



Five Mile River Watershed Summary

Five Mile River (Segments 1-3), Five Mile River (Tributary 1); Holy Ghost Father's Brook (Segment 1), Keelers Brook (Segment 1), Keelers Brook (Tributary 1)

WATERSHED DESCRIPTION AND MAPS

The Five Mile River watershed covers an area of approximately 7,994 acres in the southwestern corner of Connecticut (Figure 1). The watershed is located in New Canaan, Norwalk, and Darien, CT and the northern portion of the watershed extends into southeastern New York.

The Five Mile River watershed includes seven segments impaired for recreation due to elevated bacteria levels. These segments were assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. The other segment (CT7401-00_04) in the watershed is currently unassessed for recreation as of the writing of this document. This does not mean 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. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of other waterbodies in the watershed (CT DEEP, 2010).

The Five Mile River begins at the New Canaan Reservoir in New Canaan, CT and flows south through New Canaan, Norwalk, and Darien before reaching its outlet at Sheffield Island Harbor. The Five Mile River (Tributary 1) (CT7401-02_01) consists of 0.20 miles of river in New Canaan, CT (Figure 2). The Five Mile River (Tributary 1) begins at the outlet to Taeger Pond just upstream of the Route 123 crossing, ends at the confluence with the Five Mile River just downstream of the Glen Drive crossing, and includes Field Club Pond. The Five Mile River (Segment 3) (CT7401-00_03) consists of 1.82 miles of river in New Canaan. The Five Mile River (Segment 3) begins at the confluence with an unnamed tributary (Five Mile River (Tributary 1)) just upstream of New Norwalk Road (Route 123) crossing on the northeastern side of Parade Hill Road and ends at the downstream

Impaired Segment Facts

Impaired Segments, Classifications, and Lengths (miles):

1. Keelers Brook (Segment 1) (CT7401-06_01); A; 1.08
2. Keelers Brook (Tributary 1) (CT7401-07_01); A; 1.03
3. Holy Ghost Father's Brook (Segment 1) (CT7401-05_01); A; 0.61
4. Five Mile River (Segment 1) (CT7401-00_01); B; 5.62
5. Five Mile River (Segment 2) (CT7401-00_02); B; 0.23
6. Five Mile River (Segment 3) (CT7401-00_03); A; 1.82
7. Five Mile River (Tributary 1) (CT-7401-02_01); A; 0.20

Municipalities: New Canaan, Norwalk, and Darien

Designated Use Impairment: Recreation

Sub-regional Basin Name and Code: Five Mile, 7401

Regional Basin: Southwest Western Complex

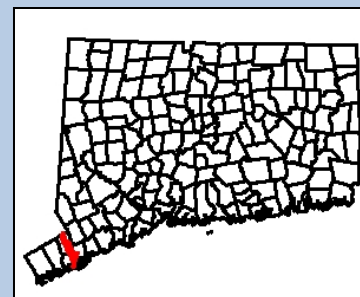
Major Basin: Southwest Coastal

Watershed Area (acres): 7,994

MS4 Applicable? Yes

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

Figure 1: Watershed location in Connecticut



confluence with the New Canaan publicly owned treatment works (POTW) outfall. The Five Mile River (Segment 2) (CT7401-00_02) consists of 0.23 miles of river in New Canaan. The Five Mile River (Segment 2) begins upstream of the confluence with the New Canaan POTW outfall and flows 0.23 miles downstream to the Old Norwalk Road crossing. The Five Mile River (Segment 1) (CT7401-00_01) consists of 5.62 miles of the river in New Canaan, Norwalk, and Darien. This segment begins just upstream of the Old Norwalk Road crossing, flows southerly into Norwalk, follows the Norwalk-Darien town border, and ends at the inlet to Jacob Pond downstream of the Amtrak and Carolyn Court crossing in Norwalk. Holy Ghost Father’s Brook (Segment 1) (CT7401-05_01), consists of 0.61 miles of river in Norwalk. Holy Ghost Father’s Brook (Segment 1) begins at the confluence with an unnamed tributary just downstream of the Fillow Street crossing, ends at the Cedar Pond confluence with the Five Mile River just downstream of Bonny Brook Road crossing, and includes Land Pond and Bethmarlea Pond. Keelers Brook (Tributary 1) (CT7401-07_01) consists of 1.03 miles of river in Norwalk. Keelers Brook (Tributary 1) begins at the outlet to Scribner Pond just upstream of the Gillies Lane crossing, and ends at the confluence with Keelers Brook just upstream of the Flax Hill Road crossing and downstream of Interstate 95. Keelers Brook (Segment 1) (CT7401-06_01), consists of 1.08 miles of river in Norwalk (Figure 2). Keelers Brook (Segment 1) begins at the confluence with an unnamed tributary (Keelers Brook (Tributary 1)), and ends at the confluence with the Five Mile River on the Darien-Norwalk town line just downstream of the Rowayton Avenue crossing.

The Five Mile River (Segments 1 and 2) have a water quality classification of B. Designated uses include habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. All other impaired segments of the Five Mile River have a water quality classification of A. Designated uses include potential drinking water supply, habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. As there are no designated beaches in these segments of the Five Mile River, the specific recreation impairment is for non-designated swimming and other water contact related activities.

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

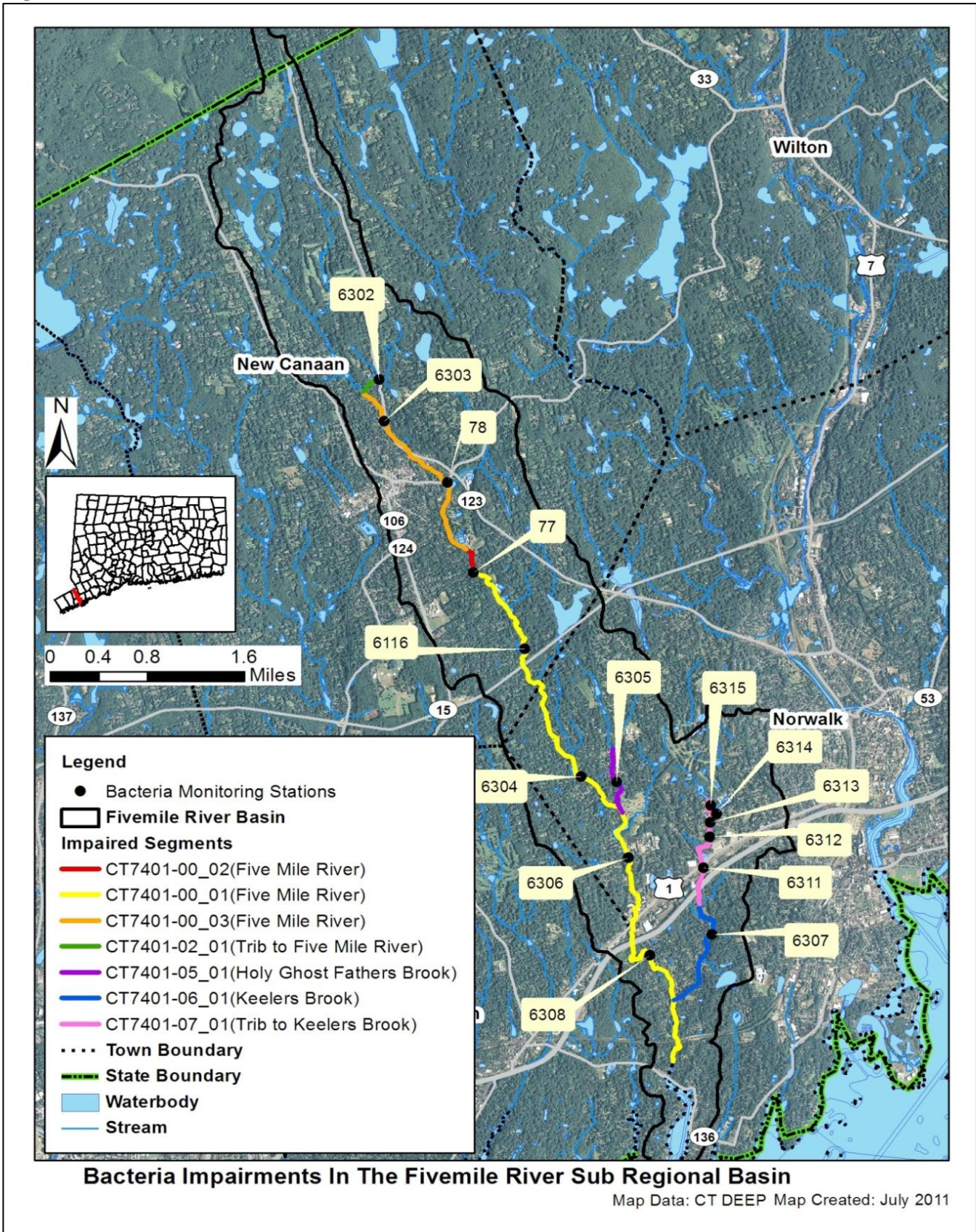
Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT7401-06_01	Keelers Brook (Norwalk)-01	Mouth at confluence with Five Mile River on Darien/Norwalk town line, 0.3 miles DS of Rowayton Avenue crossing (at Woodchuck Lane intersection) US to confluence with unnamed tributary, 0.3 miles US of Flax Hill Road crossing and just DS of I-95, Norwalk.	1.08	U	NOT	U
CT7401-07_01	Unnamed tributary to Keelers Brook (Norwalk)-01	Mouth at confluence with Keelers Brook 0.3 miles US of Flax Hill Road crossing and just DS of I-95, US to outlet of Scribner Pond just US of Gillies Lane crossing, Norwalk.	1.03	U	NOT	U

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

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT7401-05_01	Holy Ghost Fathers Brook (Norwalk)-01	Mouth at confluence with Five Mile River (Cedar Pond section), DS of Bonny Brook Road crossing, US to confluence with unnamed tributary just DS of Fillow Street crossing, Norwalk. (Includes Land and Bethmarlea Ponds)	0.61	U	NOT	U
CT7401-00_01	Five Mile River (New Canaan)-01	From inlet to Jacob Pond (DS of Amtrak crossing and Carolyn Court crossing), Norwalk/Darien town border, US to Old Norwalk Road crossing (0.2 miles DS of POTW), New Canaan.	5.62	U	U*	FULL
CT7401-00_02	Five Mile River (New Canaan)-02	From Old Norwalk Road crossing (0.2 miles DS of POTW), US to confluence with New Canaan POTW outfall, New Canaan.	0.23	NOT	NOT	FULL
CT7401-00_03	Five Mile River (New Canaan)-03	From confluence with New Canaan POTW outfall, US to confluence with unnamed tributary (US of New Norwalk Road (Route 123) crossing, on northeastern side of Parade Hill Road, near Cemetery), New Canaan.	1.82	NOT	U*	FULL
CT7401-00_04	Five Mile River (New Canaan)-04	From confluence with unnamed tributary (US of New Norwalk Road (Route 123) crossing, on northeastern side of Parade Hill Road, near Cemetery), US to headwaters at New Canaan Reservoir dam outlet (US of Country Club Road crossing), New Canaan.	1.69	U	U	FULL
CT7401-02_01	Unnamed tributary to Five Mile River (New Canaan)-01	Mouth at confluence with Five Mile River, DS of Glen Drive crossing, US to outlet of Taeger Pond, just US of Route 123 crossing, New Canaan. (includes Field Club Pond)	0.20	U	NOT	U

Shaded cells indicate impaired segment addressed in this TMDL
***Impairment determined from 2010 data; will be listed as impaired on the 2012 303(d) List of Impaired Waters**
FULL = Designated Use Fully Supported
NOT = Designated Use Not Supported
U = Unassessed

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



Land Use

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

As shown in Figures 3 and 4, the Five Mile River watershed consists of 70% urban, 26% forest, 3% water, and 1% agriculture land uses. Portions of the watershed in New Canaan and Norwalk, particularly near the impaired segments of the Five Mile River, are characterized by dense urban and suburban residential land use. Small forested areas also surround the Five Mile River (Segment 2) in New Canaan. These forested areas are small tracts of developed open spaces, including golf courses and protected open spaces, such as Hoyt Swamp, Ponus Avenue Open Space, and Fox Run Open Space located downstream of Old Norwalk Road in New Canaan, CT. The lower portion of the Five Mile River is intersected by I-95 and CT-15 and is characterized by dense commercial areas, particularly near the City of Norwalk. The upper watershed near the headwaters at New Canaan Reservoir are more heavily forested, though new construction of large-lot suburban residences may be threatening this drinking water supply.

