



Naugatuck River Watershed Summary

Hockanum Brook

WATERSHED DESCRIPTION AND MAPS

The Naugatuck River watershed covers an area of approximately 49,515 acres in western Connecticut (Figure 1). There are multiple municipalities located at least partially in the watershed, including Woodbury, Beacon Falls, Bethany, Washington, and Morris, CT.

The Naugatuck River watershed includes one segment, Hockanum Brook (CT-6900-28_01), impaired for recreation due to elevated bacteria levels. This segment was assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. Some segments in the watershed were currently unassessed as of the writing of this document. This does not suggest that there are no issues on these segments, but indicates a lack of current data to evaluate the segments as part of the assessment process. An excerpt of the Integrated Water Quality Report is included in Table 1 (CTDEEP, 2010).

The Hockanum Brook (CT6900-28_01) begins in eastern Bethany at the Bethany Veterans Memorial Park Pond, along Beacon Road (Route 42), flows west toward Beacon Falls through a large emergent wetland at the Beacon Falls-Bethany municipal boundary, continues southwest, then west through the village of Beacon Falls, and ends at its confluence with the Naugatuck River between Noe Place and Bethany Road.

The impaired segment of the Hockanum Brook has a water quality classification of A. Designated uses include existing or proposed drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, 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 the Hockanum Brook, the specific recreation impairment is for non-designated swimming and other water contact related activities.

Impaired Segment Facts

Impaired Segments:

Hockanum Brook (CT6900-28_01)

Towns:

Beacon Falls and Bethany

Impaired Segments and Lengths

(miles): CT6900-28_01 (3.17)

Water Quality Classifications:

Class A

Designated Use Impairments:

Recreation

Sub-regional Basin Name and

Code: Naugatuck River, 6900

Regional Basin: Naugatuck

Major Basin: Housatonic

Watershed Area (acres): 49,515

MS4 Applicable? Yes

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

Figure 1: Watershed location in Connecticut

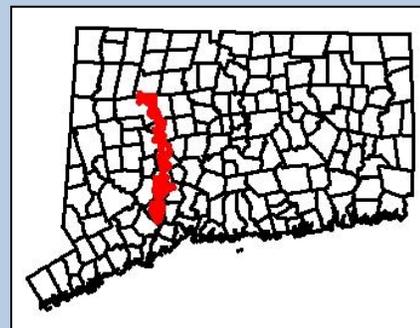


Table 1: Impaired segments and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report

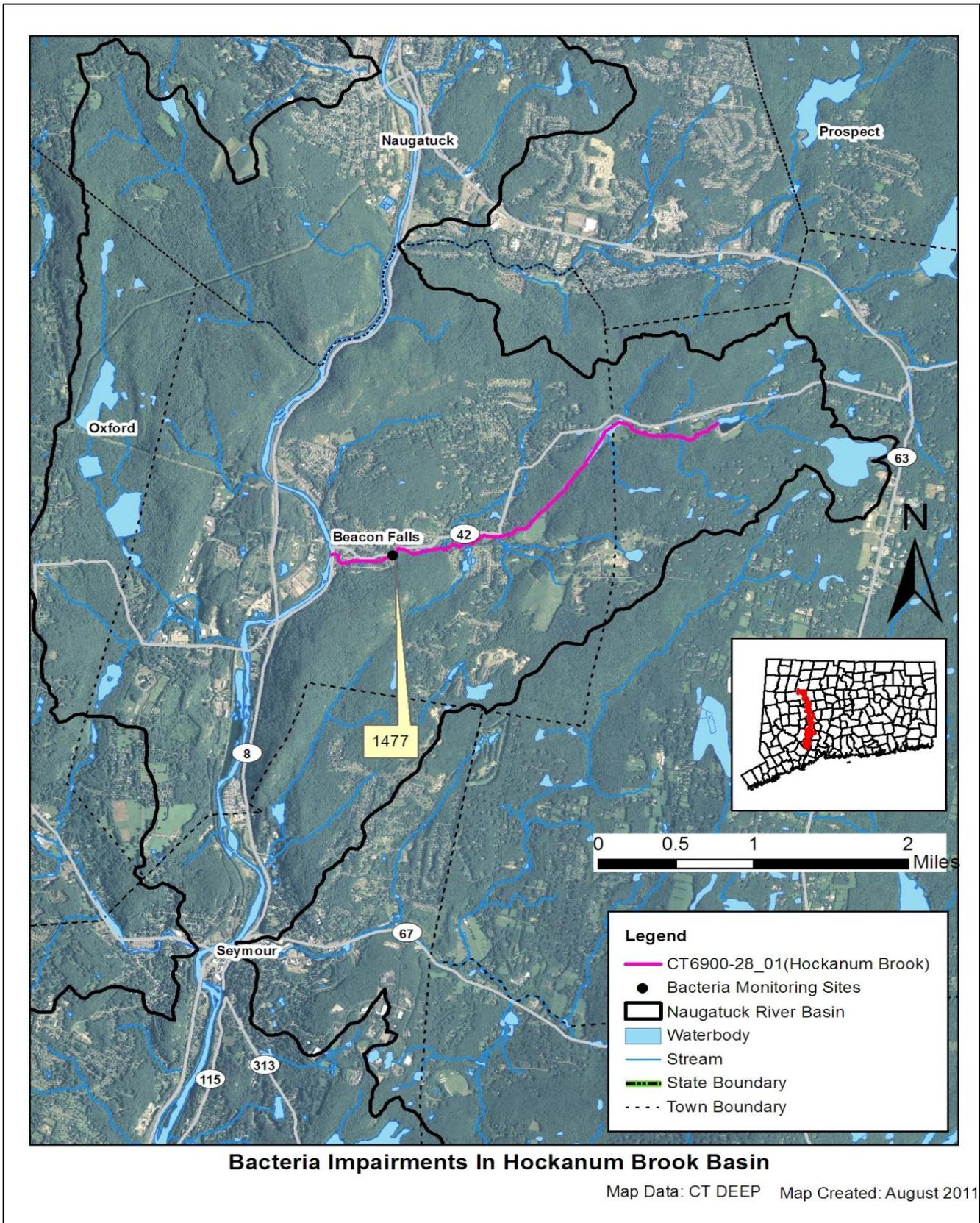
Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT6900-28_01	Hockanum Brook (Beacon Falls)-01	From mouth at confluence with Naugatuck River (just DS of Main Street (Route 42) crossing), Beacon Falls, US to headwaters at Simpson Lake outlet dam (parallel to Beacon Road (Route 42)), Bethany.	3.17	FULL	NOT	FULL
CT6900-00_01	Naugatuck River-01	From mouth at confluence with Housatonic River (DS of Railroad crossing), Derby, US to Rimmon (Tingue) outlet dam (US of Broad Street crossing, and just DS of Route 8 crossing), Seymour.	6.15	NOT	NOT	FULL
CT6900-00_02	Naugatuck River-02	From Rimmon (Tingue) outlet dam (just DS of Route 8 crossing), Seymour, US to confluence with Hopeville Pond Brook, just US of Waterbury WPCF. (Segment includes Wtby, Naug & Beacon Falls WPCFs, & dredge holes in river between Rts 42 & 67 in Beacon Falls)	11.26	NOT	NOT	FULL
CT6900-00_03	Naugatuck River-03	From confluence with Hopeville Pond Brook, just US of Waterbury WPCF, US to confluence with Steele Brook (west side of Route 8, at Route 73 connection), Waterbury.	3.52	NOT	NOT	FULL
CT6900-00_04	Naugatuck River-04	From confluence with Steele Brook (west side of Route 8, at Route 73 connection), Waterbury, US to sewage leak from pipe under river (near old bridge abutment) along Chase River Road, Watertown/Waterbury town border.	1.65	NOT	NOT	FULL
CT6900-00_05	Naugatuck River-05	From US side of sewage leak from pipe under river (near old bridge abutment) along Chase River Road, Watertown/Waterbury town border, US to confluence with Thomaston WPCF outfall (just US of confluence with Branch Brook), Thomaston.	4.46	NOT	NOT	FULL

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
CT6900-00_06	Naugatuck River-06	From confluence with Thomaston WPCF outfall (just US of confluence with Branch Brook), Thomaston, US to confluence with Spruce Brook (west side of Route 8), Litchfield/Harwinton town border.	9	NOT	NOT	FULL
CT6900-00_07	Naugatuck River-07	From confluence with Spruce Brook (west side of Route 8), Litchfield/Harwinton town border, US to confluence with Torrington WPCF (just US of bend north of plant), Harwinton/Torrington town border.	2.71	NOT	U	FULL
CT6900-00_08	Naugatuck River-08	From confluence with Torrington WPCF (just US of bend, north of plant), Harwinton/Torrington town border, US to headwaters at confluence of East and West Branches of Naugatuck River (just US of East Albert Street crossing), Torrington.	1.36	NOT	U	FULL
Shaded cells indicate impaired segment addressed in this TMDL FULL = Designated Use Fully Supported NOT = Designated Use Not Supported U = Unassessed						

The impaired segments of the Naugatuck River listed in the above table were included in a TMDL for the Naugatuck River that was approved in April 2008. To review this TMDL document follow this link: http://www.ct.gov/dep/lib/dep/water/tmdl/tmdl_final/naugatucktmdl_final.pdf.

