# *Tenmile River*

## *Watershed Summary*

### WATERSHED DESCRIPTION AND MAPS

The Tenmile River watershed covers an area of approximately 7,081 acres in the mid-eastern area of Connecticut (Figure 1). The Tenmile River watershed is located in the municipalities of Lebanon and Columbia, CT.

The entire length of the Tenmile River is impaired for recreation due to elevated bacteria levels (CT3110-00_01). This river was assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of waterbodies in the watershed (CTDEEP, 2010).

The Tenmile River begins in Lebanon at the outlet to Stiles Pond, flows northeasterly parallel to Clubhouse Road, crosses Tobacco Street and Route 87, follows the Lebanon-Columbia border, and ends at the confluence with the Willimantic River just south of Route 66 at the border meetings of Willimantic, Columbia, and Lebanon.

The Tenmile River has a water quality classification of A. Designated uses include potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. The Tenmile River is impaired due to elevated bacteria concentrations, affecting the designated use of recreation. As there are no designated beaches in the Tenmile River, the specific recreation impairment is for non-designated swimming and other water contact related activities.

**Impaired Segment Facts**

**Impaired Segment:**
Tenmile River (CT3110-00_01)

**Municipalities:**
Lebanon, Columbia

**Impaired Segment Length (miles):**
8.67

**Water Quality Classifications:**
Class A

**Designated Use Impairments:**
Recreation

**Sub-regional Basin Name and Code:** Tenmile River, 3110

**Regional Basin:** Willimantic

**Major Basin:** Thames

**Watershed Area (acres):** 7,081

**MS4 Applicable?** Yes

**Applicable Season:** Recreation Season (May 1 to September 30)

**Figure 1: Watershed location in Connecticut**

**Table 1: Impaired segments and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report**

| Waterbody ID | Waterbody Name | Location | Miles | Aquatic Life | Recreation | Fish Consumption |
|---|---|---|---|---|---|---|
| CT3110-00_01 | Tenmile River (Willimantic)-01 | From mouth at confluence with Willimantic River (south of Route 66), Willimantic, US to Stiles Pond outlet dam, Lebanon. | 8.67 | FULL | NOT | FULL |

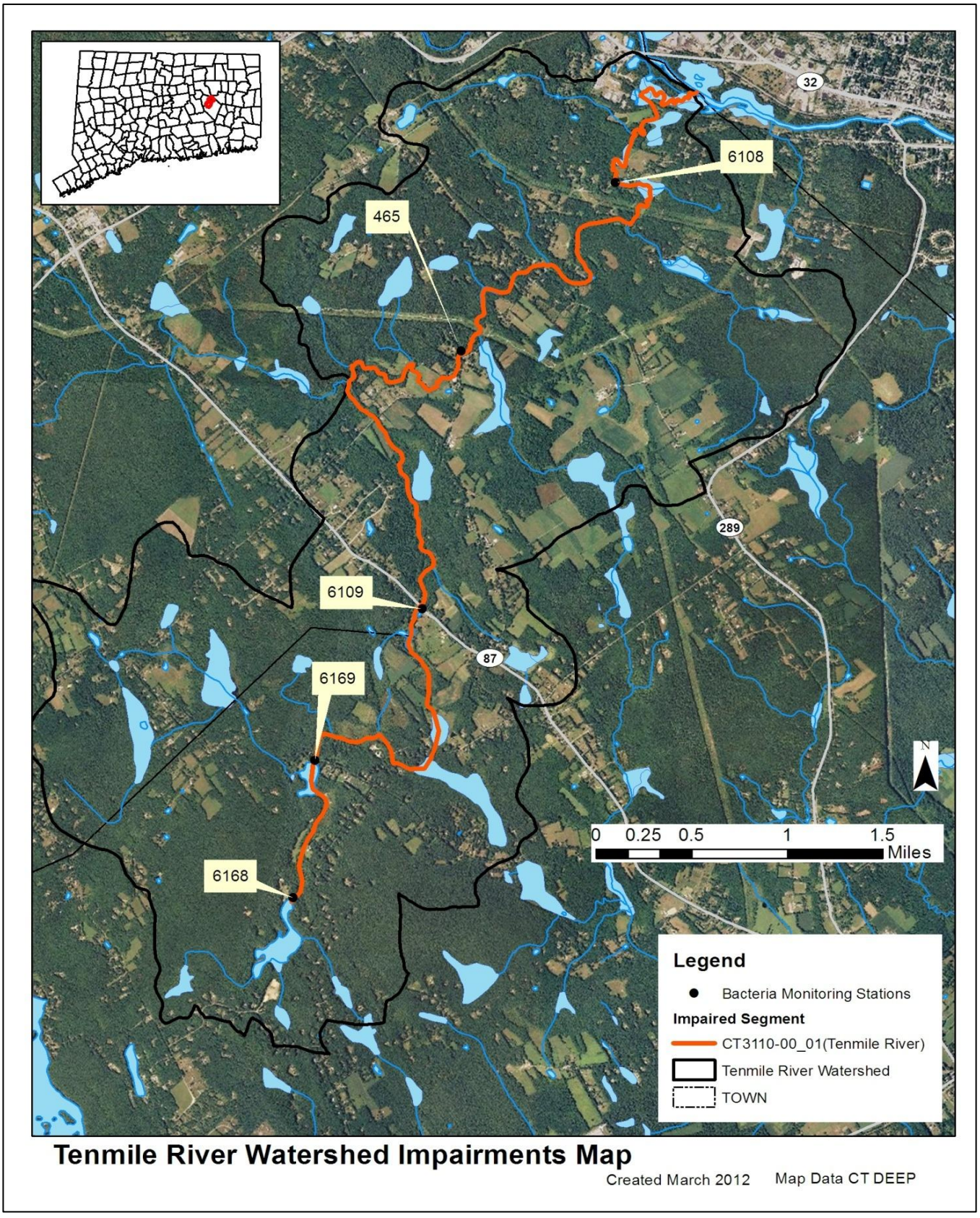
**Shaded cells indicate impaired segment addressed in this TMDL**

**FULL = Designated Use Fully Supported**

**NOT = Designated Use Not Supported**

**U = Unassessed**

**Figure 2: GIS map featuring general information of the Tenmile River watershed at the sub-regional level**



### *Land Use*

Existing land use can affect the water quality of waterbodies within a watershed (USEPA, 2011c). Natural processes, such as soil infiltration of stormwater and plant uptake of water and nutrients, can occur in undeveloped portions of the watershed. As impervious surfaces (such as rooftops, roads, and sidewalks) increase within the watershed landscape from commercial, residential, and industrial development, the amount of stormwater runoff to waterbodies also increases. These waterbodies are negatively affected as increased pollutants from failing and insufficient septic systems, oil and grease from automobiles, and sediment from construction activities become entrained in this runoff. Agricultural land use activities, such as fertilizer application and manure from livestock, can also increase pollutants in nearby waterbodies (USEPA, 2011c).

As shown in Figures 3 and 4, the Tenmile River watershed consists of 64% forest, 16% agriculture, 12% urban, and 8% water land uses. The majority of the Tenmile River flows through a major agricultural sector with forested areas and low intensity development. The agricultural fields include hayfields, row crops, and livestock pads, particularly near Graves and Palmer Ponds and along Cook Hill Road, Synagogue Road, Cards Mill Road, and Kingsley Road. Exposed banks were identified in a hayfield along Synagogue Road. Residential development tends to be concentrated around main roads and Route 87, and increases in intensity near the Willimantic River in Willimantic. Camp Laurel was identified at the headwaters in Stiles Pond with large open lawns extending to the shoreline and a dock with a beach and swimming area.