Figure 3: Land use within the Five Mile River watershed

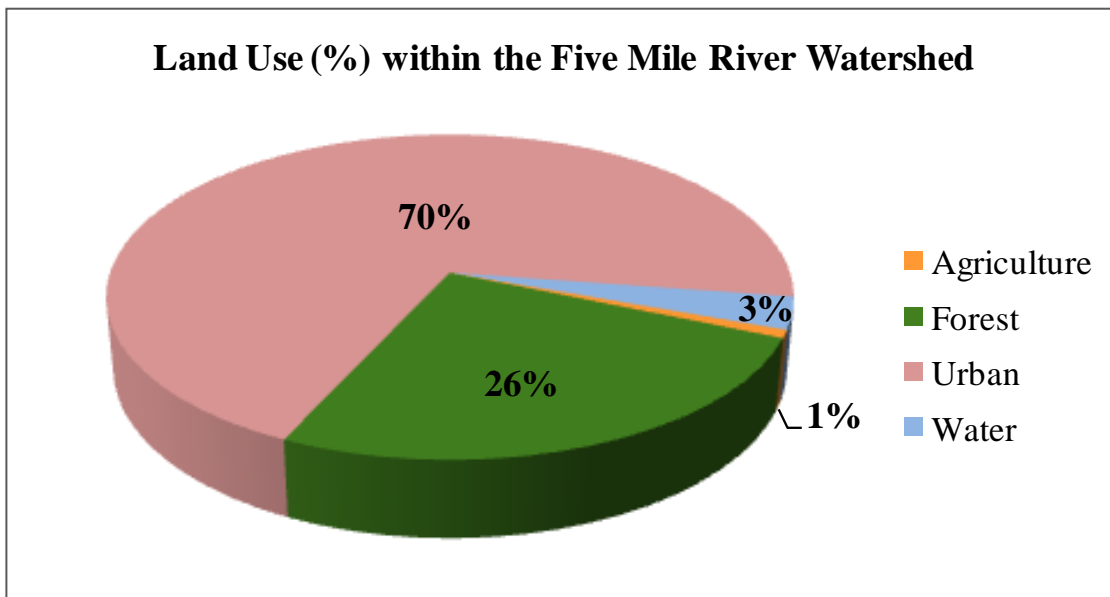
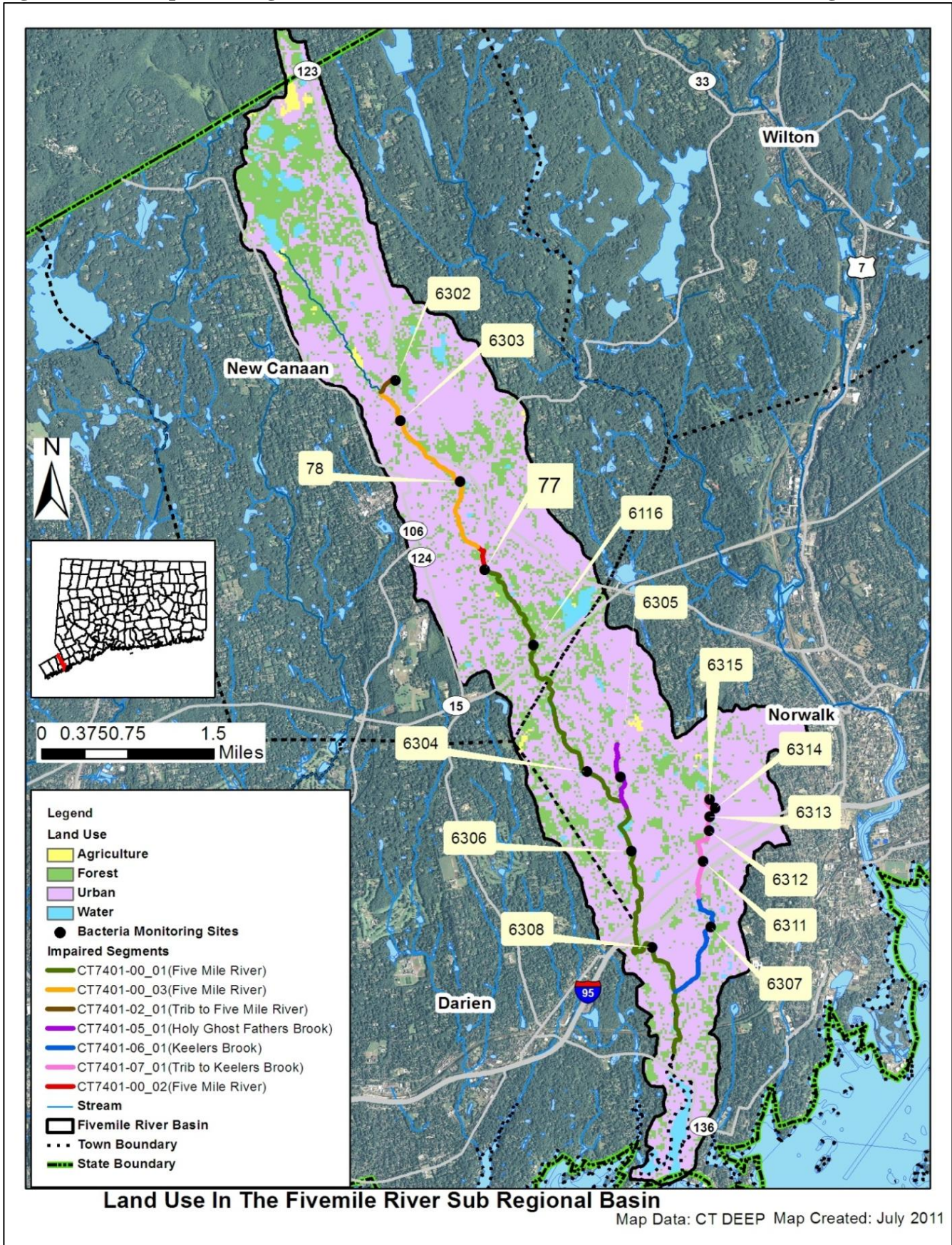


Figure 4: GIS map featuring land use for the Five Mile River watershed at the sub-regional level



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 Five Mile River watershed (stations organized downstream to upstream)

Waterbody ID	Waterbody Name	Station	Station Description	Town	Latitude	Longitude
CT7401-06_01	Keeler Brook (Segment 1)	6307	Primrose Court	Norwalk	41.090777	-73.440977
CT7401-07_01	Keeler Brook (Tributary 1)	6315	Gillies Lane	Norwalk	41.107174	-73.441357
		6314	Ledge Brook Drive	Norwalk	41.106103	-73.440386
		6313	Scribner Avenue	Norwalk	41.104985	-73.441370
		6312	West Cedar Street	Norwalk	41.103188	-73.441438
		6311	Rampart Road	Norwalk	41.099260	-73.442385
CT7401-05_01	Holy Ghost Father's Brook (Segment 1)	6305	Geneva Road	New Canaan	41.110019	-73.456249
CT7401-00_01	Five Mile River (Segment 1)	6308	N Flax Hill Road and Shady Brook Lane	New Canaan	41.088136	-73.450741
		6306	West Cedar Street and Beechwood Road	New Canaan	41.100452	-73.454333
		6304	Fallow Street	New Canaan	41.110664	-73.461894
		6116	Nursery Road	New Canaan	41.126850	-73.471010
CT7401-00_02	Five Mile River (Segment 2)	77	Old Norwalk Road	New Canaan	41.136472	-73.479292
CT7401-00_03	Five Mile River (Segment 3)	6303	Route 13 near Parade Hill Road	New Canaan	41.155567	-73.493611
		78	Route 106 (East Street)	New Canaan	41.147844	-73.483533
CT7401-02_01	Five Mile River (Tributary 1)	6302	#183 Route 123	New Canaan	41.160781	-73.494436

The impaired segments of the Five Mile River (Segments 1 and 2) are Class B freshwater rivers (Figure 5). Their applicable designated uses are habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. Water quality analyses were conducted using data from four sampling locations on the Five Mile River (Segment 1) from 2010-2011 and from one sampling location on Five Mile River (Segment 2) (Station 77) from 1998, 2003-2004, and 2006-2010 (Table 2). To aid in identifying possible bacteria sources, the geometric mean was also calculated for each station for wet-weather and dry-weather sampling days, where appropriate.

For the Five Mile River (Segments 1 and 2), the water quality criteria for *E. coli*, along with bacteria sampling results for all stations from 1998, 2003-2004, and 2006-2011, are presented in Tables 17-18. The annual geometric mean was calculated and multiple stations exceeded the WQS for *E. coli* in several sampling years. Single sample values at several stations also exceeded the WQS for *E. coli* multiple

times. For the Five Mile River (Segments 1 and 2), geometric mean values during wet and dry-weather at Stations 6116, 77, 6304, 6306, and 6308 exceeded the WQS for *E. coli*.

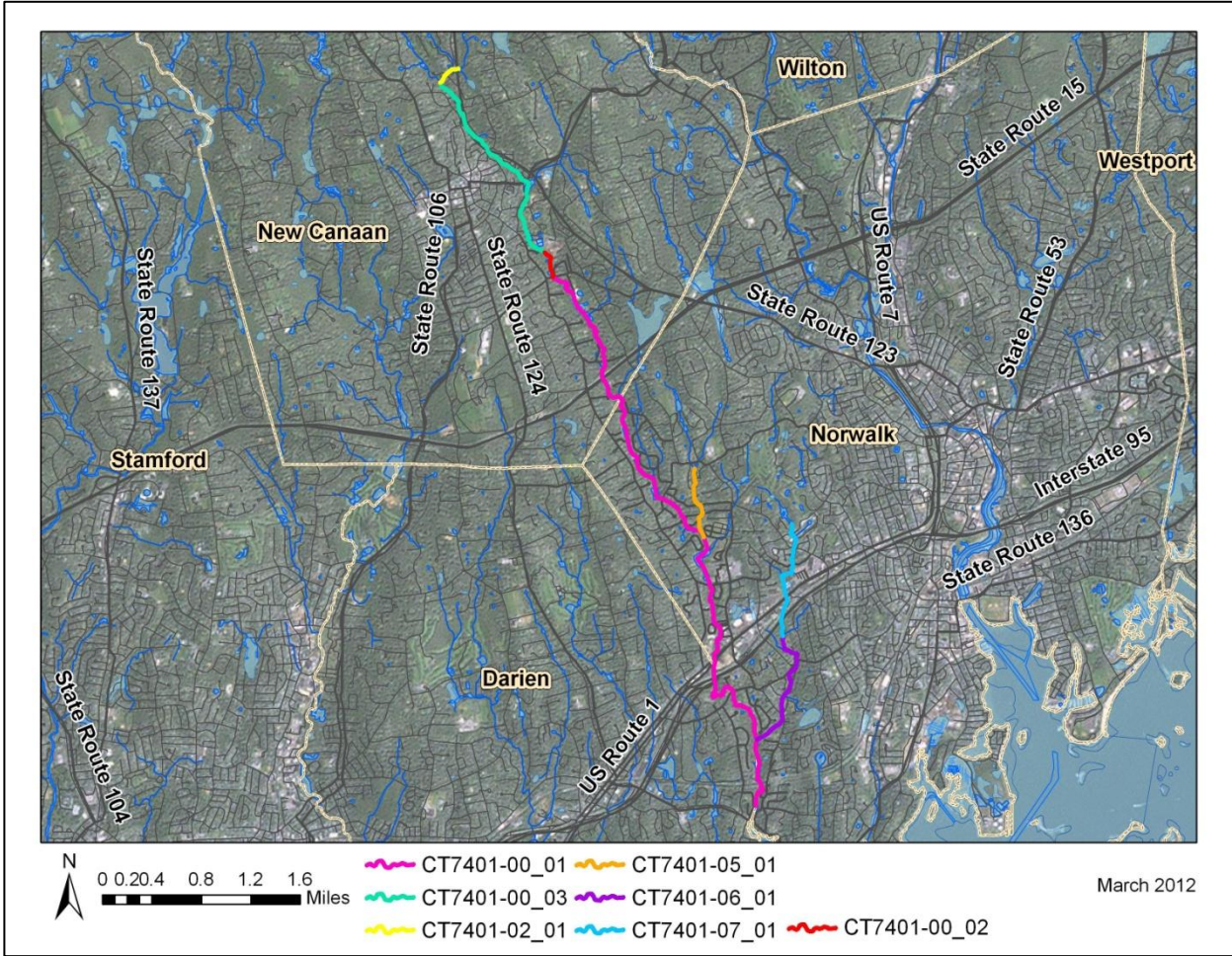
All other impaired segments in the Five Mile River watershed are Class A freshwater rivers. Designated uses include potential drinking water supply, habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. Water quality analyses were conducted using data from two sampling locations on the Five Mile River (Segment 3), from one sampling location on the Five Mile River (Tributary 1), Holy Ghost Father's Brook (Segment 1), and Keelers Brook (Segment 1), and from five sampling locations on Keelers Brook (Tributary 1) in 2011 (Table 2).

