultural activity, and nuisance wildlife and/or pets. In order to quantify bacteria levels and identify potential sources of bacteria to the French River and Long Branch Brook, ECCD conducted bacteria sampling during June and July of 2015.

## Procedure

In March 2015, ECCD prepared and submitted a Water Quality Monitoring Plan to CT DEEP outlining the methods ECCD would employ to conduct water quality sampling of the French River and its tributary streams. Upon approval of the Water Quality Monitoring Plan by CT DEEP, ECCD, in partnership with The Last Green Valley (TLGV) Volunteer Water Quality Monitoring program, recruited local volunteers to participate in water quality sampling. A bacteria sampling workshop was held at the Thompson Public Library in Thompson, CT. in May 2015. The volunteers were trained to utilize sampling protocols specified in The Last Green Valley Volunteer Water Quality Monitoring Program Bacteria Sampling Quality Assurance Project Plan (QAPP). This QAPP (US EPA Tracking Number RFA #13504) was approved by CT DEEP and US Environmental Protection Agency (US EPA) in June 2012.

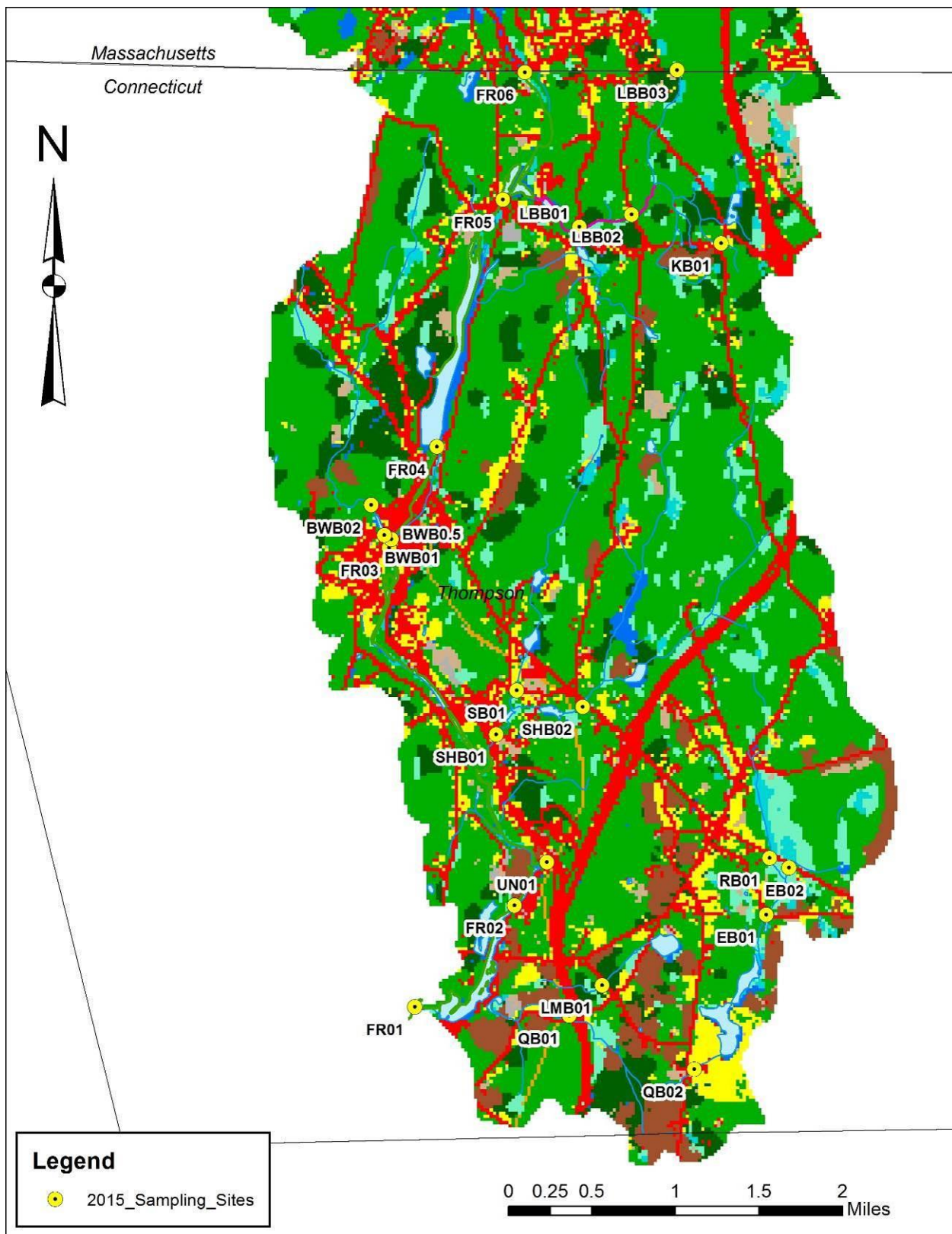


**Figure 1. The French River sub-regional watershed in Massachusetts and Connecticut. The Long Branch Brook local watershed is depicted in dark green.**



**Figure 2. French River watershed bacteria sampling sites. Local watersheds are delineated.**





**Figure 3. French River watershed bacteria sampling sites relative to land use/land cover (CLEAR 2010).**

Prior to the commencement of water sample collection, ECCD identified eighteen sites along the French River and its tributaries to be sampled (Fig. 2). The sampling sites were selected to identify and quantify potential sources of bacterial contamination to the French River based on a review of local land use (Fig. 3) and recommendations made in the *French River Watershed Summary* appendix of CT DEEP's *A Statewide Total Maximum Daily Load Analysis for Bacteria Impaired Waters* (September 19, 2012). The sampling sites were numbered beginning with the downstream-most site on the French River (FR01, located 500 feet upstream of the confluence with the Quinebaug River) and proceeding upstream to the Massachusetts state line (FR06). Named tributaries were designated by their initials (eg. Long Branch Brook was called LBB), and followed the same downstream-to-upstream numbering convention if multiple sites existed. The one unnamed tributary was designated as "UN." In week 6, four additional sites (QB02, RB01, EB01 and EB02) were added upstream of the Quinatissett Brook site (QB01), in the southeast part of the watershed to bracket high bacteria levels documented at QB01. In the final week of sampling, an additional site at the confluence of Backwater Brook with the French River (BWB0.5) was added to document water conditions in response to a "sewage" odor in a nearby catch basin that discharges to Backwater Brook, bringing the total number of sampling sites to twenty-three.

The water samples were collected once a week for eight weeks, beginning June 9<sup>th</sup> and ending July 28<sup>th</sup>, utilizing the QAPP protocols in accordance with the approved monitoring plan. Water samples were collected by hand or via an extension pole, using sterilized 125 ml Nalgene collection bottles provided by the CT Department of Public Health. In order to ensure quality control, on each sampling day, one duplicate and one blank sample was collected for every ten samples collected. The locations of the duplicate and blank sample sites were determined using a random number generator. Butterfield's buffer solution was used for the blank sample. Water samples were placed on ice in a cooler during the sampling process. Water samples were delivered to Northeast District Department of Health (NDDH), in Brooklyn, CT., where they were picked up by a Connecticut Department of Public Health (DPH) courier and delivered to the DPH Laboratory in Rocky Hill, CT., for processing. Bacteria analysis results were reported to Northeast District Department of Health and relayed to ECCD by NDDH staff. Bacteria results were tabulated and evaluated by ECCD.

## Results

The 2013 Connecticut Water Quality Standards establish water quality criteria for indicator bacteria, including *E. coli*, which is the preferred indicator bacterium for fresh waterbodies. For recreational contact, excluding designated and non-designated swimming areas, the single sample maximum is 576 colony-forming units (cfu) per 100 milliliters of water and the maximum sample set geometric mean is less than 126 cfu/100 ml.

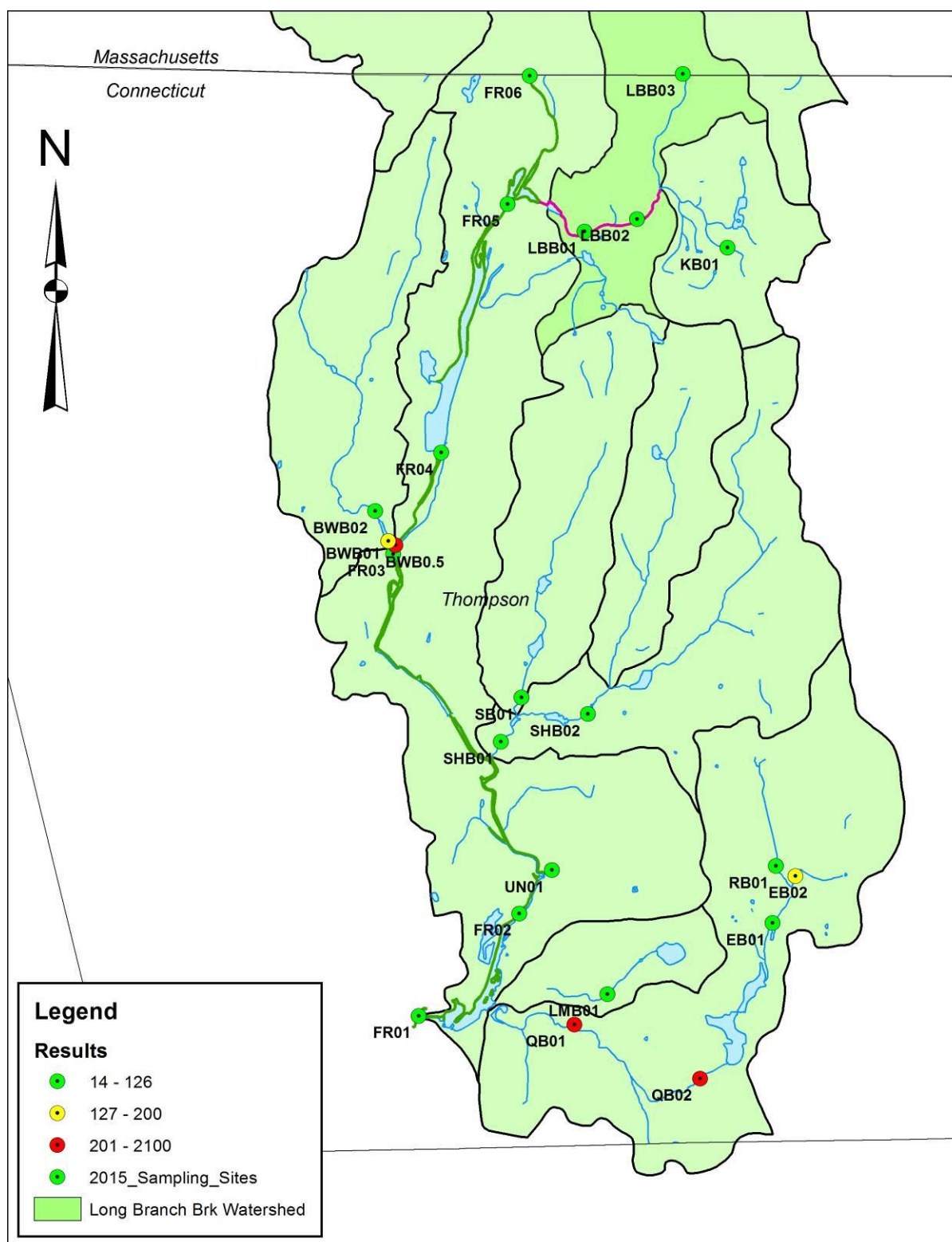
Bacteria sampling results for the French River and its tributary streams are summarized in Table 1 and depicted in Fig. 4. A geometric mean was calculated for each sample set, with the exception of site BWB0.5, for which only one sample was obtained. Bacteria levels listed in **bold** font in the table below exceed the established water quality limits. Bacteria samples with (D = n) indicate a duplicate sample was collected at that site on that sampling day. Table 1 also

notes whether the sample was collected during wet (a rainfall in excess of 0.1 inches within 24 hours) or dry conditions. A simple statistical distribution of the sampling results was prepared, using a box and whicker plot of the data set (Fig. 5). Summaries of each individual sampling site are provided below, following Fig. 5.

**Table 1. French River watershed bacteria sampling results.**

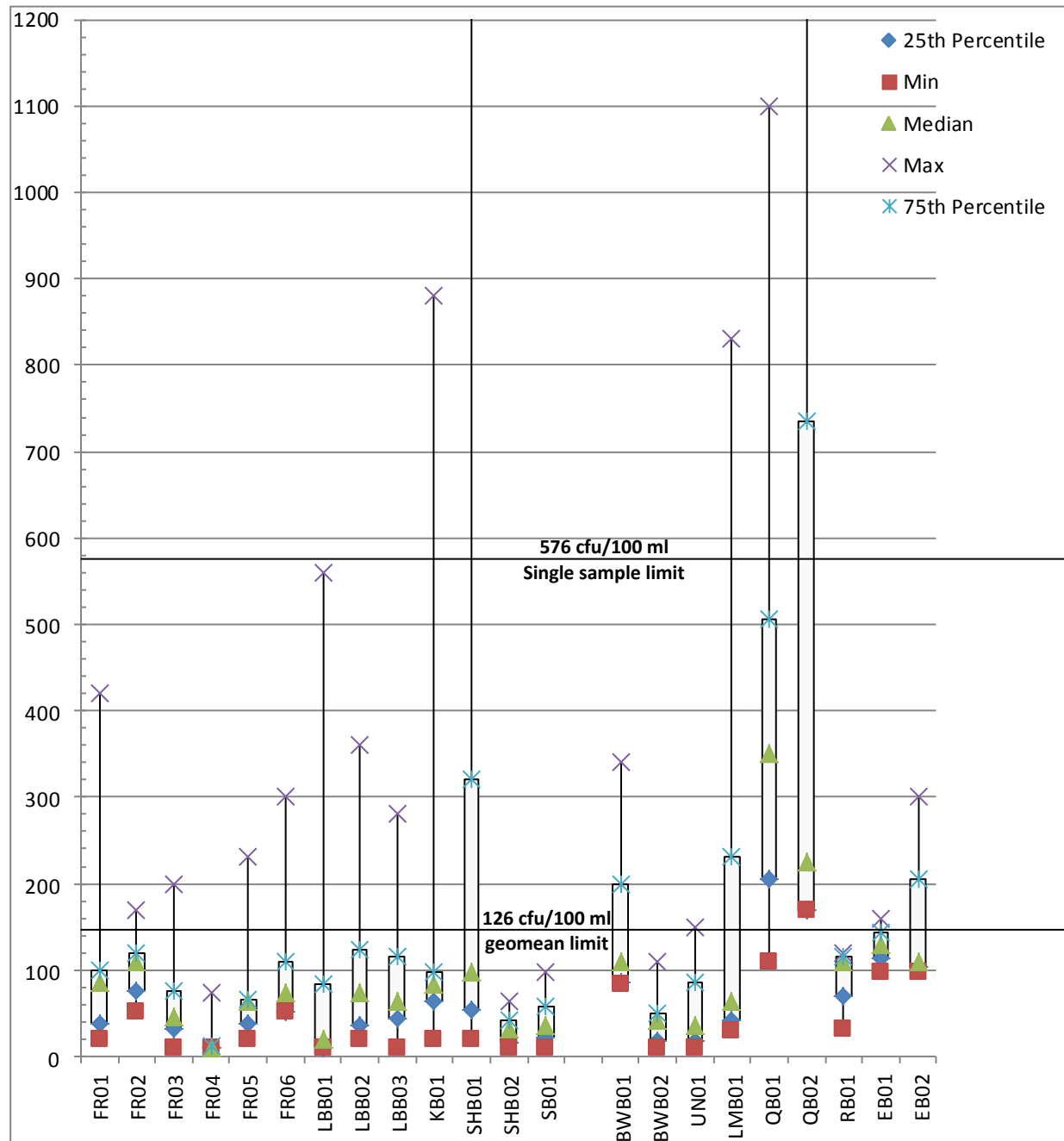
Site	6/9/15	6/16/15	6/23/15	6/30/15	7/7/15	7/14/15	7/21/15	7/28/15	geomean
FR01	20	420	140	85	41	31	86	86	74
FR02	75	63	110	110	110	52	170 (D=160)	120	101
FR03	130	51	200	31	20 (D=10)	31	74	75 (D=41)	47
FR04	<10	10	73	<10	<10	<10	20	<10	14
FR05	41	230	63	20	31	63	63	75	57
FR06	75	300	74	52	52	150	52	96	87
LBB01	20	560	110 (D=52)	10	<10	84	20	10	36
LBB02	20	360	160	85	74	31	<10	41	56
LBB03	<10	280	170	63	20	98	52	63	61
KB01	84	<b>880</b>	98	85	31	63 (D=73)	20	110	83
SHB01	96	320	53	31 (D=20)	98	160	<b>1400</b>	320	124
SHB02	10	63	41	41	<10	20	31	<10	22
SB01	41	98	63	31	31	10 (D=10)	75	41 (D=20)	33
BWB0.5								<b>820</b>	---
BWB01	86	200 (D=230)	130	110	340	110	84	85	<b>135</b>
BWB02	20	73	41	110	<10	<10	41	41	32
UN01	10	150	120	41	10	73	20	31	37
LMB01	41 (D=30)	230	84	63	41	270	52	<b>830</b>	96
QB01	160	410	330	220	110	370	<b>790</b>	<b>1100</b>	<b>338</b>
QB02						<b>2100</b>	280 (D=170)	170	<b>361</b>
RB01						110	120	31	74
EB01						160	97	---	125
EB02						110	300	98	<b>148</b>
Wet/Dry	dry	wet	dry	dry	dry	dry	dry/wet*	dry	dry