**Figure 3: Land uses within the Tenmile River watershed**

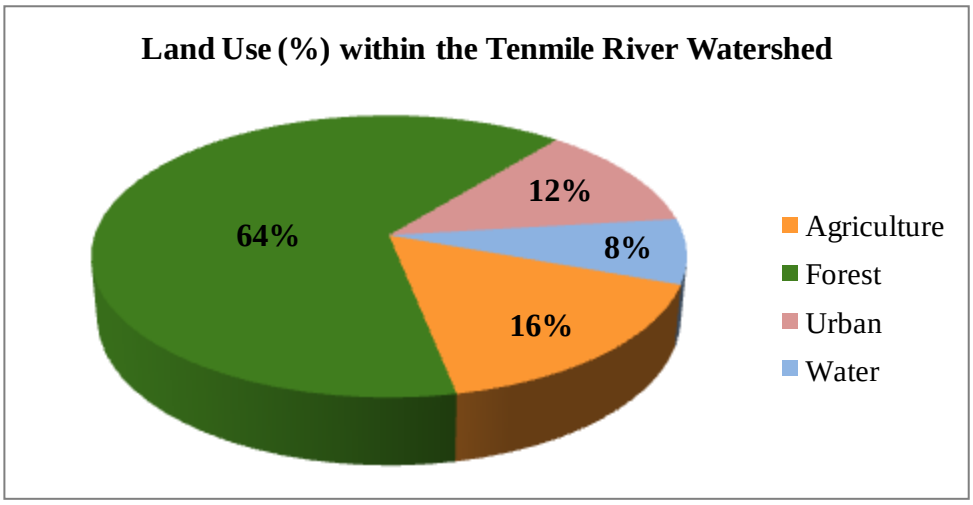
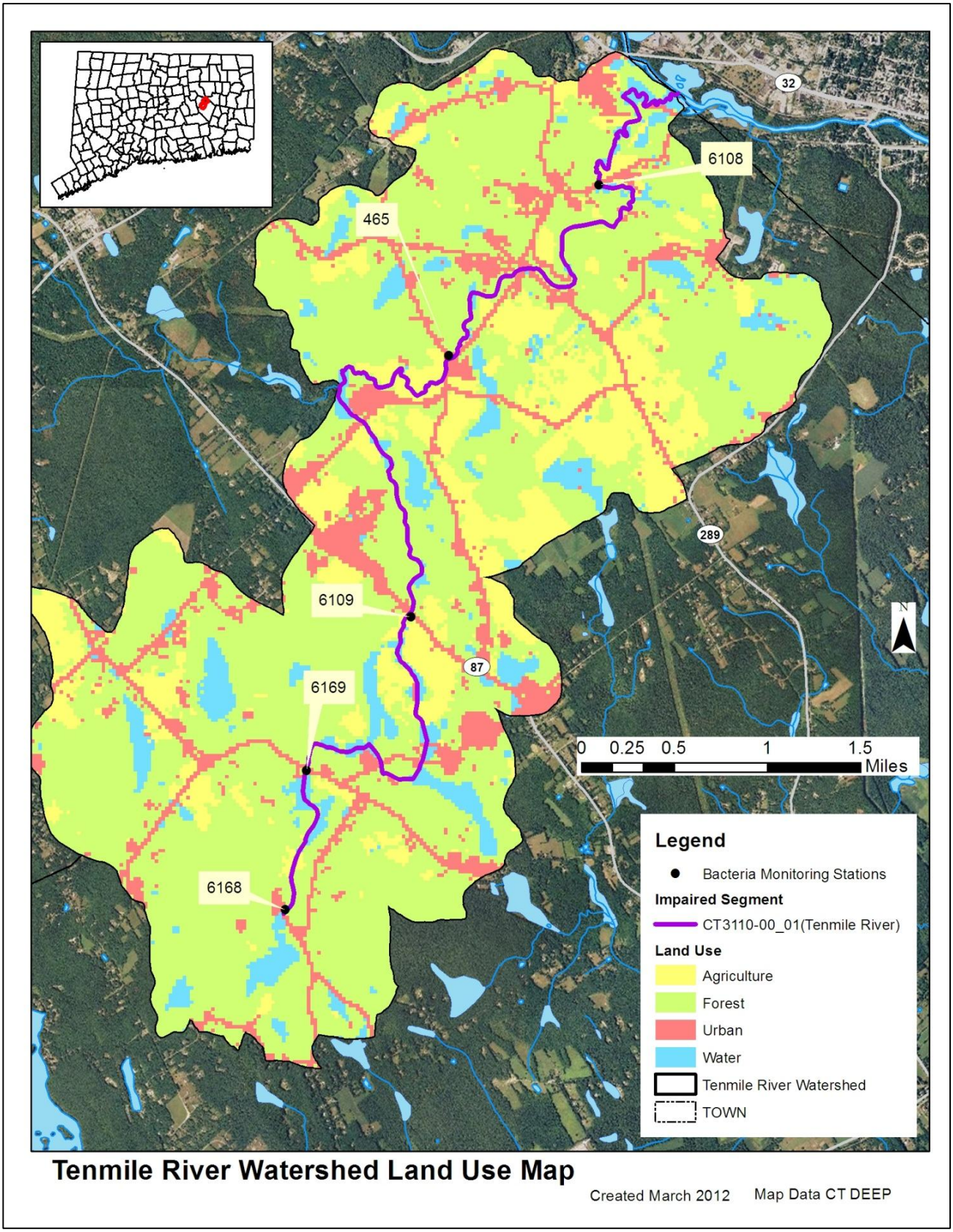


**Figure 4: GIS map featuring land use for the Tenmile River watershed at the sub-regional level**



## WHY IS A TMDL NEEDED?

*E. coli* is the indicator bacteria used for comparison with the CT State criteria in the CT Water Quality Standards (WQS) (CTDEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture, or volunteer monitoring efforts at stations located on the impaired river.

**Table 2: Sampling station location description for the impaired segment in the Tenmile River Watershed (stations organized downstream to upstream)**

