Natchaug River

Watershed Summary

Watershed Description and Maps

The Natchaug River watershed makes up 114,000 acres of land in northeastern Connecticut, and supports the largest public surface drinking water supply watershed in Connecticut. The smaller Natchaug subwatershed, and the focus of this TMDL, covers an area of approximately 18,733 acres in northeastern Connecticut, and makes up the southern portion of the larger Natchaug River watershed (Figure 1). The upper watershed is located primarily in Eastford, with a small portion of land in Ashford to the west. The central watershed is located in Chaplin with a small portion in Hampton to the east. The southern portion of the watershed is located in Mansfield and Windham.

The Natchaug River watershed includes one segment 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. An excerpt of the Integrated Water Quality Report is included in Table 1 (CTDEEP, 2010).

The Natchaug River begins within the northwest corner of the Natchaug State Forest just south of the intersection of Routes 44 and 198 in Eastford. From there, the river flows south along the edge of the State Forest, and then flows southwest into Chaplin, and west into the Mansfield Hollow State Park in Mansfield. The river flows through Mansfield Hollow Lake, a 500-acre lake created by the damming of the Natchaug River. The river continues south into the Willimantic Reservoir, a public drinking water supply which includes the Windham Reservoir Dam, a pump house and the Town of Windham Water Treatment Facility. The impaired segment (CT3200-00_01) begins at the dam outlet and flows south under Route 6, past Phillip Lauter Park, under Route 66, and into the Willimantic River within the City of Willimantic. The Natchaug River and Willimantic River join to form the Shetucket River. The most heavily developed area of the watershed is located in the southern portion of the watershed adjacent to the impaired segment.

Impaired Segment Facts

Impaired Segment Name: Natchaug River (CT3200-00_01)

Municipalities: Windham and Mansfield

Impaired Segment Length (miles): 3.38

Water Quality Classification: Class A

Designated Use Impairment: Recreation

Sub-regional Basin Name and Code: Natchaug River, 3200

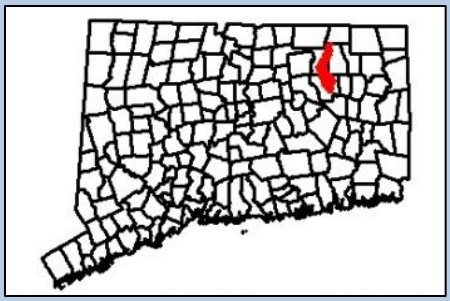
Regional Basin: Natchaug

Major Basin: Connecticut

Watershed Area (acres): 18,733

MS4 Applicable? No

Figure 1: Watershed location in Connecticut



The impaired segment of the Natchaug River has a water quality classification of A. Designated uses include potential drinking water supply, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. This segment of the river is impaired due to

elevated bacteria concentrations, affecting the designated use of recreation. Phillip Lauter Park in Willimantic has a designated beach and therefore, the specific recreation impairment is for designated swimming and other water contact related activities.

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

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT3200-00_01	Natchaug River-01	From mouth at confluence with Willimantic River, above Shetucket River (DS of Brick Top Road (Route 14) crossing), Windham, US to Willimantic Reservoir outlet dam (Natchaug River Dam), southwest of Windham Airport, Windham/Mansfield town border.	3.38	U	NOT	FULL*
CT3200-00_02	Natchaug River-02	From Mansfield Hollow Reservoir inlet at Basset Bridge Road crossing (name changes to Station Road between North Windham Road and Route 6), Windham, US to headwaters (confluence of Bigalow Brook and Still River), Eastford.	11.03	FULL	FULL	FULL*

