



Muddy Brook

Watershed Summary

WATERSHED DESCRIPTION AND MAPS

The Muddy Brook watershed covers an area of approximately 7,118 acres in the north-central area of Connecticut (Figure 1). The remainder of the watershed is located in Massachusetts. There are several towns located at least partially in the watershed, including the municipalities of Suffield, CT, and Agawam, MA.

The Muddy Brook watershed includes one segment addressed in this TMDL impaired for recreation due to elevated bacteria levels (CT4101-00_01). 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. One segment in the watershed is currently unassessed as of the writing of this document. This does not suggest that there are no issues on this segment, 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 (CTDEEP, 2010).

Muddy Brook (CT4101-00_01) begins at the confluence with Philo Brook west of Russell Avenue in Suffield, flows south through urban and agricultural development, and ends at the confluence with Stony Brook within Stony Brook Park north of South Street in central Suffield. The impaired segment is 2.23 miles long and is located entirely within the Town of Suffield.

The impaired segment of Muddy 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, navigation, and industrial and agricultural water supply. This segment of the river is impaired due to elevated bacteria concentrations, affecting the designated use of recreation. As there are no designated beaches in this segment of Muddy Brook, the specific recreation impairment is for non-designated swimming and other water contact related activities.

Impaired Segment Facts

Impaired Segment:

Muddy Brook (CT4101-00_01)

Municipalities: Suffield

Impaired Segment Length (miles):

2.23

Water Quality Classification:

Class A

Designated Use Impairment:

Recreation

Sub-regional Basin Name and

Code: Muddy Brook, 4101

Regional Basin: Stony Brook

Major Basin: Connecticut

Watershed Area (acres): 7,118

MS4 Applicable: Yes

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

Figure 1: Watershed location in Connecticut

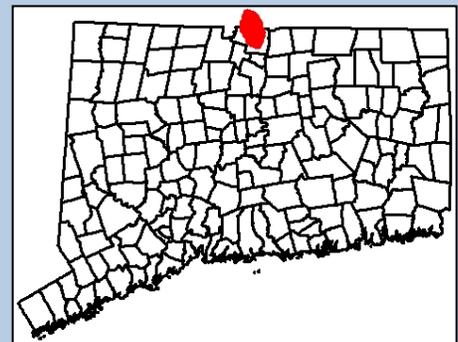
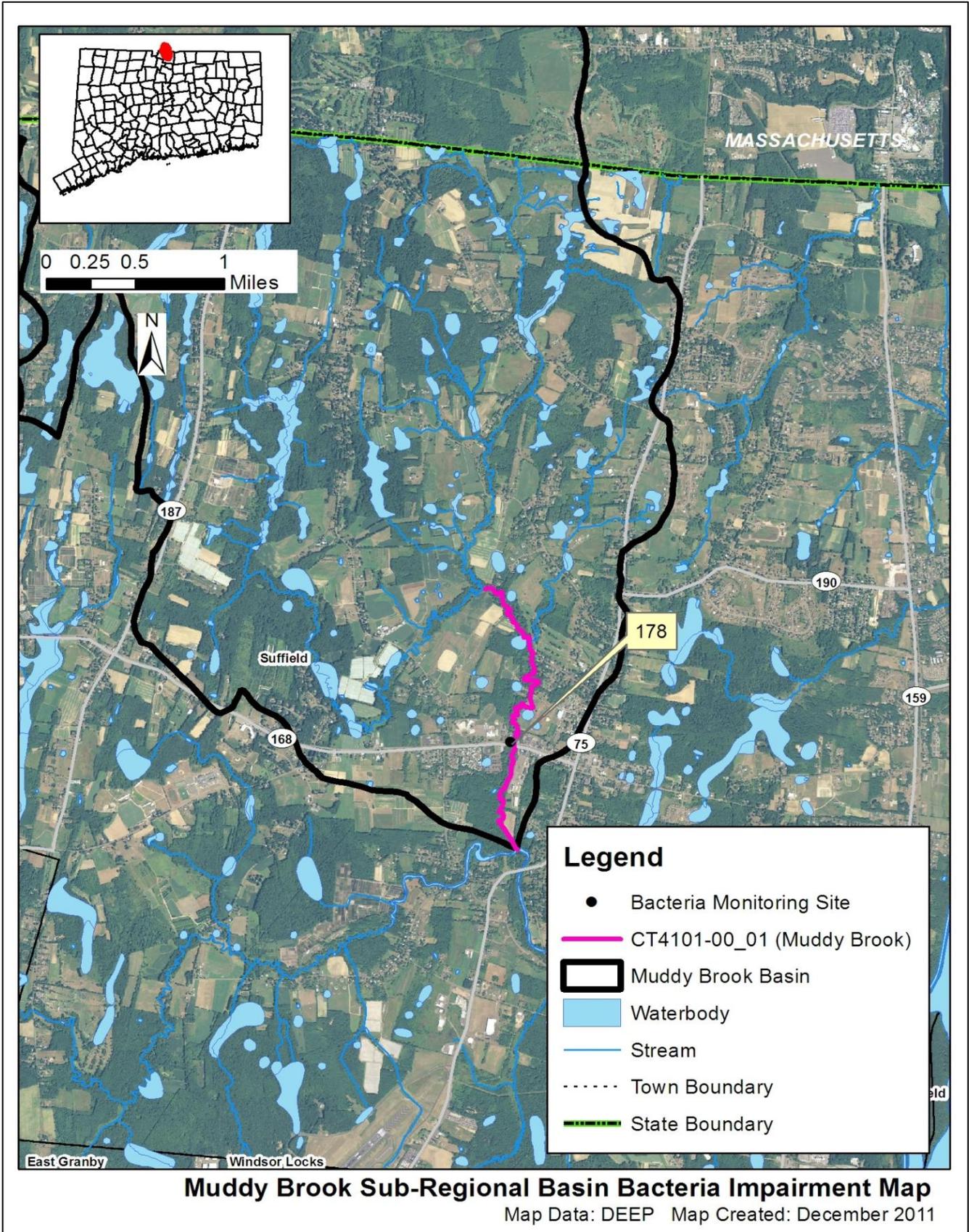