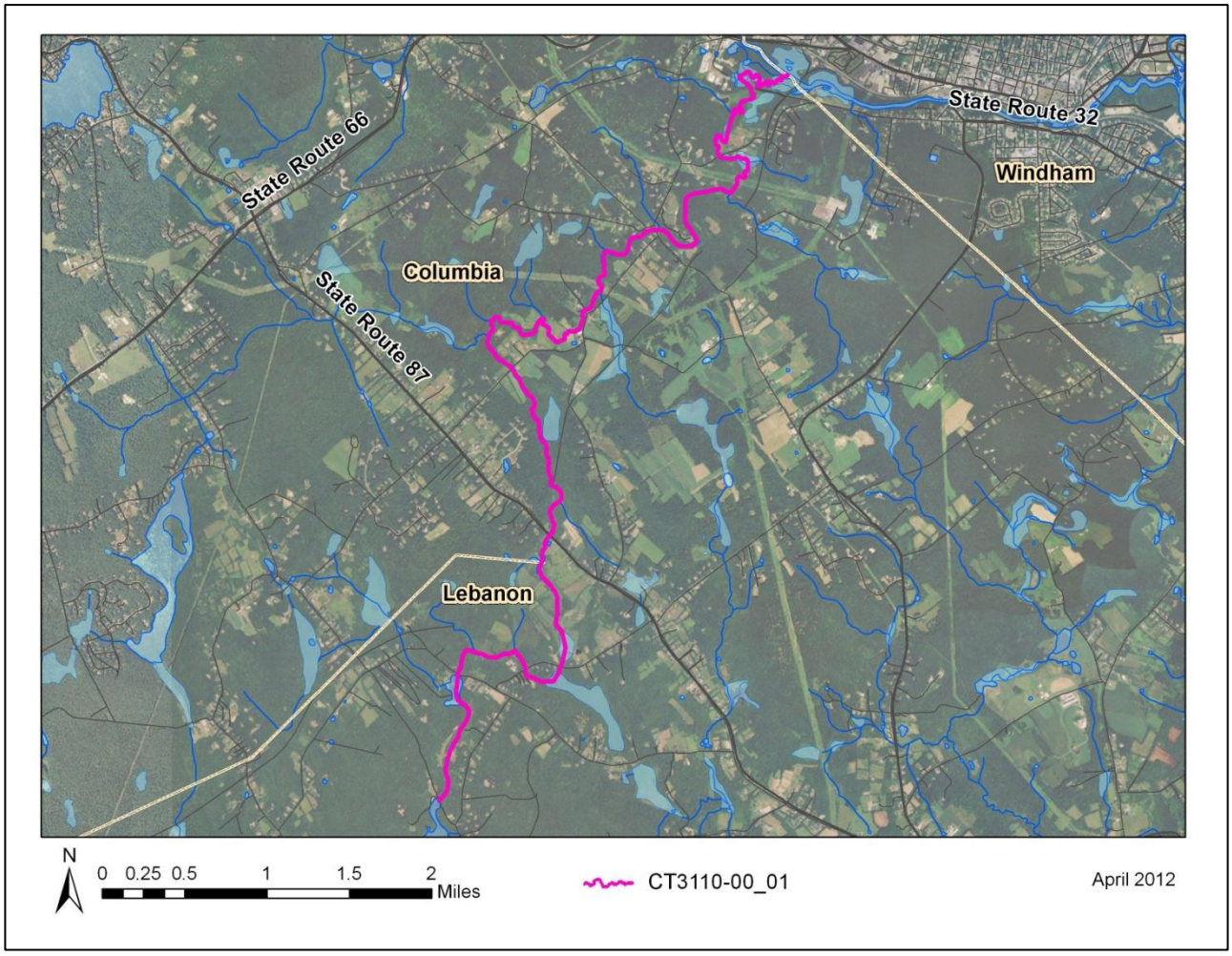
| Waterbody ID | Waterbody Name | Station | Station Description | Municipality | Latitude | Longitude |
|---|---|---|---|---|---|---|
| CT3110-00_01 | Tenmile River | 6108 | At Baker Hill Road crossing | Lebanon | 41.70699 | -72.24752 |
| | | 465 | Jones Road | Lebanon | 41.69373 | -72.263247 |
| | | 6109 | At Route 87 crossing | Lebanon | 41.67343 | -72.26729 |
| | | 6169 | crossing at Tobacco Street | Lebanon | 41.66148 | -72.278235 |
| | | 6168 | downstream of the Stiles Pond impoundment | Lebanon | 41.65067 | -72.280505 |

The Tenmile River (CT3110-00_01) is a Class A freshwater river. Its applicable designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from five sampling locations in 1999 and 2010 (Table 2). To aid in identifying possible bacteria sources, the geometric mean was also calculated for all stations for wet-weather and dry-weather sampling days, where possible (Table 7).

As shown in Table 7, geometric mean and single sample values exceeded the WQS for *E. coli* at Stations 6108 and 6109 in 2010. Geometric mean values also exceeded the WQS for *E. coli* at Stations 6108 and 6109 during wet-weather.

Due to the elevated bacteria measurements presented in Table 7, this impaired segment does not meet CT's bacteria WQS, was identified as impaired, and was placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. 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 to comply with State WQS.

**Figure 5: Aerial map of the Tenmile River watershed**



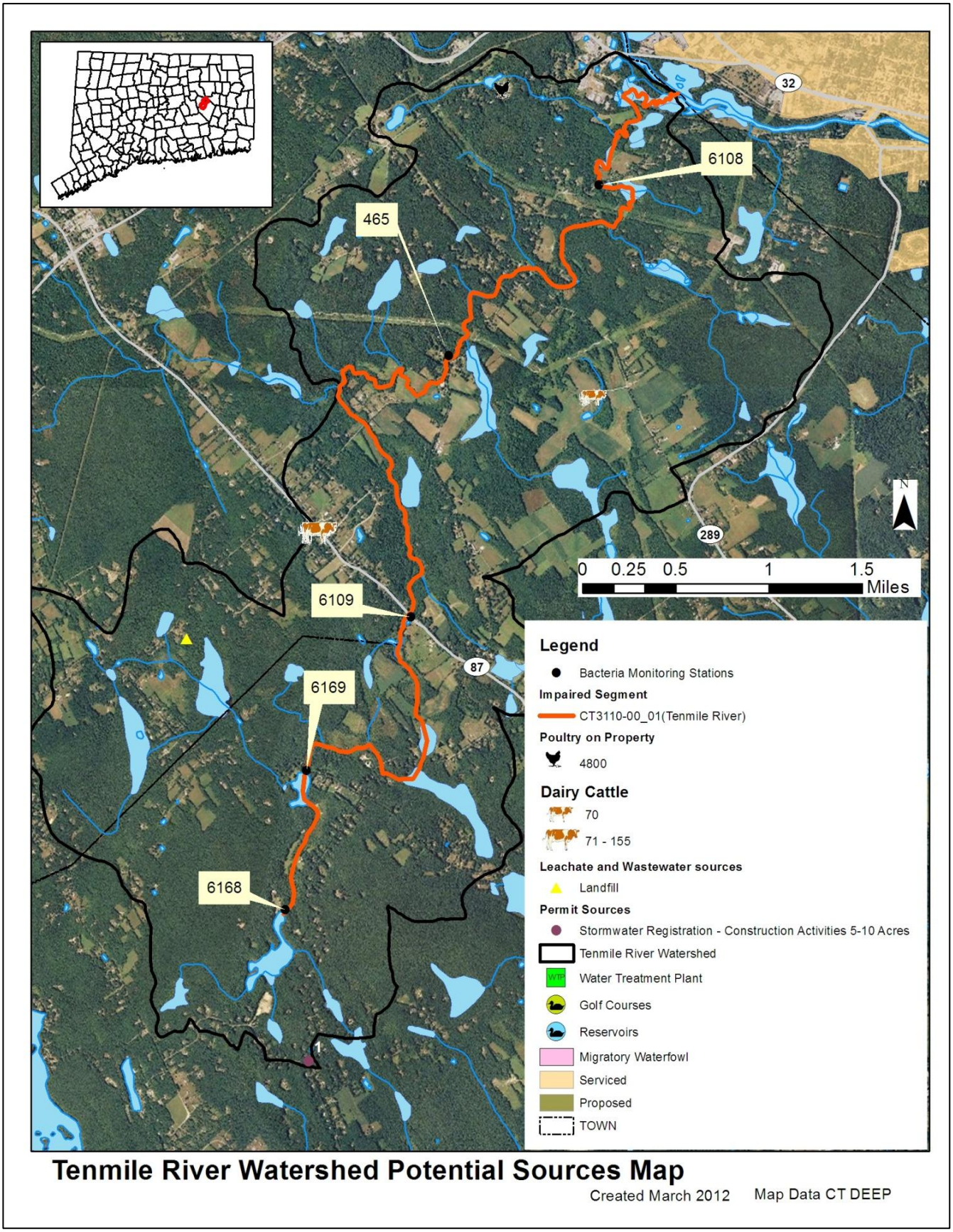
## POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), illicit discharges, and inappropriate discharges to the waterbody. Potential sources that have been tentatively identified in the Tenmile River watershed based on land use (Figures 3 and 4) and a collection of local information for each of the waterbodies is presented in Table 3 and Figure 9. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segment. Further monitoring and investigation will confirm listed sources and discover additional ones. For some segments, there are data from permitted sources, and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