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



Land Use

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

As shown in Figures 3 and 4, the Naugatuck River watershed consists of 55% forest, 37% urban area, 4% water, and 4% agriculture. The impaired segment of Hockanum Brook appears less developed than the overall watershed. The eastern portion of the watershed, where the headwaters are located, is primarily forested with a strip of development along Route 42. There are agricultural fields on the southern portion of the Hockanum Brook drainage, and the western portion of the drainage area is a mix of developed and forested.

Figure 3: Land use within the Naugatuck River watershed

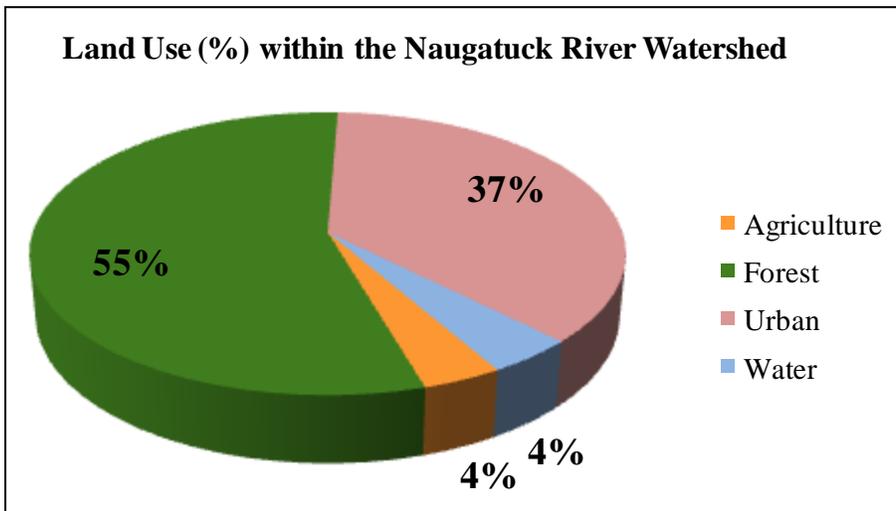
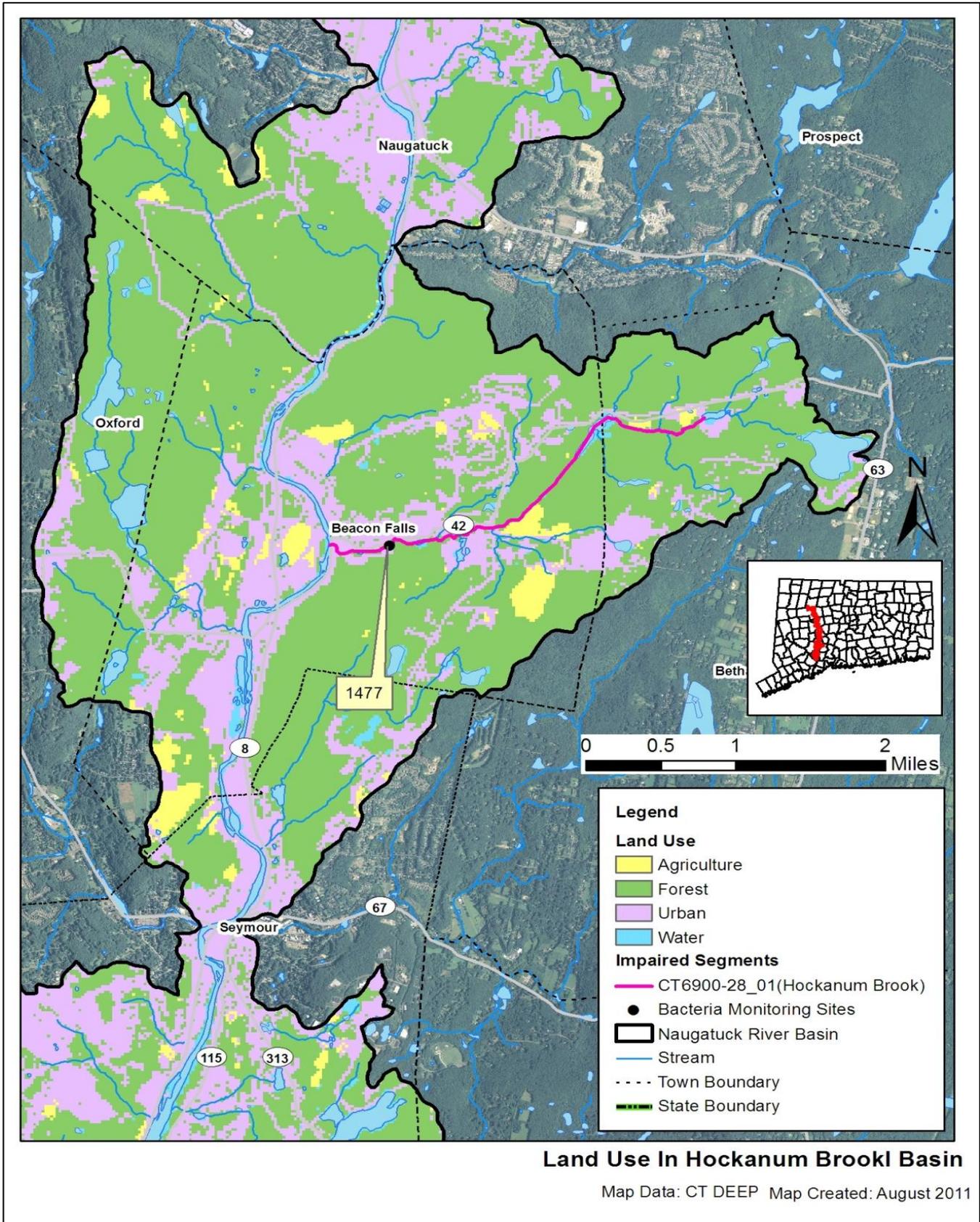


Figure 4: GIS map featuring land use for the Naugatuck River watershed at the sub-regional level



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 Naugatuck River watershed

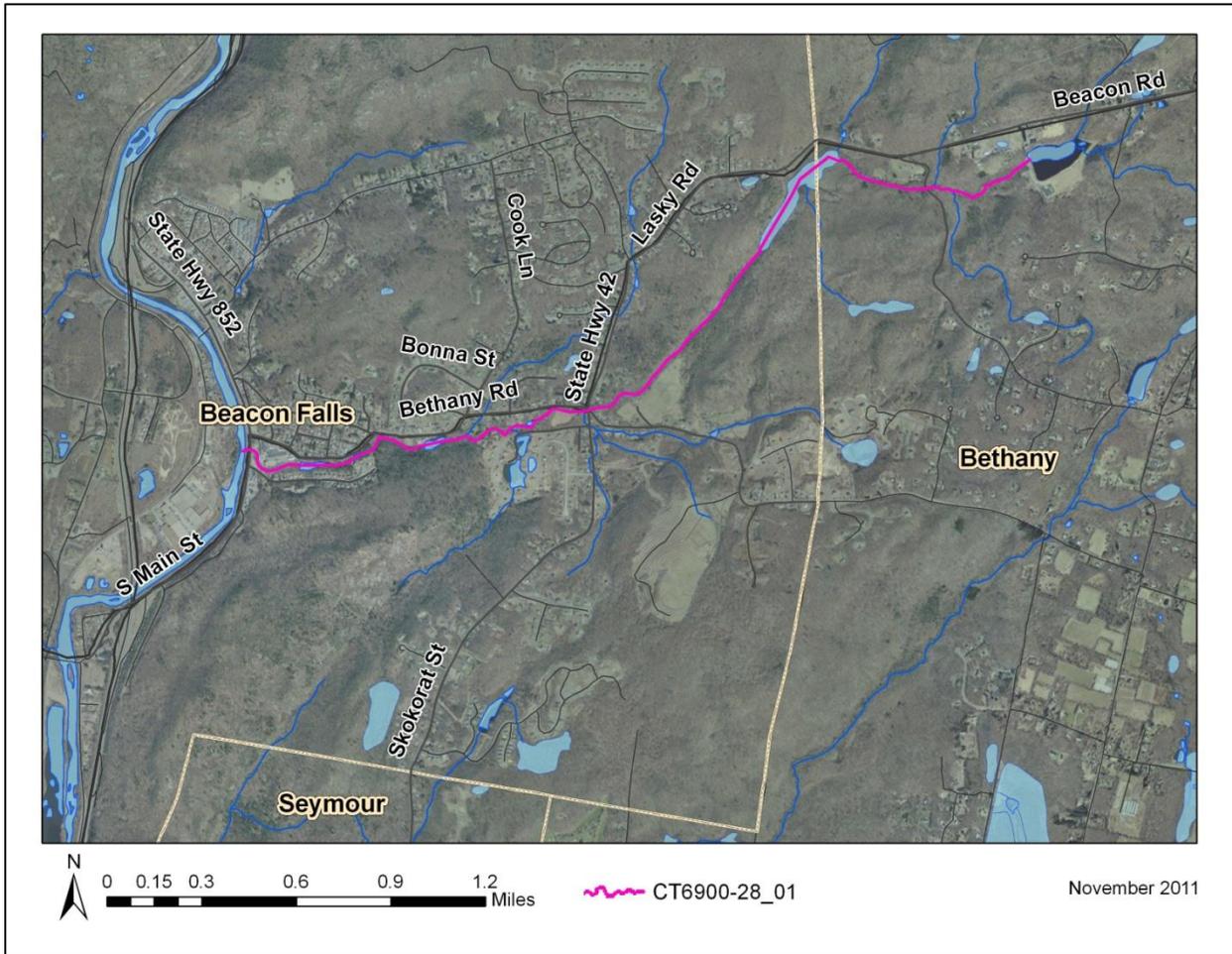
Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT6900-28_01	Hockanum Brook	1477	Route 42 Bethany Road before Feldspar Ave	Beacon Falls	41.436747	-73.052356

