



# Mattabesset River Watershed Summary

## East Branch Willow Brook

### WATERSHED DESCRIPTION AND MAPS

The Mattabesset River watershed covers an area of approximately 24,845 acres in central Connecticut (Figure 1). There are multiple municipalities located at least partially in the watershed, including Cromwell, Rocky Hill, Berlin, and Southington, CT.

The Mattabesset River watershed includes one segment, East Branch Willow Brook (CT4600-27\_trib\_01), impaired for recreation due to elevated bacteria levels. This segment was assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. Some segments in the watershed are currently unassessed as of the writing of this document. This does not suggest that there are no issues on these segments, but indicates a lack of current data to evaluate the segments as part of the assessment process. An excerpt of the Integrated Water Quality Report is included in Table 1 (CT DEEP, 2010).

The impaired segment of East Branch Willow Brook begins in Cromwell west of Route 3 and east of Sovereign Ridge Road, flows southwest, and ends at the confluence with Willow Brook just downstream of the Evergreen Road crossing. The impaired segment is 0.76 miles long and is located entirely within the Town of Cromwell.

The impaired segment of East Branch Willow Brook has a water quality classification of A. Designated uses include potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. As there are no designated beaches in the East Branch Willow Brook, the specific recreation impairment is for non-designated swimming and other water contact related activities.

All segments in Table 1 listed as not supporting for recreation and not addressed in this document were included in the Mattabesset Regional TMDL from May 2005. The 2005 report can be viewed and downloaded at this web address: [http://www.ct.gov/dep/lib/dep/water/tmdl/tmdl\\_final/mattbasintmdlfinal.pdf](http://www.ct.gov/dep/lib/dep/water/tmdl/tmdl_final/mattbasintmdlfinal.pdf).

### Impaired Segment Facts

#### **Impaired Segments:**

East Branch Willow Brook  
(CT4600-27\_trib\_01)

#### **Town:**

Cromwell

#### **Impaired Segments and Lengths**

(miles): CT4600-27\_trib\_01 (0.76)

#### **Water Quality Classifications:**

Class A

#### **Designated Use Impairments:**

Recreation

#### **Sub-regional Basin Name and**

**Code:** Mattabesset River, 4600

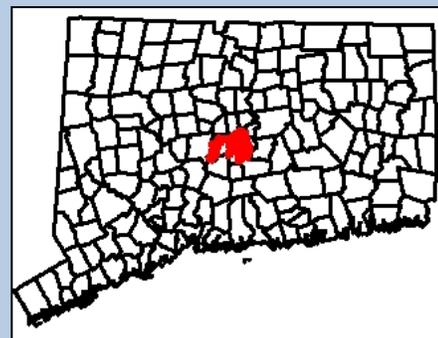
**Regional Basin:** Mattabesset River

**Major Basin:** Connecticut

**Watershed Area (acres):** 24,845

**MS4 Applicable?** No

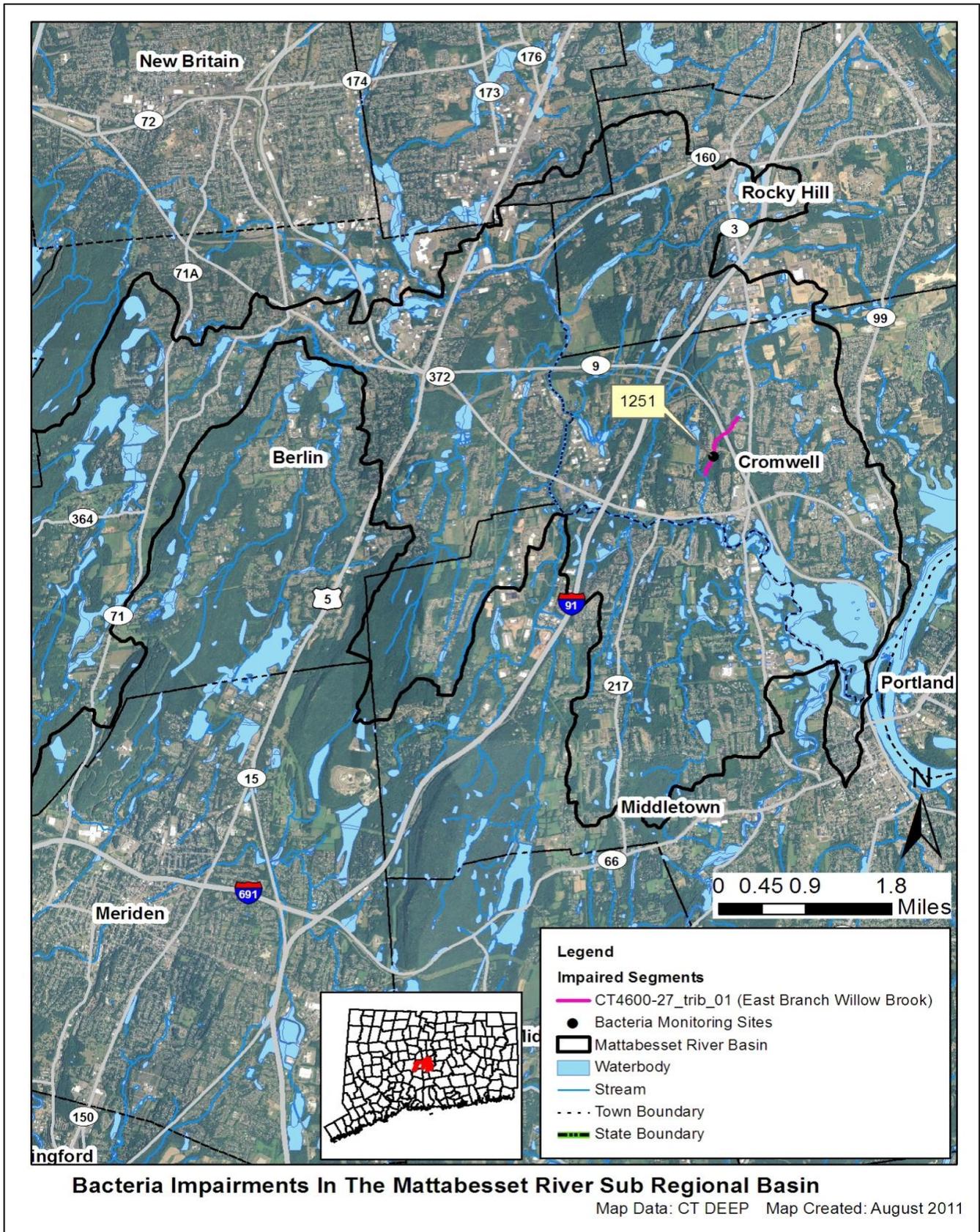
**Figure 1: Watershed location in Connecticut**