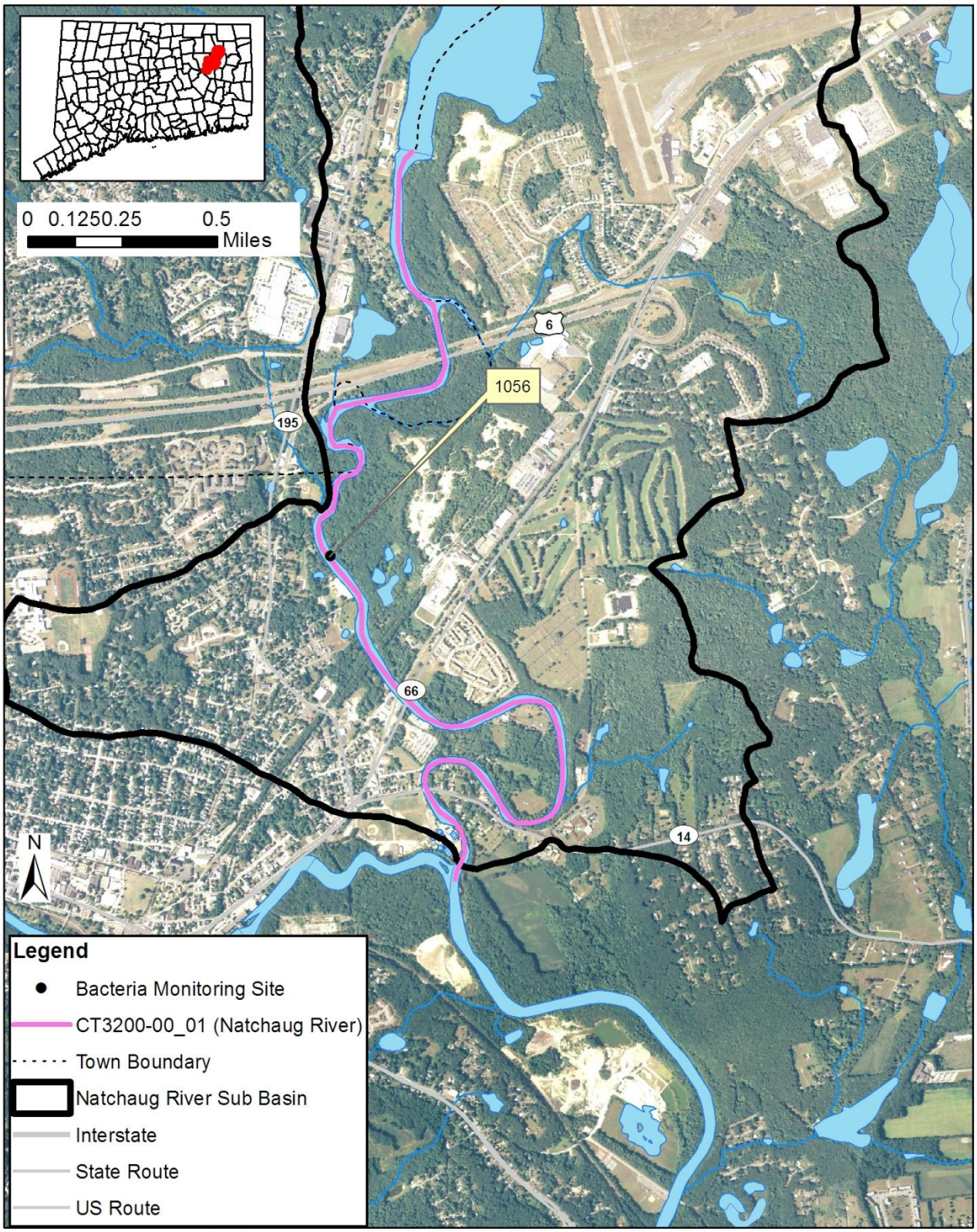
Shaded cells indicate impaired segment addressed in this TMDL

FULL = Designated Use Fully Supported

NOT = Designated Use Not Supported

U = Unassessed

Figure 2: GIS map featuring general information of the Natchaug River watershed at the sub-regional level (the location and name of the sampling station is indicated on the impaired segment)