Table 1: Impaired segment and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT4101-00_01	Muddy Brook (Suffield)-01	From mouth at Stony Brook, Suffield, US to confluence with Philo Brook.	2.23	NOT	NOT	FULL
CT4101-00_02	Muddy Brook (Suffield)-02	From confluence with Philo Brook US to headwaters (confluence of Still Brook and Spears Brook).	7.45	U	U	FULL
<p>Shaded cells indicate impaired segment addressed in this TMDL FULL = Designated Use Fully Supported NOT = Designated Use Not Supported U = Unassessed</p>						

Figure 2: GIS map featuring general information of the Muddy Brook 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 Muddy Brook watershed consists of 23% urban area, 35% forest, 37% agriculture, and 5% water. The majority of the land near the impaired segment is a mix of urban and agricultural land uses. There is some high density residential development near the brook off Russel Avenue and North Street in Suffield. There are also large agricultural areas throughout the Muddy Brook watershed, particularly on Russell Avenue and Hill Street in Suffield.

Figure 3: Land use within the Muddy Brook watershed

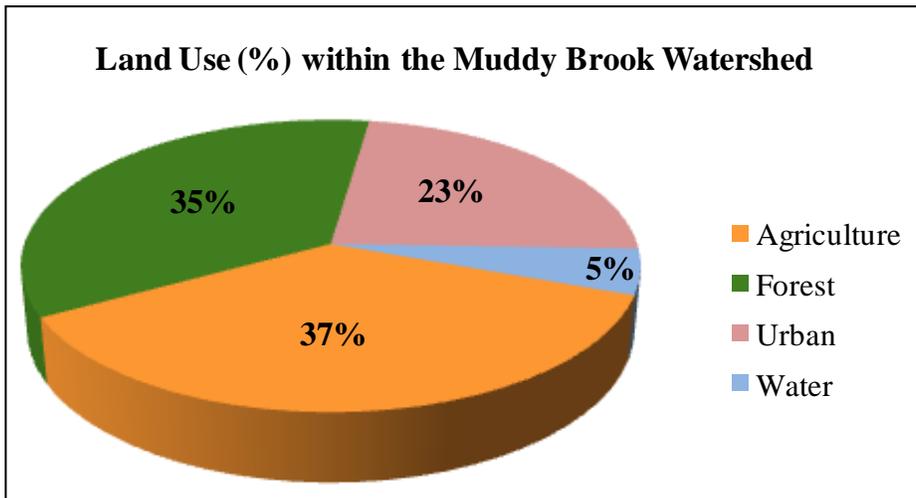
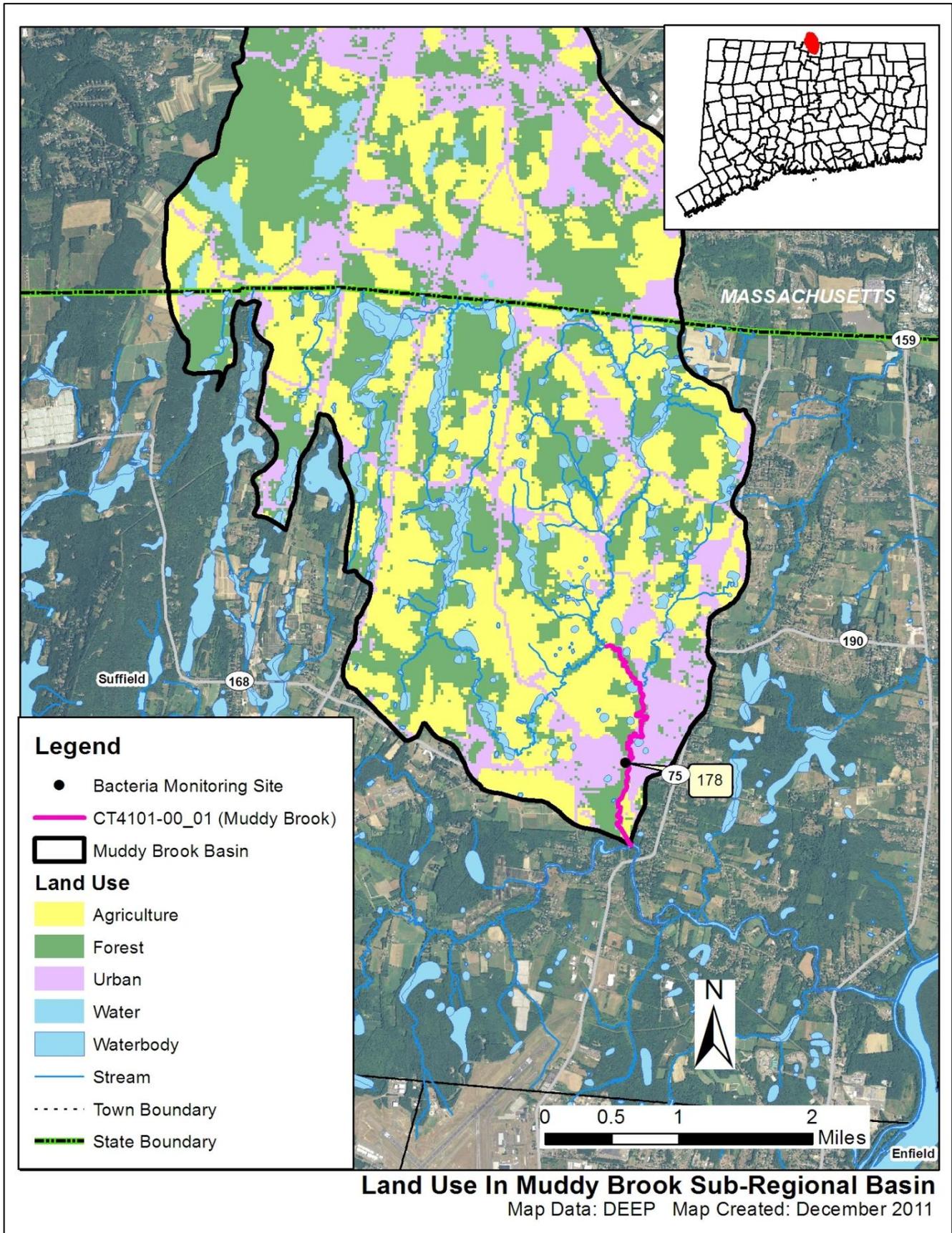