The Naugatuck River (CT6900-28_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, navigation, and industrial and agricultural water supply. *E. coli* was sampled at one location (Station 1477) from 2004 - 2005 (Table 2). The *E. coli* water quality criteria and results are presented in Table 9. The geometric mean and two single sample results (one each year) exceeded the water quality standard.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for Station 1477 for wet-weather and dry-weather sampling days, where possible (Table 9). Bacteria concentrations were slightly higher in wet-weather conditions than dry, evidenced by the geometric means of 333 and 213, respectively.

Due to the elevated bacteria measurements presented in Table 9, this impaired segment did not meet CT's bacteria WQS, was identified as impaired, and was placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with State WQS.

Figure 5: Aerial map of the Naugatuck River



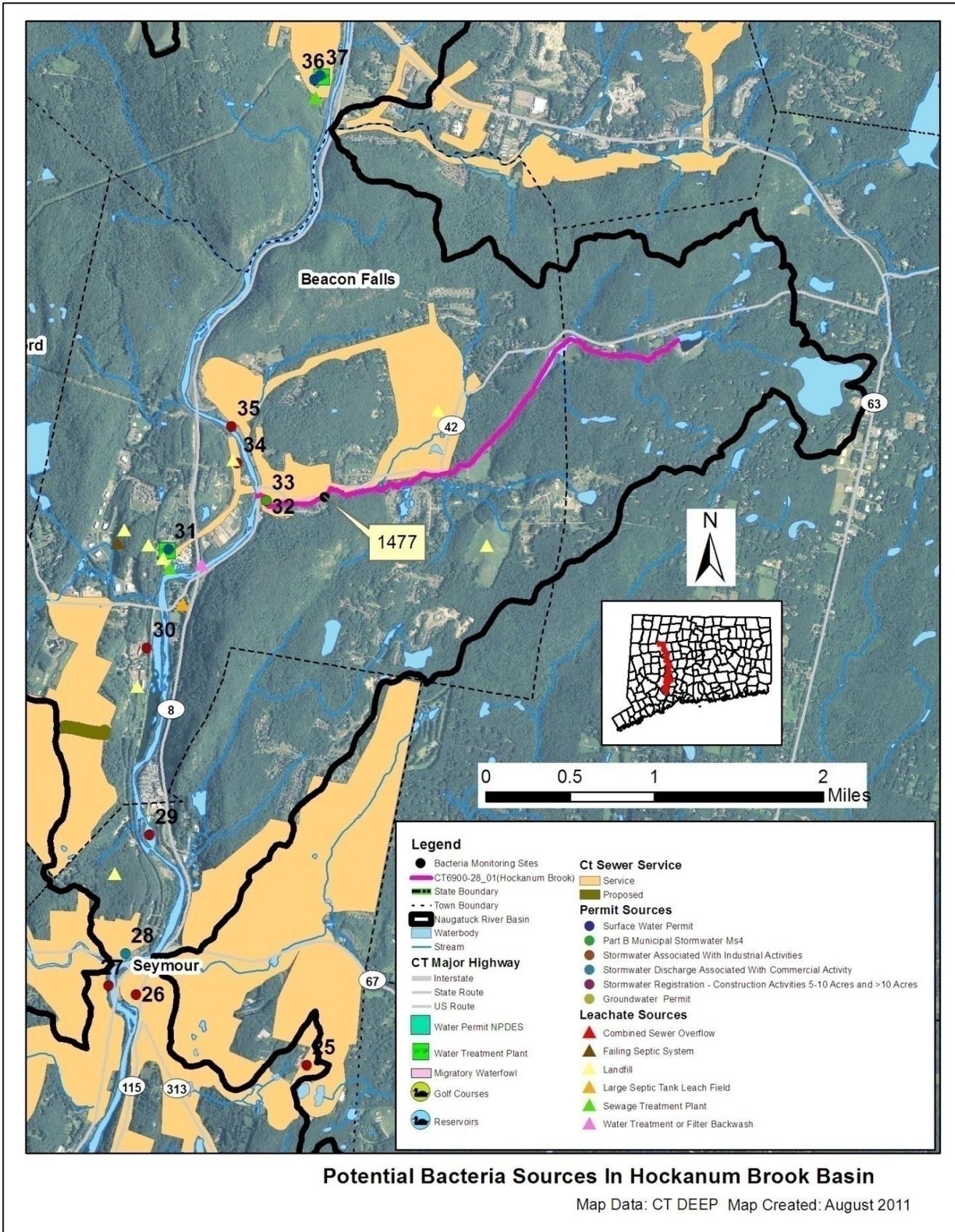
POTENTIAL BACTERIA SOURCES

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 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 Naugatuck River watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/Pets	Other
Hockanum Brook CT6900-28_01	x	x		x	x	x	x	

Figure 6: Potential sources in the Naugatuck 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 5 and 8.

Table 4: General categories list of other permitted discharges

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	15
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	5
GSI	Stormwater Associated with Industrial Activity	62
GSM	Part B Municipal Stormwater MS4	10
GSN	Stormwater Registration – Construction	10
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	0

Permitted Sources

As shown in Table 5, there are numerous permitted discharges in the Naugatuck River watershed. Aside from Part B Municipal Stormwater discharges associated with Beacon Falls’ MS4 area, none discharge into the impaired segment of Hockanum Brook.

Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4 permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

Table 5: Permitted facilities within the Naugatuck River watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Ansonia	City Of Ansonia	200903879	Part B Municipal Stormwater MS4	Ansonia, City Of	4
Ansonia	City Of Ansonia	GSM000098	Part B Municipal Stormwater Ms4	Ansonia, City Of	N/A(13)
Ansonia	Farrel Corporation	GSI000358	Stormwater Associated With Industrial Activities	Farrel Corporation	15
Ansonia	Ansonia Copper & Brass Inc	GSI000530	Stormwater Associated With Industrial Activities	Ansonia Copper & Brass, Inc.	16
Ansonia	City Of Ansonia	GSI001101	Stormwater Associated With Industrial Activities	City Of Ansonia DPW	10
Ansonia	Target Stores, Inc.	GSC000339	Stormwater Discharge Associated With Commercial Activity	Target Store T2249 Ansonia	14
Ansonia	Ansonia Copper & Brass Inc	CT0002968	Surface Water Permit	Ansonia Copper & Brass, Inc.	17
Ansonia	City Of Ansonia	CT0100013	Surface Water Permit	Ansonia Sewage Treatment	9
Ansonia	City Of Ansonia	CT0100013	Surface Water Permit	Ansonia Landfill	11
Beacon Falls	Town Of Beacon Falls	200901950	Part B Municipal Stormwater MS4	Beacon Falls, Town Of	32
Beacon Falls	Town Of Beacon Falls	GSM000065	Part B Municipal Stormwater MS4	Beacon Falls, Town Of	N/A (33)
Beacon Falls	Connecticut Department Of Transportation	GSI000004	Stormwater Associated With Industrial Activities	Beacon Falls Maintenance Facility	35
Beacon Falls	O & G Industries, Inc.	GSI001675	Stormwater Associated With Industrial Activities	O & G Beacon Falls	34
Beacon Falls	O & G Industries, Inc.	GSI001679	Stormwater Associated With Industrial Activities	Breault Road Fabrication & Distribution	30
Beacon Falls	Town Of Beacon Falls	CT0101061	Surface Water Permit	Beacon Falls WPCF	31
Derby	City Of Derby	200901940	Part B Municipal Stormwater MS4	Derby, City Of	4
Derby	City Of Derby	GSM000114	Part B Municipal Stormwater Ms4	Derby, City Of	N/A(5)
Derby	Valley Transit District	GSI000420	Stormwater Associated With Industrial Activities	Valley Transit District	1
Derby	City Of Derby	GSI001731	Stormwater Associated With Industrial Activities	Derby Public Works Garage	6

Table 5: Permitted facilities within the Naugatuck River watershed (continued)