**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
CT4600-27_trib_01	East Branch Willow Brook-01	From mouth at confluence with Willow brook (DS of Evergreen Road crossing), US to headwaters (in marsh US of Route 9 crossing, along west side of Shunpike Road (Route 3) area), Cromwell.	0.76	U	NOT	FULL
CT4600-27_01	Willow Brook (Cromwell)-01	From mouth at confluence with Mattabeset River (DS of Berlin Road (Route 372) crossing, US to headwaters, just US of Coles Road crossing (near junction of Coles Road and Willow Brook Road), Cromwell.	1.38	U	NOT	FULL
CT4600-00_01	Mattabeset River-01	From mouth at Connecticut River, Cromwell, US to Route 3 crossing (south of Route 372 intersection).	3.31	U	NOT	FULL
CT4600-00_02	Mattabeset River-02	From Route 3 crossing, Cromwell and Middletown Town line, US to High Pond Dam (just US of Berlin Street crossing), East Berlin.	3.65	NOT	NOT	FULL
CT4600-00_03	Mattabeset River-03	From High Pond Dam just US of Berlin Street crossing, East Berlin, US to confluence with Willow Brook.	3.6	NOT	NOT	FULL
CT4600-00_04	Mattabeset River-04	From confluence with Willow Brook, US to Kensington Dam at outlet of Railroad Pond (just US of Kensington Road crossing), Berlin.	2.83	NOT	NOT	FULL
CT4600-00_05	Mattabeset River-05	From Kensington Dam at outlet of Railroad Pond (just US of Kensington Road crossing), Berlin, US to inlet of Paper Goods Pond (segment includes both ponds).	1.01	NOT	U	FULL
CT4600-00_06	Mattabeset River-06	From inlet to Paper Goods Pond, US to Lower Hart Pond outlet dam (Both Lower and Upper Hart Ponds are not in segment).	1.32	NOT	NOT	FULL
CT4600-00_07	Mattabeset River-07	From inlet to Upper Hart Pond (Both Lower and Upper Hart Ponds are not in segment), US to Wasel Reservoir inlet dam (segment includes Smith Brothers Pond).	1.6	U	U	FULL
<p><b>Shaded cells indicate impaired segment addressed in this TMDL</b>  <b>FULL = Designated Use Fully Supported</b>  <b>NOT = Designated Use Not Supported</b>  <b>U = Unassessed</b></p>						

Figure 2: GIS map featuring general information of the Mattabeset 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 nutrients and bacteria 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 Mattabesset River watershed consists of 35% forest, 46% urban area, 8% water, and 11% agriculture. These land uses pertain to the entire Mattabesset River watershed. The area surrounding the impaired segment of the East Branch Willow Brook is dominated by urban and forested land uses. The impaired segment is near two large roadways. It begins just west of Route 3 (Shunpike Road) and flows under Route 9 (Chester Bowles Highway). There appear to be multiple subdivisions that have replaced agricultural and forested lands in the recent past along the impaired segment’s course.

**Figure 3: Land use within the Mattabesset River watershed**

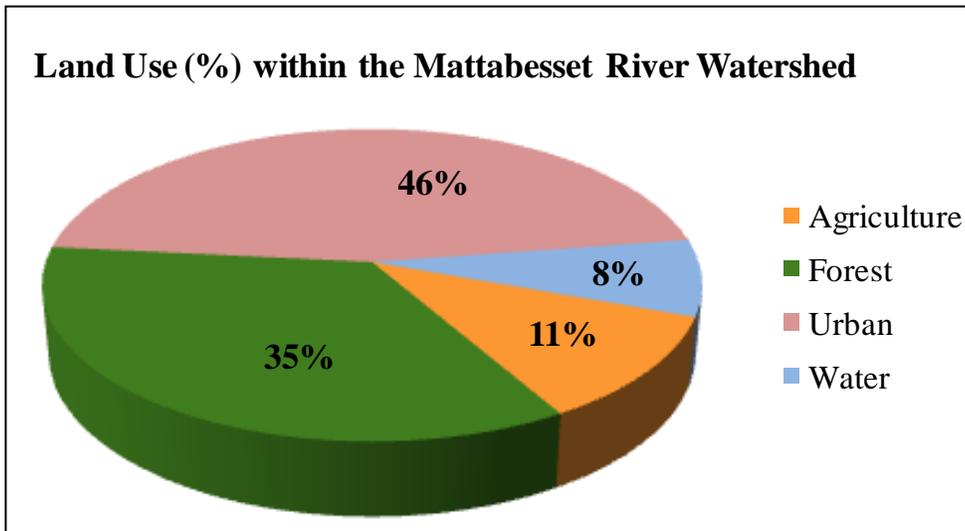
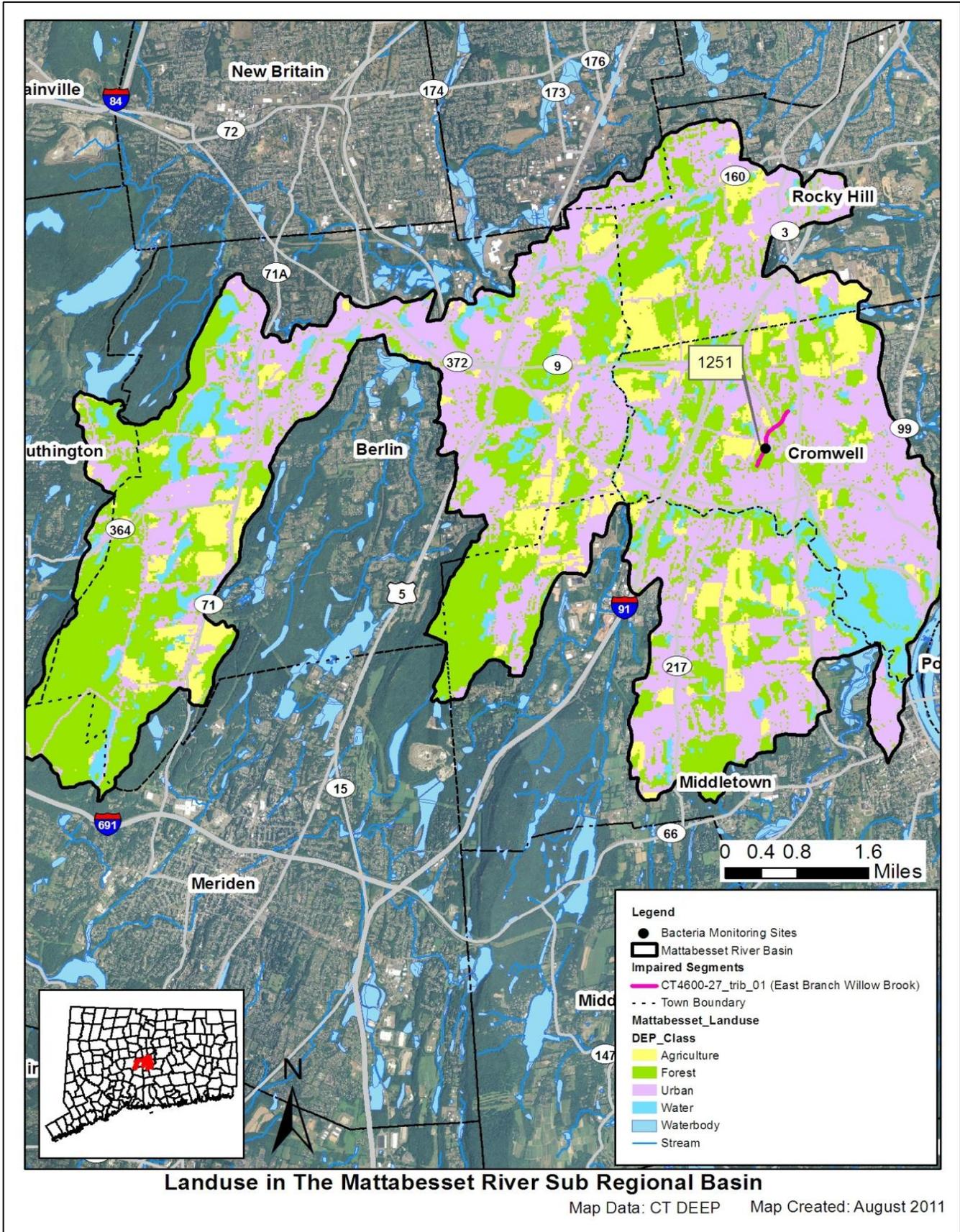