Figure 4: GIS map featuring land use for the Muddy Brook watershed at the sub-regional level



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 the impaired segment in the Muddy Brook watershed

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT4101-00_01	Muddy Brook	178	Route 168 (Main Street)	Suffield	41.983767	-72.658231

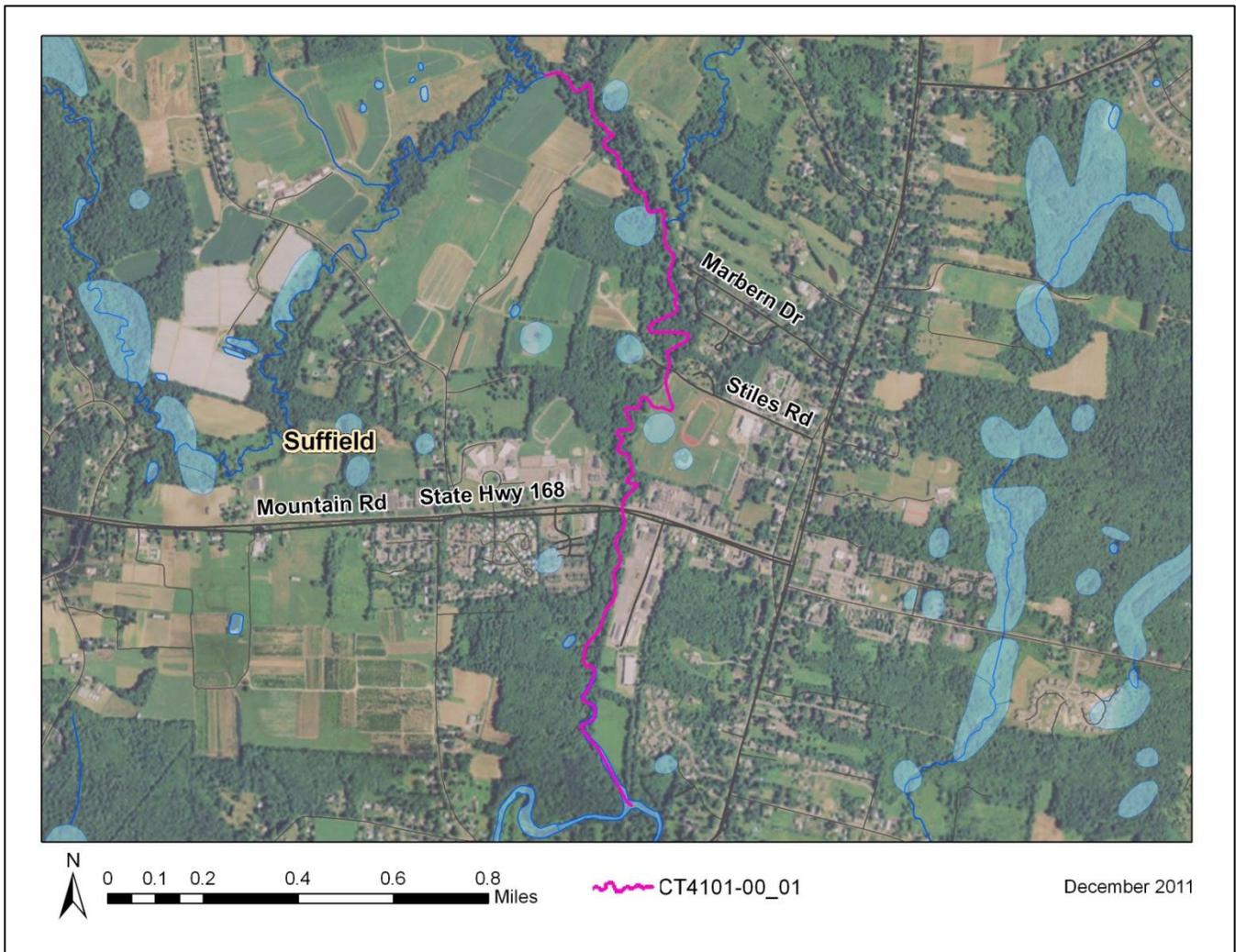
The Muddy Brook's impaired segment (CT4101-00_01) is a Class A freshwater river (Figure 5). Its applicable designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location, Station 178, from 1998-1999 (Table 2).