\* Began to rain midway through sampling

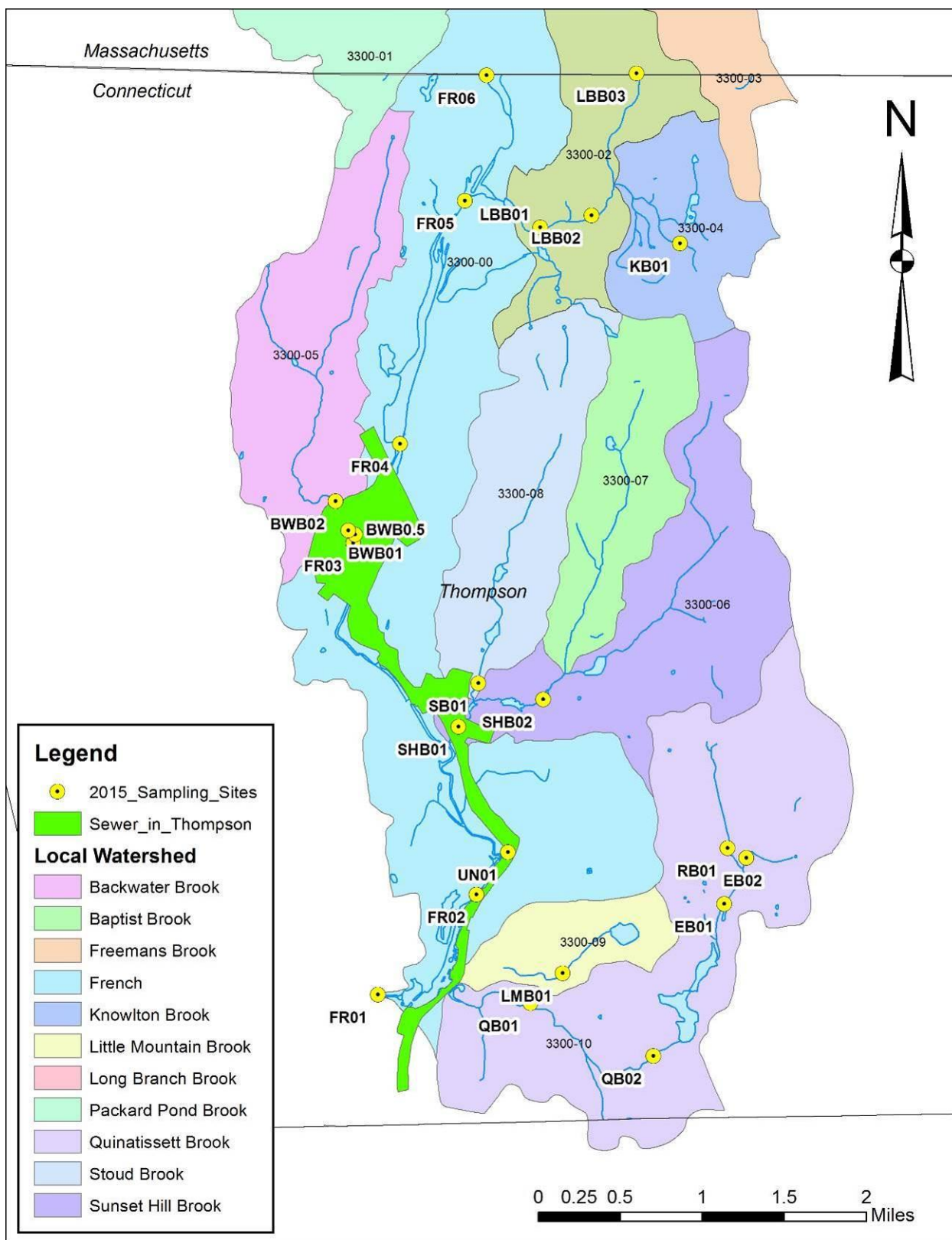


**Figure 4. French River watershed bacteria sampling results.** A green dot indicates the site may have had a single sample exceedance, but met established water quality criteria for the geometric mean; a yellow dot indicates that the site had no single sample exceedances but failed to meet the geometric mean criteria; and a red dot indicates the site exceeded both single sample and geometric mean criteria.





**Figure 5. Statistical distribution of bacteria results by sampling site.**

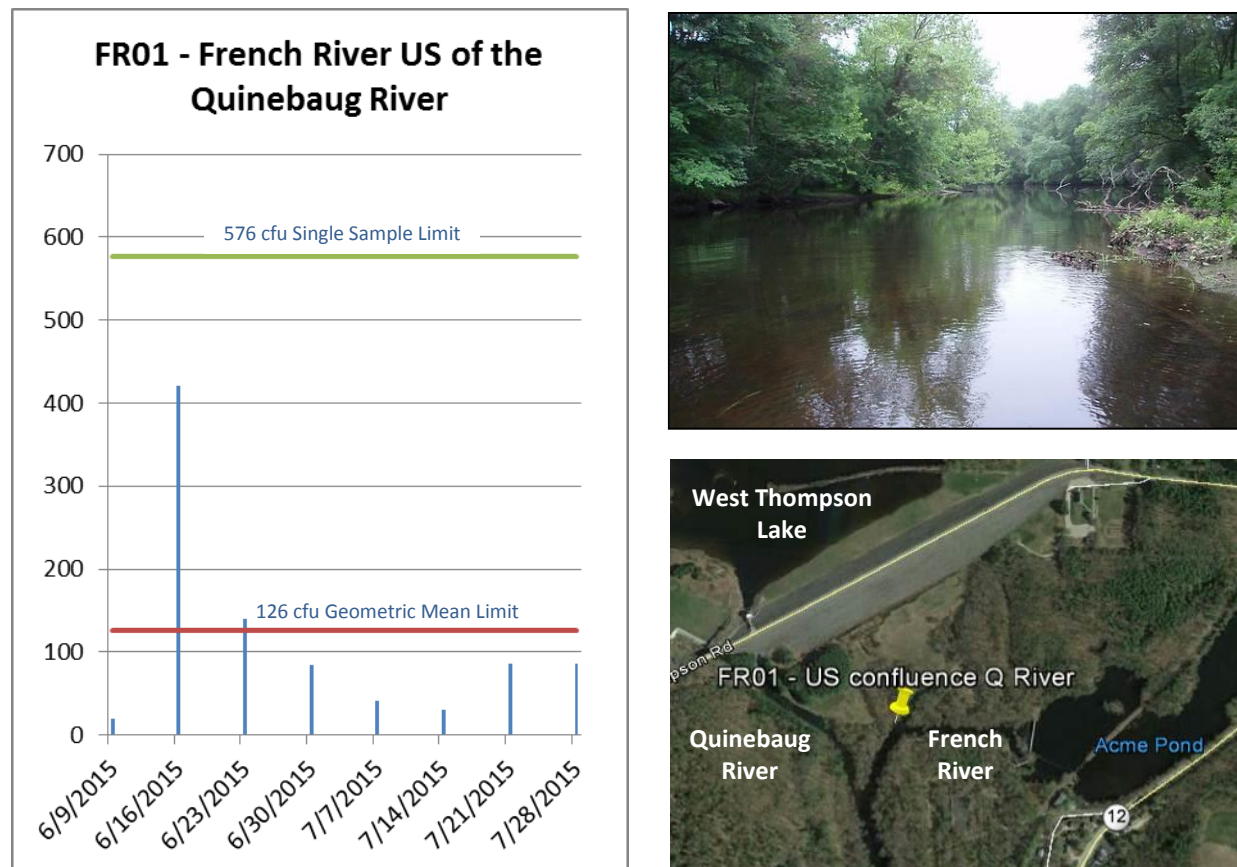


**Figure 6. French River local watersheds with sewer service area (in green).**

## Bacteria Sampling Results by Sampling Site

The results of bacteria sampling by sampling site are provided below.

### FR01 – French River upstream of the confluence with the Quinebaug River:

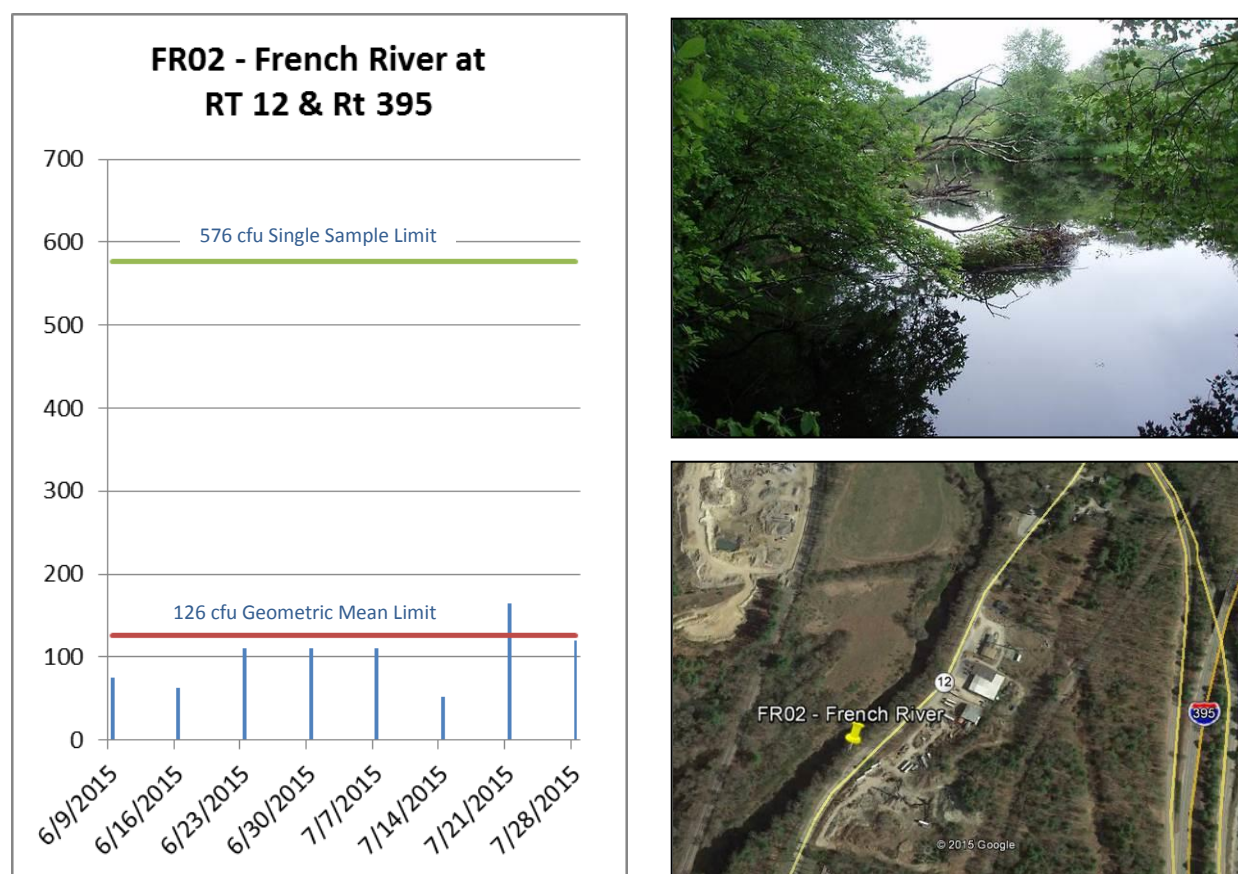


**Figure 7. Graph of bacteria sampling results at FR01; downstream view of the French River at the sampling location; and aerial (Google Earth) image of the sampling site location and vicinity.**

FR01 is located on the French River, south of the US Army Corps of Engineers flood control dam at the West Thompson Lake (Quinebaug River) flood control facility. This is the southern-most sampling site on the French River, and is located approximately 500 feet upstream of the confluence with the Quinebaug River. This site was selected to document bacteria levels in the French River prior to its discharge into the Quinebaug River.

Eight water samples were collected at this site. All of the samples met the single sample Connecticut water quality standard of 576 cfu/100ml. The geometric mean for this site is 74, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.

## **FR02 – French River at Route 12:**



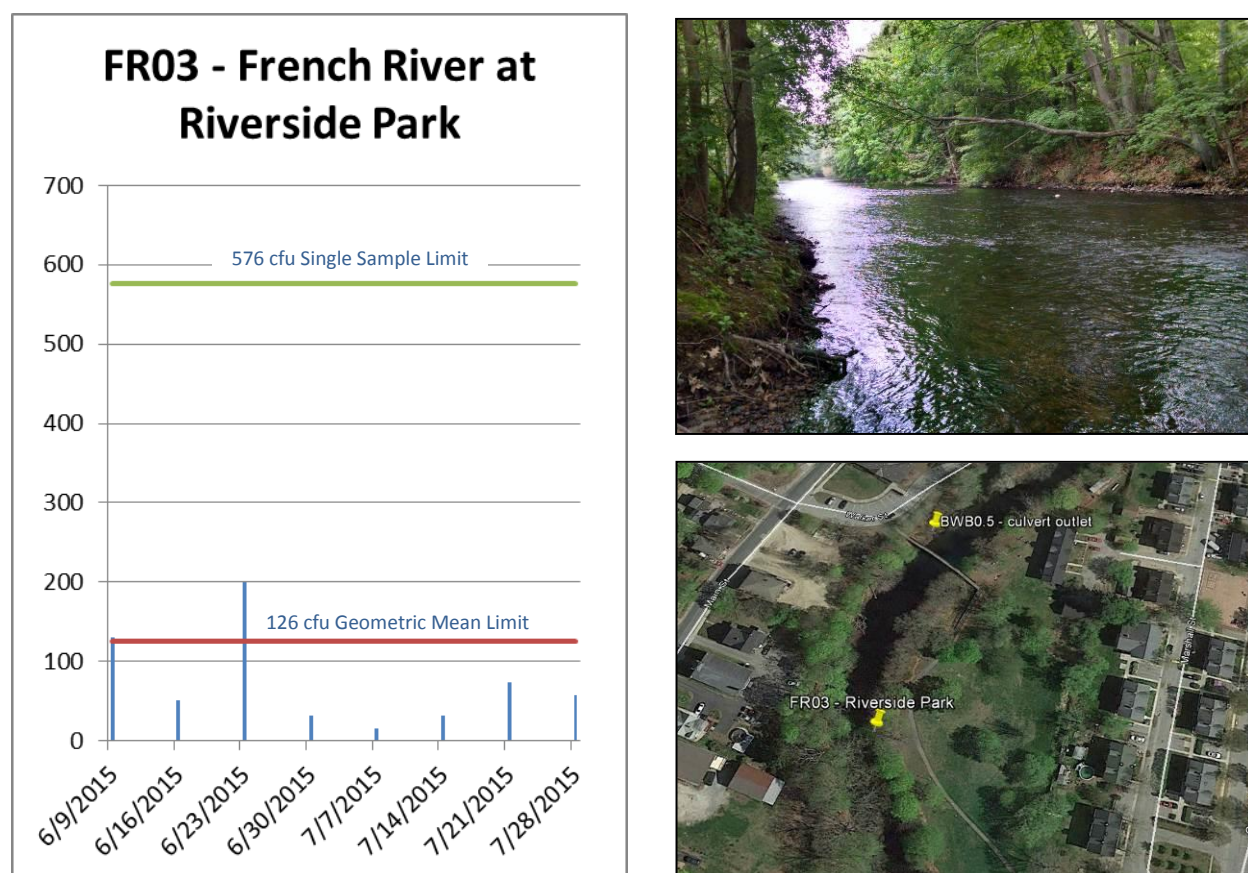
**Figure 8. Graph of bacteria sampling results at FR02; downstream view of the French River at the sampling location; and aerial image of the sampling site location and vicinity.**

FR02 is located on the French River along State Route 12, approximately 1 mile upstream of FR01. This site is downstream of a stormwater outfall from Interstate Route 395 and the confluence of an unnamed stream that originates at or near a septic lagoon on the Marianapolis Preparatory School property, and was selected to document potential bacteria contributions from both locations. Land use in the vicinity of this site is mixed, with agricultural fields and a gravel quarry located on the west side of the river, and commercial/industrial uses along Route 12 on the east side of the river. Properties located along the Route 12 corridor are served by municipal sewers (Fig. 6).