**Table 3: Potential bacteria sources in the Tenmile River watershed**

| Impaired Segment | Permit Source | Illicit Discharge | CSO/SSO Issue | Failing Septic System | Agricultural Activity | Stormwater Runoff | Nuisance Wildlife/Pets | Other |
|---|---|---|---|---|---|---|---|---|
| Tenmile River CT3110-00_01 | x | | | x | x | x | x | x |

**Figure 6: Potential sources in the Tenmile River watershed at the sub-regional level**



The potential sources map for the impaired basin was developed after thorough analysis of available data sets. If information is not displayed in the map, then no sources were discovered during the analysis. The following is the list of potential sources that were evaluated: problems with migratory waterfowl, golf course locations, reservoirs, proposed and existing sewer service, cattle farms, poultry farms, permitted sources of bacteria loading (surface water discharge, MS4 permit, industrial stormwater, commercial stormwater, groundwater permits, and construction related stormwater), and leachate and discharge sources (agricultural waste, CSOs, failing septic systems, landfills, large septic tank leach fields, septage lagoons, sewage treatment plants, and water treatment or filter backwash).

## Point Sources

Permitted sources within the watershed that could potentially contribute to the bacteria loading are identified in Table 4. This table includes permit types that may or may not be present in the impaired watershed. Additional investigation and monitoring could reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type.

**Table 4: General categories list of other permitted discharges**

| Permit Code | Permit Description Type | Number in watershed |
|---|---|---|
| CT | Surface Water Discharges | 0 |
| GPL | Discharge of Swimming Pool Wastewater | 0 |
| GSC | Stormwater Discharge Associated with Commercial Activity | 0 |
| GSI | Stormwater Associated with Industrial Activity | 0 |
| GSM | Part B Municipal Stormwater MS4 | 0 |
| GSN | Stormwater Registration – Construction | 1 |
| LF | Groundwater Permit (Landfill) | 0 |
| UI | Underground Injection | 0 |

### *Permitted Sources*

As shown in Table 5, there is one permitted discharge in the Tenmile River watershed located far upstream of the impaired segment. Bacteria data were not available for this permitted facility. Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4 permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit. Besides the municipal stormwater sources described below, there are no known permitted discharge points in the Latimer Brook watershed.

**Table 5: Permitted facilities within the Tenmile River watershed**

| Town | Client | Permit ID | Permit Type | Site Name | Address | Map # |
|---|---|---|---|---|---|---|
| Lebanon | Town of Lebanon | GSN002088 | Stormwater Registration - Construction Activities 5-10 Acres | Tyler Field | Bascom Road | 1 |

***Municipal Stormwater Permitted Sources***

Per the EPA Phase II Stormwater rule all municipal storm sewer systems (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate State agency. There is an EPA waiver process that municipalities can apply for to not participate in the MS4 program. In Connecticut, EPA has granted such waivers to 19 municipalities. All participating municipalities within UAs in Connecticut are currently regulated under MS4 permits by CT DEEP staff in the MS4 program.

The US Census Bureau defines a UA as a densely settled area that has a census population of at least 50,000. A UA generally consists of a geographic core of block groups or blocks that exceeds the 50,000 people threshold and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place. (67 FR 11663)

For the 2000 Census a new geographic entity was created to supplement the UA blocks of land. This created a block known as an Urban Cluster (UC) and is slightly different than the UA. The definition of a UC is a densely settled area that has a census population of 2,500 to 49,999. A UC generally consists of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. A UC consists of all or part of one or more incorporated places and/or census designated places; such a place(s) together with adjacent territory; or territory outside of any place. The major difference is the total population cap of 49,999 people for a UC compared to >50,000 people for a UA. (67 FR 11663)

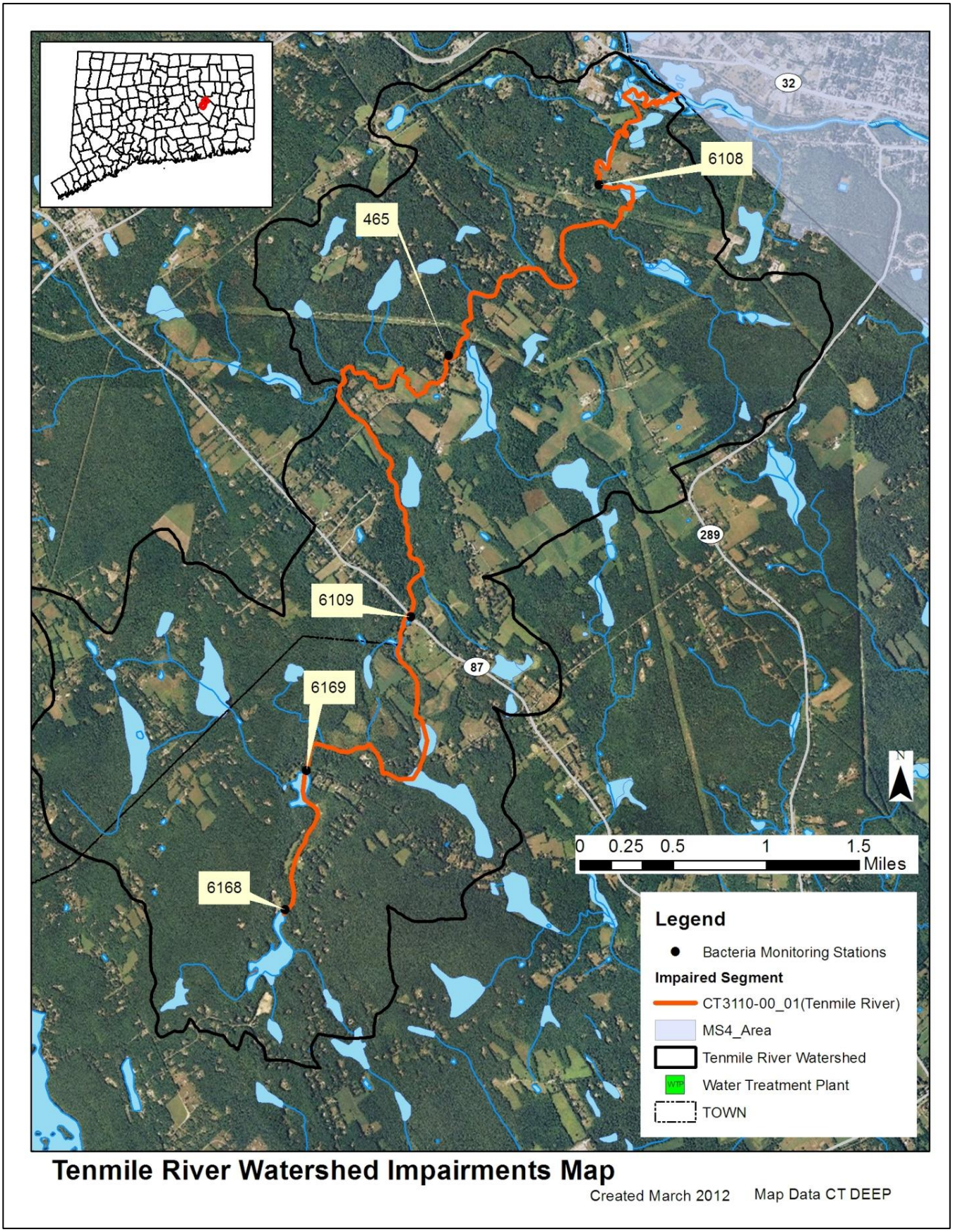
While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some municipalities that appear to be within an MS4 program that are not currently regulated through an MS4 permit. This oversight can explain a municipality that is at least partially shaded grey in the maps and there are no active MS4 reporting materials or information included in the appropriate appendix. While these areas are not technically in the MS4 permit program, they are still considered urban by the cluster definition above and are likely to contribute similar stormwater discharges to affected waterbodies covered in this TMDL.