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 Natchaug River watershed consists of 67% forest, 17% urban, 9% water (which includes wetlands), and 7% agricultural land uses. A concentrated area of urban development is located in the southern portion of the watershed adjacent to the impaired segment (Figure 4). This area includes the Windham Airport, large residential subdivisions and condominium complexes, the North Windham Shopping Center, the Willimantic Country Club, a portion of the Eastern Connecticut State University campus, mining operations, and a mix of commercial and residential development. The remainder of the urban development in the watershed is limited to the roadways and village centers. The upper Natchaug River watershed is dominated by forestland including a large area within the Natchaug State Forest in Eastford which forms the headwaters of the Natchaug River. Additional protected land in the watershed includes the Nathaniel Lyon Memorial State Park, north of the Natchaug State Forest, portions of the James L. Goodwin State Forest and CT State Wildlife Management Area in Chaplin, and a portion of the Beaver Brook State Park Scenic Reserve in Windham. There are several lakes and ponds throughout the watershed, upstream of the impaired segment, including the Willimantic Reservoir and Mansfield Hollow Lake in the southern portion of the watershed, Black Spruce Pond within the State Forest in Chaplin, and Hall's Pond in Eastford. The Natchaug River wateshed has been called the "Last Green Valley" between Washington and Boston (GVI, 2000).

Figure 3: Land use within the Natchaug River watershed

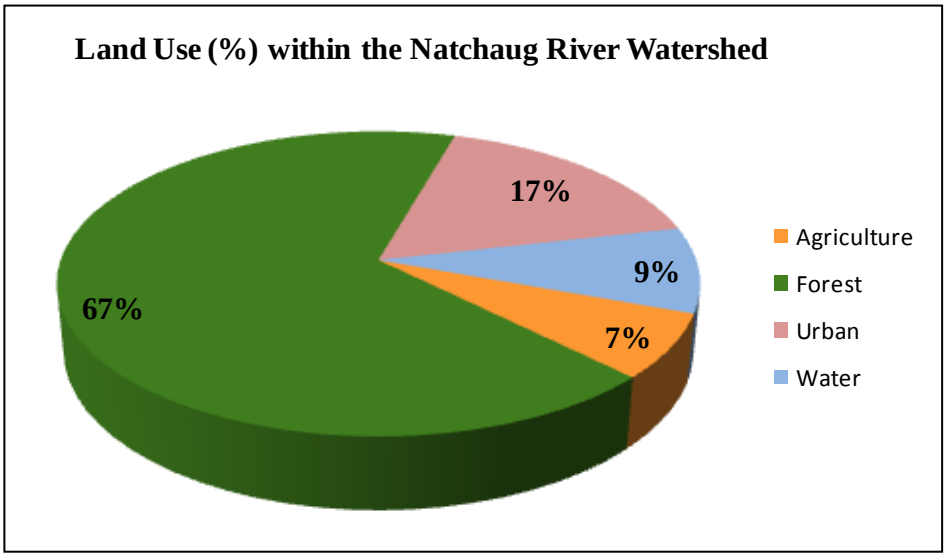
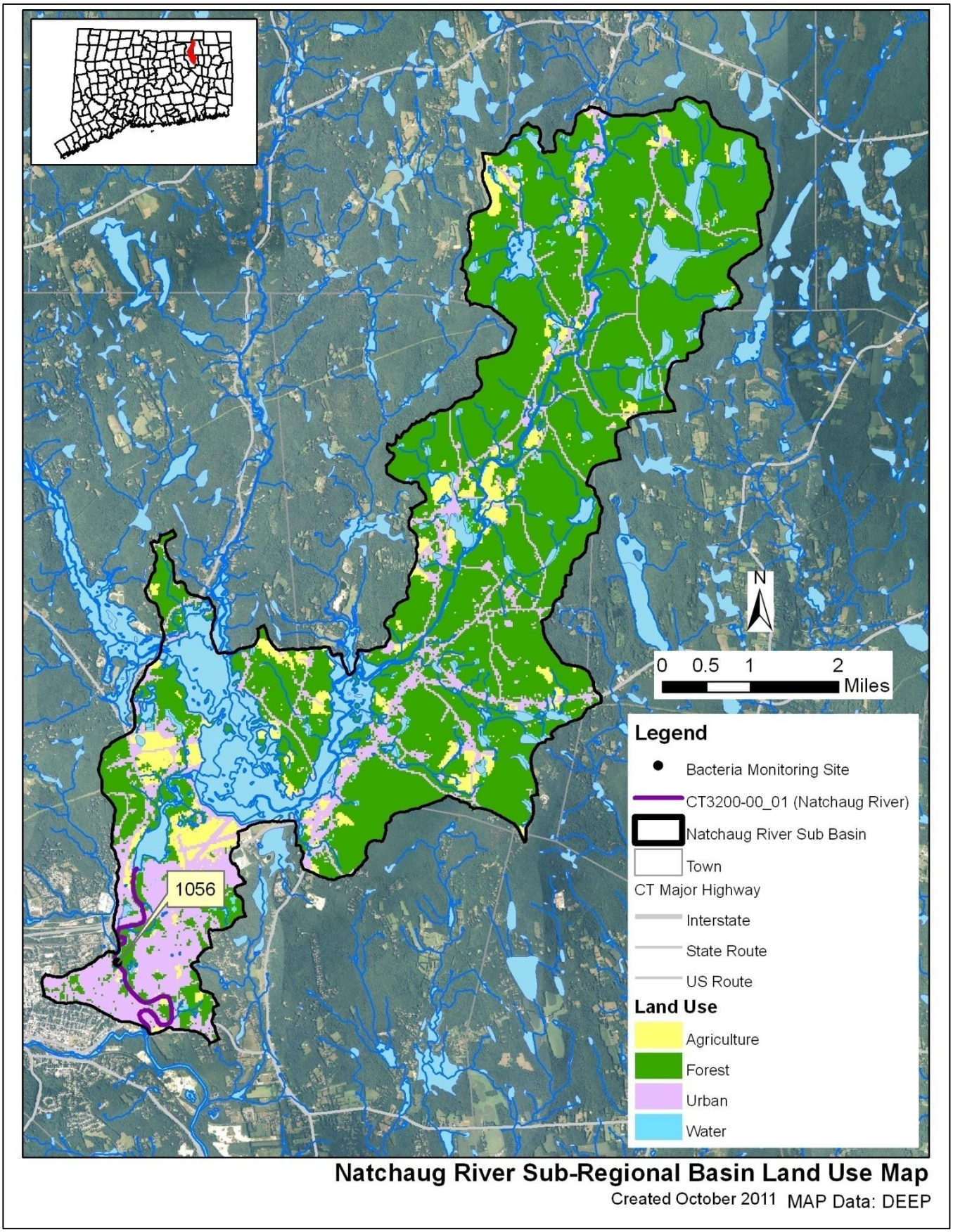