Nine water samples were collected at this site, including one duplicate sample. All of the samples (100%) met the single sample Connecticut water quality standard of 576 cfu/100ml. The geometric mean for this site is 101, which did not exceed the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.



### **FR03 – French River at Riverside Park in North Grosvenordale:**

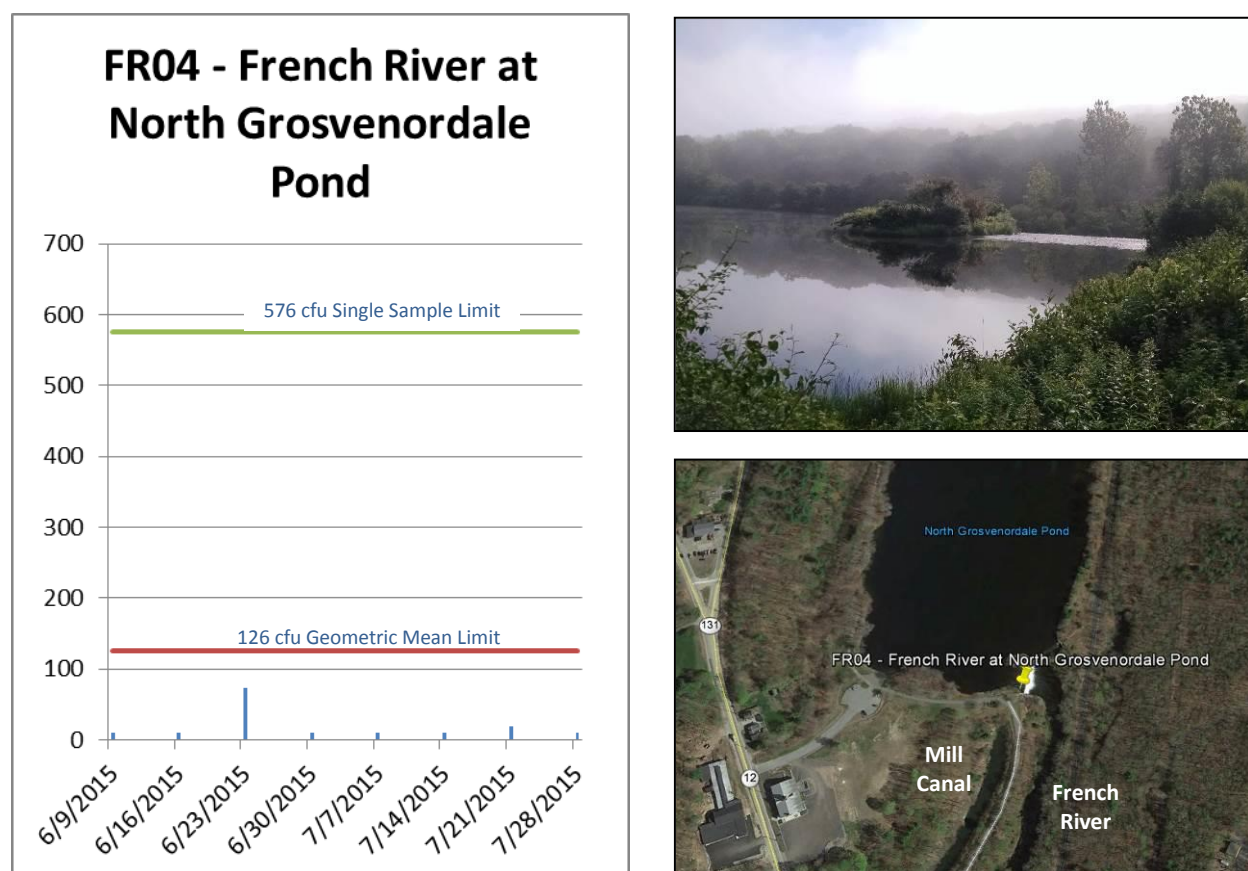


**Figure 9. Graph of bacteria sampling results at FR03; downstream view of the French River at the sampling location; and aerial image of the sampling site location and vicinity.**

FR03 is located on the French River at Riverside Park in the North Grosvenordale section of Thompson. This river segment (CT3300-00\_01), beginning at the outlet of North Grosvenordale Pond (approximately 3500 feet upstream) and continuing to the confluence with the Quinebaug River, has been periodically listed as impaired due to high bacteria levels. The sampling site is approximately 260 feet downstream of the confluence with Backwater Brook. North Grosvenordale in the immediate vicinity of this site is the most densely developed area in Thompson, and is one of Thompson's two designated MS-4 areas. This site was selected to document water quality impacts related to urban development.

Ten water samples were collected at this site, including two duplicate samples. All of the samples (100%) met the single sample Connecticut water quality standard of 576 cfu/100ml. The geometric mean for this site is 47, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.

#### **FR04 – French River at North Grosvenordale Pond:**

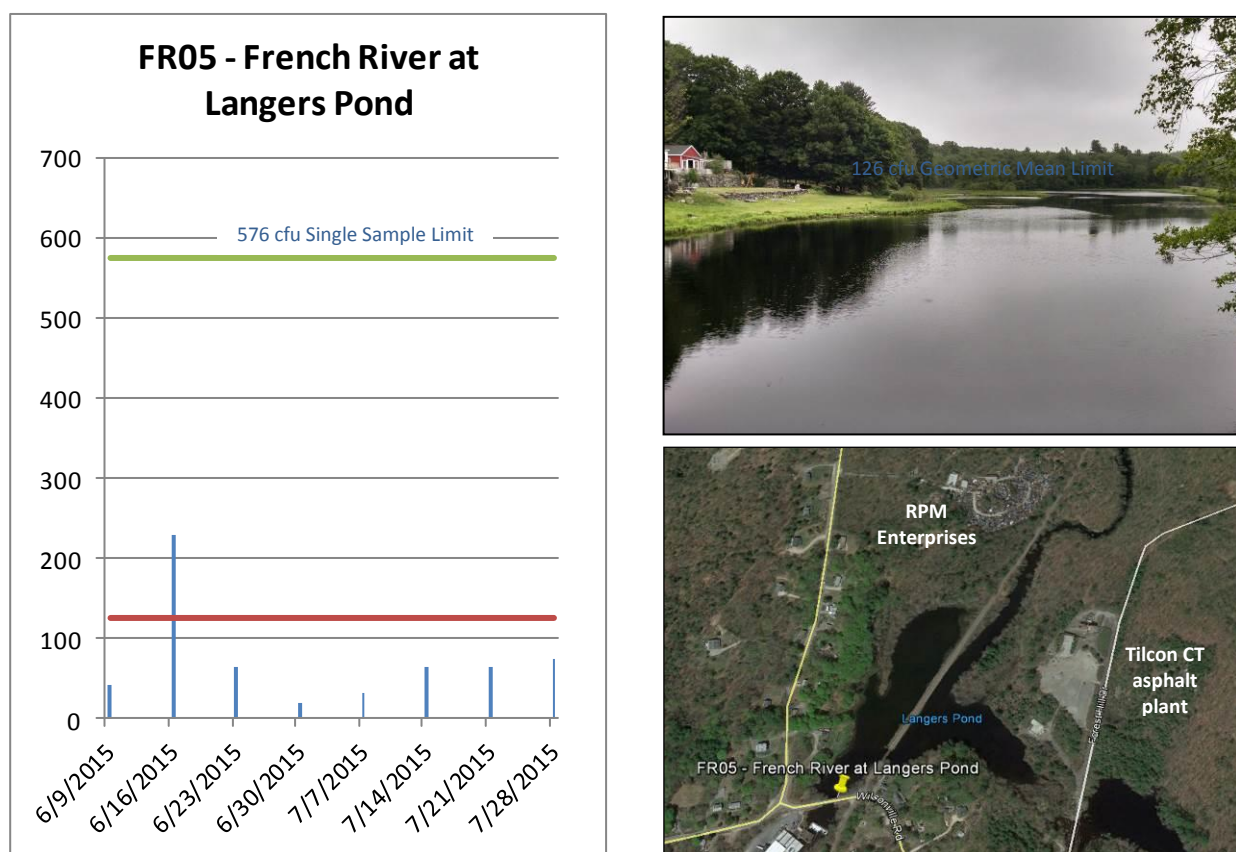


**Figure 10. Graph of bacteria sampling results at FR04; view of the sampling site at the North Grosvenordale Pond spillway; and aerial imagery of the sampling site location and vicinity.**

FR04 is located just upstream of the outlet dam of North Grosvenordale Pond, an impoundment of the French River. Land cover in the vicinity and upstream of this site is comprised primarily of undeveloped tracts of forest land. The river segment (CT3300-00\_01) from the outlet of this pond to the confluence with the Quinebaug River has periodically been listed as impaired for recreation due to high levels of bacteria. This site was selected to document water quality conditions upstream of the impaired segment.

Eight water samples were collected at this site. All of the samples (100%) met the single sample Connecticut water quality standard of 576 cfu/100ml. The geometric mean for this site is 14, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.

## **FR05 – French River at Langers Pond/Wilsonville Road:**



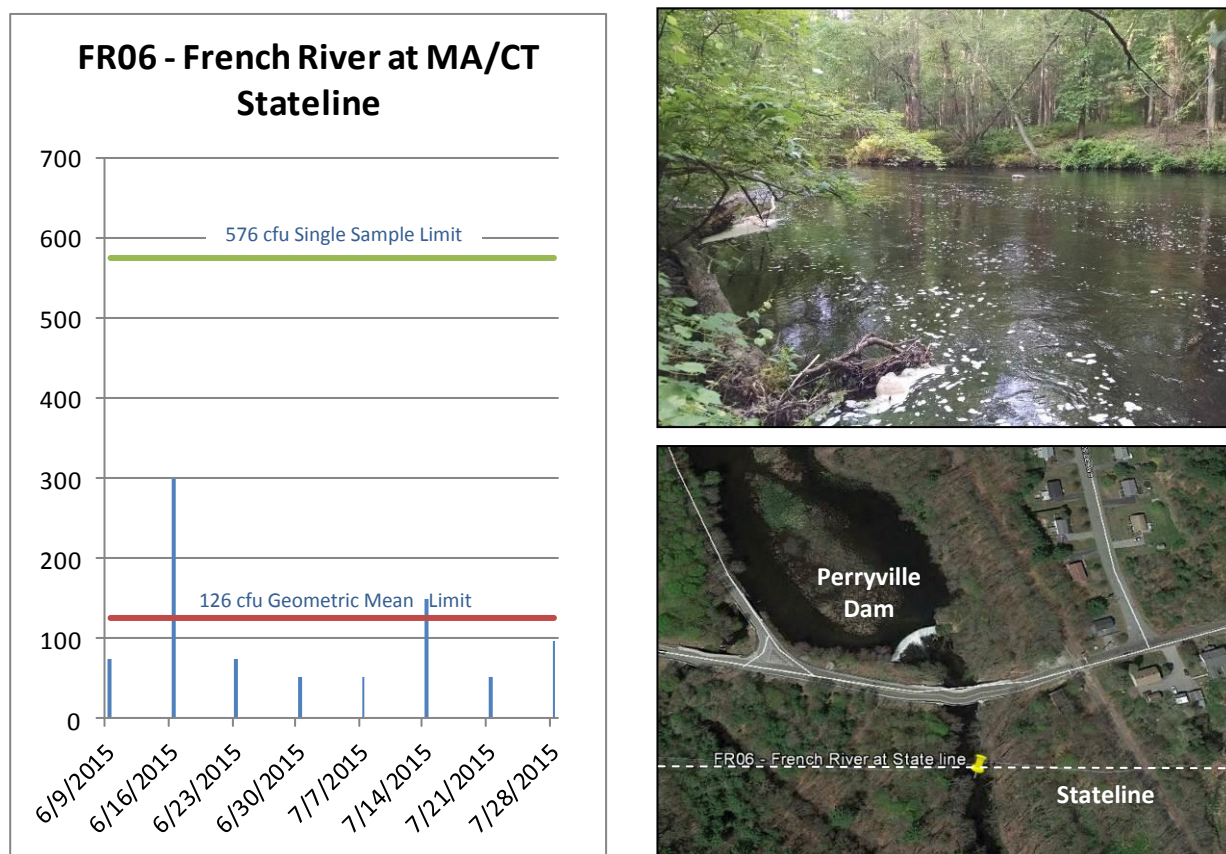
**Figure 11. Graph of bacteria sampling results at FR05; upstream view of the French River at the sampling location; and aerial image of the sampling site location and vicinity.**

FR05 is located at the crossing of the French River at Wilsonville Road, at an impoundment known as Langers Pond. The sample was collected from the upstream side of the road crossing. Land cover in the vicinity of the French River from this site to the Massachusetts state line is primarily undeveloped and comprised of large forest tracts. However, two industrial sites of note are located adjacent to the river, including an inactive asphalt plant owned and operated by Tilcon Connecticut, and an automotive junk yard owned and operated by RPM Enterprises. The Tilcon plant has been inactive for a number of years. However, water quality data collected as part of the plant's NPDES industrial permit will be reviewed as part of the water quality investigation. The auto junk yard is located approximately 1800 feet upstream of sampling site, on the west side of the river.

Eight water samples were collected at this site. All of the samples (100%) met the single sample Connecticut water quality standard of 576 cfu/100ml. The geometric mean for this site is 57, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.