For the Five Mile River (Tributary 1), Holy Ghost Father's Brook (Segment 1), and Keelers Brook (Segment 1 and Tributary 1), the water quality criteria for *E. coli*, along with bacteria sampling results for all stations in 2011, are presented in Tables 14-16, and 20. The annual geometric mean was calculated and all stations exceeded the WQS for *E. coli* in 2011, and single sample values exceeded the WQS for *E. coli* multiple times at all stations. The geometric mean values during wet and dry-weather exceeded the WQS for *E. coli* at all stations on these impaired segments. In particular, Station 6302 on the Five Mile River (Tributary 1) had dry-weather value slightly higher than wet-weather, but overall low geometric mean values. Stations 6315, 6314, and 6312 had high geometric means during wet-weather as compared to dry-weather values.

For the Five Mile River (Segment 3), the water quality criteria for *E. coli*, along with bacteria sampling results for both stations in 2011, are presented in Table 19. The annual geometric mean was calculated and both stations exceeded the WQS for *E. coli* in 2011. Single sample values exceeded the WQS for *E. coli* multiple times at Station 78 and once at Station 6303. Geometric mean values during wet and dry-weather exceeded the WQS for *E. coli* at Stations 78 and 6303.

Due to the elevated bacteria measurements presented in Tables 14-20, these segments of the Five Mile River watershed did not meet CT's bacteria WQS, were identified as impaired, and were or will be 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 Five Mile River



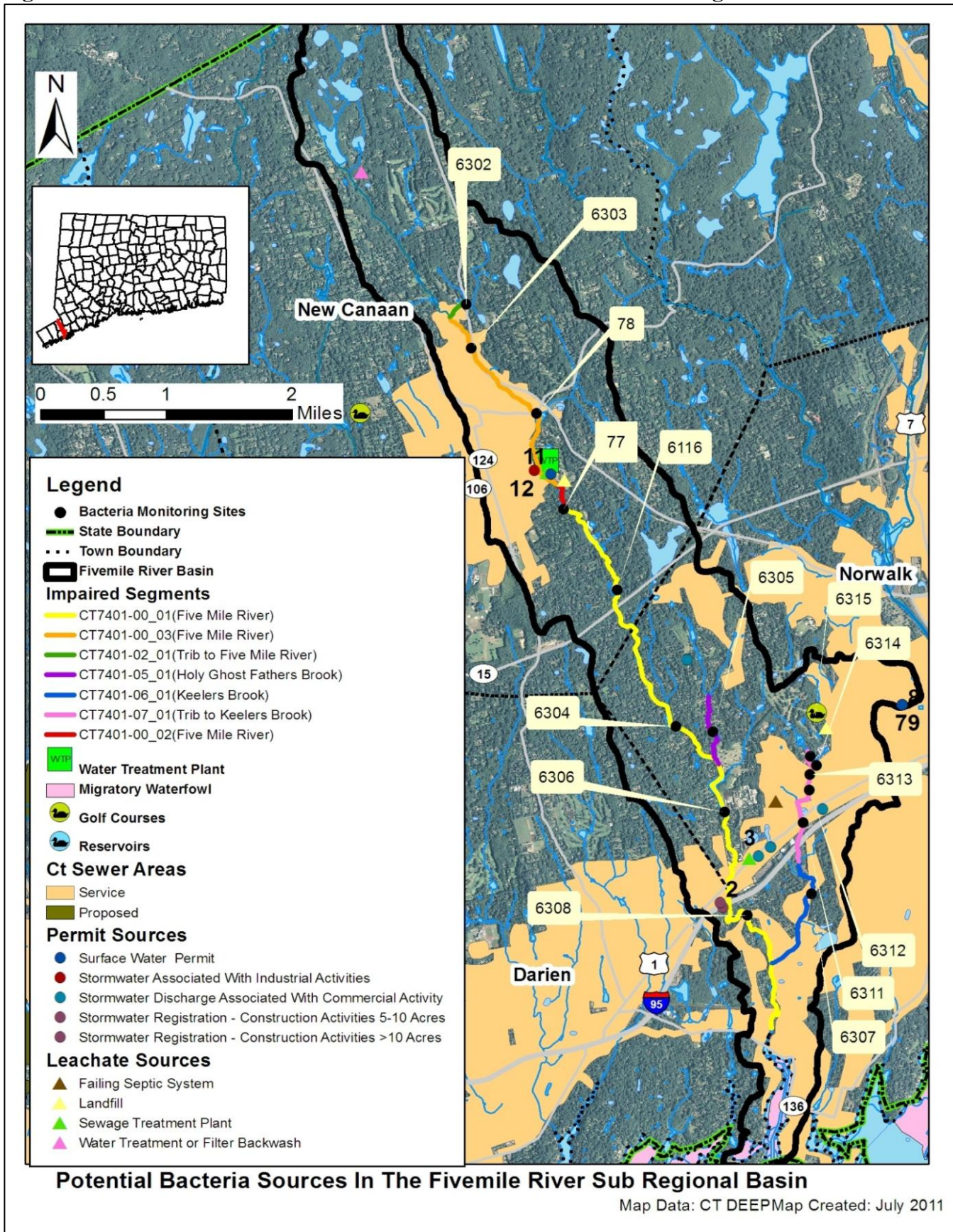
POTENTIAL BACTERIA SOURCES

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 Five Mile River watershed based on land use (Figures 3 and 4) and a collection of local information for the impaired waterbodies are 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 segment. Further monitoring and investigation will confirm listed sources and discover additional sources. 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 Five Mile River watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/Pets	Other
Keelers Brook (Segment 1) CT7401-06_01	x	x		x		x	x	x
Keelers Brook (Tributary 1) CT7401-07_01	x	x		x		x	x	x
Holy Ghost Father's Brook (Segment 1) CT7401-05_01		x		x	x	x	x	
Five Mile River (Segment 1) CT7411-00_01	x	x		x	x	x	x	x
Five Mile River (Segment 2) CT7411-00_02	x	x		x		x	x	x
Five Mile River (Segment 3) CT7401-00_03	x	x		x		x	x	x
Five Mile River (Tributary 1) CT7401-02_01		x		x	x	x	x	

Figure 6: Potential sources in the Five Mile 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 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. When available, bacteria data results from these permitted sources are listed in Tables 6 - 8.

Table 4: General categories list of other permitted discharges

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	2
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	5
GSI	Stormwater Associated with Industrial Activity	3
GSM	Part B Municipal Stormwater MS4	3
GSN	Stormwater Registration – Construction	2
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	0

Permitted Sources

As shown in Table 5, there are multiple permitted discharges in the Five Mile River watershed. Bacteria data from 2001 and 2002 for some of these industrial permitted facilities are included in Table 6. Though this data cannot be compared to a water quality standard as Connecticut only has a fecal coliform bacteria water quality standard for shellfishing uses, samples from outfalls at the Town of New Canaan (GSI001415) were within reasonable limits of 150 colonies/100 ml or less. The New Canaan DPW (GSI001415) sampled sites in 2002 had results that were “too numerous to count,” which indicates that the values were above the maximum number the analytical method could measure.

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 Five Mile River watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Darien	Town of Darien	GSM000046	Part B Municipal Stormwater MS4	Darien, Town of	N/A
Darien	Project Services, LLC	GSN002178	Stormwater Registration - Construction Activities >10 Acres	I-95 Southbound Service Plaza In Darien	1
Darien	Project Services, LLC	GSN002176	Stormwater Registration - Construction Activities 5-10 Acres	I-95 Northbound Service Plaza In Darien	2
New Canaan	Town of New Canaan	GSM000079	Part B Municipal Stormwater MS4	New Canaan, Town of	N/A
New Canaan	Town Of New Canaan	GSI001415	Stormwater Associated With Industrial Activities	New Canaan Public Works/Transfer Station	12
New Canaan	Town Of New Canaan	CT0101273	Surface Water Permit	New Canaan Sewage Treatment	11
Norwalk	City of Norwalk	GSM000024	Part B Municipal Stormwater MS4	Norwalk, City of	N/A
Norwalk	King Industries, Inc.	GSI000628	Stormwater Associated With Industrial Activities	King Industries	7
Norwalk	Meadow St. Partnership, Norwalk Recycling, Inc.	GSI001974	Stormwater Associated With Industrial Activities	Norwalk Solid Waste Volume Reduction Facility	8
Norwalk	Wal-Mart Stores East, LP	GSC0000291	Stormwater Discharge Associated With Commercial Activity	Wal-Mart Store #3547	3
Norwalk	The Stop & Shop Supermarket Company LLC	GSC000147	Stormwater Discharge Associated With Commercial Activity	Stop & Shop #640	6
Norwalk	Brcp Ct Operating, LLC	GSC000171	Stormwater Discharge Associated With Commercial Activity	Dolce Norwalk Hotel & Resort	10
Norwalk	Home Depot U. S. A., Inc.	GSC000190	Stormwater Discharge Associated With Commercial Activity	Norwalk Home Depot	4
Norwalk	Home Depot U. S. A., Inc.	GSC000190	Stormwater Discharge Associated With Commercial Activity	Norwalk Home Depot	5
Norwalk	King Industries, INC	CT0000841	Surface Water Permit	King Industries	9

Table 6: Industrial permits on the Five Mile River 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
New Canaan	Town of New Canaan	GSI001415	Five Mile River	CB-1	09/20/01	150
New Canaan	Town of New Canaan	GSI001415	Five Mile River	DB-1	09/20/01	68
New Canaan	New Canaan DPW	GSI001415	Five Mile River	SW-2	09/26/02	TNTC
New Canaan	New Canaan DPW	GSI001415	Five Mile River	SW-3	09/26/02	TNTC
TNTC (too numerous to count) = above the maximum number that the analytical method can measure.						