As previously noted, EPA can grant a waiver to a municipality to preclude their inclusion in the MS4 permit program. One reason a waiver could be granted is a municipality with a total population less than 1000 people, even if the municipality was located in a UA. There are 19 municipalities in Connecticut that have received waivers, this list is: Andover, Bozrah, Canterbury, Coventry, East Hampton, Franklin, Haddam, Killingworth, Litchfield, Lyme, New Hartford, Plainfield, Preston, Salem, Sherman, Sprague, Stafford, Washington, and Woodstock. There will be no MS4 reporting documents from these towns even if they are displayed in an MS4 area in the maps of this document.

The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, Willimantic, Winsted, and the border area with Westerly, RI (67 FR 11663). Any MS4 maps showing these municipalities may show grey areas that are not currently regulated by the CT DEEP MS4 permit program.

The impaired segment of the Tenmile River watershed is located within the Towns of Lebanon and Columbia, CT. Neither town is largely urbanized, as defined by the U.S. Census Bureau, and are not required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by CT DEEP (Figure 7). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit requires municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants and protect water quality. The MS4 permit is discussed further in the "TMDL Implementation Guidance" section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

**Figure 7: MS4 areas of the Tenmile River watershed**



### *Publicly Owned Treatment Works*

As shown in Figure 7, there are no publicly owned treatment works (POTWs), or wastewater treatment plants, in the Tenmile River watershed, and therefore, POTWS are not a potential source of bacterial contamination.

## Non-point Sources

Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with land-use practices. Examples of NPS that can contribute bacteria to surface waters include insufficient septic systems, pet and wildlife waste, agriculture, and contact recreation (swimming or wading). Potential sources of NPS within the Tenmile River watershed are described below.

### *Agricultural Activities*

Agricultural operations are an important economic activity and landscape feature in many areas of the State. Runoff from agricultural fields may contain pollutants such as bacteria and nutrients (USEPA, 2011a). There are livestock farms and agricultural fields scattered throughout the Tenmile River watershed, some of which are adjacent to the Tenmile River, particularly near Graves and Palmer Ponds and along Route 87, Cook Hill Road, Synagogue Road, Cards Mill Road, and Kingsley Road (Figure 4). Two dairy farms were identified in Figure 6, one of which has 71-155 cattle along Route 87 near Station 6109 and the other approximately 70 cattle off Krause and Village Hill Road upstream of Station 6108. A large chicken farm was also identified in Figure 6 with approximately 4800 chickens off a tributary along Old Willimantic Road near the confluence with the Willimantic River. Agricultural runoff from these farms and others in the area is a potential source of bacteria to the Tenmile River.

### *Wildlife and Domestic Animal Waste*

Wildlife and domestic animals within the Tenmile River watershed represent another potential source of bacteria to the impaired waterbody. Elevated bacteria levels that are due solely to a natural population of wildlife are not subject to the WQS. Any exacerbation of wildlife population sizes or residency times influenced by human activities is subject to the CT WQS and TMDL provisions. With the construction of roads and drainage systems, wildlife waste may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface waterbody. As such, these physical land alterations can exacerbate the impact of natural sources on water quality (USEPA, 2001). As the majority of the watershed is undeveloped, wildlife waste is a potential source of bacteria in the Tenmile River watershed.

There are several areas in the Tenmile River watershed where open spaces like agricultural fields or recreational lands are adjacent to or near the water. Geese and other waterfowl are known to congregate in open areas including recreational fields, agricultural crop fields, and golf courses. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can lead to habitat destruction as a result of overgrazing on wetland and riparian plants.

Much of the residential development in the watershed is located near the impaired segment of the Tenmile River, particularly along the main roads. As such, pet waste may also be contributing to bacterial concentrations in the Tenmile River either from neighborhoods or nearby open spaces, which are popular destinations for pets and their owners.

### *Insufficient Septic Systems and Illicit Discharges*

As shown in Figure 6, the area surrounding the impaired segment of the Tenmile River watershed relies on onsite wastewater treatment systems, such as septic systems. Properly managed septic systems and leach fields have the ability to effectively remove bacteria from waste. If systems are not maintained, waste will not be adequately treated and may result in bacteria reaching nearby surface and ground water. In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient or failing septic systems in a specific municipality. Columbia is part of the Eastern Highlands health district (http://www.ehhd.org). Lebanon has a part-time health director (http://www.lebanontownhall.org/department.htm?id=076acxwe).

### *Stormwater Runoff from Developed Areas*

Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate the soil. Studies have shown a link between the amount of impervious area and water quality conditions in a watershed (CWP, 2003). In one study, researchers correlated the amount of fecal coliform to the percent of impervious cover (Mallin *et al.*, 2000). Although the majority of the Tenmile River watershed is undeveloped with only 0-6% impervious surfaces, approximately 12% of the watershed is considered urban, and this area is concentrated around the impaired segment along the agricultural and residential development of main roads within the watershed (Figures 4, 8, and 9). As shown in Table 8, geometric mean values for wet-weather exceeded the WQS for *E. coli* at Stations 6108 and 6109. As such, stormwater runoff is a likely source of bacterial contamination to the Tenmile River.