The water quality criteria for *E. coli*, along with bacteria sampling results from 1998-1999, are presented in Table 10. The annual geometric mean was calculated for Station 178 and exceeded the WQS for *E. coli* in 1999. Single sample values at this station exceeded the WQS for *E. coli* on two out of three sample dates in 1999. The single sample taken in 1998 did not exceed WQS for *E. coli*, and the geometric mean could not be calculated due to insufficient data.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for Station 178 for wet-weather and dry-weather sampling days, where appropriate (Table 10). For Station 178, the geometric mean exceeded the WQS for *E. coli* during both wet and dry-weather with wet-weather three times greater than dry-weather.

Due to the elevated bacteria measurements presented in Table 10, this segment of the Muddy Brook 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 the impaired segment of Muddy Brook



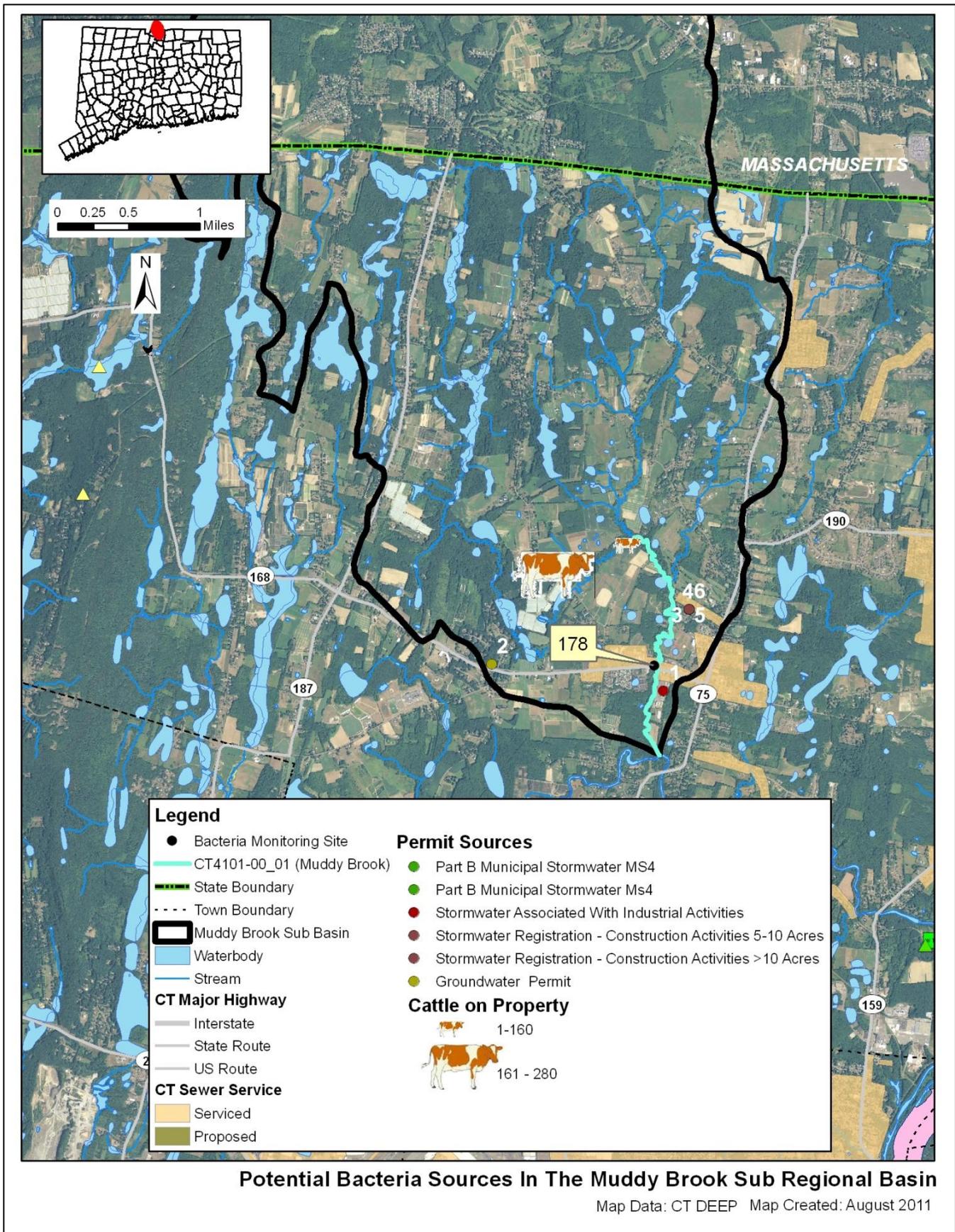
POTENTIAL BACTERIA SOURCES

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 may be 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 Muddy Brook watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/Pets	Other
Muddy Brook CT4101-00_01	x	x		x	x	x	x	

Figure 6: Potential sources in the Muddy Brook 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 may 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	1
GSM	Part B Municipal Stormwater MS4	1
GSN	Stormwater Registration – Construction	2
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	1

Permitted Sources

As shown in Table 5, there are several permitted discharges in the Muddy Brook watershed. Bacteria data from 2001-2002 from one of these industrial permitted facilities are presented in Table 6 (where available). Though this data cannot be compared to a CT WQS as there is no recreation standard for fecal coliform bacteria, multiple samples were high from the Town of Suffield (GSI001459), exceeding 8,000 colonies/100 mL on several sample dates.

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 Muddy Brook watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Suffield	Town Of Suffield	UI0000090	Groundwater Permit	Town Of Suffield, WPCF	2
Suffield	Town Of Suffield	GSM000015	Part B Municipal Stormwater MS4	Suffield, Town Of	N/A
Suffield	Town Of Suffield	GSI001459	Stormwater Associated With Industrial Activities	Suffield Public Works Department	1
Suffield	Somerset Development Corp.	GSN001807	Stormwater Registration - Construction Activities >10 Acres	Stony Brook Farm	5
Suffield	State Of Connecticut DOT	GSN001798	Stormwater Registration - Construction Activities 5-10 Acres	State Project No. 48-184	6

Table 6: Industrial permits in the Muddy Brook watershed and available fecal coliform data (colonies/100mL). The results cannot be compared to the water quality standard as there is no recreation standard for fecal coliform.