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 segments of the Five Mile River watershed are located within the Towns of New Canaan and Darien and the City of Norwalk, CT. The municipalities are largely urbanized, as defined by the U.S. Census Bureau, and are 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 and protect water quality. The MS4 permit is discussed further in the “TMDL Implementation Guidance” section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP’s website (http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

Multiple MS4 outfalls have been sampled for *E. coli* bacteria in the watershed (Table 7). In New Canaan, six MS4 outfalls were sampled from 2006 – 2010. Of these outfalls, three exceeded the single sample water quality standard of 410 colonies/100 mL on at least one sample date.

Figure 7: MS4 areas of the Five Mile River watershed

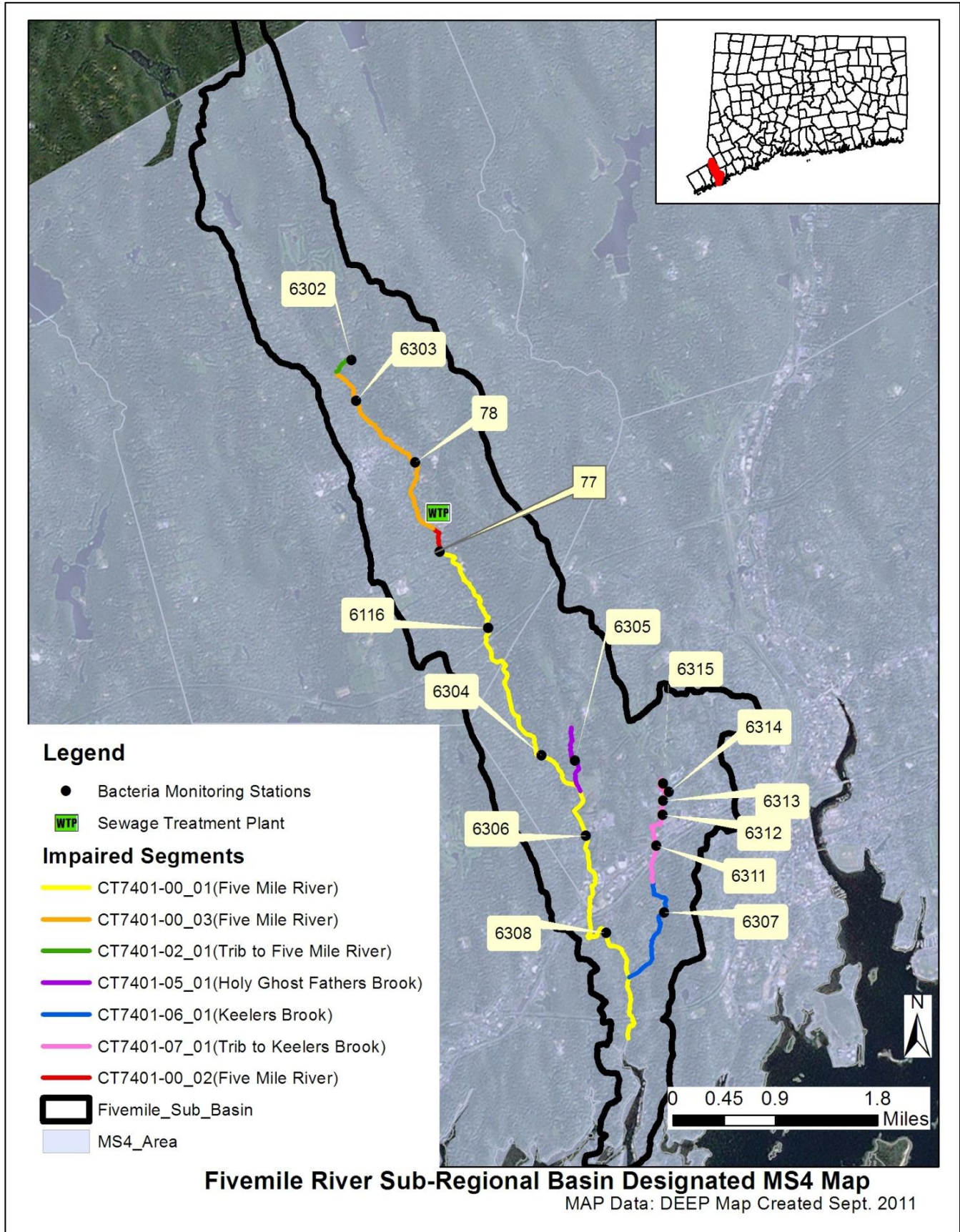


Table 7: List of MS4 sample locations and *E. coli* (colonies/100 mL) results in the Five Mile River watershed

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
New Canaan	SW-1 406 Main Street	Residential	Five Mile River	11/08/06	264
New Canaan	SW-1 406 Main Street	Residential	Five Mile River	10/24/07	950
New Canaan	SW-1 406 Main Street	Residential	Five Mile River	09/26/08	80
New Canaan	SW-1 406 Main Street	Residential	Five Mile River	09/11/09	380
New Canaan	SW-1 406 Main Street	Residential	Five Mile River	09/27/10	440
New Canaan	SW-2 Mill Pond	Residential	Five Mile River	11/08/06	464
New Canaan	SW-2 Mill Pond	Residential	Five Mile River	10/24/07	400
New Canaan	SW-2 Mill Pond	Residential	Five Mile River	09/26/08	120
New Canaan	SW-2 Mill Pond	Residential	Five Mile River	09/11/09	230
New Canaan	SW-2 Mill Pond	Residential	Five Mile River	09/27/10	900
New Canaan	SW-3 Mill Pond	Residential	Five Mile River	11/08/06	480
New Canaan	SW-3 River Road	Residential	Five Mile River	10/24/07	25
New Canaan	SW-3 River Road	Residential	Five Mile River	09/26/08	180
New Canaan	SW-4 Brook & Summer	Commercial/Residential	Five Mile River	11/08/06	328
New Canaan	SW-5 River Road	Residential	Five Mile River	11/08/06	24
New Canaan	SW-6 Deep Valley Road	Residential	Five Mile River	11/08/06	8
Shaded cells indicate an exceedance of single-sample based water quality criteria (410 colonies/100 mL)					

Publicly Owned Treatment Works

As shown in Figure 7, there is one publicly owned treatment work (POTW), or wastewater treatment plant, in the Five Mile River watershed upstream of the Five Mile River (Segment 2) in New Canaan, CT. The New Canaan Sewage Treatment Plant (CT0101273) discharges directly to the Five Mile River (Segment 3), and did not exceed its permit limits on any date sampled (Table 6).

Table 8: Wastewater Treatment Plant fecal coliform (colonies/100 mL) data discharging to the Five Mile River

Town	Permittee	Permit Number	Receiving Water	Date	30-Day Geometric Mean	7-Day Geometric Mean
New Canaan	New Canaan STP	CT0101273	Fivemile River	01/31/2009	9	12
New Canaan	New Canaan STP	CT0101273	Fivemile River	02/28/2009	7	9
New Canaan	New Canaan STP	CT0101273	Fivemile River	03/31/2009	9	12
New Canaan	New Canaan STP	CT0101273	Fivemile River	04/30/2009	9	12
New Canaan	New Canaan STP	CT0101273	Fivemile River	05/31/2009	9	11
New Canaan	New Canaan STP	CT0101273	Fivemile River	06/30/2009	8	10

Table 8: Wastewater Treatment Plant fecal coliform (colonies/100 mL) data discharging to the Five Mile River (continued)

Town	Permittee	Permit Number	Receiving Water	Date	30-Day Geometric Mean	7-Day Geometric Mean
New Canaan	New Canaan STP	CT0101273	Fivemile River	07/31/2009	8	10
New Canaan	New Canaan STP	CT0101273	Fivemile River	08/31/2009	8	10
New Canaan	New Canaan STP	CT0101273	Fivemile River	09/30/2009	8	11
New Canaan	New Canaan STP	CT0101273	Fivemile River	10/31/2009	8	10
New Canaan	New Canaan STP	CT0101273	Fivemile River	11/30/2009	8	9
New Canaan	New Canaan STP	CT0101273	Fivemile River	12/31/2009	8	12
New Canaan	New Canaan STP	CT0101273	Fivemile River	01/31/2010	7	8
New Canaan	New Canaan STP	CT0101273	Fivemile River	02/28/2010	7	10
New Canaan	New Canaan STP	CT0101273	Fivemile River	03/31/2010	9	12
New Canaan	New Canaan STP	CT0101273	Fivemile River	04/30/2010	8	11
New Canaan	New Canaan STP	CT0101273	Fivemile River	05/31/2010	9	9
New Canaan	New Canaan STP	CT0101273	Fivemile River	06/30/2010	10	15
New Canaan	New Canaan STP	CT0101273	Fivemile River	07/31/2010	7	9
New Canaan	New Canaan STP	CT0101273	Fivemile River	08/31/2010	9	12
New Canaan	New Canaan STP	CT0101273	Fivemile River	09/30/2010	9	15
New Canaan	New Canaan STP	CT0101273	Fivemile River	10/31/2010	8	10
New Canaan	New Canaan STP	CT0101273	Fivemile River	11/30/2010	8	9
New Canaan	New Canaan STP	CT0101273	Fivemile River	12/31/2010	8	2
New Canaan	New Canaan STP	CT0101273	Fivemile River	01/31/2011	9	1
New Canaan	New Canaan STP	CT0101273	Fivemile River	02/28/2011	8	1
New Canaan	New Canaan STP	CT0101273	Fivemile River	03/31/2011	6	10
New Canaan	New Canaan STP	CT0101273	Fivemile River	04/30/2011	8	10
New Canaan	New Canaan STP	CT0101273	Fivemile River	05/31/2011	8	11
New Canaan	New Canaan STP	CT0101273	Fivemile River	06/30/2011	10	11
New Canaan	New Canaan STP	CT0101273	Fivemile River	07/31/2011	9	12
New Canaan	New Canaan STP	CT0101273	Fivemile River	08/31/2011	8	11
New Canaan	New Canaan STP	CT0101273	Fivemile River	09/30/2011	9	14
30-Day Geometric Mean Permit Limit = 200 colonies/100 mL						
7-Day Geometric Mean Permit Limit = 400 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 Five Mile River watershed are described below. The 2011 Five Mile River Watershed Based Plan describes many of these sources in greater detail (http://www.swrpa.org/Uploads/5mile_P1_reduced.pdf?phpMyAdmin=727f2ac42cbcd584386014c03e889f71).

Stormwater Runoff from Developed Areas

The majority of the Five Mile River watershed is developed. Approximately 70% of the land use in the watershed is considered urban, and the impaired segments are located within the densely populated mid to lower portion of the watershed (Figures 4 and 9). Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate the soil. Studies have shown a link between 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).

As shown in Figure 8, approximately 63% of the Five Mile River watershed contains more than 16% impervious cover, particularly in the area around the impaired segments (Figure 9). Water quality data taken at Stations 77 and 6116, located within the heavily urbanized portion of the watershed in New Canaan were consistently high, especially during wet weather, which suggests that stormwater runoff may be a source of bacteria to the Five Mile River (Table 14). Stormwater pollution sources include fertilizer runoff, leaky septic systems, horse farms, golf courses, and impervious surfaces.