Figure 4: GIS map featuring land use for the Mattabeset River watershed at the sub-regional level



**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 segments.

**Table 2: Sampling station location description for impaired segments in the Mattabeset River watershed**

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT4600-27_trib_01	East Branch Willow Brook	1251	Evergreen Road	Cromwell	41.611739	-72.682747

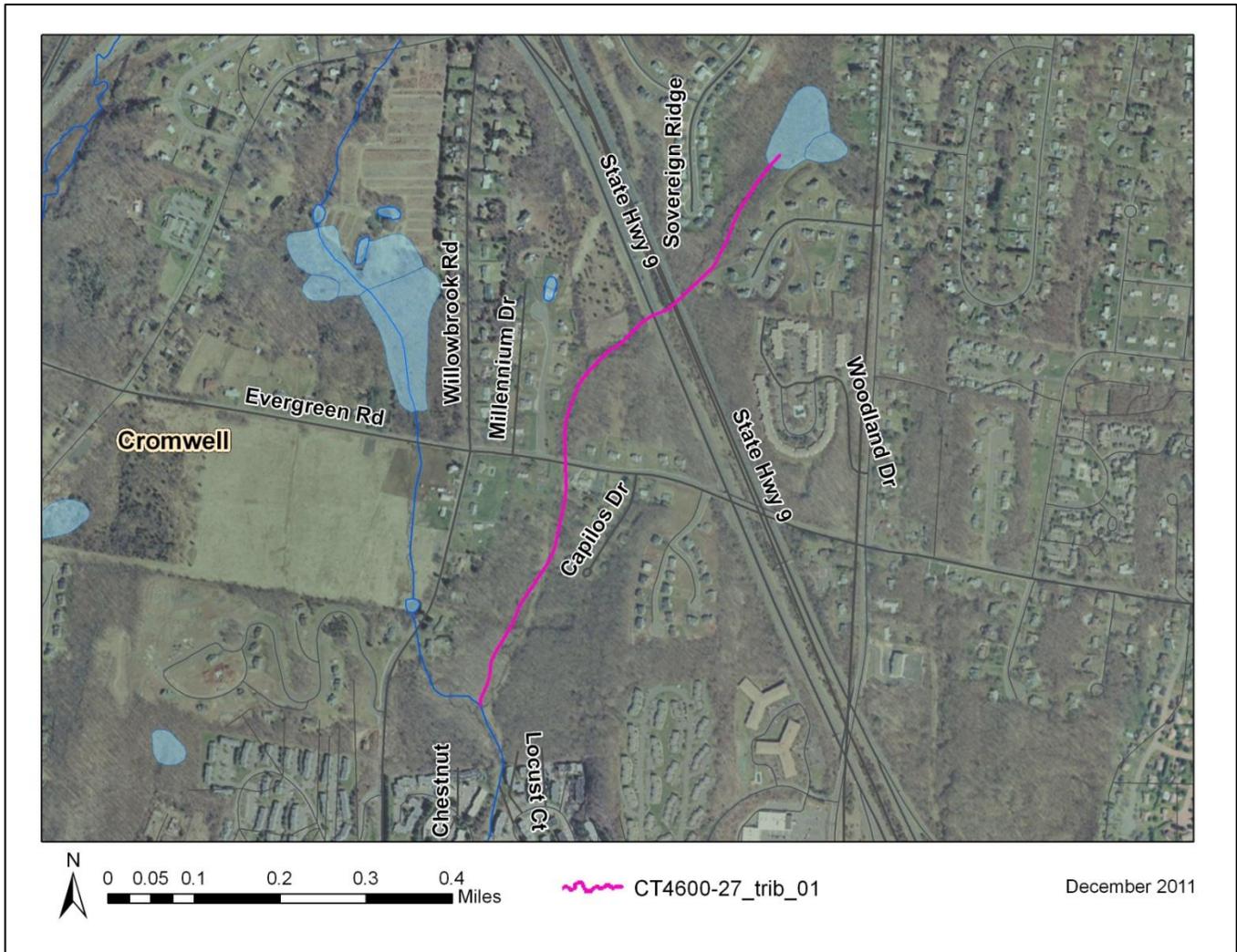
East Branch Willow Brook (CT4600-27\_trib\_01) is a Class A freshwater stream (Figure 5). Its applicable designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location on East Branch Willow Brook (Station 1251) (Table 2).

The water quality criteria for *E. coli*, along with bacteria sampling results in 2002, are presented in Table 9. Single sample values at Station 1251 exceeded the WQS for *E. coli* on both sample dates in 2002, the only sample year. The annual geometric mean was calculated for Station 1251 and exceeded the WQS for *E. coli* in 2002.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for each station for wet-weather and dry-weather sampling days (Table 9). For East Branch Willow Brook, the geometric means during wet and dry-weather could be calculated for Station 1251 due to insufficient data. However, the wet-weather sample taken in 2002 was more than five times greater than dry-weather.