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
Suffield	Town of Suffield	GSI1459	Muddy Brook-Stoney Brook	002	10/15/01	8,800
Suffield	Town of Suffield	GSI1459	Muddy Brook-Stoney Brook	001	10/15/01	8,900
Suffield	Town of Suffield	GSI1459	Muddy Brook	PW outfall 1	10/16/02	50
Suffield	Town of Suffield	GSI1459	Muddy Brook	PW outfall 2	10/16/02	540

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 Muddy Brook is located within the Town of Suffield. Suffield has designated urban areas within the Muddy Brook watershed, as defined by the U.S. Census Bureau. Therefore, Suffield 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 required municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants as well as to protect water quality. While not applicable to the Muddy Brook watershed, 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).

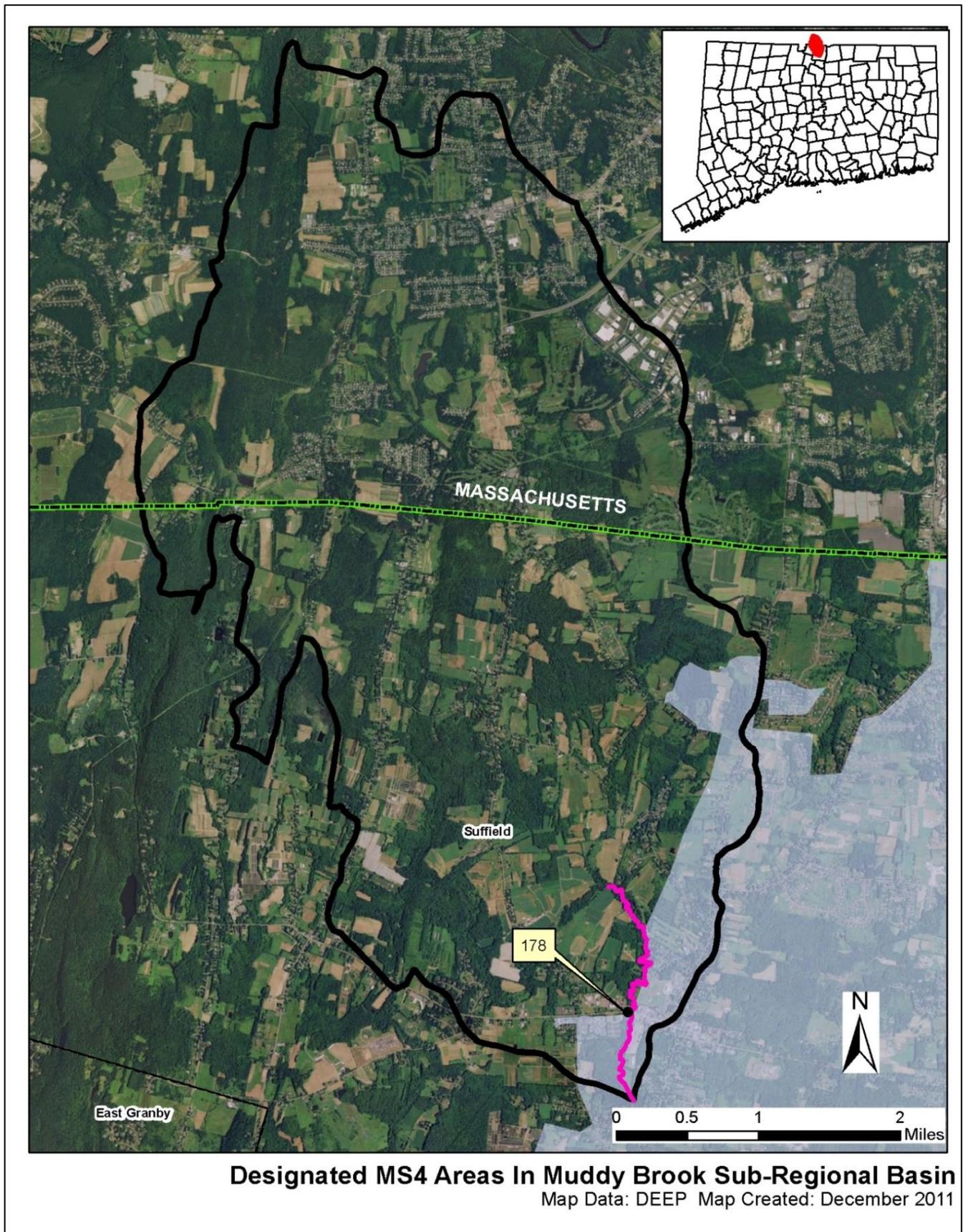
Table 7 displays sample results for *E. coli* from a MS4 discharge within the Muddy Brook watershed from the Town of Suffield. Suffield had one outfall sampled with a total of six samples. Four out of six

(67%) samples from Suffield exceeded the single sample WQS for *E. coli*. These results indicate that the MS4 discharge from Suffield is a potential source of bacterial contamination to Muddy Brook.