Figure 8: Range of impervious cover (%) in the Five Mile River watershed

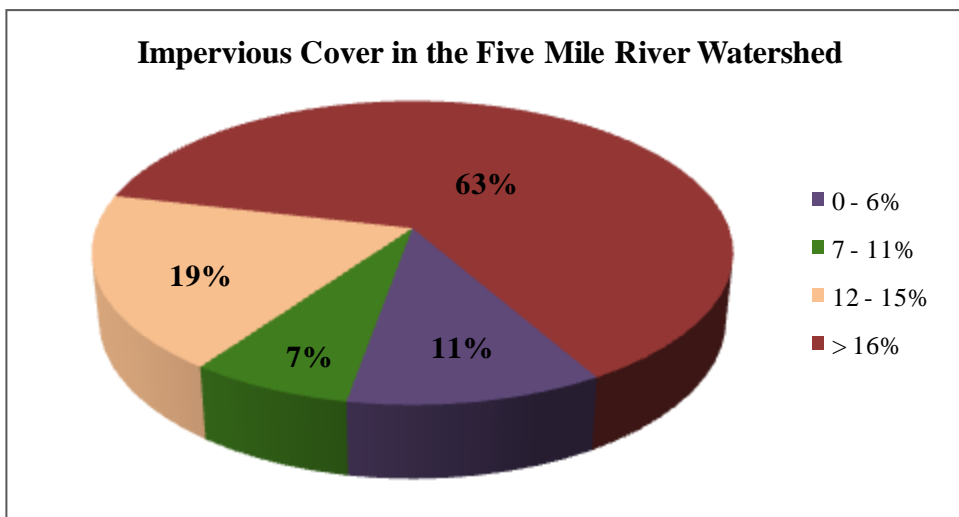
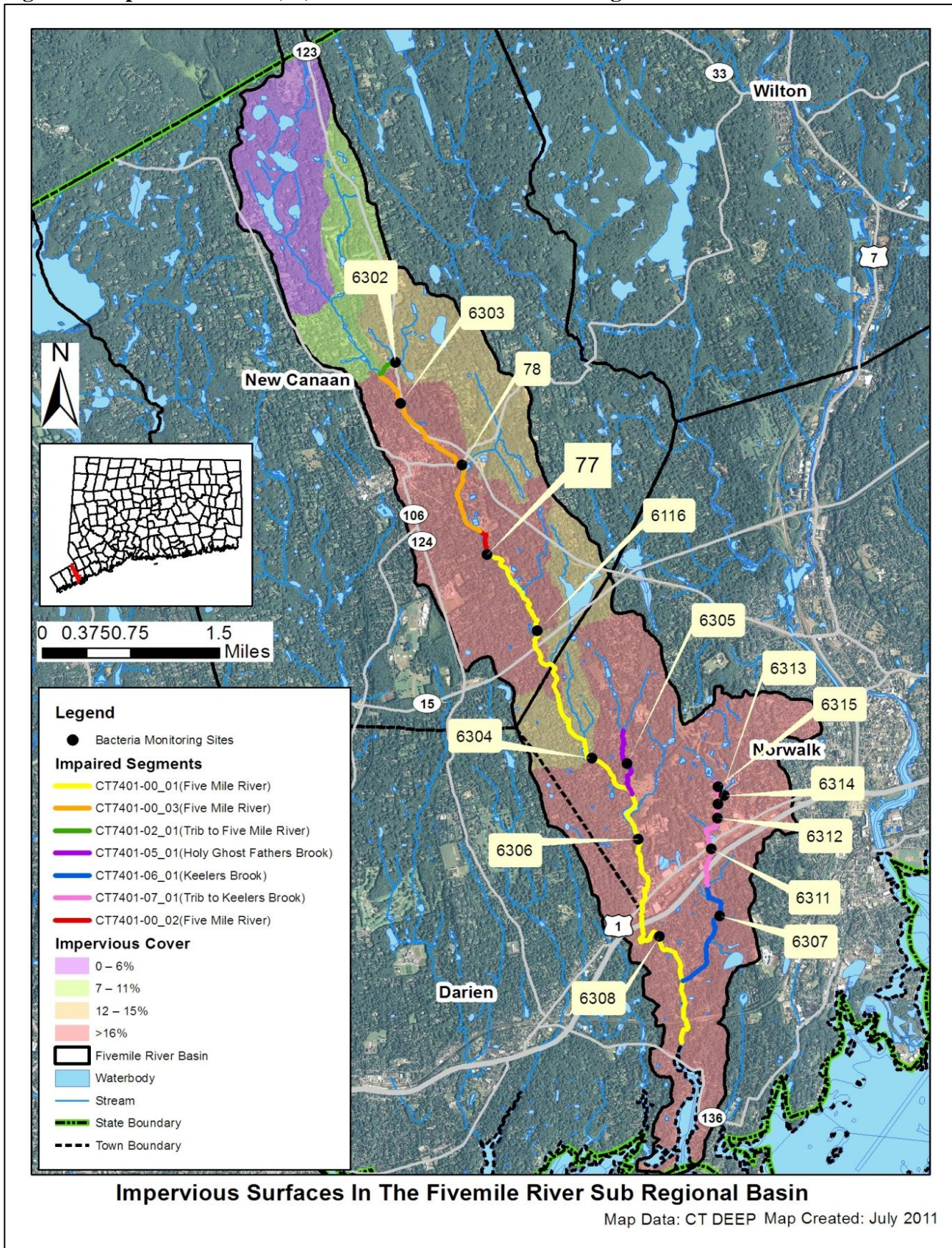


Figure 9: Impervious cover (%) for the Five Mile River sub-regional watershed



Insufficient Septic Systems and Illicit Discharges

As shown in Figure 6, the majority of the watershed in New Canaan and northwestern Norwalk 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. As shown in Figure 6, there is a failing septic system along Keelers Brook (Tributary 1) leading to the lower portion of the Five Mile River (Segment 1). There are also two potential leachate sources, including a water treatment or filter backwash facility upstream of the impaired segments and a sewage treatment plant adjacent to the Five Mile River (Segment 1).

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 New Canaan has a full-time health director (<http://www.newcanaan.info/content/293/307/default.aspx>), the Town of Norwalk has a full-time health director (<http://norwalkhealthdept.org/>), and the Town of Darien also has a full-time health director (<http://www.darienct.gov/content/104/114/163/default.aspx>).

The areas surrounding the lower portion of the Five Mile River (Segment 1) and along the Five Mile River (Segment 3) and Keelers Brook (Segment 1 and Tributary 1) are serviced by the municipal sewer system (Figure 6). Sewer system leaks and other illicit discharges or connections can contribute bacteria to nearby surface waters. Illicit discharges and failing wastewater conveyance systems (i.e. pumping stations) were addressed as a significant problem in the Five Mile Watershed Based Plan (2011).

High geometric means during dry-weather may indicate that sources such as failing and insufficient septic systems or illicit discharges may be contributing to the bacterial impairment in a river segment. As shown in Tables 14-20, the geometric mean for dry weather exceeded the WQS, indicating that there is a dry-weather source of bacteria at these locations.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Five Mile River watershed represent another potential source of bacteria to surface waters. 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). The northern quarter of the watershed located in New Canaan is undeveloped and wildlife waste may be a potential source of bacteria to the Five Mile River. The Five Mile Watershed Based Plan (2011) identified deer and duck hunting as popular sports along the river, which may indicate a more widespread wildlife bacterial waste source along the river. As the majority of the watershed is urban residential development adjacent to the impaired segments, pet waste may be a more direct potential source of bacteria.

The Oak Hills Park Golf Club and New Canaan Country Club are located within the Five Mile River watershed along Keelers Brook connecting to the downstream portion of the Five Mile River (Segment 1) (Figure 6) and along the Five Mile River (Segment 3), respectively. Geese and other waterfowl are known to congregate in open areas including recreational fields, agricultural crop fields, and golf courses. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants.

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 1% of the Five Mile River watershed. Although there are no major agricultural areas near the impaired segments, there are agricultural fields and/or livestock farms located in the upper half of the Five Mile River watershed. Agricultural activities are likely a small source of bacteria to the Five Mile River.

Additional Sources

The Five Mile Watershed Based Plan (2011) identified failing wastewater conveyance systems, failing septic systems, Oak Hills Country Club, dense commercial areas, Ledge Brook Condominiums, landfills, and POTWs as potential sources of bacterial contamination to the Five Mile River. As shown in Figure 6, there are two landfills along Keelers Brook leading to the lower portion of the Five Mile River (Segment 1) and adjacent to the Five Mile River (Segment 2).

There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment in the Five Mile River. 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

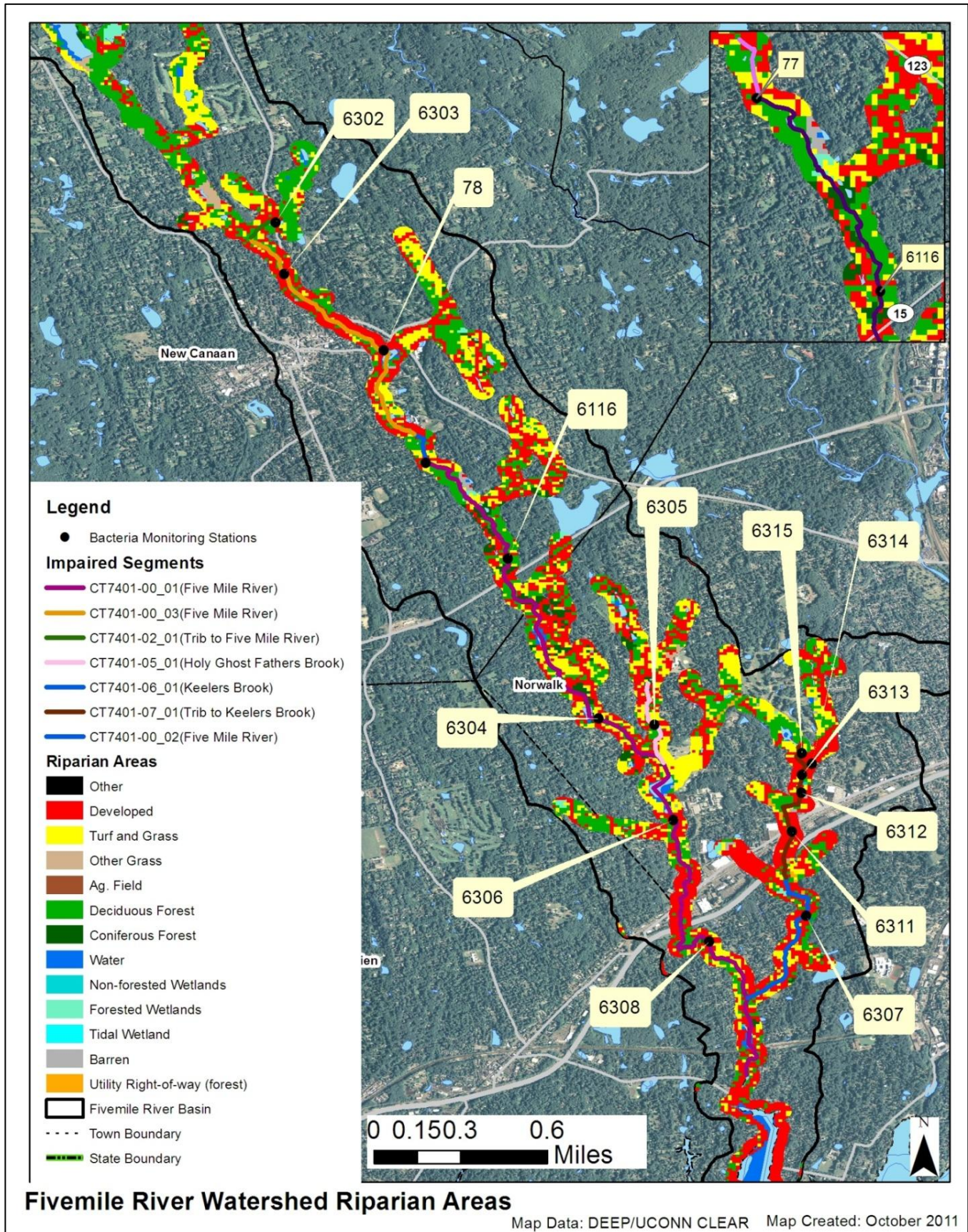
Riparian Buffer Zones

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 segments of the Five Mile River is characterized by developed land use with portions of turf/grass and forested areas (Figure 10). As previously noted, if not properly treated, runoff from developed areas may contain pollutants such as bacteria and nutrients.