Due to the elevated bacteria measurements presented in Table 9, East Branch Willow Brook's impaired segment did 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 East Branch Willow Brook in the Mattabeset River watershed



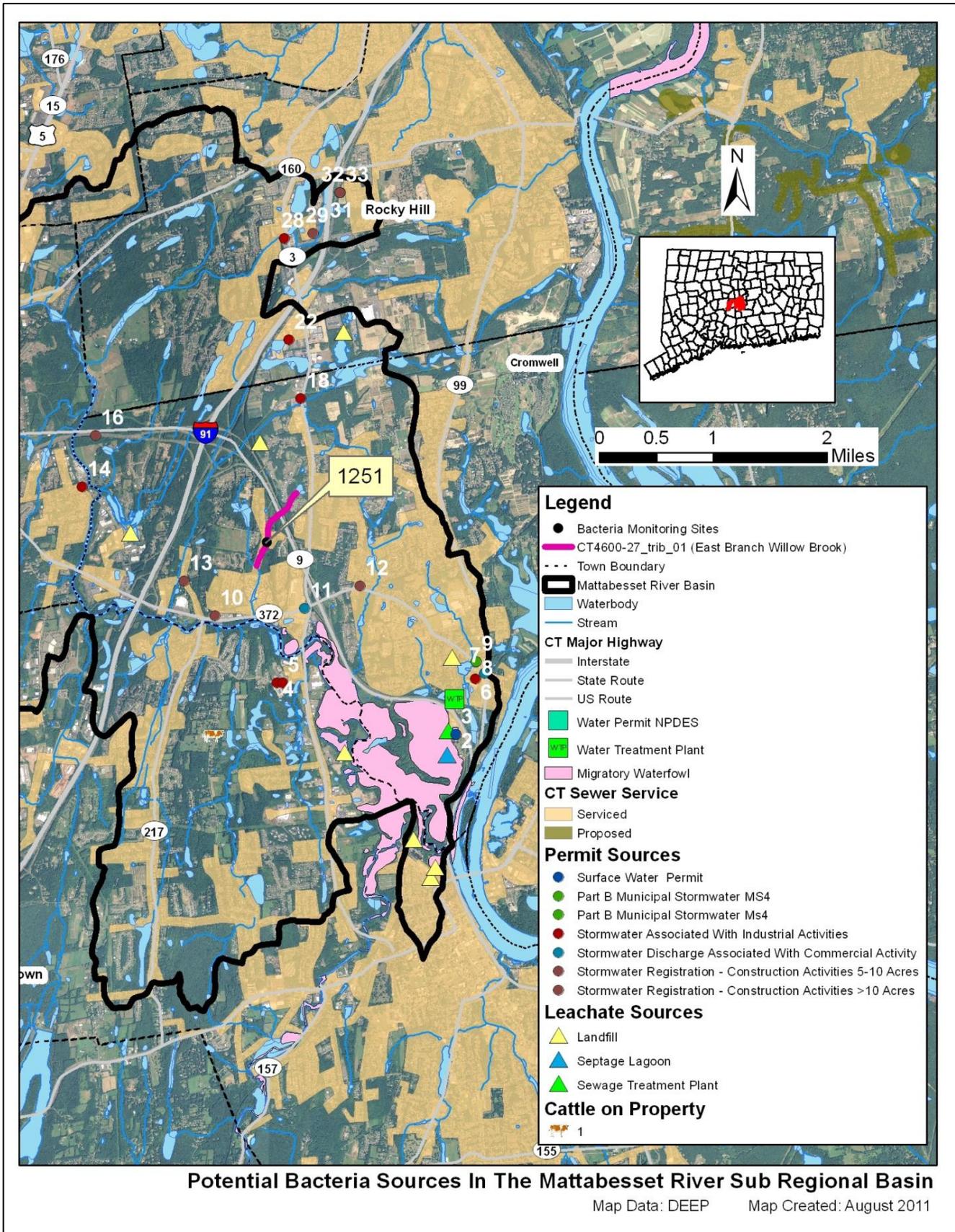
**POTENTIAL BACTERIA SOURCES**

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 watershed based on land use (Figures 3 and 4) and a collection of local information for the impaired waterbody is presented in Table 3 and Figure 6. 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 segments. Further monitoring and investigation will confirm listed sources and discover additional ones. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not suggest that there are no potential issues on this segment, but indicates a lack of current data to evaluate the segment as part of the assessment process. 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 Mattabeset River watershed**

<b>Impaired Segment</b>	<b>Permit Source</b>	<b>Illicit Discharge</b>	<b>CSO/SSO Issue</b>	<b>Failing Septic System</b>	<b>Agricultural Activity</b>	<b>Stormwater Runoff</b>	<b>Nuisance Wildlife/Pets</b>	<b>Other</b>
East Branch Willow Brook CT4600-27_trib_01	<b>x</b>	<b>x</b>		<b>x</b>		<b>x</b>	<b>x</b>	

Figure 6: Potential sources in the Mattabeset 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. A list of active permits in the watershed is included in Table 5. 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. When available, bacteria data results from these permitted sources are listed in Table 6.

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

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	1
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	2
GSI	Stormwater Associated with Industrial Activity	3
GSM	Part B Municipal Stormwater MS4	1
GSN	Stormwater Registration – Construction	4
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	0

***Permitted Sources***

As shown in Table 5, there are multiple permitted discharges in the Mattabesset River watershed. Bacteria data are not currently available for the permitted discharges within Cromwell in the Mattabesset River watershed. However, permitted discharges within Cromwell near the impaired segment of East Branch Willow Brook may be a potential source of bacterial contamination to East Branch Willow Brook. 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.

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

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Cromwell	Town Of Cromwell	GSM000061	Part B Municipal Stormwater Ms4	Cromwell, Town Of	NA (9)
Cromwell	Mattabeset District	GSI001700	Stormwater Associated With Industrial Activities	Mattabeset District, The	2
Cromwell	Town Of Cromwell	GSI001606	Stormwater Associated With Industrial Activities	Cromwell Highway Garage & Facilities	6
Cromwell	Town Of Cromwell	GSI001605	Stormwater Associated With Industrial Activities	Cromwell Transfer Station	18
Cromwell	Wal-Mart Stores East, Lp	GSC000278	Stormwater Discharge Associated With Commercial Activity	Wal-Mart Store #2299	7
Cromwell	The Stop & Shop Supermarket Company Llc	GSC000086	Stormwater Discharge Associated With Commercial Activity	Stop & Shop Store #606	11
Cromwell	Northwoods Of Cromwell, Llc	GSN002083	Stormwater Registration - Construction Activities >10 Acres	Northwoods Estate Subdivision	16
Cromwell	Cobblestone Associates Llc	GSN001668	Stormwater Registration - Construction Activities 5-10 Acres	Cobblestone Plaza	10
Cromwell	Housewright Development, Inc.	GSN001643	Stormwater Registration - Construction Activities 5-10 Acres	West Street Commons	12
Cromwell	Larry Webster	GSN001718	Stormwater Registration - Construction Activities 5-10 Acres	Pond View Subdivision	13
Cromwell	Mattabeset District	CT0100307	Surface Water Permit	Mattabeset District, The	3