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Derby	City Of Derby	GSI001949	Stormwater Associated With Industrial Activities	Derby WPCF	2
Derby	BJ's Wholesale Club, Inc., Kimley-Horn & Associates, Inc.	GSC000319	Stormwater Discharge Associated With Commercial Activity	BJ's Wholesale Club	8
Derby	Terra Development Llc	GSN001743	Stormwater Registration - Construction Activities 5-10 Acres	Edgebrook Estates	7
Derby	City Of Derby	CT0100161	Surface Water Permit	Derby WPCF	3
Harwinton	O & G Industries, Inc.	GSI000586	Stormwater Associated With Industrial Activities	Harwinton Asphalt Concrete and Sand & Gravel Plants	94
Litchfield	Albreda Refuse & Sweeping, Llc	GSI001519	Stormwater Associated With Industrial Activities	Albreda Refuse & Sweeping, Llc	93
Naugatuck	Borough Of Naugatuck	200902264	Part B Municipal Stormwater MS4	Naugatuck, Borough Of	39
Naugatuck	Borough Of Naugatuck	GSM000047	Part B Municipal Stormwater Ms4	Naugatuck, Borough Of	N/A(40)
Naugatuck	Naugatuck Glass Company	GSI000192	Stormwater Associated With Industrial Activities	Flabeg Technical Glass Us Corp	45
Naugatuck	Culox Technologies, Inc.	GSI000556	Stormwater Associated With Industrial Activities	Culox Technologies, Inc.	46
Naugatuck	Chemtura Usa Corporation	GSI000864	Stormwater Associated With Industrial Activities	Chemtura Usa Corporation	38
Naugatuck	Pennsylvania Steel Co., Inc.	GSN001767	Stormwater Registration - Construction Activities >10 Acres	Pennsylvania Steel Co., Inc.	41
Naugatuck	Borough Of Naugatuck	GSN001768	Stormwater Registration - Construction Activities 5-10 Acres	Guntown Park And Conservation Area	42
Naugatuck	Industrial Development Group, Llc	GSN001782	Stormwater Registration - Construction Activities 5-10 Acres	Lot 8	43
Naugatuck	Borough Of Naugatuck	GSN002072	Stormwater Registration - Construction Activities 5-10 Acres	Former Uniroyal Parcel C	44
Naugatuck	Town Of Naugatuck	CT0100641	Surface Water Permit	Naugatuck POTW	36
Naugatuck	Town Of Naugatuck	CT0100641	Surface Water Permit	Naugatuck Sewage Treatment	37

Table 5: Permitted facilities within the Naugatuck River watershed (continued)

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Seymour	Olin Corporation	GSI000346	Stormwater Associated With Industrial Activities	New Haven Copper Company	26
Seymour	Daddio's Auto Parts, Incorporated	GSI001010	Stormwater Associated With Industrial Activities	Daddio's Auto Parts, Inc.	20
Seymour	The Stop & Shop Supermarket Company Llc	GSC000184	Stormwater Discharge Associated With Commercial Activity	Stop & Shop Store #603	28
Seymour	Housatonic Wire Co Inc	GSI001067	Stormwater Associated With Industrial Activities	Housatonic Wire Co. Inc.	27
Seymour	O & G Industries, Inc.	GSI001754	Stormwater Associated With Industrial Activities	O&G Industries - Seymour	29
Seymour	State Of Connecticut Department Of Transportation	GSI001795	Stormwater Associated With Industrial Activities	Seymour Satellite Salt Storage Facility	23
Seymour	Town Of Seymour	GSI001990	Stormwater Associated With Industrial Activities	Seymour WPCF	21
Seymour	Winter Bros. Hauling Of Ct., Llc	GSI002320	Stormwater Associated With Industrial Activities	Winter Bros. Hauling Of Ct, Llc	18
Seymour	Schyler Wells	GSN001736	Stormwater Registration - Construction Activities >10 Acres	Chatfield Farms	24
Seymour	Town Of Seymour	CT0100501	Surface Water Permit	Seymour Sewage Treatment	19
Seymour	Town Of Seymour	CT0100501	Surface Water Permit	Seymour WPCF	22
Thomaston	State Of Connecticut Department Of Transportation	GSI000067	Stormwater Associated With Industrial Activities	Thomaston Salt Storage	89
Thomaston	State Of Connecticut Department Of Transportation	GSI000068	Stormwater Associated With Industrial Activities	Thomaston Maintenance Facility	91
Thomaston	Summit Corporation Of America	GSI000406	Stormwater Associated With Industrial Activities	Summit Corporation Of America	82
Thomaston	Drawn Metal Tube Company	GSI000412	Stormwater Associated With Industrial Activities	Drawn Metal Tube Company	90
Thomaston	Stewart-Efi	GSI000413	Stormwater Associated With Industrial Activities	Stewart Efi Connecticut, Llc	88

Table 5: Permitted facilities within the Naugatuck River watershed (continued)

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Thomaston	Coreslab Structures, Inc	GSI001212	Stormwater Associated With Industrial Activities	Coreslab Structures Inc.	84
Thomaston	Whyco Technologies Inc	GSI001649	Stormwater Associated With Industrial Activities	Whyco Finishing Technologies, Llc	85
Thomaston	Town Of Thomaston	GSI001825	Stormwater Associated With Industrial Activities	Thomaston WPCF	86
Thomaston	Johnny's Auto Parts, Inc.	GSI001926	Stormwater Associated With Industrial Activities	Johnny's Auto Parts, Inc.	92
Thomaston	Summit Corporation Of America	CT0001180	Surface Water Permit	Summit Corporation Of America	83
Thomaston	Town Of Thomaston	CT0100781	Surface Water Permit	Thomaston WPCF	87
Torrington	State Of Connecticut Department Of Transportation	GSI000070	Stormwater Associated With Industrial Activities	Dot Maintenance Facility	101
Torrington	Torrington Casting Company, The	GSI000267	Stormwater Associated With Industrial Activities	Torrington Casting Company, Inc.	100
Torrington	Connecticut Resource Recovery Authority	GSI000521	Stormwater Associated With Industrial Activities	Torrington Transfer Station	98
Torrington	City Of Torrington	GSI000613	Stormwater Associated With Industrial Activities	Torrington Landfill	99
Torrington	City Of Torrington	GSI000622	Stormwater Associated With Industrial Activities	Torrington DPW	102
Torrington	O & G Industries, Inc.	GSI001573	Stormwater Associated With Industrial Activities	O & G Industries, Inc.	97
Torrington	City Of Torrington	GSI001688	Stormwater Associated With Industrial Activities	Torrington Water Pollution Control Facility	95
Torrington	City Of Torrington	CT0100579	Surface Water Permit	Torrington WPCF	96
Waterbury	City Of Waterbury	200902070	Part B Municipal Stormwater MS4	Waterbury, City Of	71
Waterbury	City Of Waterbury	GSM000094	Part B Municipal Stormwater Ms4	Waterbury, City Of	N/A(72)

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Waterbury	State Of Connecticut Department Of Transportation	GSI000078	Stormwater Associated With Industrial Activities	Waterbury Maintenance & Repair Facility	73
Waterbury	Municipal Road Llc	GSI000177	Stormwater Associated With Industrial Activities	Municipal Road Llc	52

Table 5: Permitted facilities within the Naugatuck River watershed (continued)

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Waterbury	Eyelet Crafters Inc	GSI000275	Stormwater Associated With Industrial Activities	Eyelet Crafters Inc.	47
Waterbury	City Of Waterbury	GSI000454	Stormwater Associated With Industrial Activities	North End Disposal Area	79
Waterbury	City Of Waterbury	GSI000486	Stormwater Associated With Industrial Activities	Waterbury Water Pollution Control Facility	50
Waterbury	Luvata Waterbury, Inc	GSI000501	Stormwater Associated With Industrial Activities	Luvata Waterbury Incorporated	81
Waterbury	Ansonia Copper & Brass Inc	GSI000531	Stormwater Associated With Industrial Activities	725 Bank Street	65
Waterbury	Tilcon Connecticut Inc.	GSI000574	Stormwater Associated With Industrial Activities	Tilcon Connecticut, Inc. - Waterbury	74
Waterbury	Platt Brothers & Company	GSI000648	Stormwater Associated With Industrial Activities	Platt Brothers & Company	48
Waterbury	Allegheny Ludlum Corp.	GSI000913	Stormwater Associated With Industrial Activities	Allegheny Ludlum Corporation	60
Waterbury	North East Transportation Co., Inc.	GSI000941	Stormwater Associated With Industrial Activities	North East Transportation Co., Inc.	80
Waterbury	United States Postal Service	GSI001075	Stormwater Associated With Industrial Activities	Waterbury Vehicle Maintenance Facility	69
Waterbury	Tom's Foreign Auto Parts	GSI001126	Stormwater Associated With Industrial Activities	Tom's Foreign Auto Parts, Inc.	61
Waterbury	Phoenix Soil Llc	GSI001315	Stormwater Associated With Industrial Activities	Phoenix Soil, LLC	70
Waterbury	City Of Waterbury	GSI001425	Stormwater Associated With Industrial Activities	City Of Waterbury Streets Department Garage	77