## **FR06 – French River near the Massachusetts State Line:**



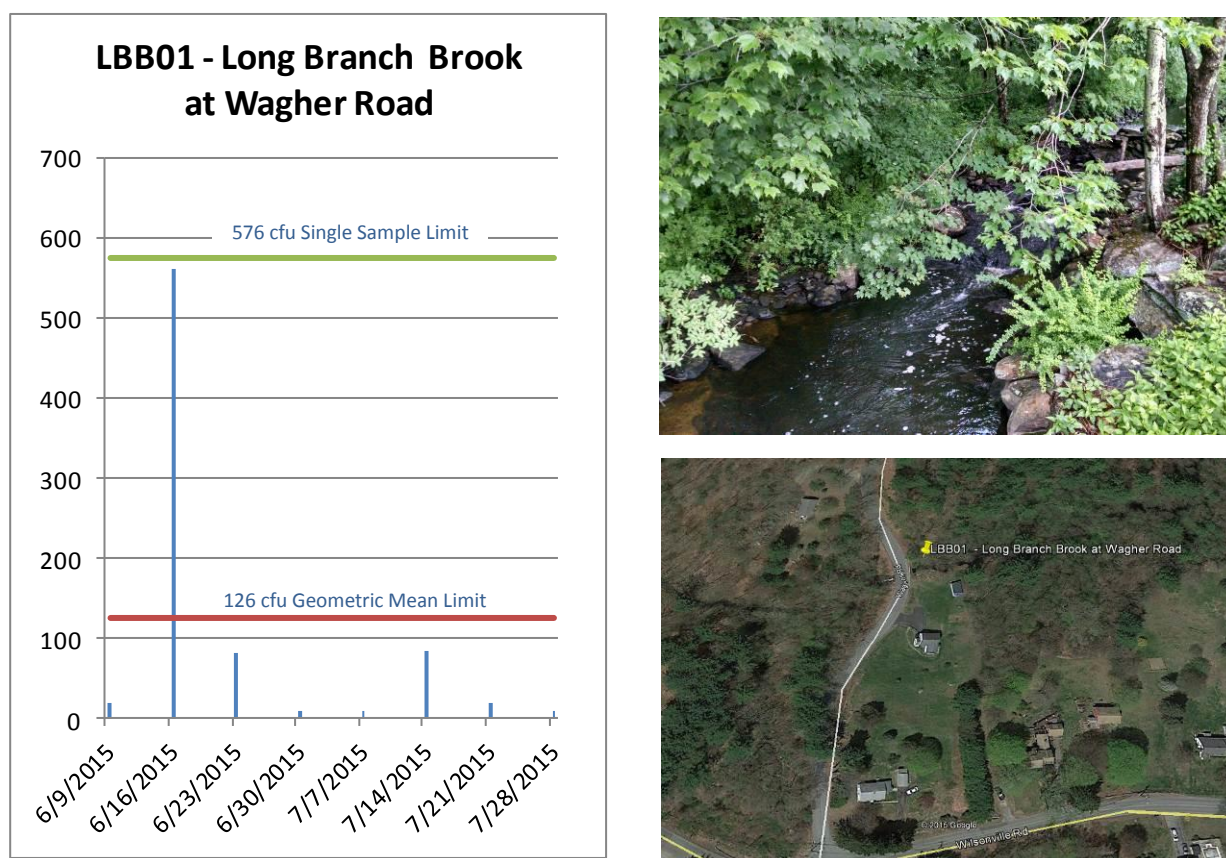
**Figure 12. Graph of bacteria sampling results at FR06; downstream view of the French River at the sampling location; and aerial image of the sampling site location and vicinity.**

FR06 is located south of Perryville Road in Dudley, MA, approximately 100 feet south of the state line. This site was selected to establish baseline water quality as water entered Connecticut from Massachusetts.

Eight water samples were collected at this site. All of the samples (100%) met the single sample Connecticut water quality standard of 576 cfu/100ml. The geometric mean for this site is 87, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.



### **LBB01 – Long Branch Brook at Wagher Road:**

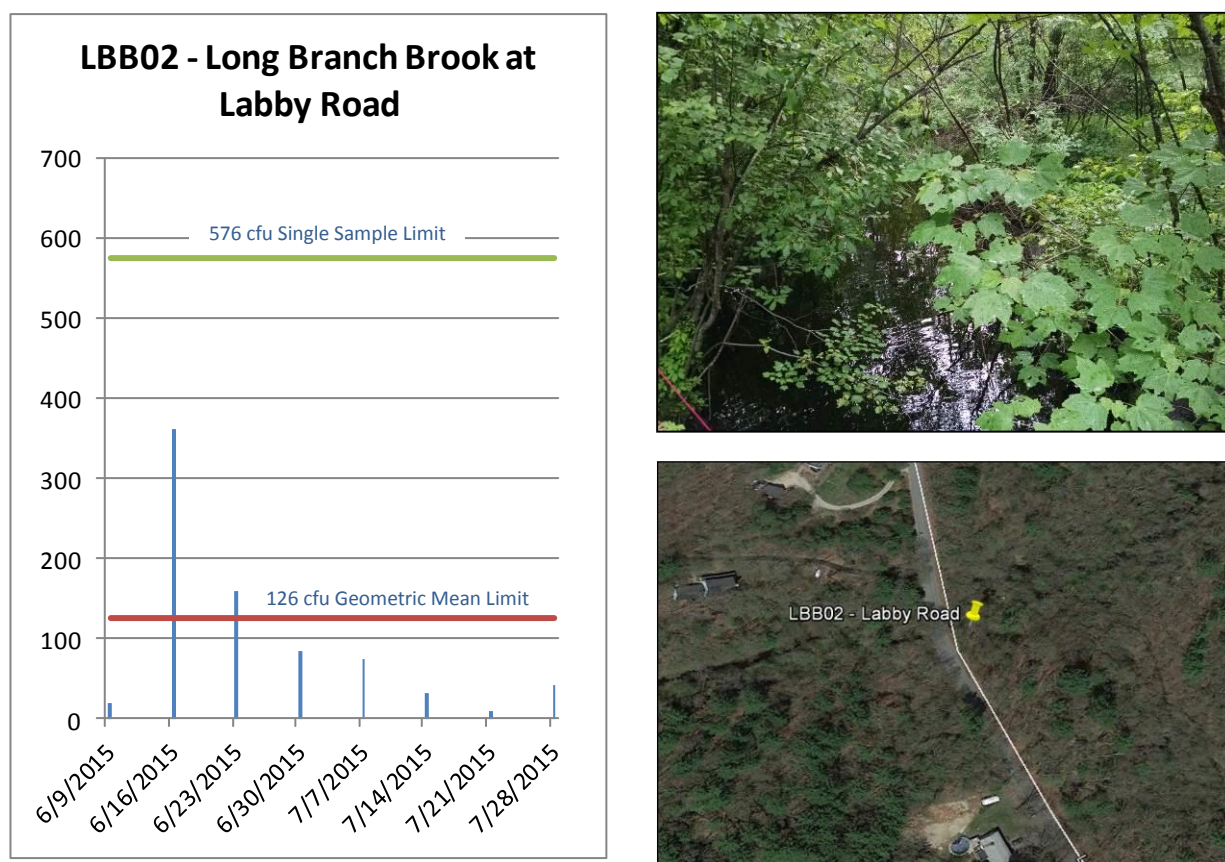


**Figure 13. Graph of bacteria sampling results at LBB01; upstream view of Long Branch Brook at the sampling location; and aerial image of the sampling site location and vicinity.**

LBB01 is located at the Wagher Road crossing of Long Branch Brook. This site is located downstream of the CT DEEP probabilistic water quality monitoring site (6134), at which data that was used to determine the water quality impairment was collected. The surrounding area is rural residential and there is very little development between this site and LBB02, located approximately 1725 feet upstream. This site was selected to bracket water quality data at LBB02.

Nine water samples were collected at this site, including one duplicate sample. All of the samples (100%) met the Connecticut water quality standard of 576 cfu/100ml for single samples. The geometric mean for this site is 36, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.

## **LBB02– Long Branch Brook at Labby Road:**

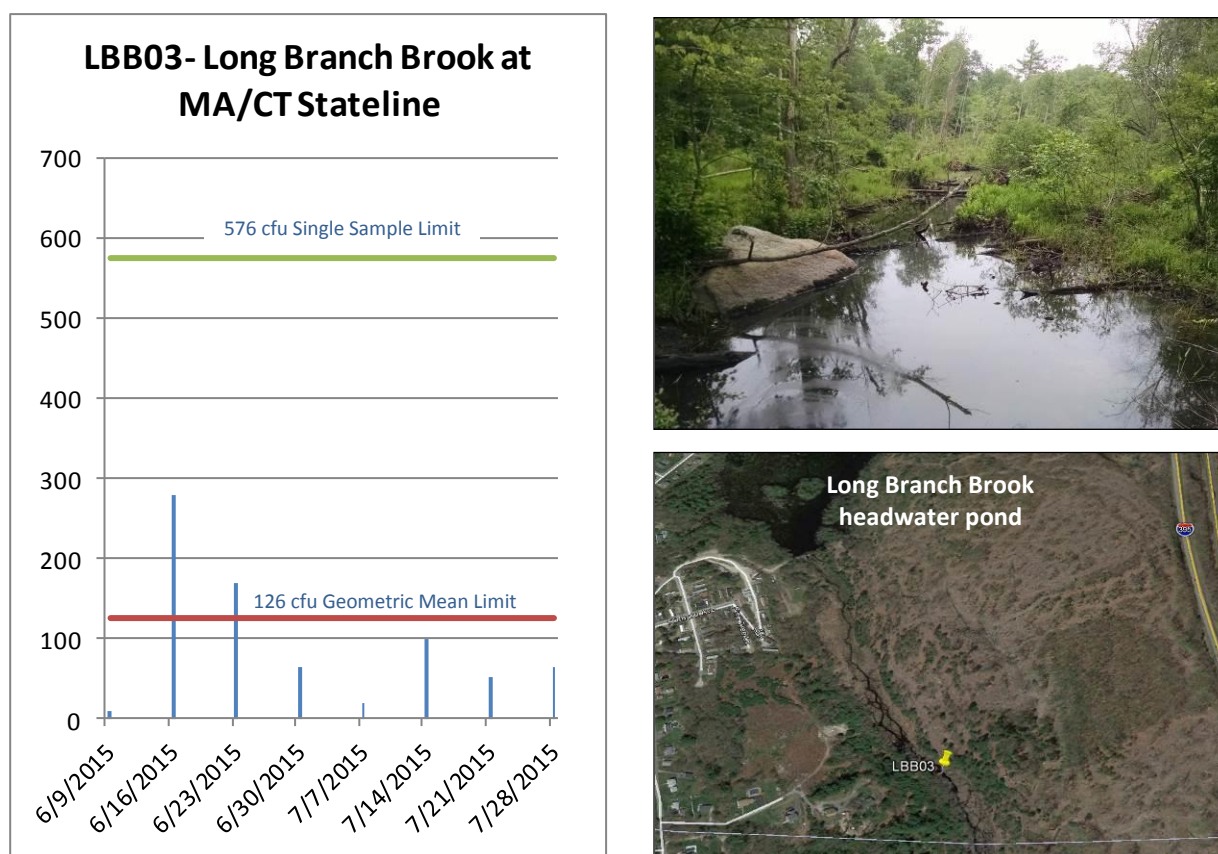


**Figure 14. Graph of bacteria sampling results at LBB02; upstream view of Long Branch Brook at the sampling location; and aerial image of the sampling site location and vicinity.**

LBB02 is located at the crossing of Long Branch Brook at Labby Road. This site is just downstream of the CT DEEP probabilistic water quality monitoring site (6134), at which the data that was used to determine the water quality impairment was collected. The surrounding area is very sparsely developed. Long Branch Brook flows through undeveloped forest land between this site and LBB01, approximately 5000 feet upstream.

Eight water samples were collected at this site. All the samples (100%) met the single sample Connecticut water quality standard of 576 cfu/100ml. The geometric mean for this site is 56, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.

### **LBB03 – Long Branch Brook at the Massachusetts State Line:**



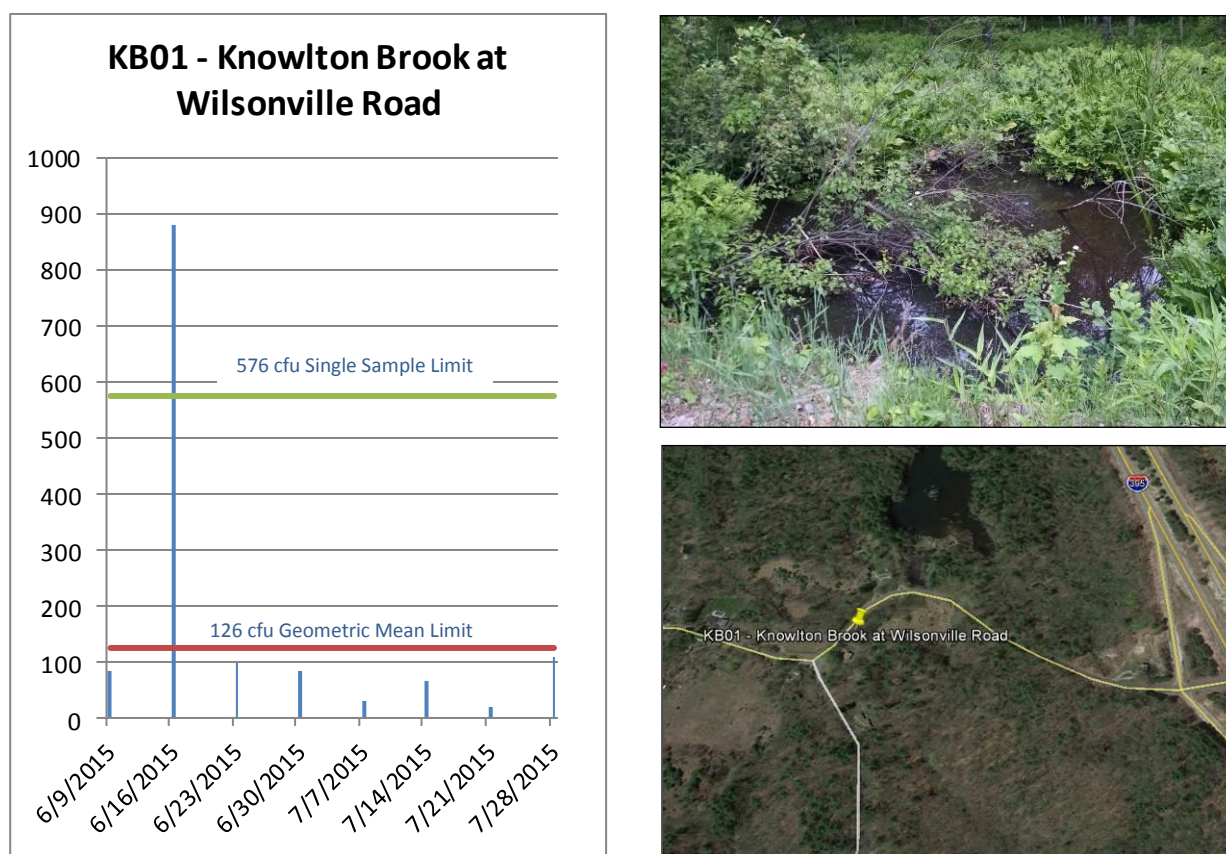
**Figure 15. Graph of bacteria sampling results at LBB03; downstream view of Long Branch Brook at the sampling location; and aerial image of the sampling site location and vicinity.**

LBB03 is located on Long Branch Brook near the Connecticut-Massachusetts state line. This site is located between a sewered residential neighborhood to the west and Interstate Route 395 to the east. The area in the immediate vicinity of the sampling site is forested. The headwaters of Long Branch Brook are located approximately 1700 feet upstream. This site was selected to obtain baseline water quality conditions as the stream entered Connecticut.

Eight water samples were collected at this site. All the samples (100%) met the Connecticut water quality standard of 576 cfu/100ml for single samples. The geometric mean for this site is 61, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.



### **KB01 – Knowlton Brook at Wilsonville Road:**



**Figure 16. Graph of bacteria sampling results at KB01; downstream view of Knowlton Brook at the sampling location; and aerial image of the sampling site location and vicinity.**

KB01 is located at the Wilsonville Road crossing of Knowlton Brook. The surrounding area is rural residential and is primarily forested. Elevation relief in the vicinity of this site is very low. As a result, Knowlton Brook alternates between a defined channel and a scrub-shrub wetland and is very slow-moving. Knowlton Brook flows into Long Branch Brook approximately 3000 feet downstream of this site. This site was selected to document water quality being discharged to Long Branch Brook from the Knowlton Brook watershed.