### ***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)

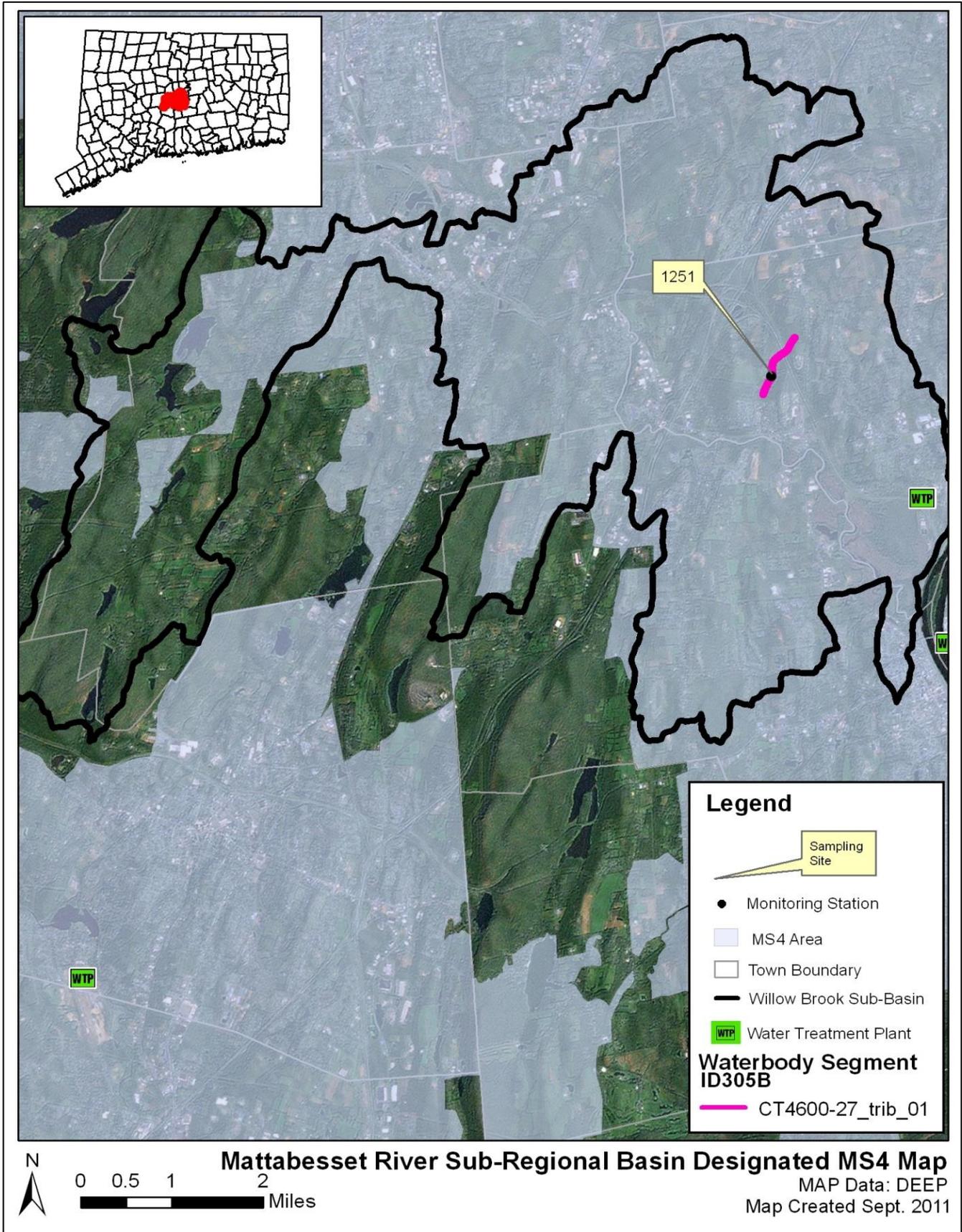
While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some 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 Cromwell. 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 East Branch Willow Brook in the Mattabeset River watershed is located within the Town of Cromwell, CT. Cromwell has designated urban areas, as defined by the U.S. Census Bureau, and is required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the Connecticut Department of Energy and Environmental Protection (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 as well as to 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](http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654)).

Figure 7: MS4 areas of the Mattabeset River watershed



Multiple MS4 outfalls that discharge to the Mattabeset River in Cromwell have been sampled for *E. coli* bacteria (Table 6). In Cromwell, five MS4 outfalls were sampled from 2005 – 2008 for a total of 20 samples. Of these outfalls, all five exceeded the single sample water quality standard of 410 colonies/100 mL on at least one sample date. In all, eight out of 20 (40%) samples exceeded the single sample water quality standard of 410 colonies/100mL. These MS4 outfalls sampled in Cromwell do not discharge directly to the impaired segment of East Branch Willow Brook's impaired segment. However, the results indicate that MS4 outfalls within the watershed are contributing bacteria to the receiving waters.

**Table 6: List of MS4 sample locations and *E. coli* (colonies/100 mL) results in the Housatonic River watershed**

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
Cromwell	Easting/Northing MacDonald's	Commercial	Mattabeset River	11/22/05	125
Cromwell	Easting/Northing MacDonald's	Commercial	Mattabeset River	07/11/06	550
Cromwell	Easting/Northing MacDonald's	Commercial	Mattabeset River	07/18/07	0
Cromwell	Easting/Northing MacDonald's	Commercial	Mattabeset River	06/29/08	4,500
Cromwell	Easting/Northing Sebeth Drive	Industrial	Mattabeset River	11/09/05	0
Cromwell	Easting/Northing Sebeth Drive	Industrial	Mattabeset River	07/11/06	320
Cromwell	Easting/Northing Sebeth Drive	Industrial	Mattabeset River	07/18/07	2,000
Cromwell	Easting/Northing Sebeth Drive	Industrial	Mattabeset River	06/29/08	900
Cromwell	Easting/Northing Stop & Shop	Industrial	Mattabeset River	11/09/05	78
Cromwell	Easting/Northing Stop & Shop	Industrial	Mattabeset River	07/11/06	2,000
Cromwell	Easting/Northing Stop & Shop	Industrial	Mattabeset River	07/18/07	0
Cromwell	Easting/Northing Stop & Shop	Industrial	Mattabeset River	06/29/08	1,300
Cromwell	Easting/Northing Court Street	Residential	Mattabeset River	11/09/05	90
Cromwell	Easting/Northing Court Street	Residential	Mattabeset River	07/11/06	110
Cromwell	Easting/Northing Court Street	Residential	Mattabeset River	07/18/07	0
Cromwell	Easting/Northing Court Street	Residential	Mattabeset River	06/29/08	1,200
Cromwell	Easting/Northing Kristen Lane	Residential	Mattabeset River	11/22/05	66
Cromwell	Easting/Northing Kristen Lane	Residential	Mattabeset River	07/11/06	150
Cromwell	Easting/Northing Kristen Lane	Residential	Mattabeset River	07/18/07	0
Cromwell	Easting/Northing Kristen Lane	Residential	Mattabeset River	06/29/08	450

**Shaded cells indicate an exceedance of single-sample based water quality criteria (410 colonies/100 mL)**

### 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 Mattabeset River watershed are described below.

**Stormwater Runoff from Developed Areas**

Approximately 46% of the watershed is considered urban, and some of that area is concentrated around the impaired segment in the Town of Cromwell (Figure 4). 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 into the soil. Studies have shown a link between increasing impervious cover and degrading water quality conditions in a watershed (CWP, 2003). In one study, researchers correlated the amount of fecal coliform to the percent of impervious cover in a watershed (Mallin *et al.*, 2000).