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Waterbury	The General Stone Company, Llc.	GSI001522	Stormwater Associated With Industrial Activities	General Stone Company, Llc	53
Waterbury	O & G Industries, Inc.	GSI001566	Stormwater Associated With Industrial Activities	O & G Industries, Inc.	55

Table 5: Permitted facilities within the Naugatuck River watershed (continued)

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Waterbury	American Medical Response Of Connecticut, Incorporated	GSI001854	Stormwater Associated With Industrial Activities	AMR Waterbury	76
Waterbury	First Student, Inc.	GSI002058	Stormwater Associated With Industrial Activities	First Student, Inc.	68
Waterbury	The Waterbury Plating Company	GSI002122	Stormwater Associated With Industrial Activities	Waterbury Plating Co.	62
Waterbury	Campion Ambulance Services, Inc.	GSI002141	Stormwater Associated With Industrial Activities	Campion Ambulance Service, Inc.	54
Waterbury	Waterbury Generation, Llc	GSI002189	Stormwater Associated With Industrial Activities	725 Bank Street	64
Waterbury	Gbc Metals, Llc.	GSI002267	Stormwater Associated With Industrial Activities	Gbc Metals, Llc	58
Waterbury	Hubbard-Hall Inc.	GSC000033	Stormwater Discharge Associated With Commercial Activity	Hubbard-Hall Inc.	56
Waterbury	Home Depot U. S. A., Inc.	GSC000194	Stormwater Discharge Associated With Commercial Activity	Home Depot #6212	67
Waterbury	Waterbury Generation, Llc	GSN001772	Stormwater Registration - Construction Activities 5-10 Acres	725 Bank Street	66
Waterbury	Yankee Gas Services Company	GSN002143	Stormwater Registration - Construction Activities 5-10 Acres	47 Eagle Street	57
Waterbury	City Of Waterbury	GSN002167	Stormwater Registration - Construction Activities 5-10 Acres	Jonathan E. Reed School	75
Waterbury	City Of Waterbury	GSN002246	Stormwater Registration - Construction Activities 5-10 Acres	Reconstruction & Widening Of Chase Avenue	78

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Waterbury	GBC Metals, Llc., Somers Thin Strip	CT0021873	Surface Water Permit	GBC Metals, Llc	59
Waterbury	City Of Waterbury	CT0100625	Surface Water Permit	Waterbury Sewage Treatment	49
Ansonia	CITY OF ANSONIA (Applicant)	200903879	Part B Municipal Stormwater MS4	ANSONIA, CITY OF	N/A (12)
Seymour	RAF ELECTRONIC HARDWARE (Permittee)	GSI001068	Stormwater Associated With Industrial Activities	RAFFERTY REALTY	25
Waterbury	City Of Waterbury	CT0100625	Surface Water Permit	Waterbury /DPW (S.S.I.)	51

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 (Hockanum Brook) in the Naugatuck River watershed is located within the Town of Beacon Falls, CT. The town has designated urban areas, as defined by the U.S. Census Bureau, and is required to comply with MS4 General Permit issued by CT DEEP (Figure 7). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit requires municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants as well as to protect water quality. The MS4 permit is discussed further in the "TMDL Implementation Guidance" section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CT DEEP'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 6). Twenty-two sites appear to have been sampled in Beacon Falls (though it is difficult to distinguish which samples are from identical sites) from 2004 to 2010, and one site in Tolland in 2011. All but one of the sites in Beacon Falls, and the site in Tolland, show at least one sample that exceeds the recreational water quality criteria for *E. coli* of 410 colonies/100 mL. Some of the samples show extremely large bacteria concentrations at levels consistent with contamination from raw sewage.

Figure 7: MS4 areas of the Naugatuck River watershed

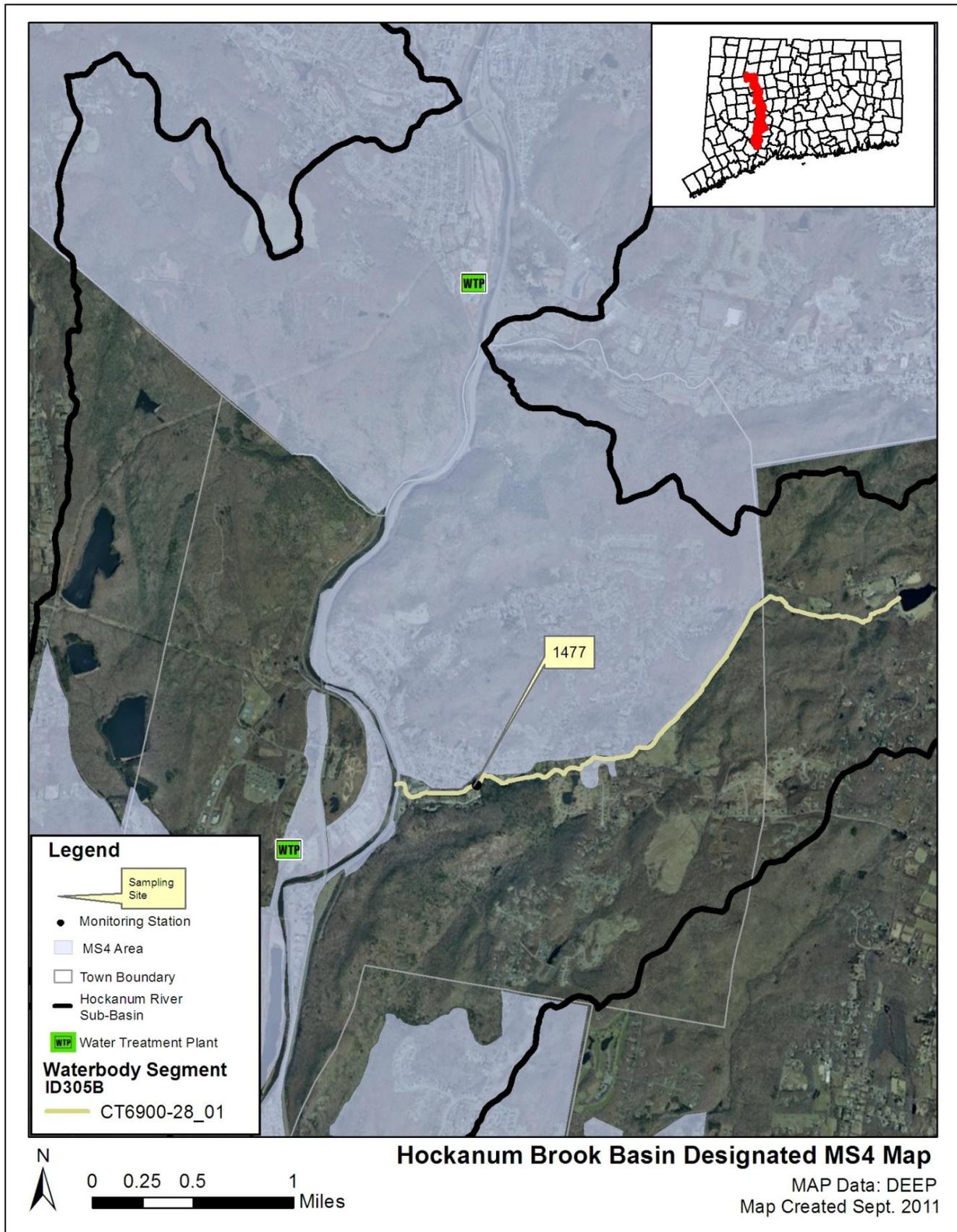


Table 6: List of MS4 sample locations and *E. coli* (colonies/100 mL) results in the Naugatuck River watershed