Nine water samples were collected at this site, including one duplicate sample. Eight samples (89%) met the Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 83, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.



### **SHB01– Sunset Hill Brook at Klondike Avenue:**



**Figure 17. Graph of bacteria sampling results at SHB01; view of Sunset Hill Brook upstream of the sampling site; and aerial image of the sampling site location and vicinity.**

SHB01 is located at the crossing of Klondike Road with Sunset Hill Brook, approximately 700 feet upstream of the confluence with the French River. This site is also located approximately 525 feet downstream of a Connecticut Water Company public drinking water supply wellhead. This site is located in a suburban residential neighborhood which is served by municipal sewer (Fig. 6). This site was selected to document water quality contributions from the Sunset Hill Brook watershed to the French River.

Nine water samples were collected at this site, including one duplicate sample. Eight of the samples (89%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 124, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.

### **SHB02 – Sunset Hill Brook at Thompson Hill Road (State Route 200):**

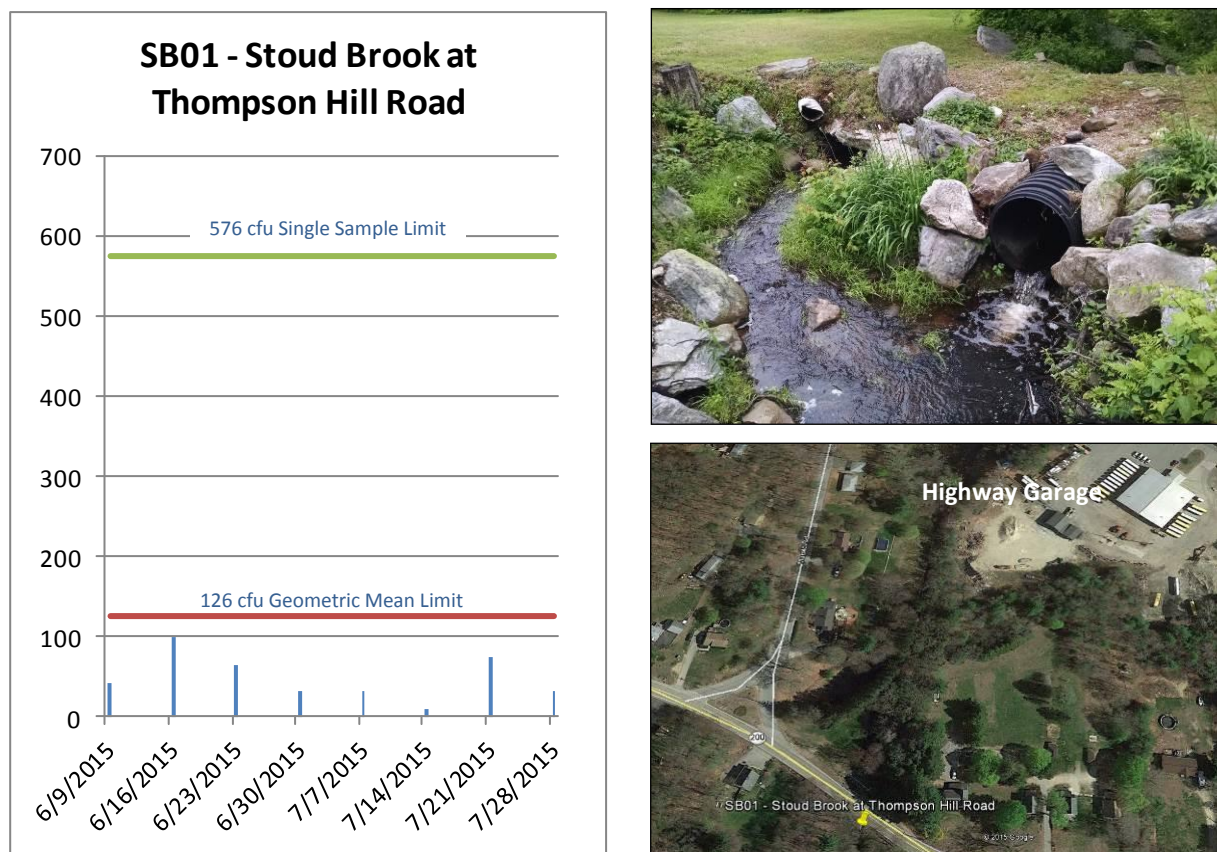


**Figure 18. Graph of bacteria sampling results at SHB02; view of the culvert at the sampling location that conveys Sunset Hill Brook under Thompson Hill Road; and aerial image of the sampling site location and vicinity.**

SHB02 is located at the crossing of Sunset Hill Brook with Thompson Hill Road, and is located approximately 3500 feet upstream of SHB01. Sunset Hill Brook is culverted under Thompson Hill Road via a 48 inch corrugated metal pipe a distance of approximately 160 feet. The area surrounding and upstream of the sampling site and is rural residential and is primarily forested. This site was selected to potentially isolate water quality contributions from the Baptist Brook watershed and the upper portions of the Sunset Hill Brook watershed (Fig. 6).

Eight water samples were collected at this site. All the samples (100%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 124, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.

### **SB01 – Stoud Brook at Thompson Hill Road (State Route 200):**



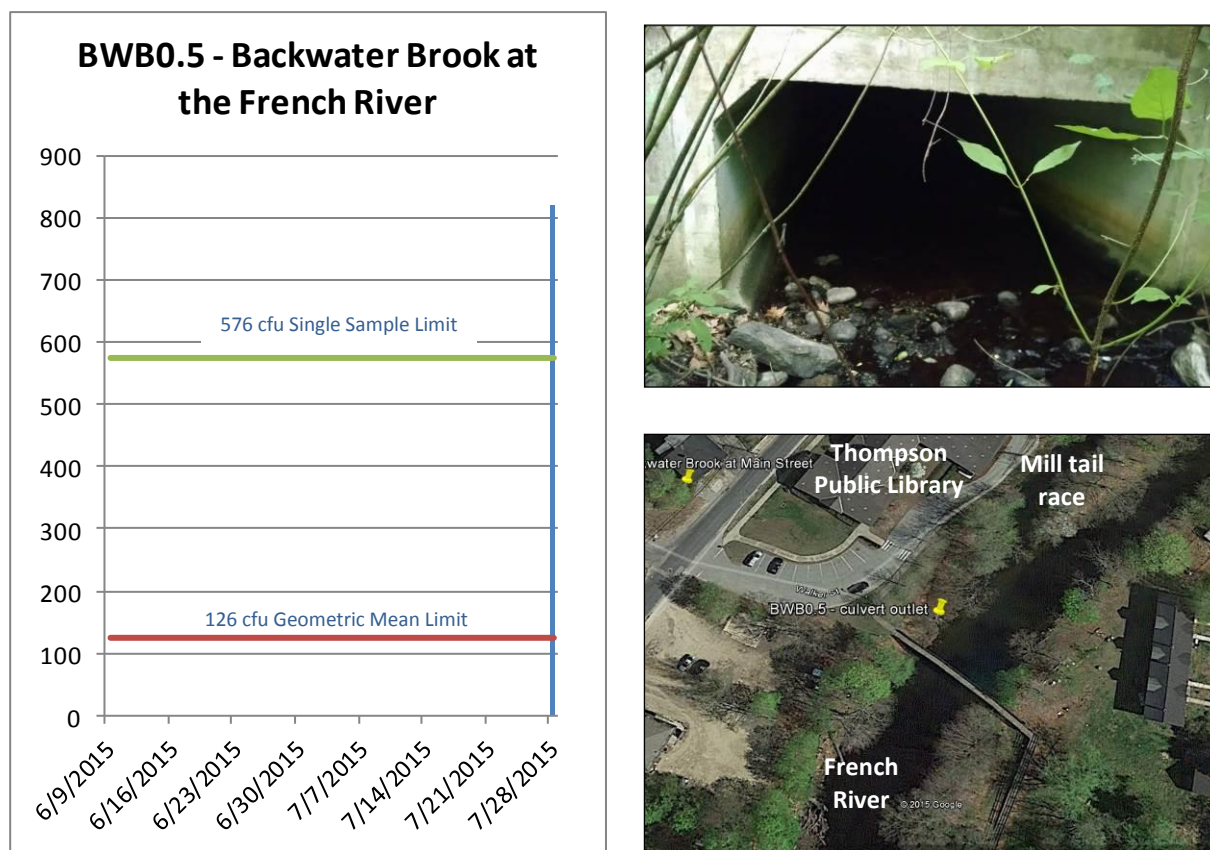
**Figure 19. Graph of bacteria sampling results at SB01; view of Stoud Brook upstream of the sampling location; and aerial image of the sampling site location and vicinity.**

SB01 is located at the crossing of Stoud Brook at Thompson Hill Road (State Route 200), in a rural residential neighborhood. It is approximately 500 feet downstream of the Thompson Highway garage. There is a small impoundment approximately 100 feet upstream of the sampling site and a larger impoundment approximately 1250 feet upstream of the sampling site. This site was selected to isolate bacteria levels in Stoud Brook from composite water bacteria levels at SHB01, 1500 feet downstream.

Ten water samples were collected at this site. All the samples (100%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 33, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.



## **BWB0.5 – Backwater Brook at the confluence with the French River:**



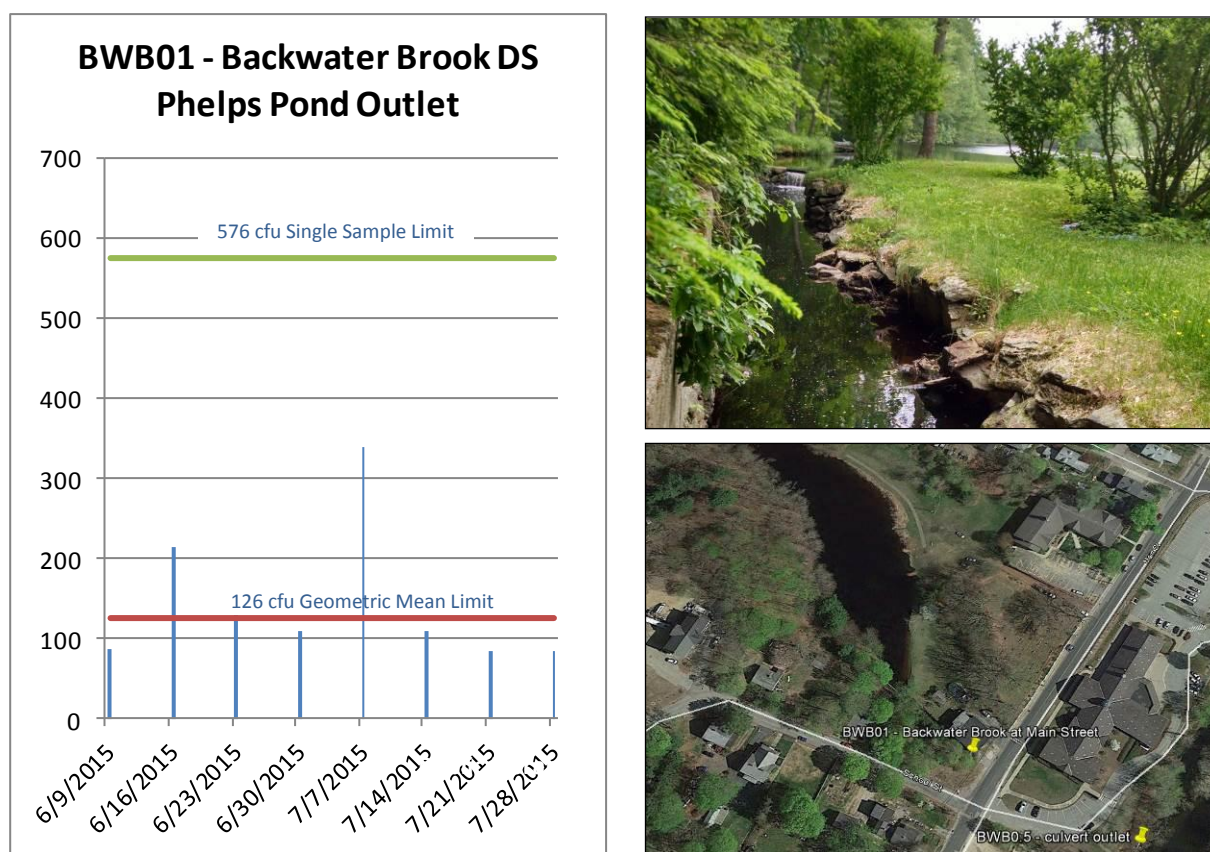
**Figure 20. Graph of bacteria sampling results at BWB0.5; view of the culvert conveying Backwater Brook under the public library property and Main Street, just upstream of the sampling location; and aerial image of the sampling site location and vicinity.**

BWB0.5 is located at the outlet of a culverted segment of Backwater Brook, approximately ten feet upstream of the confluence with the French River. This sample was collected in an attempt to quantify water quality in response to a “sewage” odor from a nearby storm drain that is believed to discharge to this culverted segment of stream.

One water sample was collected at this site. At 820 cfu/100 ml, this sample exceeded the Connecticut water quality standard of 576 cfu/100 ml for single samples. Although only one sample was collected, an 85% bacteria reduction (based on a geometric mean of 820 cfu) is required at this site.



## **BWB01 – Backwater Brook near Main Street:**

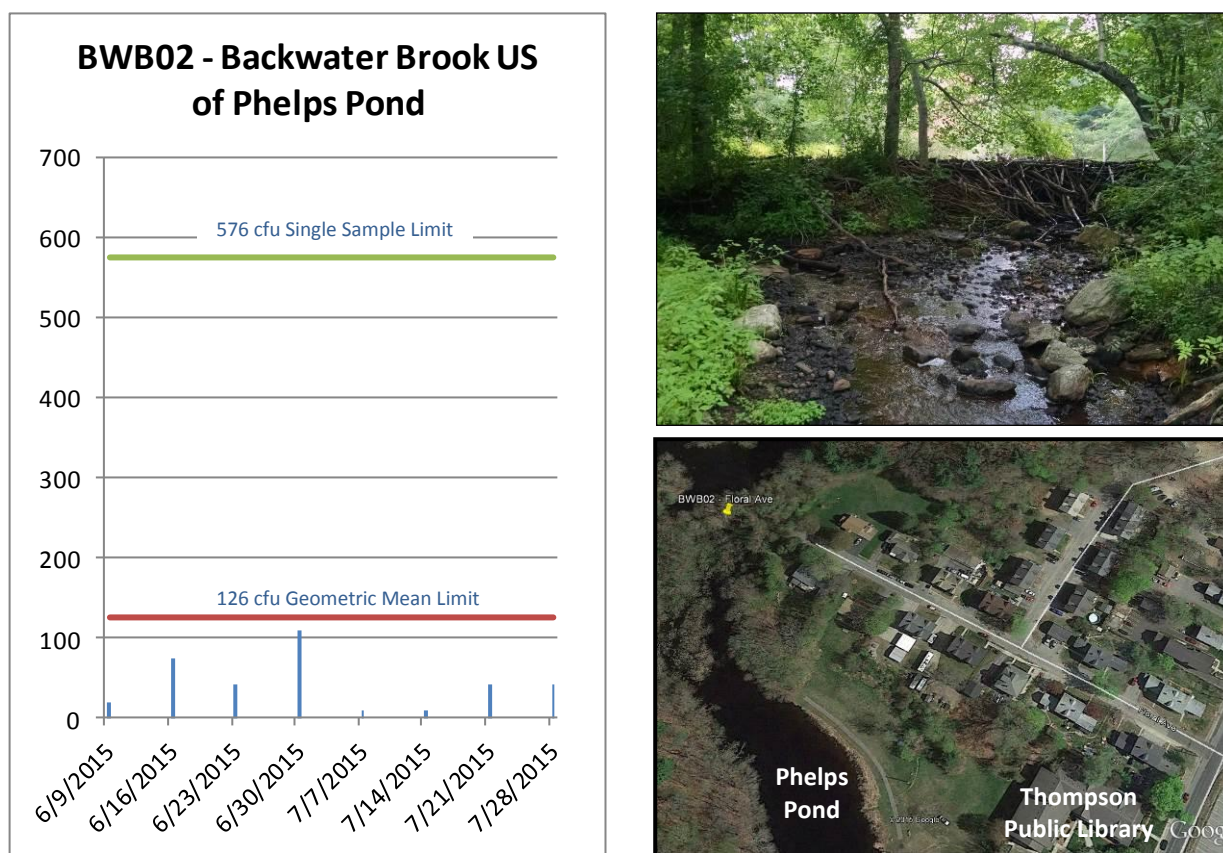


**Figure 21. Graph of bacteria sampling results at BWB01; view of Backwater Brook upstream of the sampling location; and aerial image of the sampling site location and vicinity.**

BWB01 is located on Backwater Brook approximately 70 feet downstream of the outlet of Phelps Pond, and approximately 270 feet upstream of the confluence with the French River, near Main Street in North Grosvenordale. Phelps Pond is a Town-owned 3-acre impoundment of Backwater Brook. It is frequently utilized as a nesting and foraging habitat by a variety of waterfowl. North Grosvenordale in the vicinity of this site is the most densely developed area in Thompson, and is one of Thompson's two designated MS-4 areas. This area is served by municipal sewer (Fig. 6). BWB01 was selected to quantify bacteria levels in Backwater Brook upstream prior to its discharge to the French River.