Table 7: MS4 permits in the Mill River watershed with *E. coli* Sample results

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
Suffield	C_1 CT RT 168 rip rap area south of road east bank	Commercial	Muddy Brook	11/15/05	>2000
Suffield	C_1 CT RT 168 rip rap area south of road east bank	Commercial	Muddy Brook	05/02/06	>600
Suffield	C_1 CT RT 168 rip rap area south of road east bank	Commercial	Muddy Brook	09/29/06	10
Suffield	C-1 CT RT 168 rip rap area south of road east bank	Commercial	Muddy Brook	10/27/07	1,180
Suffield	C_1 CT RT 168 rip rap area south of road east bank	Commercial	Muddy Brook	11/13/08	100
Suffield	C-1 CT RT 168 rip rap area south of road east bank	Commercial	Muddy Brook	09/11/09	2,300
Shaded cells indicate an exceedance of single-sample based water quality criteria (410 colonies/100 mL)					

Figure 7: MS4 areas of the Muddy Brook watershed



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 Muddy Brook 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). 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. There are multiple agricultural operations throughout Suffield, and the area along Muddy Brook and its tributaries are largely comprised of agricultural lands (Figure 4). Approximately 37% of the watershed is defined as agricultural, particularly around the impaired segment and its tributaries off North Street, Russell Avenue, and Hill Street in Suffield. Agricultural areas near the impaired segment and its tributaries are potentially carrying pollutants, including bacteria, into Muddy Brook.

Insufficient Septic Systems and Illicit Discharges

As shown in Figure 6, only a few small portions of the watershed are serviced by sanitary sewers. Households and businesses in the non-serviced areas of the watershed must rely on onsite wastewater treatment systems, such as septic systems. Given the number of septic systems in the area, there may be failed septic systems in the watershed that are currently undetected. 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 Suffield is part of the North Central Health District (<http://www.ncdhd.org/>) which serves multiple communities in the north central portion of Connecticut.

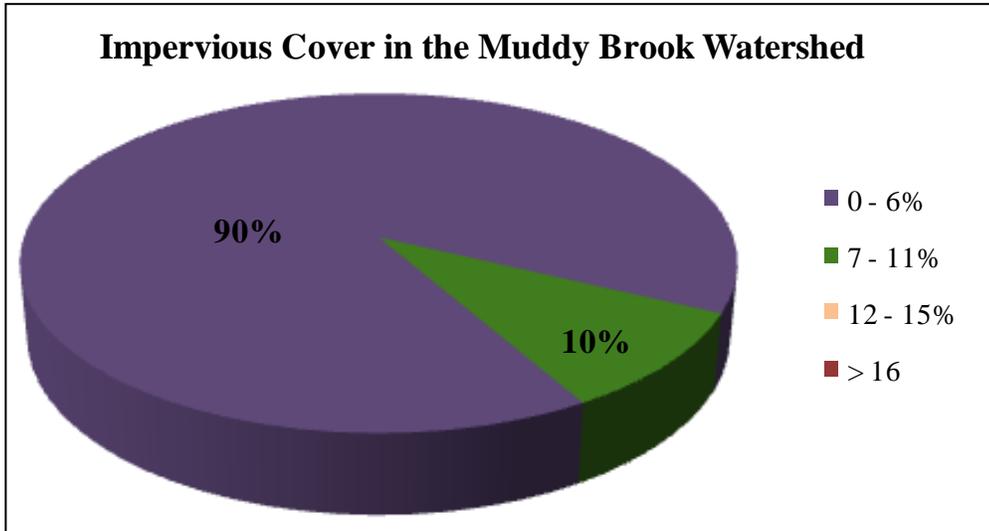
There are several areas adjacent to Muddy Brook's impaired segment that are serviced by a sanitary sewer. Sewer system leaks and other illicit discharges that are located within the watershed of the impaired segment of Muddy Brook may be contributing bacteria to this waterbody.

Stormwater Runoff from Developed Areas

Approximately 23% of the watershed is considered urban, and much of that area is concentrated around the impaired segment in Suffield (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 90% of the Muddy Brook watershed is characterized by 0-6% impervious cover, and 10% is characterized by 7-11% (Figure 8). The urban development on North Street (Route 75) in Suffield follows much of the impaired segments course near its downstream terminus. The proximity of impervious surfaces to Muddy Brook and geometric mean exceedances during wet-weather at Station 178 indicate that stormwater runoff from developed areas are a potential source of bacterial contamination.