**Figure 8: Range of impervious cover (%) in the Tenmile River watershed**

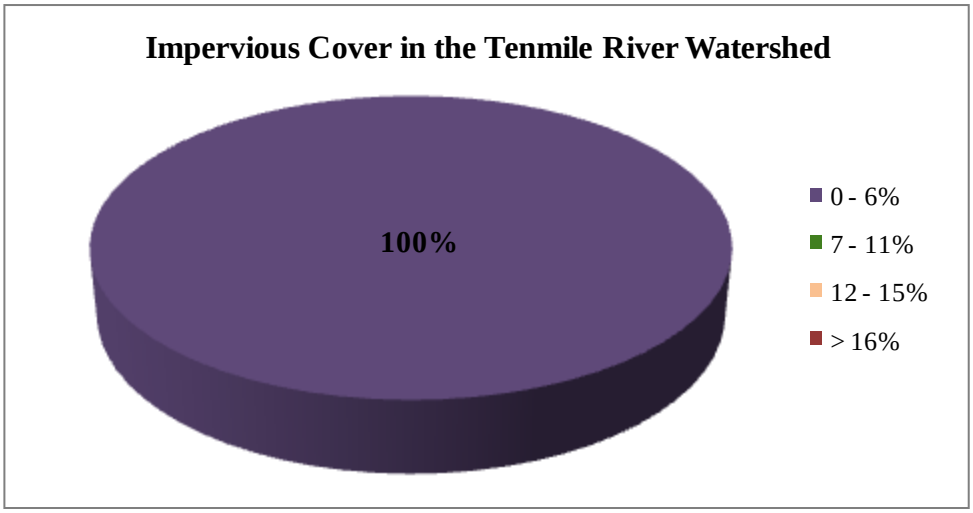
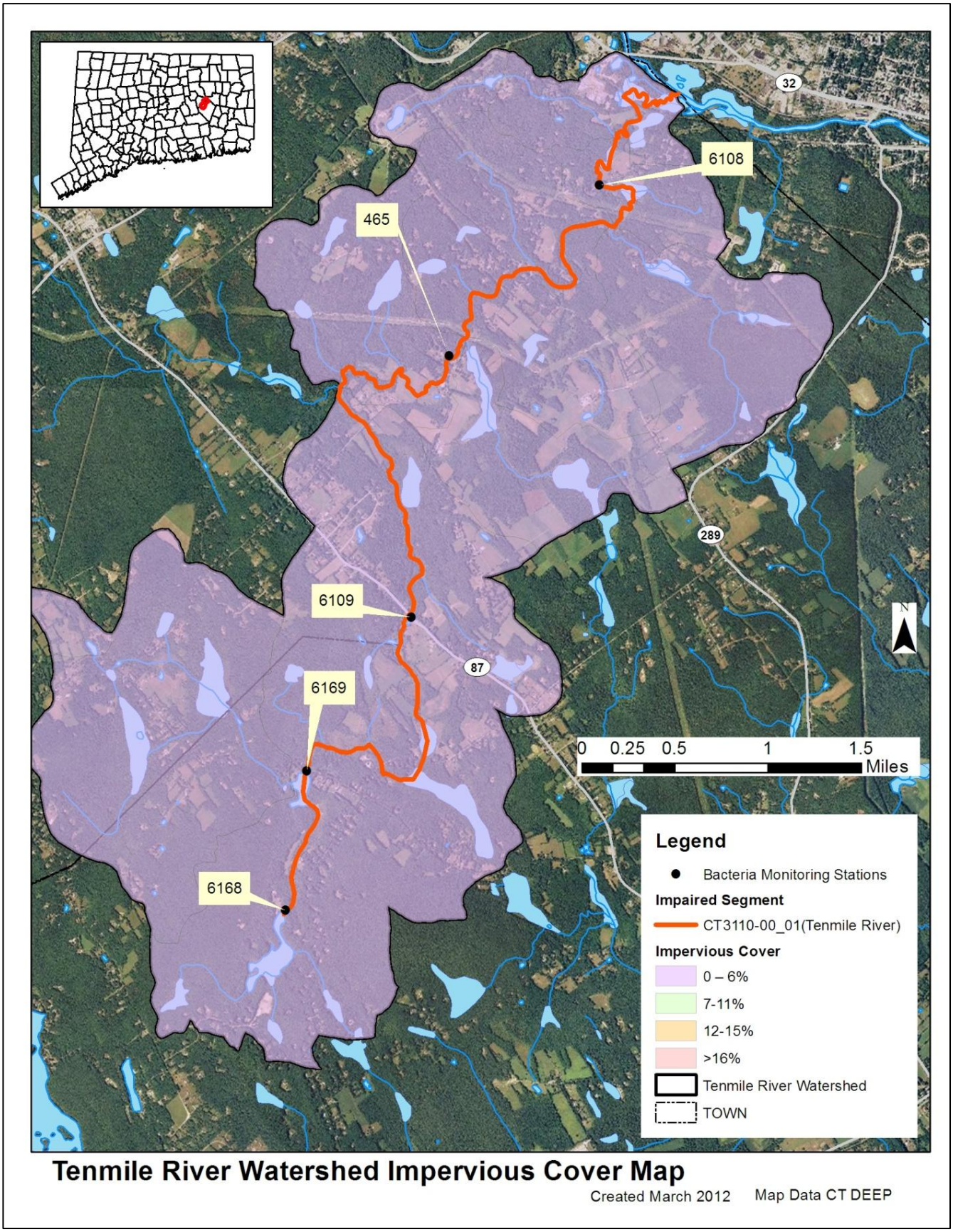


**Figure 9: Impervious cover (%) for the Tenmile River sub-regional watershed**



## Additional Sources

There is one landfill identified in Figure 6 along Giffords Brook, a tributary to the upper portion of the Tenmile River, which may be contributing to the water quality impairment in the Tenmile River. There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment in the Tenmile River watershed. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

## Land Use/Landscape

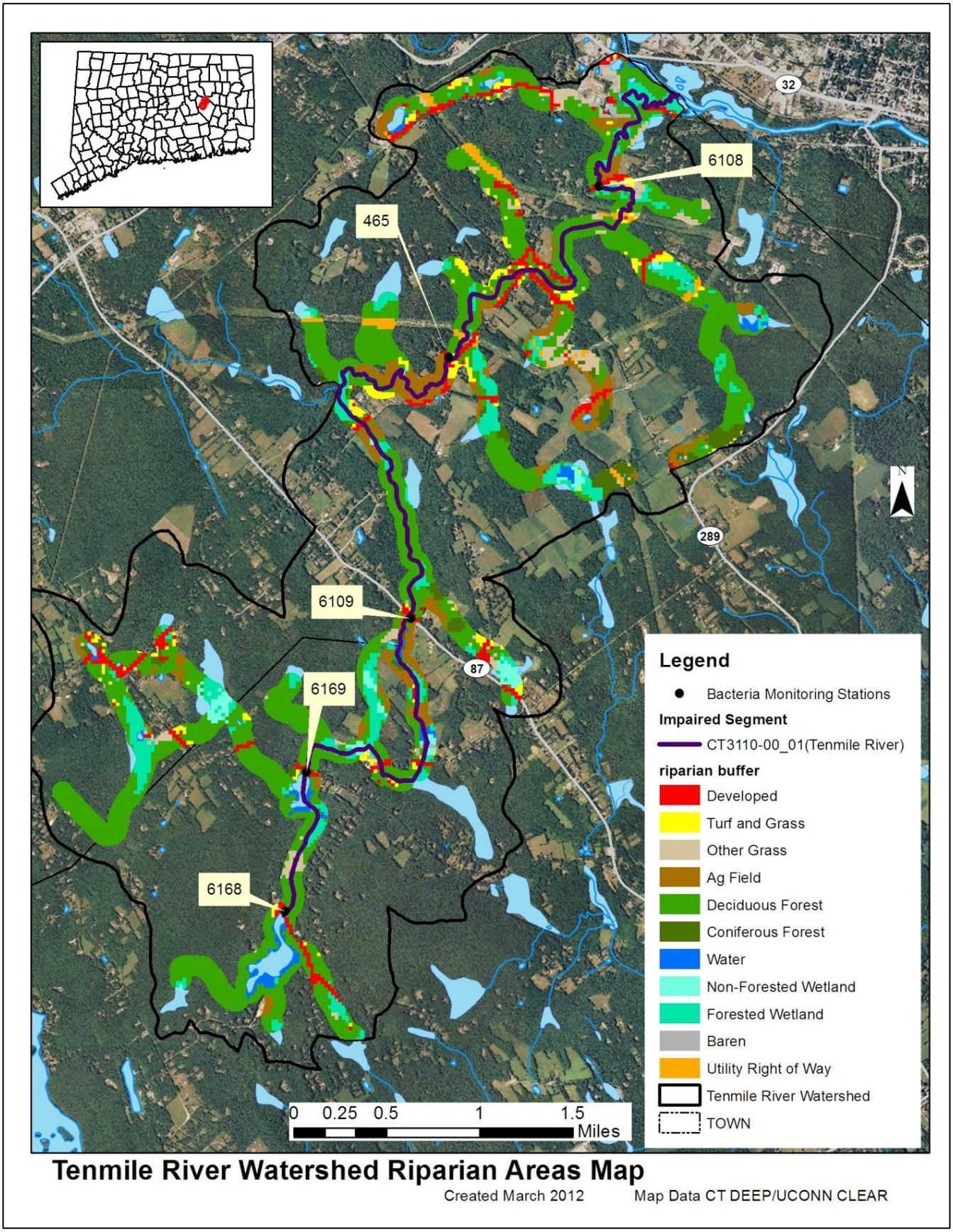
### *Riparian Buffer Zones*

The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The boundary of the riparian zone and the adjoining uplands is gradual and not always well-defined. However, riparian zones differ from the uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. Through the interaction of their unique soils, hydrology, and vegetation, natural riparian areas influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms. Any change to the natural riparian buffer zone can reduce the effectiveness of the natural buffer and has the potential to contribute to water quality impairment (USEPA, 2011b).