Nine water samples were collected at this site. Eight of the samples (89%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 135, which exceeds the allowable geometric mean of 126 cfu/100 ml. A 7% bacteria reduction is required at this site.

## **BWB02 – Backwater Brook upstream of Phelps Pond:**

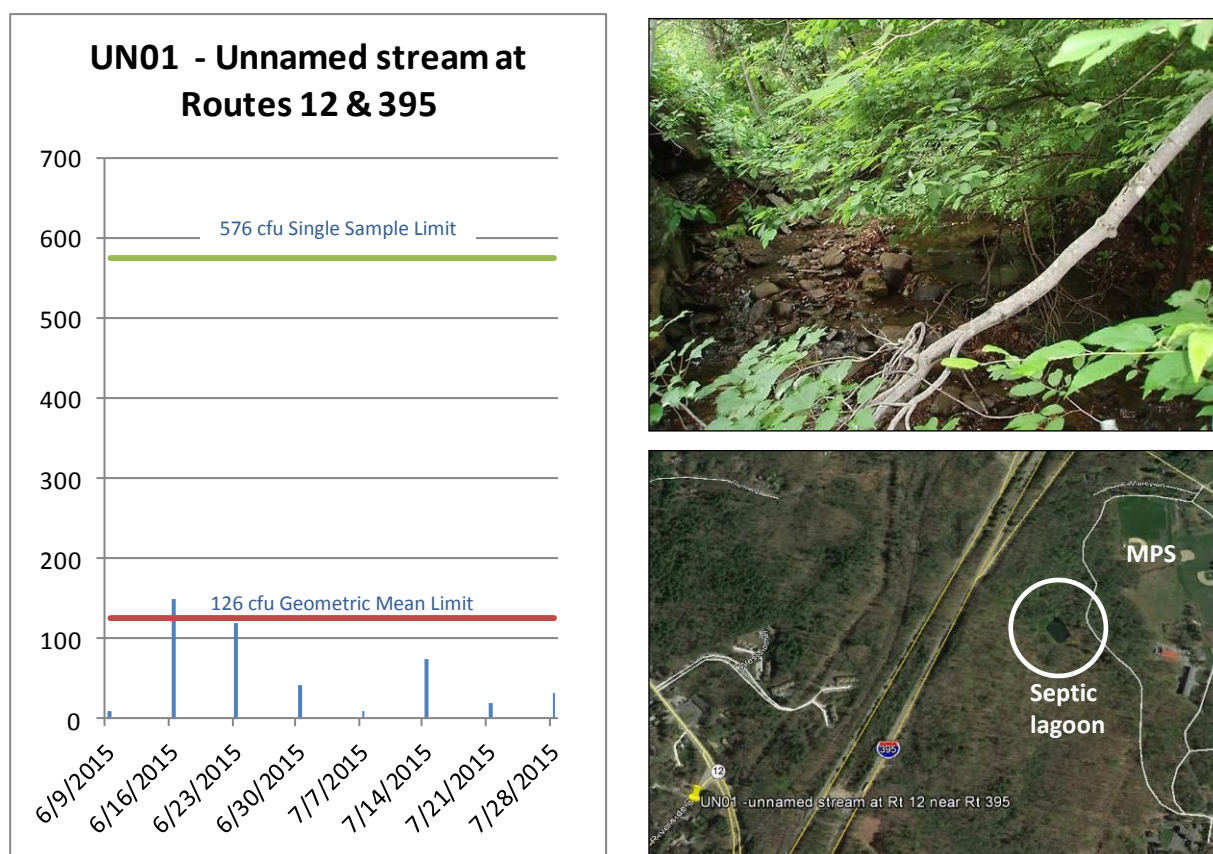


**Figure 22. Graph of bacteria sampling results at BWB02; view of a beaver dam on Backwater Brook upstream of the sampling location; and aerial image of the sampling site location and vicinity.**

BWB02 is located on Backwater Brook approximately 300 feet upstream of Phelps Pond, off the end of Floral Avenue. This site is located upstream of dense residential development and was selected to bracket water quality observations at BWB01. The watershed upstream of BWB01 is primarily forested with scattered rural residential development.

Eight water samples were collected at this site. All the samples (100%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 32, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.

### UN01 – Unnamed stream at State Route 12 and Interstate Route 395:



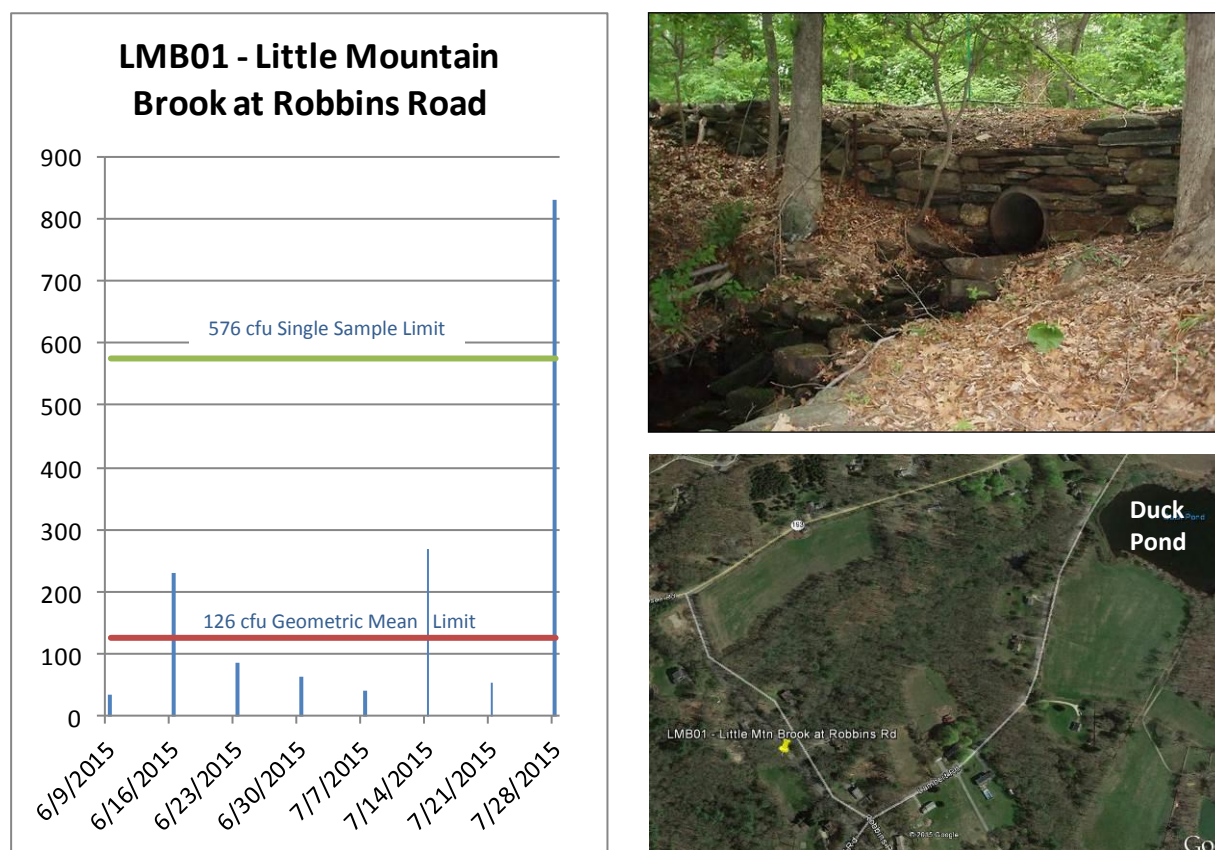
**Figure 23. Graph of bacteria sampling results at UN01; view of the unnamed stream upstream of the sampling location; and aerial image of the sampling site location and vicinity.**

UN01 is located on an unnamed stream that originates at the Marianapolis Preparatory School (MPS) property on Thompson Hill, approximately 2700 feet upstream. This stream is suspected of periodically receiving effluent from a septic lagoon. Connection of MPS to the municipal sewer system was underway at the time of this water quality investigation. This stream also receives stormwater runoff from an off-ramp of Interstate Route 395.

Eight water samples were collected at this site. All the samples (100%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 37, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.



## **LMB01 – Little Mountain Brook at Robbins Road:**



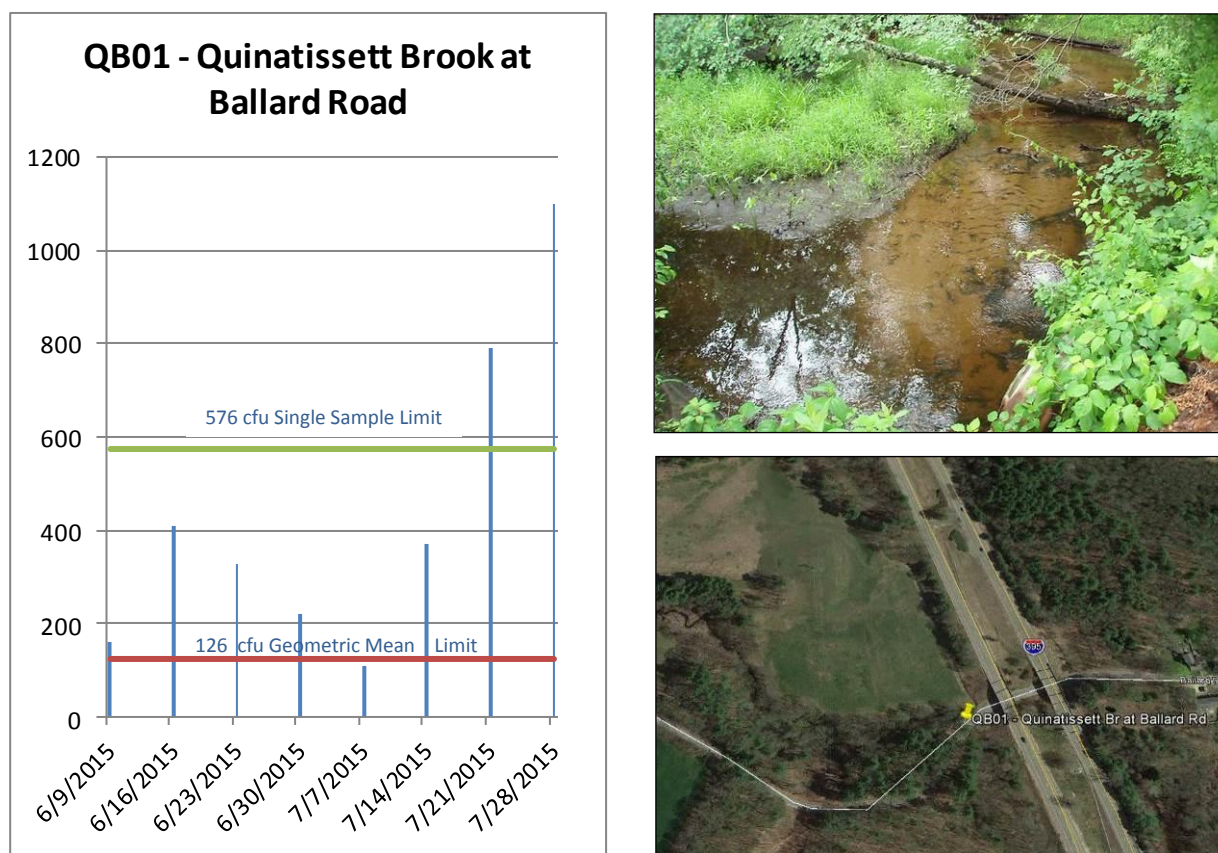
**Figure 24. Graph of bacteria sampling results at LMB01; view of Little Mountain Brook at the sampling location; and aerial image of the sampling site location and vicinity.**

LMB01 is located on Little Mountain Brook downstream of the Robbins Road crossing. Little Mountain Brook originates in a small pond known locally as Duck Pond. Land use is in the vicinity of Duck Pond and Little Mountain Brook is a mix of hayfields and rural residential development. This site was selected to quantify bacteria levels in Little Mountain Brook prior to its discharge to the French River.

Nine water samples were collected at this site. Eight of the samples (89%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 96, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site.



### **QB01 – Quinatissett Brook at Ballard Road:**

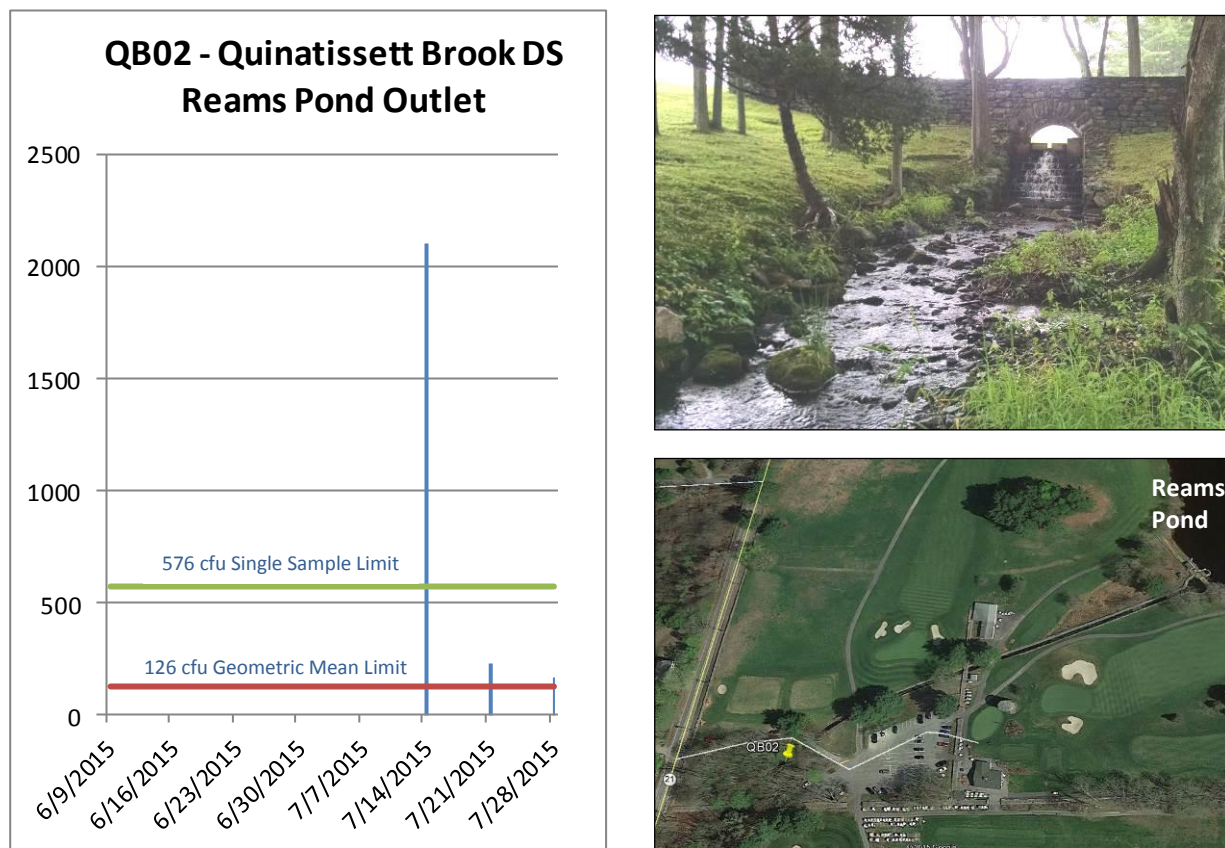


**Figure 25. Graph of bacteria sampling results at QB01; view of Quinatissett Brook downstream of the sampling location; and aerial image of the sampling site location and vicinity.**

QB01 is located on Quinatissett Brook at the crossing of Ballard Road. This site is located downstream of agricultural and rural residential land uses. It was selected to characterize bacteria levels in Quinatissett Brook prior to its discharge to the French River.