Figure 8: Range of impervious cover (%) in the Muddy Brook watershed



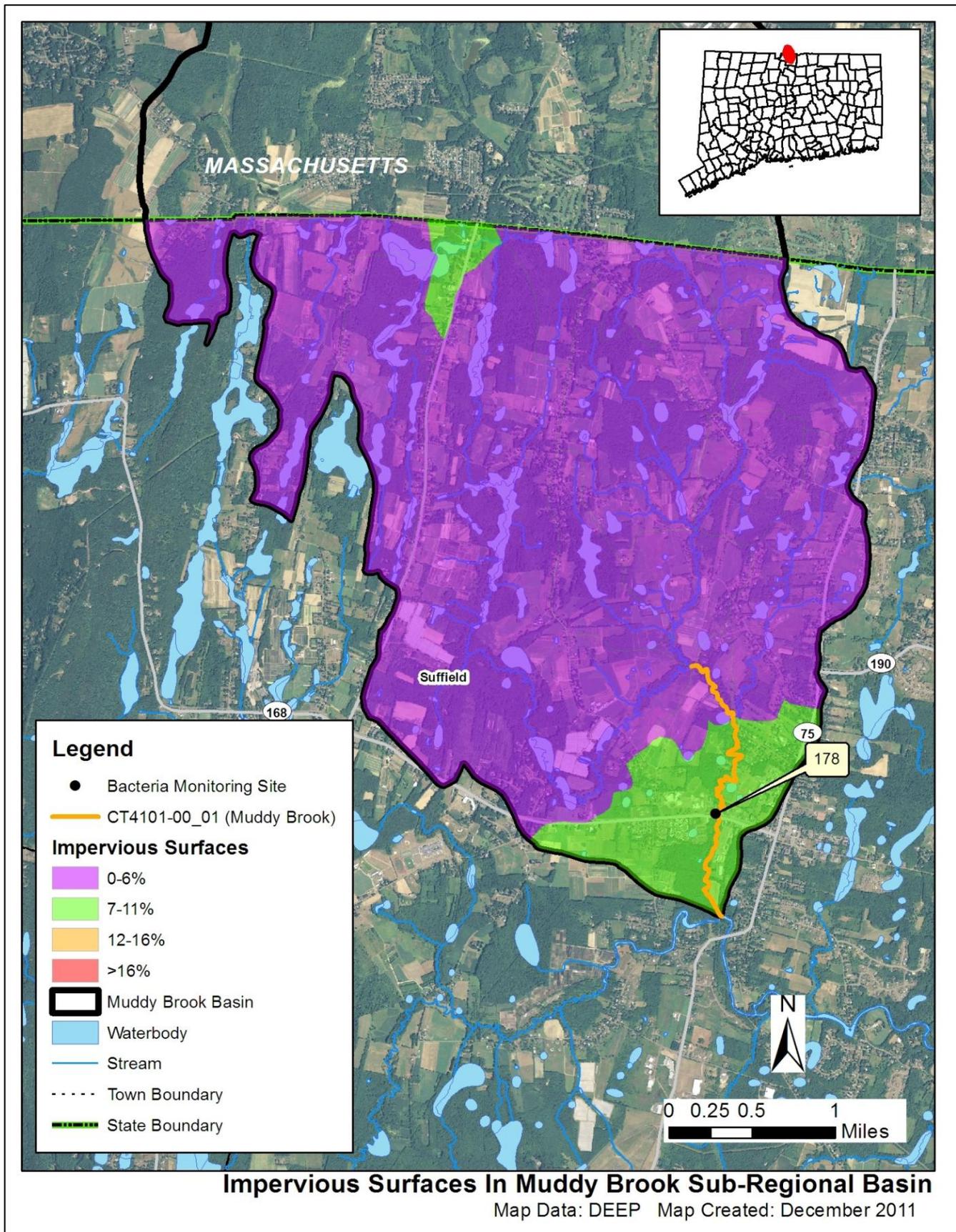
Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Muddy Brook watershed represent another 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).

Geese and other waterfowl are known to congregate in open areas including recreational fields, golf courses, agricultural crop fields, and ponds. The Suffield Country Club is located along the impaired segment on Marbern Drive in Suffield. Suffield Academy’s athletic fields are adjacent to the impaired segment on Stiles Road, and Suffield Middle School’s athletic fields are located adjacent to the impaired segment on Mountain Road in Suffield. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and ponds 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.

Also, urban development surrounds several portions of the impaired segment of Muddy Brook (Figure 4). When not properly disposed, waste from domestic animals, such as dogs, can enter surface waters directly or through stormwater infrastructure. Therefore, pet waste may also be contributing to bacteria concentrations in Muddy Brook.

Figure 9: Impervious cover (%) for the Muddy Brook sub-regional 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 Muddy 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