Figure 10: Riparian buffer zone information for the Five Mile River watershed



Fivemile River Watershed Riparian Areas

CURRENT MANAGEMENT ACTIVITIES

The Towns of New Canaan and Darien and the City of Norwalk have developed and implemented programs to protect water quality from bacterial contamination. In 2011, the Five Mile River Watershed Based Plan was completed (http://www.swrpa.org/Uploads/5mile_P1_reduced.pdf?phpMyAdmin=727f2ac42cbcd584386014c03e889f71). This document outlines current actions in 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). A \$15,000 319 grant was awarded to Earthplace-Harbor Watch/River Watch to conduct a one year study of *E. coli*, dissolved oxygen, conductivity, and water temperature at 10 monitoring sites along the Five Mile River (<http://www.depdata.ct.gov/maps/nps/npsmap.htm>). Another 319 grant was awarded to the City of Norwalk for \$33,000 to develop a watershed based management plan that addressed nonpoint source pollution in the Five Mile River watershed.

As indicated previously, New Canaan, Norwalk, and Darien are 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 new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each town 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 Tables 9 - 11.

Table 9: Summary of MS4 requirement updates related to the reduction of bacterial contamination from New Canaan, CT (Permit #GSM000079)

Minimum Measure	New Canaan Annual Report (November 2009)
Public Outreach and Education	1) Requires written confirmation of compliance with soil and erosion control plans, and includes "Erosion Control for Homeowners" fact sheet in Building Department Application Package. 2) Public Works Department displays poster on "Stormwater and the Construction Industry". 3) New stormwater brochure and litter bags distributed in 2009. 4) Animal Control Office maintained dispensers and biodegradable bags in parks for dog owners. 5) Town website includes a link for Stormwater Management.

Table 9: Summary of MS4 requirement updates related to the reduction of bacterial contamination from New Canaan, CT (Permit #GSM000079) (continued)

Minimum Measure	New Canaan Annual Report (November 2009)
Public Involvement and Participation	1) Currently developing a Stormwater Advisory Committee. 2) The Town and New Canaan Garden Club continue to sponsor river clean-ups. 3) Over 1,000 catch basins stenciled by Town Highway Department.
Illicit Discharge Detection and Elimination	1) Utilized GIS to locate and map 174 stormwater outfalls and 981 catch basins in the business district. 2) Currently developing an Illicit Discharge Town Ordinance. 3) Continuing to identify potential locations of illicit discharge by reviewing available testing data and following up any complaints. 4) Highway Department employees trained on Stormwater Pollution Prevention Plan.
Construction Site Stormwater Runoff Control	No updates.
Post Construction Stormwater Management	1) Enforcement of "zero increase" in runoff from existing developments. 2) Reviewing current drainage requirements for stormwater quality to encourage LID practices.
Pollution Prevention and Good Housekeeping	1) All town roads swept once per year. Streets within the business district are swept twice a week in the spring, summer, and fall. 2) 97% reduction in sand use with the introduction of Ice Ban.

Table 10: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Norwalk, CT (Permit #GSM000024)

Minimum Measure	Norwalk Annual Report (2007)
Public Outreach and Education	1) Norwalk River Watershed Initiative and the Maritime Aquarium continue to distribute stormwater brochures. 2) Stormwater management information has been added to the City website. 3) Will provide additional stormwater information through a local access channel.
Public Involvement and Participation	1) Sponsored annual DPW Open House for public participation. 2) Providing public education through grant on installation of catch basin filters. 3) Monthly Water Quality Committee meetings open to the public.

Table 10: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Norwalk, CT (Permit #GSM000024) (continued)

Minimum Measure	Norwalk Annual Report (2007)
Illicit Discharge Detection and Elimination	1) The City has mapped all outfalls greater than 12" on the Norwalk and Silvermine Rivers (75% of outfalls). 2) Developing program to detect and eliminate illicit discharges. 3) Developing illicit discharge ordinance.
Construction Site Stormwater Runoff Control	1) Will review its zoning and subdivision regulations pertaining to erosion and sedimentation control and stormwater control measures for all construction activities.
Post Construction Stormwater Management	1) Updated Storm Drainage Manual. 2) Will implement new training program for inspection procedures to ensure conformance to required stormwater management practices.
Pollution Prevention and Good Housekeeping	1) Developed a training program on pollution prevention measures for Public Works and other municipal operations. 2) Continued street sweeping program. 3) Purchased two new vactor trucks. 4) Spent \$250,000 to clean catch basins, stormwater pipes and other stormwater structures in the City.

Table 11: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Darien, CT (Permit #GSM000046)

Minimum Measure	Darien Annual Report (2009)
Public Outreach and Education	1) Established household hazardous waste collection program. 2) Continued promotion and education of pet waste management. 3) Will create dumping control brochures.
Public Involvement and Participation	1) Will develop an Adopt-A-Stream Program. 2) Will conduct storm drain stenciling. 3) Will participate in watershed organizations.
Illicit Discharge Detection and Elimination	1) Will develop an Illicit Discharge Ordinance and Program. 2) Will create a storm sewer map for future monitoring.
Construction Site Stormwater Runoff Control	1) No current activities.
Post Construction Stormwater Management	1) Will evaluate and update plan review and inspection programs.
Pollution Prevention and Good Housekeeping	1) Will clean catch basins and evaluate street sweeping programs. 2) Will provide spill response kits and training.

RECOMMENDED NEXT STEPS

The Towns of New Canaan and Darien and the City of Norwalk have developed and implemented programs to protect water quality from bacterial contamination. Future mitigative activities are necessary to ensure the long-term protection of the Five Mile River and have been prioritized below. Some of these actions are provided in more detail in the 2011 Five Mile River Watershed Based Plan (http://www.swrpa.org/Uploads/5mile_P1_reduced.pdf?phpMyAdmin=727f2ac42cbed584386014c03e889f71).

1) Continue monitoring of permitted sources.

Previous sampling of discharge from MS4 outfall locations have shown elevated levels of e.coli bacteria, an indicator of bacterial pollution (Table 7). A water treatment plant and water treatment of filter backwash facility near the headwaters of the New Canaan Reservoir upstream of the impaired segments were identified as potential problems within the watershed by the Five Mile River Watershed Based Plan (2011). 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 12 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 Five Mile 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 12. 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
B ⁴	Non-Stormwater NPDES	235	410	576				126	
	CSOs	235	410	576				126	
	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.

2) Identify areas along the developed portions of the Five Mile River to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, 70% of the Five Mile River watershed is considered urban, and the Towns of New Canaan and Darien and the City of Norwalk are MS4 communities regulated by the MS4 program. The majority of the watershed near the impaired segments has an impervious cover greater than 16%. As such, stormwater runoff is most likely contributing bacteria to the waterbodies. The Five Mile River Watershed Based Plan (2011) made specific recommendations to reduce the impacts of stormwater runoff on water quality. The plan highlighted multiple areas to install structural BMPs. The suggested BMPs within the watershed municipalities are listed in Table 13. In addition, the plan addressed inclusion of LID practices to local building and zoning ordinances to mitigate 1,700 acres of impervious cover and protect riparian buffers at the headwaters of the Five Mile River where the risk for increased suburban development pressures is greatest. The entire length of the river is characterized by small impoundments, which act as geese attractants, fish barriers, and nutrient sources. Many of these impoundments are located on private property, so public outreach on BMPs may be the most appropriate method to achieve water quality improvement goals in the long-term.

Table 13: Recommended structural BMPs in Norwalk, New Canaan, and Darien from the 2011 Five Mile River Watershed Based Plan

Location	Town	Recommended BMPs
Technology Plaza Park	Norwalk	Divert 1.5 acres of impervious street area to naturalized surface storage basin in the Colonial Village open space.
Kendall Elementary School	Norwalk	Install subsurface infiltration beneath the ball field to divert 7 acres of onsite and local street impervious area runoff.
Oak Hills Park	Norwalk	Add 33,000 square feet of riparian buffer around pond to mitigate runoff from golf course and restaurant; Create stormwater storage units for lots in pocket wetlands along the restored channel.
Ledgebrook Condominiums	Norwalk	Install small rain gardens and bioretention areas at strategic locations where roof and yard drain outlets discharge into the area near the channel.
Costco/Double Tree Inn	Norwalk	Retrofit existing stormwater basin.
The Wahlstrom Group	Norwalk	Retrofit surface storage swale.
Norwalk Community College	Norwalk	Divert 9 acres of impervious area to a naturalized surface storage basin.

Saint John's Cemetery	Norwalk	Construct a naturalized surface storage basin to treat road runoff from Richards Road and Priscilla Road before overflowing existing pipe that joins the subsurface stream.
Fireside Ct. Cul-de-Sac	Norwalk	Install a bioretention rain garden to filter storm events.
Fox Run Elementary School	Norwalk	Install 2-3 naturalized surface storage basins or retentions.
Kiwanis Park	New Canaan	Divert 5 acres of impervious area to a naturalized surface storage basin.
New Canaan YMCA	New Canaan	Install combination of naturalized surface storage basin and underground infiltration gallery to minimize repurposing of recreational areas.

Table 13: Recommended structural BMPs in Norwalk, New Canaan, and Darien from the 2011 Five Mile River Watershed Based Plan (continued)

Location	Town	Recommended BMPs
Saxe Middle School	New Canaan	Divert runoff from southern parking lots to existing stormwater basin and install subsurface storage at downhill baseball field on Farm Rd.
Avalon Apartments	New Canaan	Retrofit surface storage basin and modify outlet structure.
Smith Ridge Road Median	New Canaan	Redesign clogged outlet at 84 Forest Street to a small naturalized basin.
East Elementary School	New Canaan	Install curb cuts and diversions from existing inlets to a naturalized surface storage basin to capture road and parking lot runoff.
Mill Pond Park	New Canaan	Remove dam at Mill Pond and add pocket wetlands along the channel to divert storm flow.

To identify other areas that are contributing bacteria to the impaired segments, the municipalities should continue to conduct wet-weather sampling at stormwater outfalls that discharge directly to the impaired segments in the Five Mile River watershed. Outfalls that have previously shown high bacteria concentrations should be prioritized for BMP installation (Table 6). To treat stormwater runoff, the municipalities should identify areas along the impaired segment to install BMPs designed to encourage stormwater to infiltrate 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.

3) Develop a system to monitor septic systems.

While the lower portion of the Five Mile River watershed and the area surrounding the Town of New Canaan, CT rely on the municipal sanitary sewer system, many residents along and upstream of the impaired segments rely on septic systems. A failing septic system was already identified along Keelers Brook, a tributary leading to the Five Mile River (Segment 1). If not already in place, New Canaan, Norwalk, and Darien should establish programs to ensure that existing septic systems are properly operated and maintained, and create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems.

Policies that govern the eventual replacement of sub-standard systems within a reasonable timeframe can be adopted. The municipalities should also develop a program to assist citizens with the replacement and repair of older and failing systems.

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

Residents in the lower portion of the Five Mile River watershed and the area surrounding the Town of New Canaan rely on a municipal sewer system. This area overlaps the lower third of the Five Mile River (Segment 1) (Figure 6). It is important for the municipalities to develop a program to evaluate its sanitary sewer and reduce leaks and overflows. This program should include periodic inspections of the sewer line. The City of Norwalk is currently undergoing a Phase I wastewater treatment upgrade for CSO/Wet weather at their Water Pollution Control Facility near the harbor, directly downstream of the impaired segments.