The CLEAR program at UCONN has created streamside buffer layers for the entire State of Connecticut (http://clear.uconn.edu/), which have been used in this TMDL. Analyzing this information can reveal potential sources and implementation opportunities at a localized level. The land use directly adjacent to a waterbody can have direct impacts on water quality from surface runoff.

The majority of the riparian zone of the Tenmile River is characterized by forested and agricultural land use with portions of developed and turf/grass areas (Figure 10). As previously noted, waste from unmanaged livestock, pet waste, and septic system malfunction are all likely bacteria sources to the waterbody. Wildlife in non-developed areas can also contribute bacteria to nearby waterbodies, though much of this waste may be treated by natural vegetated buffer.

**Figure 10: Riparian buffer zone information for the Tenmile River watershed**



## RECOMMENDED NEXT STEPS

Future mitigative activities are necessary to ensure the long-term protection of the Tenmile River and have been prioritized below.

### 1) Ensure there are sufficient buffers on agricultural lands along the Tenmile River.

There are several identified agricultural fields, cattle farms, and chicken farms adjacent to the Tenmile River and its tributaries. In addition, exposed banks along the Tenmile River were identified in a hayfield along Synagogue Road and should be prioritized for riparian buffer restoration. If not already in place, agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict livestock and horse access to streams and wetlands, and that animal waste handling, disposal, and other appropriate Best Management Practices (BMPs) are in place. Particular attention should be paid to those agricultural operations located within the riparian buffer zone of the Tenmile River (Figure 10).

### 2) Evaluate municipal education and outreach programs regarding animal waste.

As most of the Tenmile River watershed is undeveloped with sections of agricultural areas and residential neighborhoods, any education and outreach program should highlight the importance of not feeding waterfowl and wildlife and managing waste from horses, dogs, and other pets. The town and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of the Tenmile River that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. Any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairment in the Tenmile River watershed and can harm human health and the environment.

In addition, a seasonal camp with open grassed lawns and a swimming area was identified at the headwaters of the Tenmile River at Stiles Pond. As such, human and animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of human and animal waste on water quality include installing signage, providing pet waste receptacles in high-use areas, enacting ordinances requiring the clean-up of waste, and targeting educational and outreach programs in problem areas.

### 3) Develop a system to monitor septic systems.

All residents of the Tenmile River watershed rely on septic systems. If not already in place, the watershed towns should establish a program to ensure that existing septic systems are properly operated and maintained. For instance, communities can create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of sub-standard systems within a reasonable timeframe could also be adopted. Towns can develop programs to assist citizens with the replacement and repair of older and failing systems.

**4) Identify areas in the Tenmile River watershed to implement Best Management Practices (BMPs) to control stormwater runoff.**

As noted previously, 12% of the Tenmile River watershed is considered urban, particularly along main roads, and two stations exceeded geometric mean values during wet-weather. As such, stormwater runoff is likely contributing bacteria to the waterbody. To identify other areas that are contributing bacteria to the impaired segment, the towns should conduct wet-weather sampling at high impact areas that discharge directly to the impaired segment in the Tenmile River watershed. Areas that show high bacteria concentrations should be prioritized for BMP installation. To treat stormwater runoff, the towns should identify areas along developed sections of the impaired river to install BMPs that encourage stormwater to infiltrate the ground before entering the waterbody. These BMPs would disconnect impervious areas and reduce pollutant loads to the river. More detailed information and BMP recommendations can be found in the core TMDL document.

**5) Expand monitoring of permitted sources.**

There is one permitted source identified in Figure 6 in the Tenmile River watershed located upstream of the Tenmile River. Further monitoring will provide information essential to better locate, understand, and reduce pollution sources. If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of permit required, and voluntary measures to identify and reduce sources of bacterial contamination at the facility are an additional recommendation. Regular monitoring should be established for all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

Section 6(k) of the MS4 General Permit requires a municipality to modify their Stormwater Management Plan to implement the TMDL within four months of TMDL approval by EPA if stormwater within the municipality contributes pollutant(s) in excess of the allocation established by the TMDL. For discharges to impaired waterbodies, the municipality must assess and modify the six minimum measures of its plan, if necessary, to meet TMDL standards. Particular focus should be placed on the following plan components: public education, illicit discharge detection and elimination, stormwater structures cleaning, and the repair, upgrade, or retrofit of storm sewer structures. The goal of these modifications is to establish a program that improves water quality consistent with TMDL requirements. Modifications to the Stormwater Management Plan in response to TMDL development should be submitted to the Stormwater Program of DEEP for review and approval.

Table 6 details the appropriate bacteria criteria for use as waste load allocations established by this TMDL for use as water quality targets by permittees as permits are renewed and updated, within the Tenmile River Watershed.

For any municipality subject to an MS4 permit and affected by a TMDL, the permit requires a modification of the SMP to include BMPs that address the included impairment. In the case of bacteria related impairments municipal BMPs could include: implementation or improvement to existing nuisance wildlife programs, septic system monitoring programs, any additional measures that can be added to the required illicit discharge detection and elimination (IDDE) programs, and increased street sweeping above basic permit requirements. Any non-MS4 municipalities can implement these same types of initiatives in effort to reduce bacteria source loading to impaired waterways.

Any facilities that discharge non-MS4 regulated stormwater should update their Pollution Prevention Plan to reflect BMPs that can reduce bacteria loading to the receiving waterway. These BMPs could include nuisance wildlife control programs and any installations that increase surface infiltration to reduce overall stormwater volumes. Facilities that are regulated under the Commercial Activities Stormwater Permit should report any updates to their SMP in their summary documentation submitted to DEEP.

**Table 6. Bacteria (e.coli) TMDLS, WLAs, and LAs for Recreational Use**

| | | Instantaneous *E. coli* (#/100mL) | | | | | | Geometric Mean *E. coli* (#/100mL) | |
|---|---|---|---|---|---|---|---|---|---|
| **Class** | **Bacteria Source** | **WLA[6]** | | | **LA[6]** | | | **WLA[6]** | **LA[6]** |
| | **Recreational Use** | 1 | 2 | 3 | 1 | 2 | 3 | **All** | **All** |
| A | Non-Stormwater NPDES | 0 | 0 | 0 | | | | 0 | |
| | CSOs | 0 | 0 | 0 | | | | 0 | |
| | SSOs | 0 | 0 | 0 | | | | 0 | |
| | Illicit sewer connection | 0 | 0 | 0 | | | | 0 | |
| | Leaking sewer lines | 0 | 0 | 0 | | | | 0 | |
| | Stormwater (MS4s) | 235[7] | 410[7] | 576[7] | | | | 126[7] | |
| | Stormwater (non-MS4) | | | | 235[7] | 410[7] | 576[7] | | 126[7] |
| | Wildlife direct discharge | | | | 235[7] | 410[7] | 576[7] | | 126[7] |
| | Human or domestic animal direct discharge[5] | | | | 235 | 410 | 576 | | 126 |

(1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.