Eight water samples were collected at this site. Six of the samples (75%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 338, which exceeds the allowable geometric mean of 126 cfu/100 ml. A 63% bacteria reduction is required at this site.

**QB02 – Quinatissett Brook at Quinatissett Golf Course, County Home Road (State Route 21):**

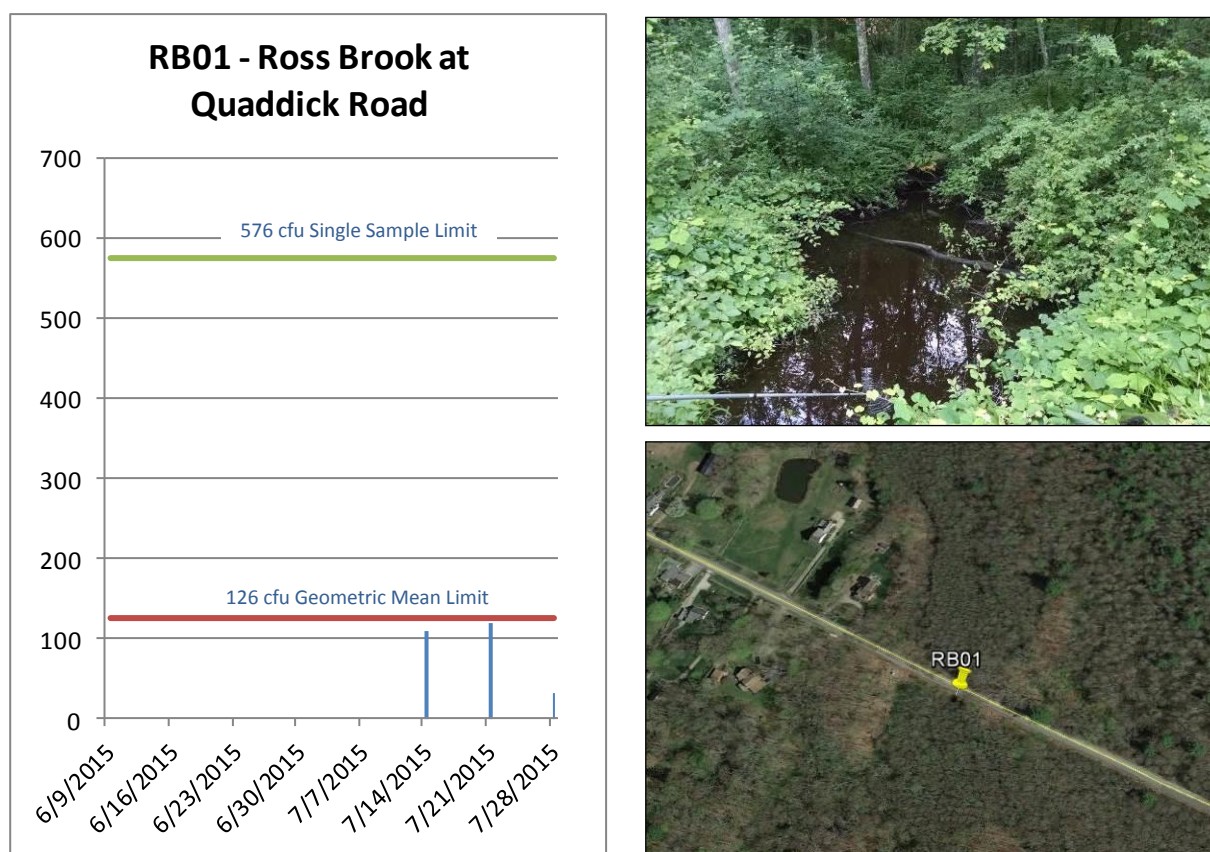


**Figure 26. Graph of bacteria sampling results at QB02; view of Quinatissett Brook upstream of the sampling location; and aerial image of the sampling site location and vicinity.**

QB02 is located on Quinatissett Brook approximately 950 feet downstream of the outlet of Reams Pond at the Quinatissett Golf Course on County Home Road (RT 21). This site was added in week six of sampling to bracket upstream bacteria levels that were documented at QB01.

Four water samples were collected at this site. Three samples (75%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 361, which exceeds the allowable geometric mean of 126 cfu/100 ml. A 65% bacteria reduction is required at this site. It should be noted that only four samples were collected from this site during the sampling period, which does not constitute a reliable sample set.

### **RB01 – Ross Brook at Quaddick Road:**



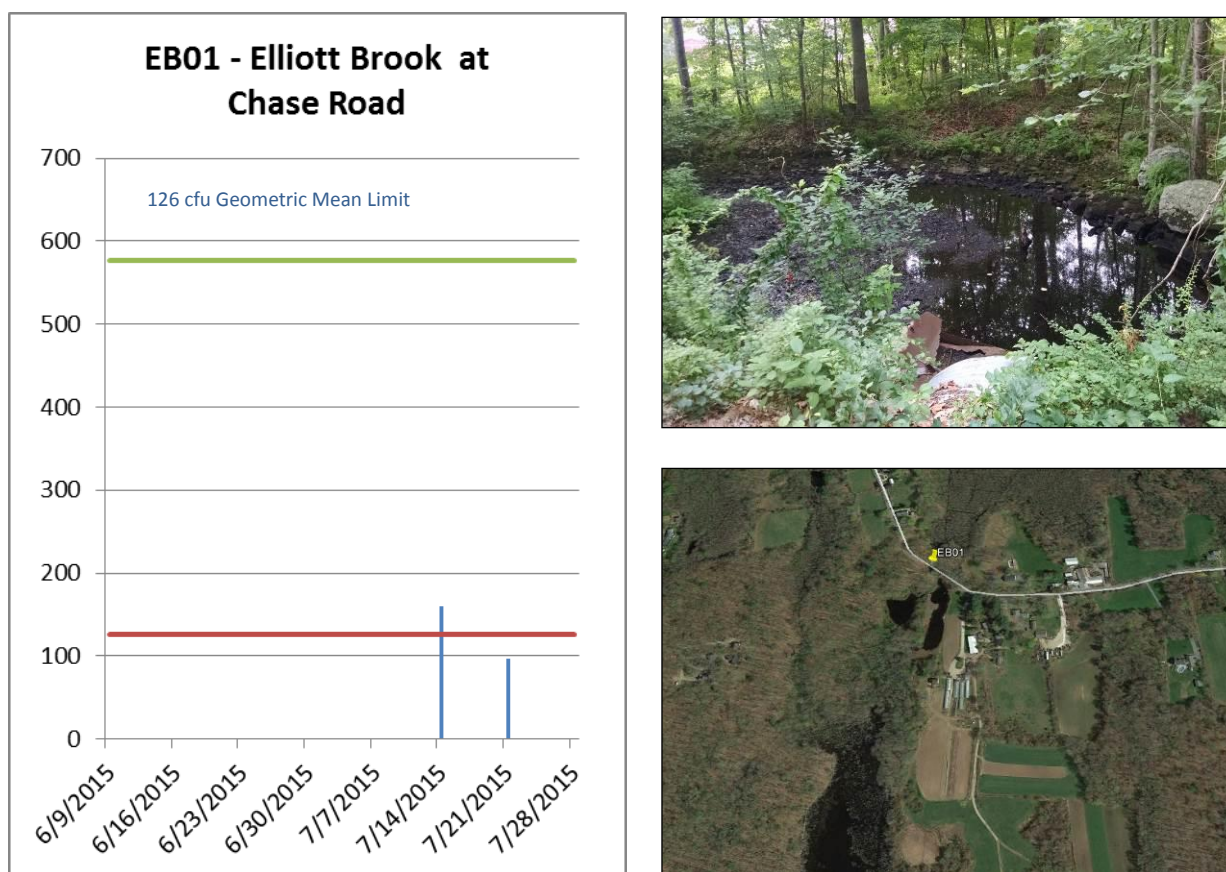
**Figure 27. Graph of bacteria sampling results at RB01; downstream view of Ross Brook at the sampling location; and aerial image of the sampling site location and vicinity.**

RB01 is located on Ross Brook at the crossing of Quaddick Road, at the southern end of an extensive red maple wetland known locally as Thompson Meadows. This site was added in week six of sampling to bracket bacteria levels that were documented at QB01, and to isolate potential bacteria sources from nearby Elliott Brook (Ross Brook and Elliott Brook merge a short distance downstream of this site and flow into Reams Pond). There is scattered rural development upstream of this site.

Three water samples were collected at this site. All the samples (100%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 74, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site. It should be noted that only three samples were collected from this site during the sampling period, which does not constitute a reliable sample set.



## **EB01 – Elliott Brook at Chase Road:**



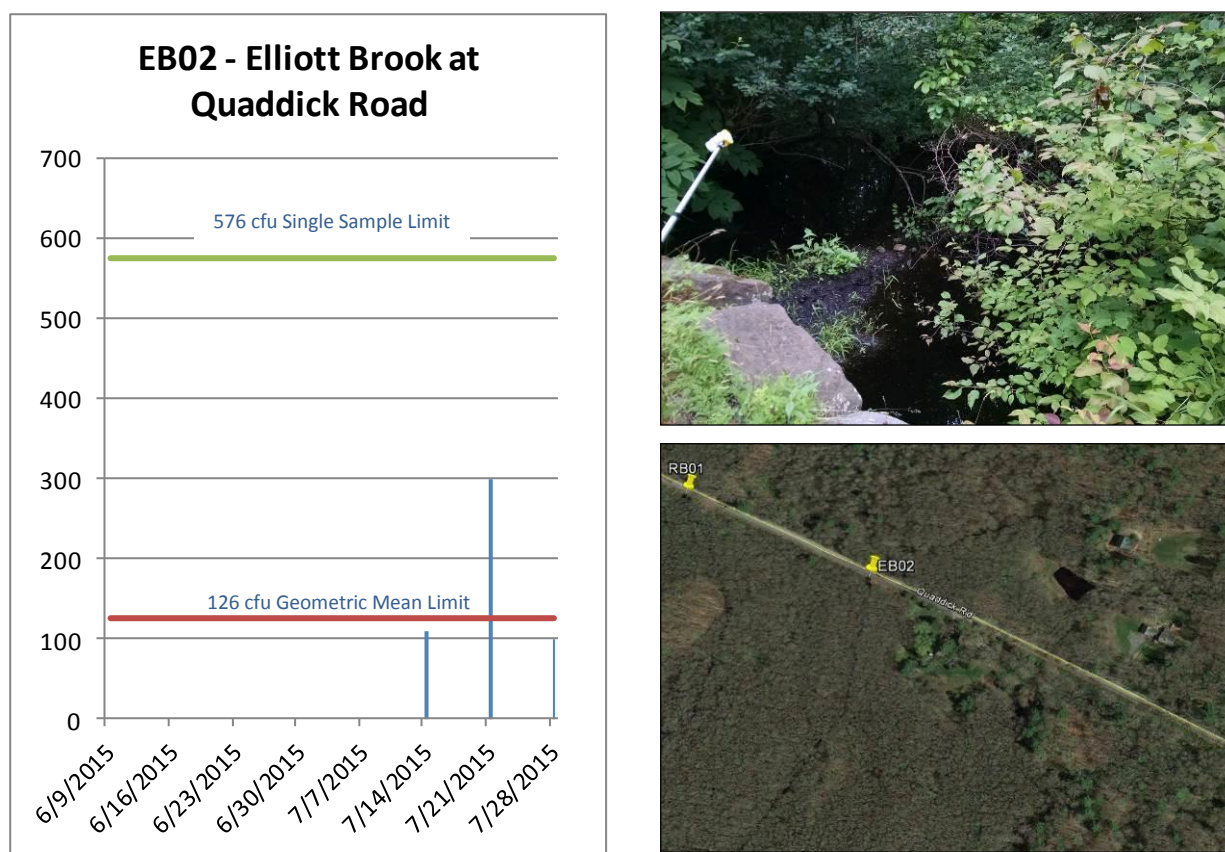
**Figure 28. Graph of bacteria sampling results at EB01; view of Elliott Brook at the sampling location; and aerial image of the sampling site location and vicinity.**

EB01 is located at the crossing of Chase Road. This site was added in week six of sampling to bracket bacteria levels that were documented at QB01. This site is located downstream of the confluence of Elliott Brook and Ross Brook.

Two samples were collected at this site. Both samples (100%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 125, which is within the allowable geometric mean of 126 cfu/100 ml. No bacteria reduction is required at this site. It should be noted that only two samples were collected from this site during the sampling period, and do not constitute a reliable sample set.



## **EB02 – Elliott Brook at Quaddick Road:**



**Figure 29. Graph of bacteria sampling results at EB02; view of Elliott Brook at the sampling location; and aerial image of the sampling site location and vicinity.**

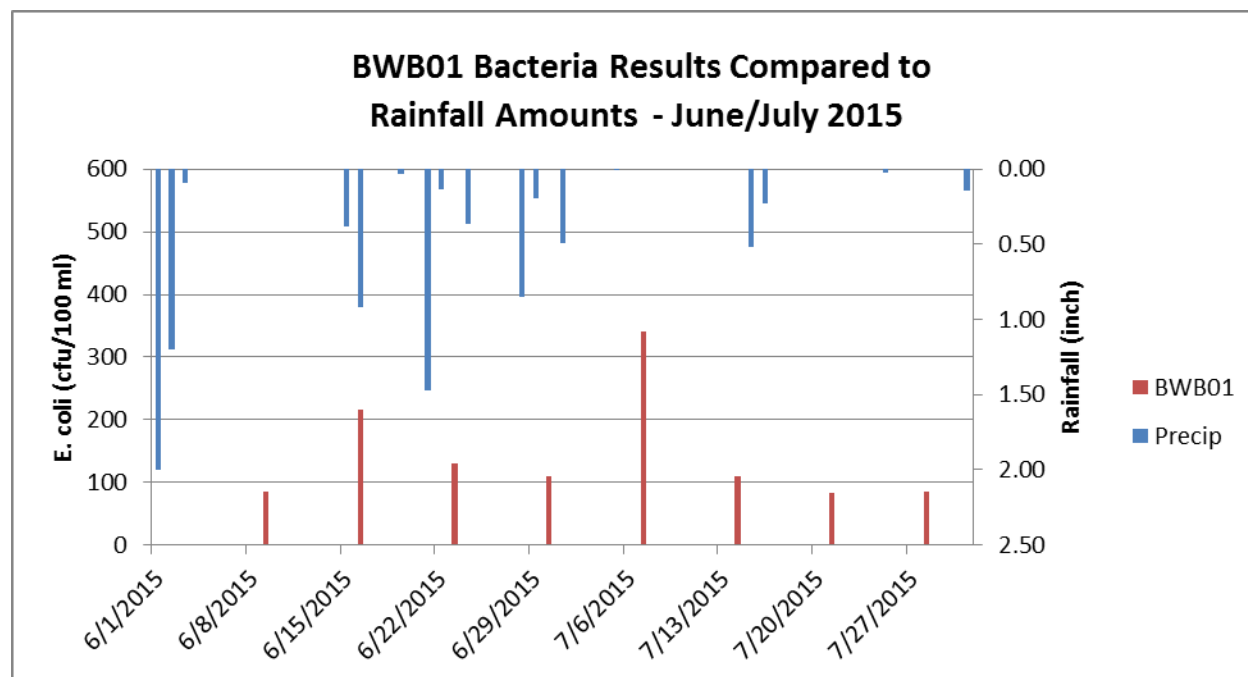
EB02 is located on Elliott Brook at the Quaddick Road stream crossing. This site was added in week six of sampling to bracket bacteria levels that were documented at QB01. EB02 is approximately 1650 feet upstream of EB01, and is upstream of the confluence of Ross Brook with Elliott Brook. This site was selected to isolate potential bacteria contributions originating in Elliott Brook from those originating in Ross Brook (Fig. 6). There is scattered rural development upstream of this site.