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

As most of the Five Mile River watershed is developed, any education and outreach program should highlight the importance of not feeding waterfowl and wildlife and managing waste from horses, dogs, and other pets. Municipalities and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of the Five Mile River that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in the Five Mile River 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-use areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

6) Ensure there are sufficient buffers on agricultural lands along the Five Mile River.

Although agricultural land use represents only 1% of the Five Mile River watershed, it may still be a concern for water quality, particularly the horse farms addressed in the Five Mile River Watershed Based Plan (2011) as a potential bacterial source in the watershed (Figure 4). 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 access to livestock and horses from streams and wetlands, and that animal waste handling, disposal, and other appropriate BMPs are in place. In addition to these recommendations, the Five Mile River Watershed Based Plan (2011) addressed horse trail stabilization at river crossings to limit bank erosion. These may also be hotspots for animal waste contamination.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 14: Keelers Brook (Segment 1) Bacteria Data

Waterbody ID: CT7401-06_01*Characteristics:* Freshwater, Class A, Potential Public Drinking Water Supply, 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: 80%

Single Sample: 96%

Data: 2011 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle**Single sample *E. coli* (colonies/100 mL) data from Station 6307 on Keelers Brook (Segment 1) with annual geometric mean calculated**

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
6307	Primrose court	5/16/2011	260	wet**	642* (80%)
6307	Primrose court	5/19/2011	1140	wet**	
6307	Primrose court	5/20/2011	620	wet**	
6307	Primrose court	5/23/2011	300	wet**	
6307	Primrose court	5/24/2011	4700	dry**	
6307	Primrose court	5/25/2011	620	dry**	
6307	Primrose court	5/26/2011	380	dry**	
6307	Primrose court	5/31/2011	900	wet**	
6307	Primrose court	6/1/2011	300	dry**	
6307	Primrose court	6/6/2011	320	dry**	
6307	Primrose court	6/13/2011	520	wet**	
6307	Primrose court	6/27/2011	1380	dry**	
6307	Primrose court	6/29/2011	11000* (96%)	wet**	
6307	Primrose court	7/11/2011	380	dry**	
6307	Primrose court	7/25/2011	270	wet**	
6307	Primrose court	8/8/2011	900	wet**	
6307	Primrose court	8/22/2011	760	dry**	

6307	Primrose court	9/12/2011	160	dry**	
6307	Primrose court	9/26/2011	600	dry**	
6307	Primrose court	9/28/2011	500	wet**	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

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

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

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 6307 on Keelers Brook (Segment 1)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
6307	Primrose court	2011	10	10	642	714	577

Shaded cells indicate an exceedance of water quality criteria

NA for Years Sampled indicates lack of precipitation data for all sampling years.

Weather condition determined from rain gages at Stamford 5 N Station in Fairfield, CT.

Table 15: Keelers Brook (Tributary 1) River Bacteria Data**Waterbody ID:** CT7401-07_01**Characteristics:** Freshwater, Class A, Potential Public Drinking Water Supply, 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: **98%**Single Sample: **98%****Data:** 2011 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle**Single sample *E. coli* (colonies/100 mL) data from all stations on Keelers Brook (Tributary 1) with annual geometric mean calculated**

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
6315	Gillies lane	6/13/2011	540	wet**	785
6315	Gillies lane	6/29/2011	400	wet**	
6315	Gillies lane	7/11/2011	380	dry**	
6315	Gillies lane	7/25/2011	4100	wet**	
6315	Gillies lane	8/22/2011	240	dry**	
6315	Gillies lane	9/28/2011	2900	wet**	
6313	Scribner Avenue	6/13/2011	800	wet**	558
6313	Scribner Avenue	6/29/2011	7000	wet**	
6313	Scribner Avenue	7/11/2011	1300	dry**	
6313	Scribner Avenue	7/25/2011	100	wet**	
6313	Scribner Avenue	8/8/2011	500	wet**	
6313	Scribner Avenue	8/22/2011	232	dry**	
6313	Scribner Avenue	9/28/2011	200	wet**	

Single sample *E. coli* (colonies/100 mL) data from all stations on Keelers Brook (Tributary 1) with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
6314	Ledgebrook Drive	6/13/2011	480	wet**	445
6314	Ledgebrook Drive	6/29/2011	3900	wet**	
6314	Ledgebrook Drive	7/11/2011	300	dry**	
6314	Ledgebrook Drive	7/25/2011	100	wet**	
6314	Ledgebrook Drive	8/8/2011	470	wet**	
6314	Ledgebrook Drive	8/22/2011	130	dry**	
6314	Ledgebrook Drive	9/28/2011	1000	wet**	
6311	Rampart Road	6/13/2011	500	wet**	1137
6311	Rampart Road	6/29/2011	7000	wet**	
6311	Rampart Road	7/11/2011	1000	dry**	
6311	Rampart Road	7/25/2011	1100	wet**	
6311	Rampart Road	8/8/2011	800	wet**	
6311	Rampart Road	8/22/2011	1000	dry**	
6311	Rampart Road	9/28/2011	800	wet**	
6312	West Cedar Street	6/13/2011	25001* (98%)	wet**	6090* (98%)
6312	West Cedar Street	6/29/2011	10000	wet**	
6312	West Cedar Street	7/25/2011	9000	wet**	
6312	West Cedar Street	8/8/2011	14000	wet**	
6312	West Cedar Street	8/22/2011	1800	dry**	
6312	West Cedar Street	9/28/2011	900	wet**	
<p>Shaded cells indicate an exceedance of water quality criteria</p> <p>†Average of two duplicate samples</p> <p>** Weather conditions for selected data taken from Hartford because local station had missing data</p> <p>*Indicates single sample and geometric mean values used to calculate the percent reduction</p>					

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for all stations on Keelers Brook (Tributary 1)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
6315	Gillies lane	2011	4	2	785	1266	302
6313	Scribner Avenue	2011	5	2	558	562	549
6314	Ledgebrook Drive	2011	5	2	445	615	197
6311	Rampart Road	2011	5	2	1137	1198	1000
6312	West Cedar Street	2011	5	1	6090	7772	NA

Shaded cells indicate an exceedance of water quality criteria

NA for Years Sampled indicates lack of precipitation data for all sampling years.

Weather condition determined from rain gages at Stamford 5 N Station in Fairfield, CT.

Table 16: Holy Ghost Father’s Brook (Segment 1) Bacteria Data

Waterbody ID: CT7401-05_01

Characteristics: Freshwater, Class A, Potential Public Drinking Water Supply, 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: **52%**

Single Sample: **89%**

Data: 2011 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from Station 6305 on Holy Ghost Father’s Brook (Segment 1) with annual geometric mean calculated

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
6305	Geneva Road	5/16/2011	380	wet**	260* (52%)
6305	Geneva Road	5/19/2011	900	wet**	
6305	Geneva Road	5/20/2011	112	wet**	
6305	Geneva Road	5/23/2011	68	wet**	
6305	Geneva Road	5/24/2011	560	dry**	
6305	Geneva Road	5/25/2011	124	dry**	
6305	Geneva Road	5/26/2011	144	dry**	
6305	Geneva Road	5/31/2011	3600* (89%)	wet**	
6305	Geneva Road	6/1/2011	108	dry**	
6305	Geneva Road	6/27/2011	120	dry**	
6305	Geneva Road	7/11/2011	200	dry**	
6305	Geneva Road	8/8/2011	2100	wet**	
6305	Geneva Road	8/22/2011	192	dry**	
6305	Geneva Road	9/12/2011	116	dry**	
6305	Geneva Road	9/26/2011	148	dry**	

Shaded cells indicate an exceedance of water quality criteria

† Average of two duplicate samples

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

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

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 6305 on Holy Ghost Father's Brook (Segment 1)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
6305	Geneva Road	2011	6	9	260	520	164

Shaded cells indicate an exceedance of water quality criteria
NA for Years Sampled indicates lack of precipitation data for all sampling years.
Weather condition determined from rain gages at Stamford 5 N Station in Fairfield, CT.

Table 17: Five Mile River (Segment 1) Bacteria Data**Waterbody ID:** CT7401-00_01**Characteristics:** Freshwater, Class B, 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: **88%**Single Sample: **98%****Data:** 2010-2011 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle**Single sample *E. coli* (colonies/100 mL) data from all stations on the Five Mile River (Segment 1) with annual geometric mean calculated**

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
6116	Nursery Road	5/19/2010	1050 [†]	wet**	1013* (88%)
6116	Nursery Road	6/9/2010	770	wet**	
6116	Nursery Road	6/16/2010	510	dry**	
6116	Nursery Road	6/23/2010	2900	wet**	
6116	Nursery Road	6/30/2010	600	dry**	
6116	Nursery Road	7/8/2010	790	dry**	
6116	Nursery Road	7/14/2010	20000* (98%)	wet**	
6116	Nursery Road	7/21/2010	640	dry**	
6116	Nursery Road	8/4/2010	660	dry**	
6116	Nursery Road	8/12/2010	490	dry**	
6116	Nursery Road	9/21/2010	490	dry**	

Single sample *E. coli* (colonies/100 mL) data from all stations on the Five Mile River (Segment 1) with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
6304	At Fallow Street	5/16/2011	900	wet**	376
6304	At Fallow Street	5/19/2011	860	wet**	
6304	At Fallow Street	5/20/2011	420	wet**	
6304	At Fallow Street	5/23/2011	380	wet**	
6304	At Fallow Street	5/24/2011	500	dry**	
6304	At Fallow Street	5/25/2011	232	dry**	
6304	At Fallow Street	5/26/2011	332	dry**	
6304	At Fallow Street	5/31/2011	2200	wet**	
6304	At Fallow Street	6/1/2011	280	dry**	
6304	At Fallow Street	6/27/2011	212	dry**	
6304	At Fallow Street	7/11/2011	180	dry**	
6304	At Fallow Street	7/25/2011	100	wet**	
6304	At Fallow Street	8/8/2011	500	wet**	
6304	At Fallow Street	8/22/2011	400	dry**	
6304	At Fallow Street	9/12/2011	100	dry**	
6304	At Fallow Street	9/26/2011	720	dry**	
6306	West Cedar Street and Beechwood Road	5/16/2011	1480	wet**	407
6306	West Cedar Street and Beechwood Road	5/20/2011	400	wet**	
6306	West Cedar Street and Beechwood Road	5/23/2011	400	wet**	
6306	West Cedar Street and Beechwood Road	5/24/2011	2100	dry**	
6306	West Cedar Street and Beechwood Road	5/25/2011	380	dry**	
6306	West Cedar Street and Beechwood Road	5/26/2011	104	dry**	
6306	West Cedar Street and Beechwood Road	5/31/2011	7400	wet**	
6306	West Cedar Street and Beechwood Road	6/1/2011	400	dry**	
6306	West Cedar Street and Beechwood Road	6/27/2011	360	dry**	
6306	West Cedar Street and Beechwood Road	7/11/2011	140	dry**	
6306	West Cedar Street and Beechwood Road	7/25/2011	10	wet**	
6306	West Cedar Street and Beechwood Road	8/8/2011	600	wet**	
6306	West Cedar Street and Beechwood Road	8/22/2011	320	dry**	
6306	West Cedar Street and Beechwood Road	9/12/2011	280	dry**	
6306	West Cedar Street and Beechwood Road	9/26/2011	880	dry**	

Single sample *E. coli* (colonies/100 mL) data from all stations on the Five Mile River (Segment 1) with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
6308	North Flax Hill Road and Shadybrook lane	5/16/2011	980	wet**	614
6308	North Flax Hill Road and Shadybrook lane	5/19/2011	1260	wet**	
6308	North Flax Hill Road and Shadybrook lane	5/20/2011	1020	wet**	
6308	North Flax Hill Road and Shadybrook lane	5/23/2011	320	wet**	
6308	North Flax Hill Road and Shadybrook lane	5/24/2011	1300	dry**	
6308	North Flax Hill Road and Shadybrook lane	5/25/2011	420	dry**	
6308	North Flax Hill Road and Shadybrook lane	5/26/2011	268	dry**	
6308	North Flax Hill Road and Shadybrook lane	5/31/2011	3300	wet**	
6308	North Flax Hill Road and Shadybrook lane	6/1/2011	236	dry**	
6308	North Flax Hill Road and Shadybrook lane	6/6/2011	380	dry**	
6308	North Flax Hill Road and Shadybrook lane	6/27/2011	340	dry**	
6308	North Flax Hill Road and Shadybrook lane	7/11/2011	680	dry**	
6308	North Flax Hill Road and Shadybrook lane	7/25/2011	600	wet**	
6308	North Flax Hill Road and Shadybrook lane	8/8/2011	1000	wet**	
6308	North Flax Hill Road and Shadybrook lane	8/22/2011	540	dry**	
6308	North Flax Hill Road and Shadybrook lane	9/12/2011	540	dry**	
6308	North Flax Hill Road and Shadybrook lane	9/26/2011	360	dry**	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

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

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

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for all stations on the Five Mile River (Segment 1)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
6116	Nursery Road	2010	4	7	1013	2617	589
6304	At Fallow Street	2011	7	9	376	541	284
6306	West Cedar Street and Beechwood Road	2011	6	9	407	468	371
6308	North Flax Hill Road and Shadybrook lane	2011	7	10	615	968	447

Shaded cells indicate an exceedance of water quality criteria

NA for Years Sampled indicates lack of precipitation data for all sampling years.