Approximately 22% of the Mattabeset River watershed is characterized by 0 to 6% impervious cover, 26% is characterized by 7 to 11% impervious cover, 31% is characterized by 12 to 15% impervious cover, and 21% is characterized by >16% (Figure 8). The entire area surrounding the impaired segment of East Branch Willow Brook is characterized by 12 to 15% impervious cover (Figure 9). There are also several areas with impervious surfaces close to the East Branch Willow Brook’s impaired segment. Route 3 is near the upstream terminus of the impaired segment and Route 9 crosses the brook. These large roadways could potentially convey large amounts of stormwater runoff to the brook during storm events. The proximity of some impervious surfaces to East Branch Willow Brook indicate that stormwater runoff from developed areas are a potential source of bacterial contamination.

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

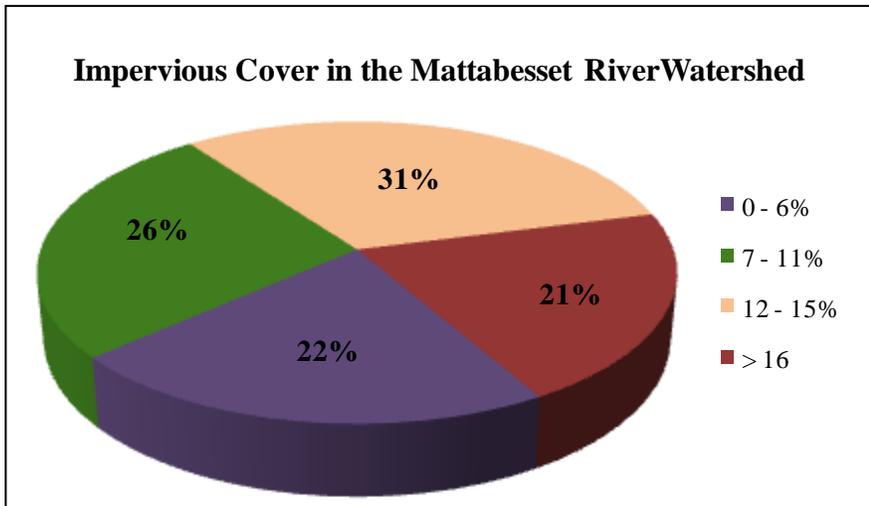
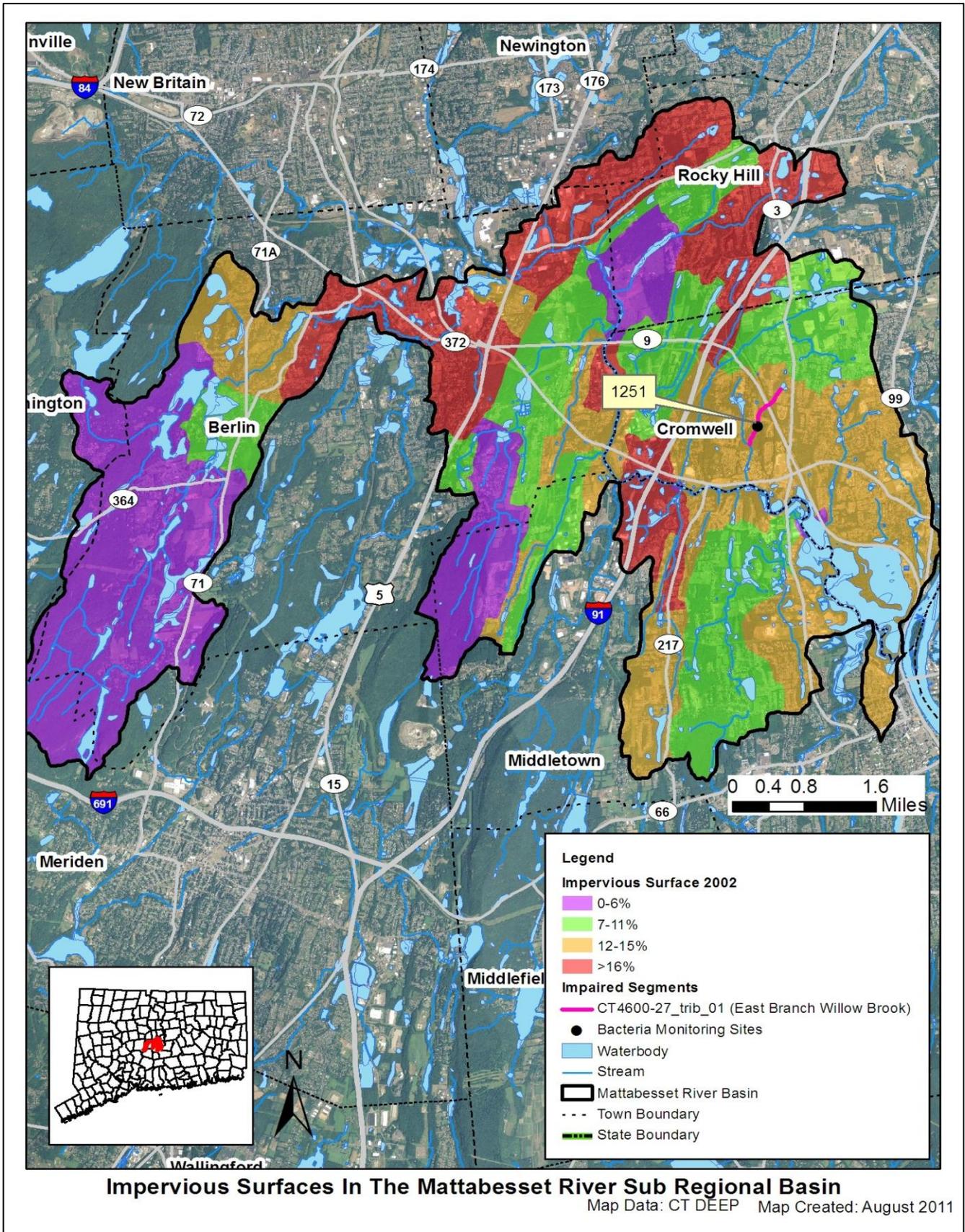


Figure 9: Impervious cover (%) for the Mattabesset River sub-regional watershed



### *Insufficient Septic Systems and Illicit Discharges*

As shown in Figure 6, businesses and residents in areas without sanitary sewer service rely on onsite wastewater treatment systems, such as septic systems. Insufficient or failing septic systems can be significant sources of bacteria by allowing raw waste to reach surface waters. 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. The Town of Cromwell has a full time health director located in the Municipal Center (<http://www.cromwellct.com/>).

There are multiple areas within the watershed with access to a sanitary sewer. Several subdivisions close to the East Branch Willow Brook have access to a sanitary sewer. Sewer system leaks and other illicit discharges that are located within the watershed of East Branch Willow Brook may be contributing bacteria to this waterbody.

### *Wildlife and Domestic Animal Waste*

Wildlife and domestic animals within the Mattabeset River watershed represent a potential source of bacteria. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. These physical land alterations can exacerbate the impact of natural sources on water quality (USEPA, 2001).