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
Beacon Falls	41°25'49"N,073°04'36W drainage outfall E side of Lancaster Dr near Alliance Circle	Industrial	Naugatuck River	04/12/07	20
Beacon Falls	41°25'49"N,073°04'36W drainage outfall E side of Lancaster Dr near Alliance Circle	Industrial	Naugatuck River	05/08/08	--
Beacon Falls	41°25'49"N,073°04'36W drainage outfall E side of Lancaster Dr near Alliance Circle	Industrial	Naugatuck River	11/13/09	8,000
Beacon Falls	41°25'49"N,073°04'36W drainage outfall E side of Lancaster Dr near Alliance Circle	Industrial	Naugatuck River	11/04/10	500
Beacon Falls	41°25'59"N,073°03'47W Murtha Industrial Park btwn last 2 major blds over bank	Industrial	Naugatuck River	04/12/07	40
Beacon Falls	41°25'59"N,073°03'47W Murtha Industrial Park btwn last 2 major blds over bank	Industrial	Naugatuck River	05/08/08	150
Beacon Falls	41°25'59"N,073°03'47W Murtha Industrial Park btwn last 2 major blds over bank	Industrial	Naugatuck River	11/13/09	1,000
Beacon Falls	41°25'59"N,073°03'47W Murtha Industrial Park btwn last 2 major blds over bank	Industrial	Naugatuck River	11/04/10	100
Beacon Falls	41°26'12"N,073°02'33W first detention pond inlet btwn homes Hockanum Dr W side	Residential	Naugatuck River	04/12/07	60
Beacon Falls	41°26'12"N,073°02'33W first detention pond inlet btwn homes Hockanum Dr W side	Residential	Naugatuck River	05/08/08	200
Beacon Falls	41°26'12"N,073°02'33W first detention pond inlet btwn homes Hockanum Dr W side	Residential	Naugatuck River	11/13/09	5
Beacon Falls	41°26'12"N,073°02'33W first detention pond inlet btwn homes Hockanum Dr W side	Residential	Naugatuck River	11/04/10	1,300
Beacon Falls	41°26'13"N,073°03'35W Across street from commercial business park, Bronson Brook Discharge	Commercial	Naugatuck River	04/12/07	1,220
Beacon Falls	41°26'13"N,073°03'35W Across street from commercial business park, Bronson Brook Discharge	Commercial	Naugatuck River	05/08/08	50
Beacon Falls	41°26'13"N,073°03'35W Across street from commercial business park, Bronson Brook Discharge	Commercial	Naugatuck River	11/13/09	800
Beacon Falls	41°26'13"N,073°03'35W Across street from commercial business park, Bronson Brook Discharge	Commercial	Naugatuck River	11/04/10	900
Beacon Falls	41°26'15"N,073°04'14W Detention Pond outlet W side just inside development from Pent Rd	Residential	Naugatuck River	04/12/07	100
Beacon Falls	41°26'15"N,073°04'14W Detention Pond outlet W side just inside development from Pent Rd	Residential	Naugatuck River	05/08/08	400

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

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
Beacon Falls	41°26'15"N,073°04'14W Detention Pond outlet W side just inside development from Pent Rd	Residential	Naugatuck River	11/13/09	5,000
Beacon Falls	41°26'15"N,073°04'14W Detention Pond outlet W side just inside development from Pent Rd	Residential	Naugatuck River	11/04/10	200
Beacon Falls	41°26'24"N,073°03'39W Across street and btwn Beacon Falls Market and Old Frontier Café	Commercial	Naugatuck River	04/12/07	300
Beacon Falls	41°26'24"N,073°03'39W Across street and btwn Beacon Falls Market and Old Frontier Café	Commercial	Naugatuck River	05/08/08	10,000
Beacon Falls	41°26'24"N,073°03'39W Across street and btwn Beacon Falls Market and Old Frontier Café	Commercial	Naugatuck River	11/13/09	100
Beacon Falls	41°26'24"N,073°03'39W Across street and btwn Beacon Falls Market and Old Frontier Café	Commercial	Naugatuck River	11/04/10	8,000
Beacon Falls	Hockanum Glen Drive 30" RCP flowing into retention pond	Residential	Naugatuck River	07/23/04	1,000
Beacon Falls	Hockanum Glen Drive E side of large access btwn 2 homes on R as entering development	Residential	Naugatuck River	07/28/06	>7,500
Beacon Falls	Hockanum Glen Drive@ end of cul-de-sac or on N side of the rd, both draining into retention pond, both accessed through ROW btwn homes	Residential	Naugatuck River	06/28/05	12,000
Beacon Falls	Intersection of Rimmon Hill & Pines Bridge Rd (RT 42) N side of intersection E of Lancaster Dr	Residential	Naugatuck River	06/28/05	44,000
Beacon Falls	intersection of S Main street (Rte 42) & Fairfield Pl. across from Frontier Café	Commercial	Naugatuck River	06/28/05	47,000
Beacon Falls	Lancaster Drive Hockanum 30" RCP flowing on E side of Rd near utility pole #5079	Industrial	Naugatuck River	07/23/04	17,000
Beacon Falls	Lancaster Drive N of Rte 42 in Pine Bridge Commerce Park E side of Rd near utility pole #5079	Industrial	Naugatuck River	06/28/05	860
Beacon Falls	Lancaster Drive Pines Bridge Commerce Park E side of Rd near utility pole #5079, 30"RCP flowing into swale	Industrial	Naugatuck River	07/28/06	3,000
Beacon Falls	Lopus Rd, S of PW garage on the E side of the rd btwn garage & WWTP	Industrial	Naugatuck River	06/28/05	47,000
Beacon Falls	Railroad Ave Murha industrial park 12" CMP discharging into Naugatuck btwn last 2 bldgs	Industrial	Naugatuck River	07/28/06	4,250
Beacon Falls	Rimmon Hill & Pines Bridge Rd 30" CPP discharging into swale o N side of intersection	Residential	Naugatuck River	07/28/06	300

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

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
Beacon Falls	Rimmon Hill & Pines Bridge Rd 30"RCP discharging into swale on N side of intersection	Residential	Naugatuck River	07/23/04	46,000
Beacon Falls	RR Ave, Murtha Ind Park 12" CMP dis into Naugatuck River btwn 2 main buildings	Industrial	Naugatuck River	07/23/04	640,000
Beacon Falls	S Main street (CT-Rte 42) & Fairfield Pl. 12" RCP discharging into Naugatuck River	Commercial	Naugatuck River	07/23/04	110,000
Beacon Falls	S Main street (Rte 42) & Fairfield Pl. across from Frontier Café 12" RCP discharging into Naugatuck	Commercial	Naugatuck River	07/28/06	300
Beacon Falls	S Main street (CT-Rte 42) 5x5 spillway discharging into Naugatuck River opp Beacon Mill Village	Commercial	Naugatuck River	07/23/04	380,000
Beacon Falls	S Main street across the street from Beacon Mill Village down back	Commercial	Naugatuck River	06/28/05	56,000
Beacon Falls	S Main street across the street from Beacon Mill Village down bank to river, large box culvert	Commercial	Naugatuck River	07/28/06	>7,500
Shaded cells indicate an exceedance of single-sample based water quality criteria (410 colonies/100 mL)					

Publicly Owned Treatment Works

As shown in Figures 9 and 11, there are several publicly owned treatment works (POTWs), or wastewater treatment plants, in the Naugatuck River watershed, however, none discharge directly into Hockanum Brook. The service area for the Beacon Falls WPCF (CT010161) does extend into the Hockanum Brook drainage area, and is a potential bacteria source if the network of sewer pipes experiences inflow and infiltration, experiences pump failures, or suffers an overflow. Discharge data for Beacon Falls WPCF is presented in Table 7 below.

Table 7: Fecal Coliform (colonies/100 mL) Data from the Wastewater Treatment Plant

Town	Permitee	Permit Number	Receiving Water	Date	30-Day Geometric Mean	7-Day Geometric Mean
Beacon Falls	Beacon Falls WPCF	CT010161	Naugatuck River	5/31/09	21	66
Beacon Falls	Beacon Falls WPCF	CT010161	Naugatuck River	6/30/09	31	46
Beacon Falls	Beacon Falls WPCF	CT010161	Naugatuck River	7/31/09	35	49
Beacon Falls	Beacon Falls WPCF	CT010161	Naugatuck River	8/31/09	30	67

Table 7: Fecal Coliform (colonies/100 mL) Data from the Wastewater Treatment Plant (continued)

Town	Permitee	Permit Number	Receiving Water	Date	30-Day Geometric	7-Day Geometric
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					Mean	Mean
Beacon Falls	Beacon Falls WPCF	CT010161	Naugatuck River	9/30/09	36	49
Beacon Falls	Beacon Falls WPCF	CT010161	Naugatuck River	5/31/10	26	57
Beacon Falls	Beacon Falls WPCF	CT010161	Naugatuck River	6/30/10	24	52
Beacon Falls	Beacon Falls WPCF	CT010161	Naugatuck River	7/31/10	35	53
Beacon Falls	Beacon Falls WPCF	CT010161	Naugatuck River	8/31/10	31	57
Beacon Falls	Beacon Falls WPCF	CT010161	Naugatuck River	9/30/10	50	58
30-Day Geometric Mean Permit Limit = 200 colonies/100 mL 7-Day Geometric Mean Permit Limit = 400 colonies/100 mL Shaded cells indicate an exceedance of permit limits						

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 Naugatuck River watershed are described below.

Insufficient Septic Systems

As shown in Figure 6, the central portion of Beacon Falls relies on the municipal sewer system, while most of the drainage area for Hockanum Brook does not. The majority of the area surrounding the impaired segment relies on onsite wastewater treatment systems, such as septic systems. Insufficient or failing septic systems can be significant sources of bacteria by allowing raw waste to reach surface waters. In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient or failing septic systems in a specific municipality. Beacon Falls is served by the Naugatuck Valley district (<http://nvhd.org>), while Bethany is served by the Quinnipiack Valley district (<http://www.qvhd.org>).

Wildlife and Domestic Animal Waste

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

There are a few agricultural areas indicated on the land use map in the central part of the impaired segment drainage area, upstream of the developed area of Beacon Falls. In addition, open areas, several of which are adjacent to ponds, are seen on the recent aerial photo (Figure 5). 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). Agricultural land use makes up 4% of the Naugatuck River watershed, particularly along Hockanum Brook (Figure 4). The largest of these is actually a landfill, however, there may be smaller agricultural activities nearby.