Weather condition determined from rain gages at Stamford 5 N Station in Fairfield, CT.

Table 18: Five Mile River (Segment 2) Bacteria Data**Waterbody ID:** CT7401-00_02**Characteristics:** Freshwater, Class B, 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: **77%**Single Sample: **98%****Data:** 1998, 2003-2004, 2006-2010 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle**Single sample *E. coli* (colonies/100 mL) data from Station 77 on the Five Mile River (Segment 2) with annual geometric mean calculated**

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
77	Under Old Norwalk Road crossing	7/15/1998	10	dry	10
77	Under Old Norwalk Road crossing	9/24/1998	10	dry	
77	Under Old Norwalk Road crossing	4/21/2003	63	dry	231
77	Under Old Norwalk Road crossing	8/19/2003	810	wet	
77	Under Old Norwalk Road crossing	10/14/2003	240	dry	
77	Under Old Norwalk Road crossing	2/19/2004	46 [†]	dry	NA

Single sample *E. coli* (colonies/100 mL) data from Station 77 on the Five Mile River (Segment 2)
with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
77	Under Old Norwalk Road crossing	6/1/2006	190	wet**	537
77	Under Old Norwalk Road crossing	6/15/2006	470	wet**	
77	Under Old Norwalk Road crossing	6/21/2006	255 [†]	dry**	
77	Under Old Norwalk Road crossing	6/29/2006	1600	wet**	
77	Under Old Norwalk Road crossing	7/12/2006	4100	wet**	
77	Under Old Norwalk Road crossing	7/20/2006	330 [†]	dry**	
77	Under Old Norwalk Road crossing	7/27/2006	560	wet**	
77	Under Old Norwalk Road crossing	8/3/2006	390 [†]	dry**	
77	Under Old Norwalk Road crossing	8/10/2006	280	dry**	
77	Under Old Norwalk Road crossing	8/17/2006	460	dry**	
77	Under Old Norwalk Road crossing	8/24/2006	765 [†]	dry**	
77	Under Old Norwalk Road crossing	6/17/2007	330 [†]	dry	
77	Under Old Norwalk Road crossing	6/20/2007	460 [†]	dry	
77	Under Old Norwalk Road crossing	7/5/2007	990 [†]	wet	
77	Under Old Norwalk Road crossing	7/11/2007	390 [†]	dry	
77	Under Old Norwalk Road crossing	7/19/2007	450	wet	
77	Under Old Norwalk Road crossing	7/26/2007	119 [†]	dry	
77	Under Old Norwalk Road crossing	8/8/2007	18000*[†] (98%)	wet	
77	Under Old Norwalk Road crossing	8/22/2007	450	wet	
77	Under Old Norwalk Road crossing	9/10/2007	190	dry**	
77	Under Old Norwalk Road crossing	9/20/2007	440	dry**	

Single sample *E. coli* (colonies/100 mL) data from Station 77 on the Five Mile River (Segment 2) with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
77	Under Old Norwalk Road crossing	6/2/2008	108 [†]	dry**	258
77	Under Old Norwalk Road crossing	6/11/2008	310	dry**	
77	Under Old Norwalk Road crossing	6/18/2008	200	wet**	
77	Under Old Norwalk Road crossing	6/25/2008	260	wet**	
77	Under Old Norwalk Road crossing	7/2/2008	150	dry**	
77	Under Old Norwalk Road crossing	7/9/2008	320	dry**	
77	Under Old Norwalk Road crossing	7/17/2008	300	dry**	
77	Under Old Norwalk Road crossing	7/30/2008	470	dry**	
77	Under Old Norwalk Road crossing	8/5/2008	360	dry	
77	Under Old Norwalk Road crossing	8/13/2008	250	dry	
77	Under Old Norwalk Road crossing	8/20/2008	320	dry	
77	Under Old Norwalk Road crossing	6/17/2009	190	dry**	
77	Under Old Norwalk Road crossing	6/24/2009	140	dry**	
77	Under Old Norwalk Road crossing	7/1/2009	120	wet**	
77	Under Old Norwalk Road crossing	7/22/2009	110	wet**	
77	Under Old Norwalk Road crossing	8/5/2009	130	dry**	
77	Under Old Norwalk Road crossing	8/12/2009	140 [†]	dry**	
77	Under Old Norwalk Road crossing	8/19/2009	1200	dry**	
77	Under Old Norwalk Road crossing	9/3/2009	150	dry**	
77	Under Old Norwalk Road crossing	9/9/2009	370	dry**	

Shaded cells indicate an exceedance of water quality criteria
[†]Average of two duplicate samples
**** Weather conditions for selected data taken from Hartford because local station had missing data**
***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 77 on the Five Mile River (Segment 2)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
77	Under Old Norwalk Road crossing	1998, 2003-2004, 2006-2009	14	33	283	593	207

Shaded cells indicate an exceedance of water quality criteria
Weather condition determined from rain gages at Stamford 5 N station in Stamford, CT and at Hartford Bradley International Airport

Table 19: Five Mile River (Segment 3) Bacteria Data**Waterbody ID:** CT7401-00_03**Characteristics:** Freshwater, Class A, Potential Public Drinking Water Supply, 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: **56%**Single Sample: **73%****Data:** 2011 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle**Single sample *E. coli* (colonies/100 mL) data from all stations on the Five Mile River (Segment 3) with annual geometric mean calculated**

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
78	Upstream of East Street (Route 106)	5/16/2011	760	wet**	289* (56%)
78	Upstream of East Street (Route 106)	5/19/2011	460	wet**	
78	Upstream of East Street (Route 106)	5/23/2011	152	wet**	
78	Upstream of East Street (Route 106)	5/24/2011	200	dry**	
78	Upstream of East Street (Route 106)	5/27/2011	316	dry**	
78	Upstream of East Street (Route 106)	5/31/2011	380	wet**	
78	Upstream of East Street (Route 106)	6/2/2011	420	dry**	
78	Upstream of East Street (Route 106)	6/3/2011	224	dry**	
78	Upstream of East Street (Route 106)	6/6/2011	208	dry**	
78	Upstream of East Street (Route 106)	6/7/2011	132	dry**	
78	Upstream of East Street (Route 106)	6/27/2011	184	dry**	
78	Upstream of East Street (Route 106)	7/11/2011	80	dry**	
78	Upstream of East Street (Route 106)	7/25/2011	160	wet**	
78	Upstream of East Street (Route 106)	8/8/2011	1500* (73%)	wet**	
78	Upstream of East Street (Route 106)	8/22/2011	940	dry**	
78	Upstream of East Street (Route 106)	9/12/2011	140	dry**	
78	Upstream of East Street (Route 106)	9/26/2011	440	dry**	

Single sample *E. coli* (colonies/100 mL) data from all stations on the Five Mile River (Segment 3) with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
6303	Route 123 near Parade Hill road	5/16/2011	160	wet**	154
6303	Route 123 near Parade Hill road	5/19/2011	268	wet**	
6303	Route 123 near Parade Hill road	5/23/2011	84	wet**	
6303	Route 123 near Parade Hill road	5/24/2011	160	dry**	
6303	Route 123 near Parade Hill road	5/31/2011	168	wet**	
6303	Route 123 near Parade Hill road	6/2/2011	56	dry**	
6303	Route 123 near Parade Hill road	6/3/2011	152	dry**	
6303	Route 123 near Parade Hill road	6/6/2011	216	dry**	
6303	Route 123 near Parade Hill road	6/7/2011	220	dry**	
6303	Route 123 near Parade Hill road	6/27/2011	72	dry**	
6303	Route 123 near Parade Hill road	7/11/2011	200	dry**	
6303	Route 123 near Parade Hill road	8/8/2011	490	wet**	
6303	Route 123 near Parade Hill road	8/22/2011	200	dry**	
6303	Route 123 near Parade Hill road	9/12/2011	80	dry**	
6303	Route 123 near Parade Hill road	9/26/2011	144	dry**	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

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

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

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for all stations on the Five Mile River (Segment 3)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
78	Upstream of East Street (Route 106)	2011	6	11	289	411	238
6303	Route 123 near Parade Hill road	2011	5	10	154	197	136

Shaded cells indicate an exceedance of water quality criteria

NA for Years Sampled indicates lack of precipitation data for all sampling dates.

Weather condition determined from rain gages at Stamford 5 N Station in Fairfield, CT.

Table 20: Five Mile River (Tributary 1) Bacteria Data

Waterbody ID: CT7401-02_01

Characteristics: Freshwater, Class A, Potential Public Drinking Water Supply, 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: **50%**

Single Sample: **77%**

Data: 2011 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from Station 6302 on the Five Mile River (Tributary 1) with annual geometric mean calculated

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
6302	at #183 mailbox Route 123	5/16/2011	104	wet**	251* (50%)
6302	at #183 mailbox Route 123	5/19/2011	1780* (77%)	wet**	
6302	at #183 mailbox Route 123	5/23/2011	112	wet**	
6302	at #183 mailbox Route 123	5/24/2011	780	dry**	
6302	at #183 mailbox Route 123	5/31/2011	120	wet**	
6302	at #183 mailbox Route 123	6/2/2011	224	dry**	
6302	at #183 mailbox Route 123	6/3/2011	172	dry**	
6302	at #183 mailbox Route 123	6/6/2011	360	dry**	
6302	at #183 mailbox Route 123	6/7/2011	252	dry**	
6302	at #183 mailbox Route 123	6/27/2011	188	dry**	
6302	at #183 mailbox Route 123	7/11/2011	180	dry**	
6302	at #183 mailbox Route 123	8/8/2011	330	wet**	
6302	at #183 mailbox Route 123	8/22/2011	220	dry**	
6302	at #183 mailbox Route 123	9/12/2011	140	dry**	
6302	at #183 mailbox Route 123	9/26/2011	420	dry**	

Shaded cells indicate an exceedance of water quality criteria

† Average of two duplicate samples

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

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

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 6302 on the Five Mile River (Tributary 1)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
6302	at #183 mailbox Route 123	2011	5	10	251	241	256
<p>Shaded cells indicate an exceedance of water quality criteria</p> <p>NA for Years Sampled indicates lack of precipitation data for all sampling years.</p> <p>Weather condition determined from rain gages at Stamford 5 N Station in Fairfield, CT.</p>							

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