Open spaces located along the impaired segments may provide an area for waterfowl to congregate. Geese and other waterfowl are known to congregate in open areas including recreational fields, golf courses, and agricultural crop fields. 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 also lead to habitat destruction as a result of overgrazing on wetland and riparian plants. These factors make wildlife waste a potential source of bacteria to the impaired segment of East Branch Willow Brook in the Mattabeset River watershed.

Residential development surrounds much of East Branch Willow Brook's impaired segment (Figure 5). When not disposed properly, waste from domestic animals such as dogs and horses can enter surface waters directly or through stormwater infrastructure. Therefore, domestic animal waste may be contributing to bacteria concentrations in the impaired segment of East Branch Willow Brook.

### *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). This runoff can include pollutants from farm practices such as storing manure, allowing livestock to wade in nearby waterbodies, applying fertilizer, and reducing the width of vegetated buffer along the shoreline. Agricultural land use makes up 11% of the Mattabeset River watershed (Figure 4). It does not appear as though there are any active agricultural operations near the impaired segment of East Branch Willow Brook. Some agricultural fields near the brook may have been converted to subdivisions. However, agricultural lands in other areas of the watershed may be carrying pollutants, including bacteria, into other waters within the Mattabeset River watershed.

### **Additional Sources**

There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment in East Branch Willow Brook. 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**

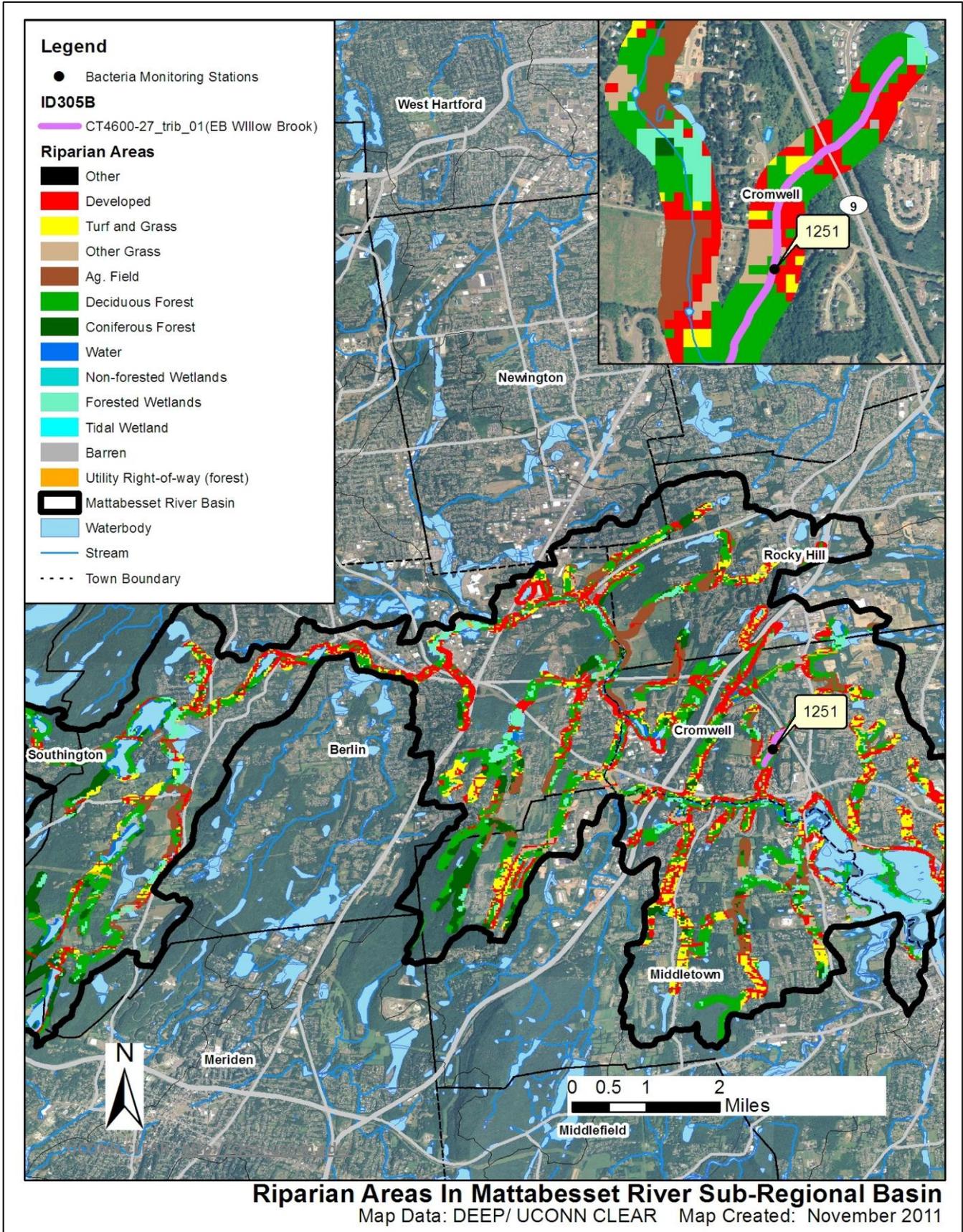
#### ***Riparian Buffer Zones***

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 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 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 sources.

The riparian zone for East Branch Willow Brook's impaired segment is dominated by developed, grassed, and forested areas (Figure 10). Developed areas within the riparian zone likely contribute pollutants such as bacteria to the waterbody since the natural riparian buffer is not available to treat runoff. Grassed areas within the riparian zone provide a place for waterfowl and other wildlife to congregate. As previously mentioned, developed and grassed areas, especially when within the riparian zone, can be sources of bacterial contamination.

Figure 10: Riparian buffer zone information for the Mattabeset River watershed



**CURRENT MANAGEMENT ACTIVITIES**

The watershed community has developed and implemented programs to protect water quality from bacterial contamination. In 2008, an implementation watershed based plan was developed for the Mattabeset River, as referenced on CTDEEP’s website ([http://www.ct.gov/dep/cwp/view.asp?a=2719&q=379296&depNav\\_GID=1654](http://www.ct.gov/dep/cwp/view.asp?a=2719&q=379296&depNav_GID=1654)). In 2000, the Management Plan for the Mattabeset River Watershed was developed and is available online ([http://www.ct.gov/dep/lib/dep/water/watershed\\_management/wm\\_plans/mattabeset\\_mp.pdf](http://www.ct.gov/dep/lib/dep/water/watershed_management/wm_plans/mattabeset_mp.pdf)). This document outlines threats to water quality within the watershed and recommends future actions necessary to maintain or improve water quality.

CT DEEP’s Non-Point Source Pollution Program administers a Non-Point Source Grant Program with funding from EPA under Section 319 of the Clean Water Act (319 grant). In 2005, a grant was awarded to the Connecticut River Coastal Conservation District to conduct stream surveys and train volunteers to help DEEP identify NPS pollution problems pertaining to agricultural operations in the Mattabeset regional basin. The location of 319 grants within Connecticut, as well as more information on these grants, is available on CT DEEP’s website (<http://www.depdata.ct.gov/maps/nps/npsmap.htm>).