(2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.

(3) **All Other Recreational Uses.**

(4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)

(5) Human direct discharge = swimmers

(6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(7) Replace numeric value with “natural levels” if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

## BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

### Table 7: Tenmile River Bacteria Data

***Waterbody ID:*** CT3110-00_01

***Characteristics:*** Freshwater, Class A, Potential Drinking Water Supplies, Habitat for Fish and Other Aquatic Life and Wildlife, Recreation, Navigation, and Industrial and Agricultural Water Supply

***Impairment:*** Recreation (*E. coli bacteria)*

***Water Quality Criteria for E. coli:***

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

***Percent Reduction to meet TMDL:***

Geometric Mean: **39%**

Single Sample: **80%**

***Data:*** 1999, 2010 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

**Single sample data from all monitoring stations on the Tenmile River with annual geometric means calculated**

| Station Name | Station Location | Date | Result | Wet/Dry | Geomean |
|---|---|---|---|---|---|
| 465 | Jones Road | 10/26/1999 | 31† | dry | NA |
| 465 | Jones Road | 3/1/2000 | 10 | dry | 80 |
| 465 | Jones Road | 5/17/2000 | 230 | dry | |
| 465 | Jones Road | 8/22/2000 | 220 | dry | |

**Single sample data from all monitoring stations on the Tenmile River with annual geometric means calculated (continued)**

| Station Name | Station Location | Date | Result | Wet/Dry | Geomean |
|---|---|---|---|---|---|
| 6108 | At Baker Hill Road crossing | 4/27/2010 | 97 | wet | 201 |
| 6108 | At Baker Hill Road crossing | 5/5/2010 | 52 | dry | |
| 6108 | At Baker Hill Road crossing | 5/11/2010 | 20 | dry | |
| 6108 | At Baker Hill Road crossing | 5/18/2010 | 10 | dry | |
| 6108 | At Baker Hill Road crossing | 5/25/2010 | 31 | dry | |
| 6108 | At Baker Hill Road crossing | 6/1/2010 | 98 | dry | |
| 6108 | At Baker Hill Road crossing | 6/8/2010 | 200 | dry | |
| 6108 | At Baker Hill Road crossing | 6/15/2010 | 110 | dry | |
| 6108 | At Baker Hill Road crossing | 6/22/2010 | 120 | dry | |
| 6108 | At Baker Hill Road crossing | 6/29/2010 | 270 | wet | |
| 6108 | At Baker Hill Road crossing | 7/6/2010 | 800 | dry | |
| 6108 | At Baker Hill Road crossing | 7/13/2010 | 500 | dry | |
| 6108 | At Baker Hill Road crossing | 7/20/2010 | 750 | wet | |
| 6108 | At Baker Hill Road crossing | 7/27/2010 | 620 | dry | |
| 6108 | At Baker Hill Road crossing | 8/3/2010 | 780 | unknown | |
| 6108 | At Baker Hill Road crossing | 8/10/2010 | 540 | unknown | |
| 6108 | At Baker Hill Road crossing | 8/17/2010 | **2000* (80%)** | unknown | |
| 6108 | At Baker Hill Road crossing | 8/24/2010 | 610 | unknown | |
| 6108 | At Baker Hill Road crossing | 8/31/2010 | 200 | unknown | |
| 6108 | At Baker Hill Road crossing | 9/7/2010 | 170 | unknown | |
| 6108 | At Baker Hill Road crossing | 9/14/2010 | 320 | unknown | |
| 6108 | At Baker Hill Road crossing | 9/21/2010 | 98 | unknown | |
| 6108 | At Baker Hill Road crossing | 9/28/2010 | 430 | unknown | |

**Single sample data from all monitoring stations on the Tenmile River with annual geometric means calculated (continued)**

| Station Name | Station Location | Date | Result | Wet/Dry | Geomean |
|---|---|---|---|---|---|
| 6109 | At Route 87 crossing | 4/27/2010 | 63 | wet | **205* (39%)** |
| 6109 | At Route 87 crossing | 5/5/2010 | 52 | dry | |
| 6109 | At Route 87 crossing | 5/11/2010 | 31 | dry | |
| 6109 | At Route 87 crossing | 5/18/2010 | 20 | dry | |
| 6109 | At Route 87 crossing | 5/25/2010 | 98 | dry | |
| 6109 | At Route 87 crossing | 6/1/2010 | 20 | dry | |
| 6109 | At Route 87 crossing | 6/8/2010 | 73 | dry | |
| 6109 | At Route 87 crossing | 6/15/2010 | 63 | dry | |
| 6109 | At Route 87 crossing | 6/22/2010 | 210 | dry | |
| 6109 | At Route 87 crossing | 6/29/2010 | 550 | wet | |
| 6109 | At Route 87 crossing | 7/6/2010 | 770 | dry | |
| 6109 | At Route 87 crossing | 7/13/2010 | 990 | dry | |
| 6109 | At Route 87 crossing | 7/20/2010 | 1400 | wet | |
| 6109 | At Route 87 crossing | 7/27/2010 | 160 | dry | |
| 6109 | At Route 87 crossing | 8/3/2010 | 150 | unknown | |
| 6109 | At Route 87 crossing | 8/10/2010 | **2000* (80%)** | unknown | |
| 6109 | At Route 87 crossing | 8/17/2010 | 170 | unknown | |
| 6109 | At Route 87 crossing | 8/24/2010 | 320 | unknown | |
| 6109 | At Route 87 crossing | 8/31/2010 | 160 | unknown | |
| 6109 | At Route 87 crossing | 9/7/2010 | 370 | unknown | |
| 6109 | At Route 87 crossing | 9/14/2010 | 570 | unknown | |
| 6109 | At Route 87 crossing | 9/21/2010 | 1200 | unknown | |
| 6109 | At Route 87 crossing | 9/28/2010 | 650 | unknown | |
| 6169 | crossing at Tobacco Street | 7/27/2010 | 20 | dry | 29 |
| 6169 | crossing at Tobacco Street | 8/3/2010 | 41 | unknown | |
| 6168 | downstream of the Stiles Pond impoundment | 7/27/2010 | 10 | dry | 10 |
| 6168 | downstream of the Stiles Pond impoundment | 8/3/2010 | 10 | unknown | |

**Shaded cells indicate an exceedance of water quality criteria**

**†Average of two duplicate samples**

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

**Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for all monitoring stations on the Tenmile River**

| Station Name | Station Location | Years Sampled | Number of Samples | | Geometric Mean | | |
|---|---|---|---|---|---|---|---|
| | | | Wet | Dry | All | Wet | Dry |
| 465 | Jones Road | 1999-2000 | 0 | 4 | 63 | NA | 63 |
| 6108 | At Baker Hill Road crossing | 2010 | 3 | 11 | 130 | 270 | 107 |
| 6109 | At Route 87 crossing | 2010 | 3 | 11 | 129 | 365 | 97 |
| 6169 | crossing at Tobacco Street | 2010 | 0 | 1 | 20 | NA | NA |
| 6168 | downstream of the Stiles Pond impoundment | 2010 | 0 | 1 | 10 | NA | NA |

**Shaded cells indicate an exceedance of water quality criteria**

**Weather condition determined from rain gages at Norwich Public Utility Plant in Norwich, CT.**

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