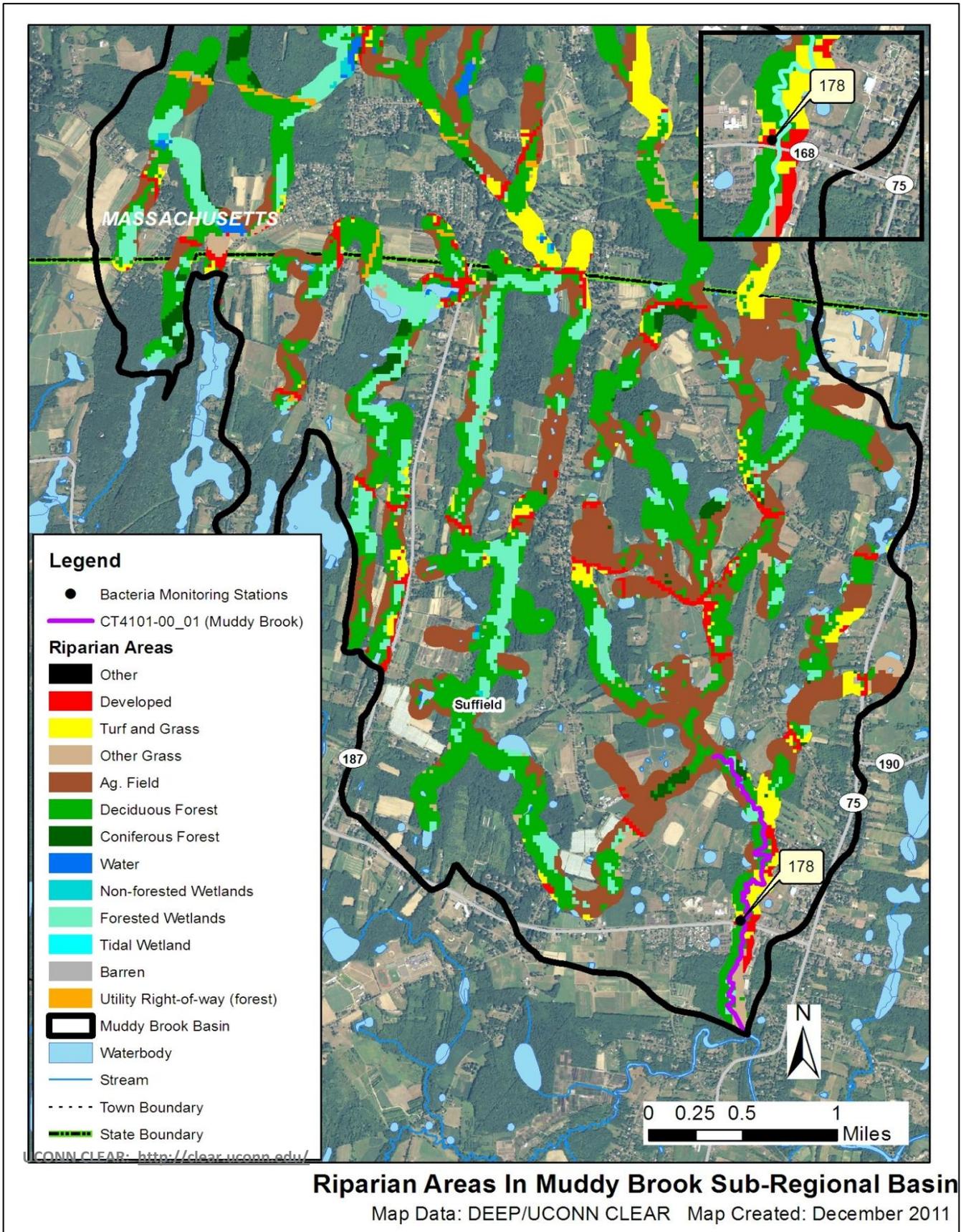
Riparian Buffer Zones

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 majority of the riparian zone for the impaired segment of Muddy Brook is characterized by agricultural and turf/grass land uses. There are several agricultural operations within the riparian zone of Muddy Brook's tributaries (Figure 10). As previously mentioned, agricultural and turf/grass areas are potential sources of bacterial contamination.

Figure 10: Riparian buffer zone information for the Muddy Brook watershed



CURRENT MANAGEMENT ACTIVITIES

The Town of Suffield has developed and implemented some programs to protect water quality from bacterial contamination. As indicated previously, the portion of the watershed surrounding the impaired segment 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 8.

Table 8: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Suffield, CT (Permit # GSM000015)

Minimum Measure	Suffield 2008 Annual Report Update
Public Outreach and Education	1) Posted Fact Sheets in the Town offices for homeowners and Stormwater Quality advice for different types of businesses to increase awareness of stormwater pollution. 2) Purchased an additional 500 storm drain markers in 2008.
Public Involvement and Participation	No updates.
Illicit Discharge Detection and Elimination	1) Set up a Stormwater Outfall book to show specific locations of outfalls, which was then used to map approximate locations.
Construction Site Stormwater Runoff Control	No updates.
Post Construction Stormwater management	No updates.
Pollution Prevention and Good Housekeeping	1) Conducted routine street sweeping throughout the town in 2008.

RECOMMENDED NEXT STEPS

Future mitigative activities are necessary to ensure the long-term protection of the impaired segment of Muddy Brook and have been prioritized below.

1) Ensure there are sufficient buffers on agricultural lands along Muddy Brook.

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 along the impaired segment and its tributaries.

2) Develop a system to monitor septic systems.

Most residents in the watershed rely on septic systems (Figure 6). If not already in place, Suffield 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.

3) Continue monitoring permitted sources.

Previous sampling from the Town of Suffield's industrial permitted discharge has shown elevated levels of fecal coliform bacteria, an indicator of bacterial pollution (Table 6). 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 9 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 Muddy Brook 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 9. 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 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.

4) Implement a program to evaluate the sanitary sewer system.

Portions of the Muddy Brook watershed rely on a sanitary sewer system (Figure 6). Ensuring there are no leaks or overflows from the sanitary sewer near the impaired segment should be made a priority. It is important for Suffield to develop a program to evaluate its sanitary sewer and reduce leaks and overflows, especially in areas near Muddy Brook's impaired segment. This program should include periodic inspections of the sewer line.

5) Identify areas along Muddy Brook to implement Best Management Practices (BMPs) to control stormwater runoff.

Since 23% of the watershed is considered urban and developed areas are located near the impaired segment, stormwater runoff is likely contributing bacteria to the waterbody. To identify specific areas that are contributing bacteria to the impaired segment, the towns should conduct wet-weather sampling at stormwater outfalls that discharge directly to Muddy Brook. To treat stormwater runoff, the town should also identify areas along the more developed sections of Muddy Brook, particularly along the impaired segment, to install BMPs that encourage stormwater to infiltrate into the ground before entering Muddy Brook. 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.

6) Evaluate municipal education and outreach programs regarding animal waste.

Suffield can take measures to minimize waterfowl-related impacts such as encouraging residents and businesses to allow tall, coarse vegetation to grow in the riparian areas of the impaired segment of Muddy Brook that are frequented by waterfowl, particularly on athletic fields, agricultural cropfields, and golf courses. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shoreline 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 Muddy Brook watershed and can harm human health and the environment.

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 10: Muddy Brook Bacteria Data

Waterbody ID: CT4101-00_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: 63%

Single Sample: 26%

Data: 1998-1999 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from Station 178 on the Muddy Brook with annual geometric means calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
178	Downstream of Route 168 (Main Street) crossing	10/13/1998	290	dry	NA
178	Downstream of Route 168 (Main Street) crossing	3/30/1999	20	dry	376* (63%)
178	Downstream of Route 168 (Main Street) crossing	6/16/1999	1900* (26%)	dry	
178	Downstream of Route 168 (Main Street) crossing	9/27/1999	1400	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 178 on Muddy Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
178	Downstream of Route 168 (Main Street) crossing	1998-1999	0	4	352	NA	352
Shaded cells indicate an exceedance of water quality criteria							
Weather condition determined from rain gage at the Hartford Bradley International Airport							

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