As indicated previously, Cromwell is regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the State. The MS4 permit requires towns to design a Stormwater Management Plan (SMP) to reduce the discharge of pollutants in stormwater to improve water quality. The plan must address the following 6 minimum measures:

1. Public Education and Outreach.
2. Public Involvement/Participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management in the new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each municipality is also required to submit an annual update outlining the steps they are taking to meet the six minimum measures. All updates that address bacterial contamination in the watershed are summarized in Table 7.

**Table 7: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Cromwell, CT (Permit # GSM000061)**

Minimum Measure	Town of Cromwell 2004 Annual Report
Public Outreach and Education	1) Developing water-based education program.
Public Involvement and Participation	1) Developing water-based education program.
Illicit Discharge Detection and Elimination	1) Developing illicit discharge and elimination programs. 2) Assessing threat to water quality priorities. 3) Creating stormwater ordinance enforcement program.
Construction Site Stormwater Runoff Control	1) Considering amendments to street and drainage design specs. 2) Modifying stormwater guidelines and specs. 3) Supporting ongoing development of stormwater runoff pollution programs.
Post Construction Stormwater Management	1) Enforcing BMP requirements for construction activities.
Pollution Prevention and Good Housekeeping	1) Implementing stormwater BMPs.

### RECOMMENDED NEXT STEPS

The watershed community has developed and implemented programs to protect water quality from bacterial contamination. Future mitigative activities are necessary to ensure the long-term protection of the Mattabesset River watershed, including East Branch Willow Brook, and have been prioritized below.

#### **1) Identify areas in the East Branch Willow Brook drainage area to implement Best Management Practices (BMPs) to control stormwater runoff.**

As noted above, 46% of the Mattabesset River watershed is considered urban. As such, stormwater runoff is likely contributing bacteria to East Branch Willow Brook. To identify other areas that are contributing bacteria to the impaired segment, Cromwell should continue to conduct wet-weather sampling at stormwater outfalls that discharge directly to the impaired segment in the Mattabesset River watershed. Outfalls that have previously shown high bacteria concentrations should be prioritized for BMP installation (Table 6). To treat stormwater runoff, the towns should identify areas along the more developed sections of the impaired segments to install BMPs that encourage stormwater to infiltrate into the ground before entering the waterbodies. 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. Below are specific recommendations made within the Management Plan for the Mattabesset River Watershed pertaining to impervious surfaces and stormwater runoff (Mattabesset, 2000):

- Educate citizens about the harmful effects of impervious surface development to the river, streams and riparian areas.
- Hold workshops for municipal officials on innovative stormwater management techniques.
- Encourage the use of porous pavement and other techniques that reduce stormwater runoff and infiltrate stormwater within the watershed.
- Identify areas on a sub watershed basis that need stormwater retrofits through aerial photography and ground-truthing, and prioritize the retrofits based on location in watershed, severity of the problem, stream sensitivity, and hydrologic energy balances, including flood prone or potential flood areas.

#### **2) Continue monitoring of permitted sources.**

As Figure 6 shows, there are multiple permitted discharges within the Mattabesset River watershed, particularly near East Branch Willow Brook. Table 6 also reveals sampling results for MS4 outfalls within the Mattabesset River watershed in Cromwell. 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 8 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 Mattabesset 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 8. Bacteria (e.coli) TMDLs, WLAs, and LAs for Recreational Use**

Class	Bacteria Source	Instantaneous <i>E. coli</i> (#/100mL)						Geometric Mean <i>E. coli</i> (#/100mL)	
		WLA <sup>6</sup>			LA <sup>6</sup>			WLA <sup>6</sup>	LA <sup>6</sup>
	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 <sup>7</sup>	410 <sup>7</sup>	576 <sup>7</sup>				126 <sup>7</sup>	
	Stormwater (non-MS4)				235 <sup>7</sup>	410 <sup>7</sup>	576 <sup>7</sup>		126 <sup>7</sup>
	Wildlife direct discharge				235 <sup>7</sup>	410 <sup>7</sup>	576 <sup>7</sup>		126 <sup>7</sup>
	Human or domestic animal direct discharge <sup>5</sup>				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.

### **3) Implement a program to evaluate the sanitary sewer system.**

Many residents and businesses surrounding East Branch Willow Brook rely on a municipal sewer system (Figure 8). Since the sanitary sewer surrounds this impaired segment, ensuring there are no leaks or overflows from the sanitary sewer in this area should be made a priority. It is important for Cromwell to develop programs to evaluate its sanitary sewer and reduce leaks and overflows, especially in the areas around this impaired segment. This program should include periodic inspections of the sewer line. Below are specific recommendations made within the Management Plan for the Mattabeset Watershed pertaining to the sanitary sewer system (Mattabeset, 2000):

- Encourage watershed municipalities to inspect their sewer lines through the Sewer System Evaluation Survey and implement the recommended corrections.
- Implement a recurring 5-year maintenance program for televising and cleaning the sanitary sewage system.

### **4) Develop a system to monitor septic systems.**

Some residents within Cromwell near East Branch Willow Brook rely on septic systems. If not already in place, the town 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 the sub-standard systems within a reasonable timeframe could also be adopted. Towns can also develop programs to assist citizens with the replacement and repair of older and failing systems. Below are specific recommendations made within the Management Plan for the Mattabeset Watershed pertaining to septic systems (Mattabeset, 2000):

- Develop a septic system maintenance program to assure the effective functioning of septic systems in the watershed.
- Based on preliminary investigations, conduct sanitary surveys of the non-sewered areas to determine the extent and severity of failing septic systems.
- Develop and adopt an incentive-based model ordinance for septic system inspection and maintenance for watershed municipalities. Include an education program for individuals and businesses affected by the ordinance.

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

As portions of the upstream drainage area of East Branch Willow Brook is undeveloped, any education and outreach program should highlight the importance of not feeding waterfowl and wildlife, managing horse and livestock waste, and picking up after 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 impaired segments 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. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in the Mattabesset River watershed and can harm human health and the environment.

Pet animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-uses areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

## BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 9: East Branch Willow Brook Bacteria Data

*Waterbody ID:* CT4600-27\_trib\_01*Characteristics:* Freshwater, Class A, Potential Drinking Water Source, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, 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: 95%

Single Sample: 93%

*Data:* 2002 from CT DEEP targeted sampling efforts, 2012 TMDL CycleSingle sample *E. coli* (colonies/100 mL) data from Station 1251 on East Branch Willow Brook with annual geometric means calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1251	Evergreen Road crossing	7/24/2002	6100* (93%)	wet	2706*(95%)
1251	Evergreen Road crossing	8/1/2002	1200	dry	

Shaded cells indicate an exceedance of water quality criteria

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

## Wet and dry weather geometric mean values for Station 1251 on East Branch Willow Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1251	Evergreen Road crossing	2002	1	1	2706	NA	NA

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gage at Markham Municipal KMMK station in Meriden, CT

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