Stormwater Runoff from Developed Areas

The majority of the Naugatuck River watershed is undeveloped. However, approximately 37% of the land use in the watershed is considered urban. Urban areas form much of the riparian corridor of the Hockanum Brook drainage area, both along Route 42 and in developed portion of Beacon Falls (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).

The majority of the Naugatuck River watershed has greater than 6% impervious surfaces (Figure 8), with about 28% in the highest category of greater than 16% impervious cover. In the Hockanum Brook drainage, most of the eastern (upstream) and southern drainage area is less than 6% impervious, but the remaining portions are 7-11% impervious. The concentration of impervious cover in the Beacon Falls downtown area represents a potential source and conduit of bacteria to the brook.

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

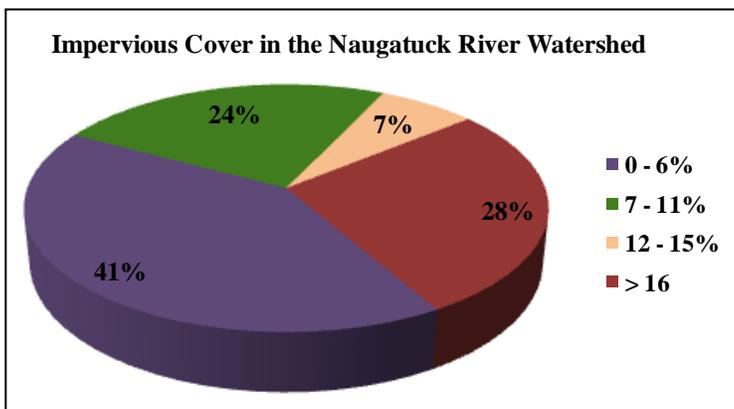
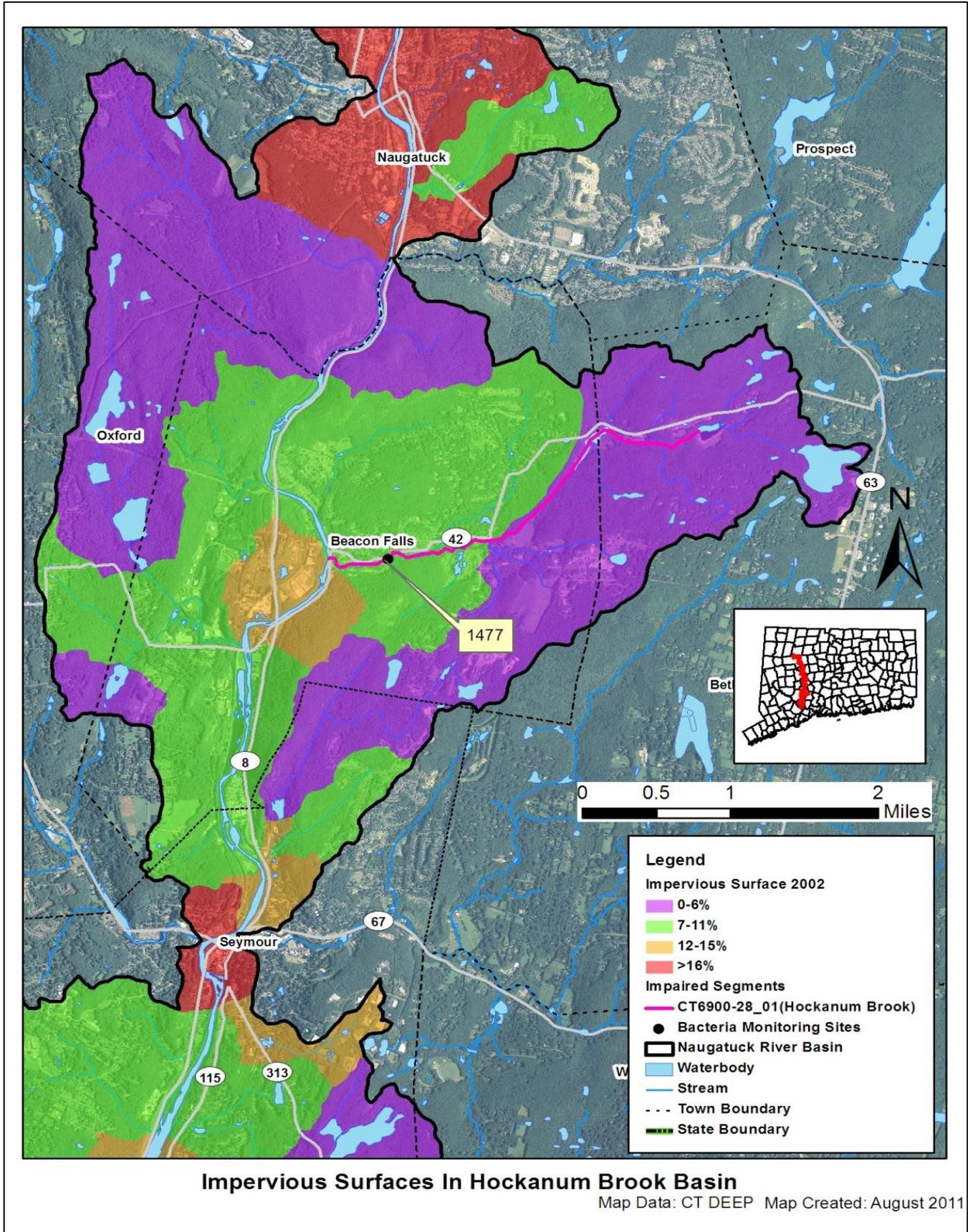


Figure 9: Impervious cover (%) for the Naugatuck River sub-regional watershed



Additional Sources

There may be other sources not listed here or identified in Figure 9 that contribute to the observed water quality impairment in the Naugatuck River watershed. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

Land Use/Landscape

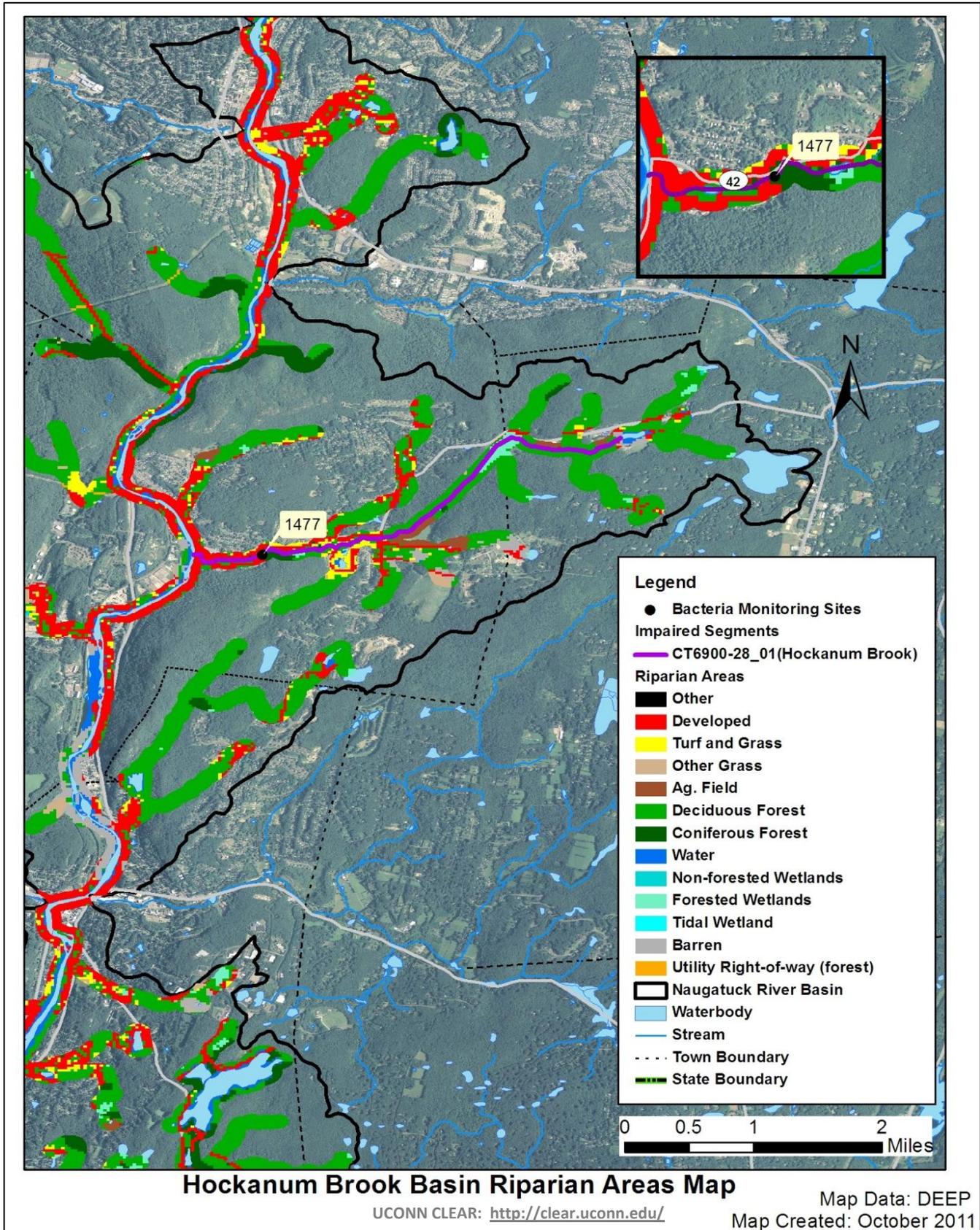
Riparian Buffer Zones

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

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

The riparian zones for the upper half of Hockanum Brook are predominantly forest. As previously noted, waste from wildlife in non-developed areas can contribute bacteria to nearby waterbodies, though much of this waste may be treated by the natural vegetated buffer. The riparian corridor in the downstream half of Hockanum Brook is dominated by developed lands, with additional turf and grass areas (Figure 10). Developed areas within the riparian zone likely contribute pollutants such as bacteria to the waterbody and indicate that the natural riparian buffer is not available to treat this runoff. Additionally, turf and grass can be frequented by waterfowl.