Three samples were collected at this site. All the samples (100%) met Connecticut water quality standard of 576 cfu/100 ml for single samples. The geometric mean for this site is 148, which exceeds the allowable geometric mean of 126 cfu/100 ml. A 15% bacteria reduction is required at this site. It should be noted that only three samples were collected from this site during the sampling period, and do not constitute a reliable sample set.

## Discussion

Bacteria levels at two of the eighteen primary sampling sites failed to meet Connecticut water quality standards for the geometric mean for each sample set. These sites included Backwater Brook downstream of Phelps Pond (BWB01, geomean = 135), near Main Street in North Grosvenordale, and Quinatissett Brook at Ballard Road (QB01, geomean = 338).

Bacteria levels at BWB01 were generally low (84 – 230 cfu/100 ml, with one higher measurement of 340 cfu/100 ml on 7/7/15). None of the samples exceeded the single sample limit of 576 cfu/100 ml. A comparison of bacteria levels at BWB01 to precipitation data collected by the Army Corps of Engineers at nearby West Thompson Lake (Fig. 30) indicates that bacteria levels spike immediately after precipitation. For example, a bacteria level of 215 (the average of 200 and 230 cfu/100 ml, the second value being a sample duplicate) was documented on 6/16/15, one day after a rainfall of 1.4 inches. In the absence of rainfall within 24 or so hours of sampling, bacteria levels in the stream water were generally low, indicating that stormwater runoff may be the primary vector for bacteria transport to Backwater Brook. The exception to this observation is a somewhat aberrant bacteria level of 340 cfu/100 ml collected on 7/7/15, during a period of dry weather. This value may be reflective of a bacteria plug from Phelps Pond due to waterfowl activity or other disturbance, or may be the result of sampling error. It should be noted that several domestic ducks were observed being kept at a property immediately upstream of the sampling site.



**Figure 30. Comparison of bacteria levels at BWB01 (Backwater Brook downstream of Phelps Pond) to occurrence of rainfall.**

A second sampling location on Backwater Brook, BWB02, upstream of Phelps Pond, was selected to bracket potential impacts of waterfowl known to utilize the pond for foraging and nesting, and to establish water quality upstream of the municipal sewer service area. Bacteria levels at this site were very low (geomean = 32), indicating that upstream bacteria contributions were insignificant.

A single water sample was collected at a third site on Backwater Brook (BWB0.5) on the final day of sample collection (7/28/15). ECCD staff and water quality volunteers noted a foul odor emanating from a storm drain behind the library (Fig. 31). Backwater Brook is culverted a distance of approximately 250 feet under Main Street and the Thompson Public Library property, before it discharges to the French River (Fig. 31). It is believed that a portion of the storm drain system serving the library parking lot may be tied into the culverted section of stream. A water sample was collected at the outlet of the culvert to determine if discharge from the storm drain system was contributing to bacteria load in Backwater Brook. This single dry weather sample yielded a bacteria level of 820 cfu/100 ml, indicating that further investigation into the layout of the storm drain system at the library should be conducted.

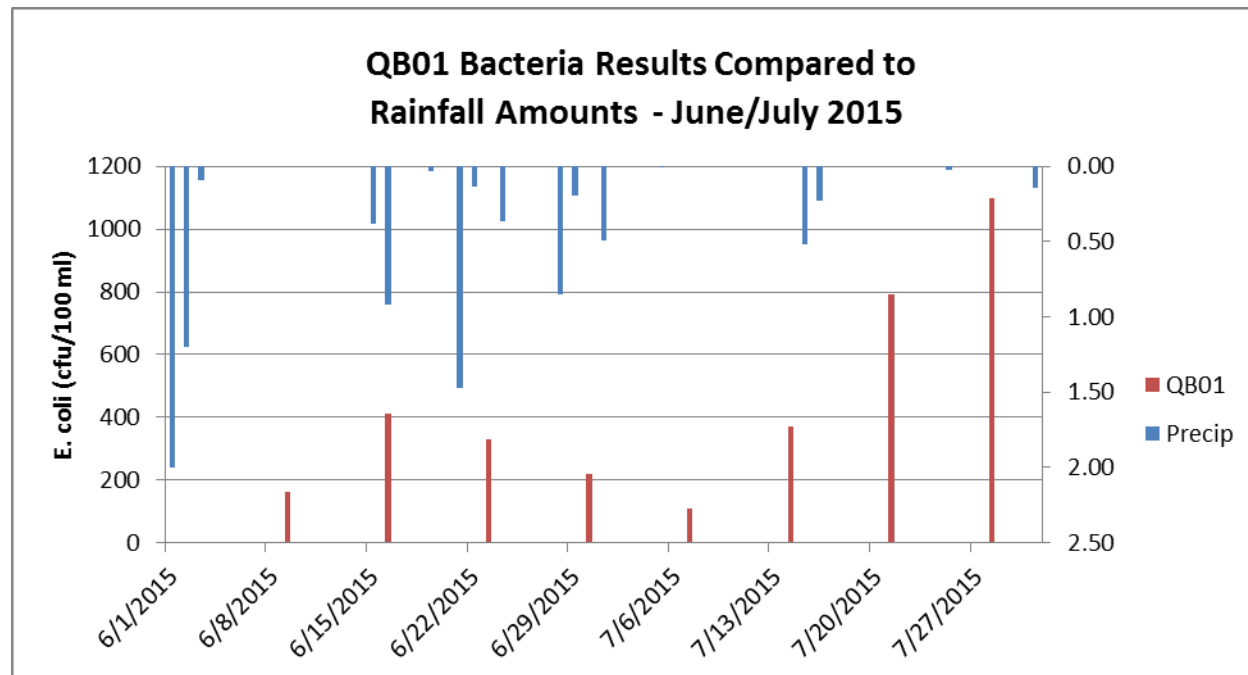


**Figure 31. Culverted segment of Backwater Brook (dashed line). Approximately 250 feet of the stream is culverted under Main Street and the Thompson Public Library property.**

Bacteria levels in Quinatissett Brook at Ballard Road (QB01) were generally higher than those observed at other sites in the French River watershed (Table 1), and dry weather samples collected on July 21<sup>st</sup> and 28<sup>th</sup> exceeded the single sample limit (Fig. 32). Typically, dry weather bacteria spikes indicate point sources, illicit discharges or base flow-related conditions such as



septic system failures. However, there is little nearby development, so potential sources of, or contributing to, the observed bacteria levels are not immediately apparent.

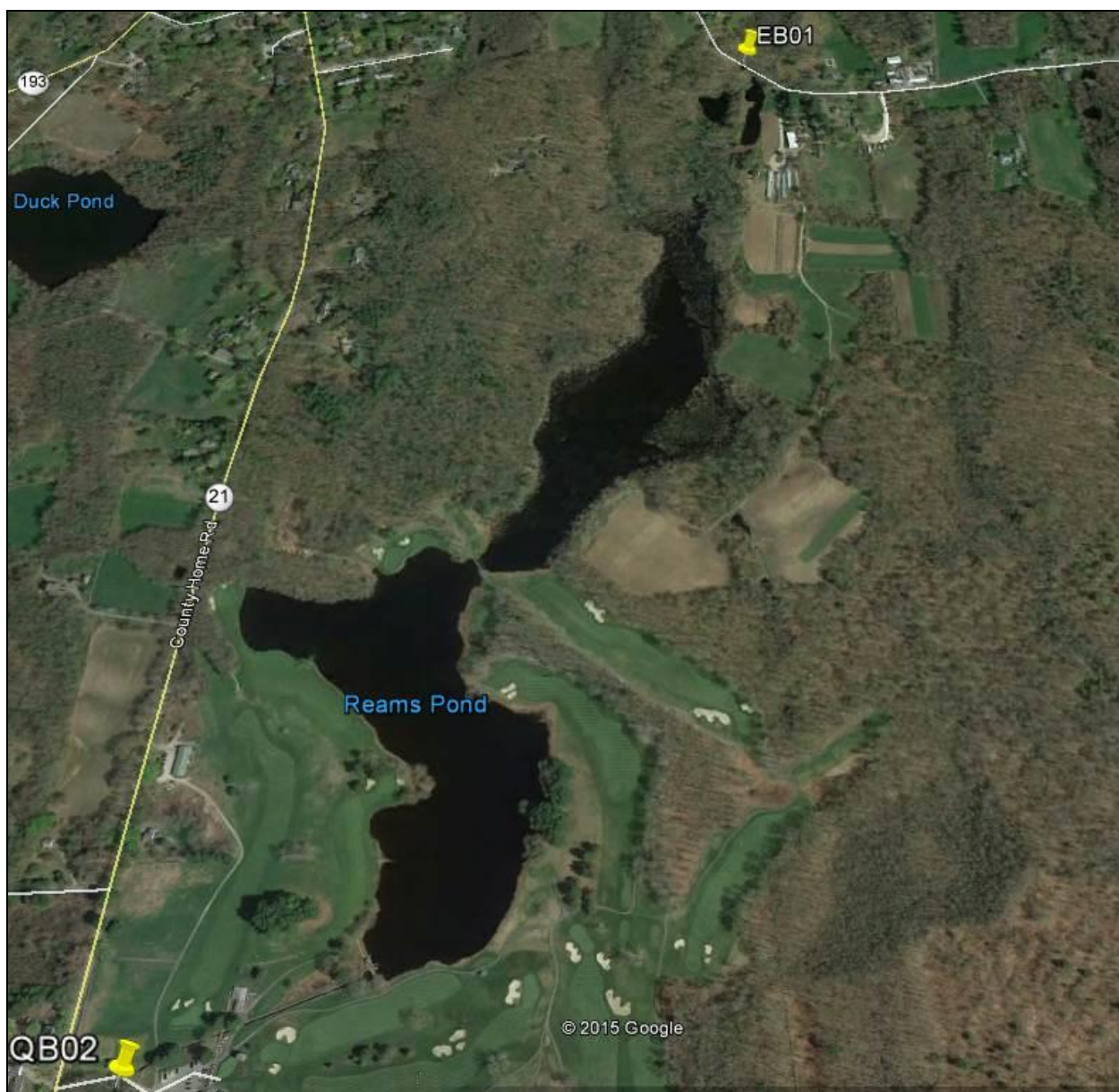


**Figure 32. Comparison of bacteria levels at QB01 (Quinatissett Brook at Ballard Road) to occurrence of rainfall.**

In order to bracket the bacteria levels observed at QB01, four additional upstream sampling sites were added in week six of sampling. These sites, QB02, RB01, EB01 and EB02 were selected to isolate potential bacteria sources below Reams Pond at the Quinatissett Golf Course (Quinatissett Brook - QB02), upstream of Reams Pond at Chase Road (Elliott Brook - EB01), and at two tributaries (Ross Brook – RB01, and Elliott Brook – EB02) upstream of the Chase Road site (Fig. 2).

The geometric mean of water samples collected at QB02, approximately 950 feet downstream of the outlet of Reams Pond, was 361 cfu/100 ml, which exceeded the established limit of 126 cfu/100 ml for the geometric mean of a sample set. A water sample collected on July 14<sup>th</sup> during a heavy shower yielded a bacteria level of 2100 cfu/100 ml, exceeding the single sample limit and indicating that pollutants conveyed in stormwater flow may be a significant source of bacteria loading to Reams Pond and Quinatissett Brook.

Potential bacteria sources to Reams Pond and Quinatissett Brook upstream of QB02 include agricultural land along the northeast shoreline, and Quinatissett Golf Course along the southeast, south and southwest shorelines. The shoreline of Reams Pond in the vicinity of the golf course is cleared with the greens extending to the water's edge, potentially creating attractive foraging conditions for waterfowl (Fig. 33). ECCD will follow up with golf course managers to determine if nuisance waterfowl is an issue at the facility.



**Figure 33. View of land use along Reams Pond, between QB02 and EB01.**

Sampling site EB01, located on Elliott Brook at Chase Road, is upstream of the golf course and the agricultural land, and was selected to bracket potential bacteria contributions from those two land uses. The area upstream of EB01 is a forested wetland, with rural residential development along the road frontage. The geometric mean at EB01 was 125 cfu/100 ml, which was within the allowable geometric mean of 126 cfu/100 ml. It should be noted that only two samples were collected at this site, and that the stream was dry on the final day of sampling.

Finally, water samples were collected during the last three weeks of sampling at Ross Brook (RB01) and Elliott Brook (EB02) at Quaddick Road, to isolate bacteria contributions to the lower sampling sites from each of these tributaries. The area upstream of both sites is comprised of a large tract of undeveloped forested wetland known locally as Thompson Meadows. The

geomean at RB01 was 74 cfu/100 ml, which was within the allowable geometric mean of 126 cfu/100 ml. The geomean at EB02 was 148 cfu/100 ml, which exceeded the allowable geometric mean. There were no obvious nearby conditions such as residential development or agricultural land that might have contributed to the documented bacteria levels in the stream. However, water levels in the stream were extremely low, and it is possible that low flow and ponding conditions may have concentrated background bacteria levels.

Bacteria levels at all six sampling sites along the French River, from the Massachusetts state line to the confluence with the Quinebaug River, including segment 01 of the French River (CT3300-00\_01), were within allowable limits for both geomean and single samples. Segment 01 has been listed in multiple cycles of the DEEP's Integrated Water Quality Report to Congress, most recently in 2010, as impaired for recreation due to periodic high levels of *E. coli*. Likewise, bacteria levels in Long Branch Brook (CT3300-02\_01), which was listed in the 2014 Integrated Water Quality Report as impaired for recreation due the presence of *E. coli*, were within allowable limits for both geomean and single samples.

## Conclusion

In June and July of 2015, ECCD and TLGV water quality monitoring volunteers collected water samples from a total of twenty-three sites along the French River and its tributaries in Thompson, Connecticut. The water samples were analyzed by the CT Department of Public Health's Microbiology Laboratory for fecal bacteria (*E. coli*) content. A review of the bacteria analysis data indicates that Quinatissett Brook (CT3300-10) and Backwater Brook (CT3300-05) do not currently meet State of Connecticut water quality standards for recreational use. However, the French River, including segment 01 (CT3300-00\_01), which has been listed in multiple cycles of the Connecticut Department of Energy and Environmental Protection's Integrated Water Quality Report to Congress, most recently in 2010, and Long Branch Brook (CT3300-02\_01), which was listed in the 2014 *Integrated Water Quality Report to Congress* as impaired for recreation due the presence of bacteria, both met established water quality standards.

## References

Connecticut, Department of Environmental Protection, *2010 Integrated Water Quality Report*, Final - May 31, 2011, Hartford, CT.

Connecticut, Department of Energy and Environmental Protection, *2014 State Of Connecticut Integrated Water Quality Report*, Draft – July 2014, Hartford, CT.

Connecticut, Department of Energy and Environmental Protection, *Water Quality Standards*, October 2013, Hartford, CT.