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



CURRENT MANAGEMENT ACTIVITIES

As indicated previously, Beacon Falls 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.

The 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 Table 8.

Table 8: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Beacon Falls, CT

Minimum Measure	Beacon Falls Annual Report Update (December, 2010)
Public Outreach and Education	<ol style="list-style-type: none"> 1) In 2005-06, the town displayed and distributed brochures at Conservation Commission meetings, through the public schools, and with every building permit. 2) Developed a website, poster, and public service announcement. 3) The Conservation Commission hosted a Community Forum in October 2008 that included stormwater Phase II information and outreach. 4) In 2010, the town completed marking of catch basins.
Public Involvement and Participation	<ol style="list-style-type: none"> 1) In 2009, the town updated the Stormwater Management Plan. 2) In 2009, a demonstration on storm drain stenciling was presented at the local high school.
Illicit Discharge Detection and Elimination\	<ol style="list-style-type: none"> 1) An Illicit Discharge and Connection Stormwater Ordinance was created in early 2006 and assigned responsibility for enforcement to the Town's Inland Wetlands and Watercourses Commission. 2) An "Illicit Discharge Detection and Elimination Manual" was created for reference and training of town personnel involved in this BMP. 3) All outfalls greater than 15" were mapped in 2006 using GPS and GIS. Additional outfalls in newer developments were mapped in 2007 and 2010. 4) Beacon Falls found and eliminated an illicit discharge on South Main Street in 2010.

Table 8: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Beacon Falls, CT (continued)

Minimum Measure	Beacon Falls Annual Report Update (December, 2010)
Construction Site Stormwater Runoff Control	<ol style="list-style-type: none"> 1) In 2006, the Town passed a "Stormwater Management Ordinance" assigning enforcement to the Inland Wetlands and Watercourses Commission and Town Engineer. 2) The Town inspectors issued twelve Notice of Inspections and three Notice of Deficiencies to developers for soil and erosion control inspections in 2010.
Post Construction Stormwater management	<ol style="list-style-type: none"> 1) Site plan review of proposed developments for stormwater compliance by the Town Engineer is ongoing.
Pollution Prevention and Good Housekeeping	<ol style="list-style-type: none"> 1) In 2010 Public Works Department swept 27.5 miles of the Town's roadways and parking lots, cleaned 253 catch basins, and repaired 3 catch basins.

RECOMMENDED NEXT STEPS

The Town of Beacon Falls has developed and implemented programs to protect water quality from bacterial contamination. Future mitigative activities are necessary to ensure the long-term protection of the Naugatuck River and have been prioritized below.

1) Continue monitoring within stormwater networks, and conduct Illicit Discharge Detection and Elimination (IDDE) wherever high bacteria concentrations are found.

Sampling of MS4 areas in Beacon Falls from 2004 to 2010 frequently revealed high bacteria concentrations (Table 6). Further sampling at these locations, and at strategic locations upstream from them, should be undertaken to help identify and eliminate the sources of bacterial contamination.

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 7 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 Naugatuck 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 7. 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			LA			WLA	LA
	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.

2) Identify areas in the Hockanum Brook drainage area to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted above, 37% of the Naugatuck River watershed is considered urban and the towns within the Naugatuck River watershed are regulated MS4 communities. Much of the Hockanum Brook drainage in Beacon Falls is between 7 – 11% impervious cover, with a small portion greater than 12%. As such, stormwater runoff is likely contributing bacteria to Hockanum Brook, especially in the densely developed areas in downtown Beacon Falls.

To identify other areas that are contributing bacteria to the impaired segments, the towns should continue to conduct wet-weather sampling at stormwater outfalls that discharge directly to the impaired segments in the Naugatuck River watershed. Outfalls that have previously shown high bacteria concentrations should be prioritized for BMP installation (Table 6). To treat stormwater runoff, the towns should identify areas along the more developed sections of the impaired segments to install BMPs designed to encourage stormwater to infiltrate into the ground before entering the waterbodies. These BMPs would disconnect impervious areas and reduce pollutant loads to the river. More detailed information and BMP recommendations can be found in the core TMDL document.

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

As much of the upstream drainage area of Hockanum Brook is undeveloped, any education and outreach program should highlight the importance of not feeding waterfowl and wildlife, managing horse and livestock waste, and managing waste from dogs and other pets. The town and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of the impaired segments that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in the Naugatuck River 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.

4) Develop a system to monitor septic systems.

Though a significant portion of the residents within the Naugatuck River watershed rely on the municipal sanitary sewer system, many residents in Beacon Falls and Bethany rely on septic systems. If not already in place, the towns should establish a program to ensure that existing septic systems are properly operated and maintained. For instance, communities can create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of 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.

5) Ensure there are sufficient buffers on agricultural lands along Hockanum Brook.

There are areas of agricultural land adjacent to Hockanum 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.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 9: Naugatuck River Bacteria Data

Waterbody ID: CT6900-28_01

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

Impairment: Recreation (*E. coli* bacteria)

Water Quality Criteria for *E. coli*:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100ml (non-designated swimming areas)

Percent Reduction to meet TMDL:

Geometric Mean: 55%

Single Sample: 73%

Data: 2004 - 2005 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

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

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	9/2/2004	110	dry	216
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	9/9/2004	1100	wet	
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	9/13/2004	96	dry	
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	9/15/2004	110	wet	
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	9/21/2004	300	wet	
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	9/23/2004	170	dry	
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	9/30/2004	340	wet	
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	7/5/2005	1500*	dry	281*
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	7/18/2005	320	dry	
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	8/1/2005	180	dry	
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	8/9/2005	290 [†]	dry	
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	8/16/2005	230	dry	
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	9/8/2005	86	dry	
<p>Shaded cells indicate an exceedance of water quality criteria</p> <p>[†]Average of two duplicate samples</p> <p>*Indicates single sample and geometric mean values used to calculate the percent reduction</p>					

Wet and dry weather geometric mean values for all monitoring stations on the Naugatuck River

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1477	Adjacent to Route 42 at Bethany Road before Feldspar Ave	2004-2005	4	9	244	333	213
<p>Shaded cells indicate an exceedance of water quality criteria</p> <p>Weather condition determined from rain gage at Tweed KMMK station in New Haven, CT</p>							

REFERENCES

- Costa, Joe (2011). Calculating Geometric Means. Buzzards Bay National Estuary Program. **Online:** <http://www.buzzardsbay.org/geomean.htm>
- CTDEEP (2010). State of Connecticut Integrated Water Quality Report. **Online:** http://www.ct.gov/dep/lib/dep/water/water_quality_management/305b/ctiwqr10final.pdf
- CTDEEP (2011). State of Connecticut Water Quality Standards. **Online:** http://www.ct.gov/dep/lib/dep/water/water_quality_standards/wqs_final_adopted_2_25_11.pdf
- CWP (2003). Impacts of Impervious Cover on Aquatic Systems. Center for Watershed Protection. **Online:** http://clear.uconn.edu/projects/tmdl/library/papers/Schueler_2003.pdf
- Federal Register 67 (March 15, 2002) 11663-11670. Urban Area Criteria for Census 2000
- Mallin, M.A., K.E. Williams, E.C. Escham, R.P. Lowe (2000). Effect of Human Development on Bacteriological Water Quality in Coastal Wetlands. *Ecological Applications* 10: 1047-1056.
- USEPA (2001). Managing Pet and Wildlife Waste to Prevent Contamination of Drinking Water. **Online:** http://www.epa.gov/safewater/sourcewater/pubs/fs_swpp_petwaste.pdf.
- USEPA (2011a). Managing Nonpoint Source Pollution from Agriculture. **Online:** <http://water.epa.gov/polwaste/nps/outreach/point6.cfm>
- USEPA (2011b). Riparian Zone and Stream Restoration. **Online:** <http://epa.gov/ada/eco/riparian.html>
- USEPA (2011c). Land Use Impacts on Water. **Online:** <http://epa.gov/greenkit/toolwq.htm>