Figure 4: GIS map featuring land use for the Natchaug River watershed at the sub-regional level



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) (CT DEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture, or volunteer monitoring efforts at stations located on the impaired segments.

Table 2: Sampling station location description for the impaired Segment in the Natchaug River watershed

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT3200-00_01	Natchaug River	1056	Lauter Park off Gordon Ave.	Windham	41.725000	-72.199167

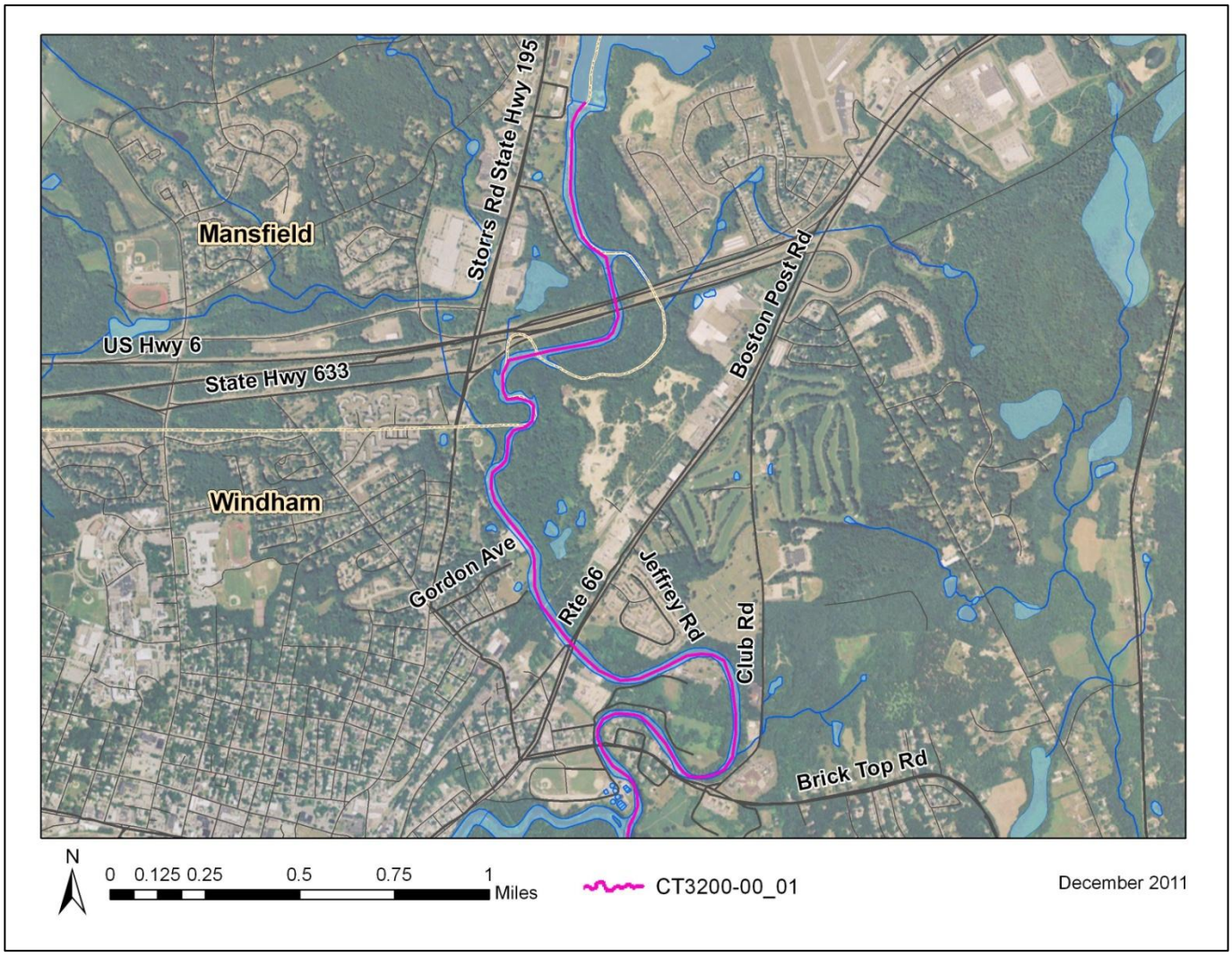
Natchaug River (CT3200-00_01) is a Class A freshwater river (Figure 5). Its applicable designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location from 1998, 1999 and 2001 (Station 1056) (Table 2).

The water quality criteria for *E. coli*, along with bacteria sampling results for Station 1056 from 1998, 1999 and 2001, are presented in Table 8. Single sample values at this station exceeded the WQS for *E. coli* once in 1999 during a wet-weather sampling event. The annual geometric mean was calculated for Station 1056 in 2001, but did not exceed the WQS for *E. coli*.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for wet-weather and dry-weather sampling days at Station 1056 (Table 8). There was not enough data to calculate a geometric mean for wet-weather samples because only one wet-weather sample was collected over the sampling period. The geometric mean during dry-weather did not exceed the WQS for *E. coli.*

Due to the elevated bacteria measurement presented in Table 8, this segment of Natchaug River 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 Natchaug River



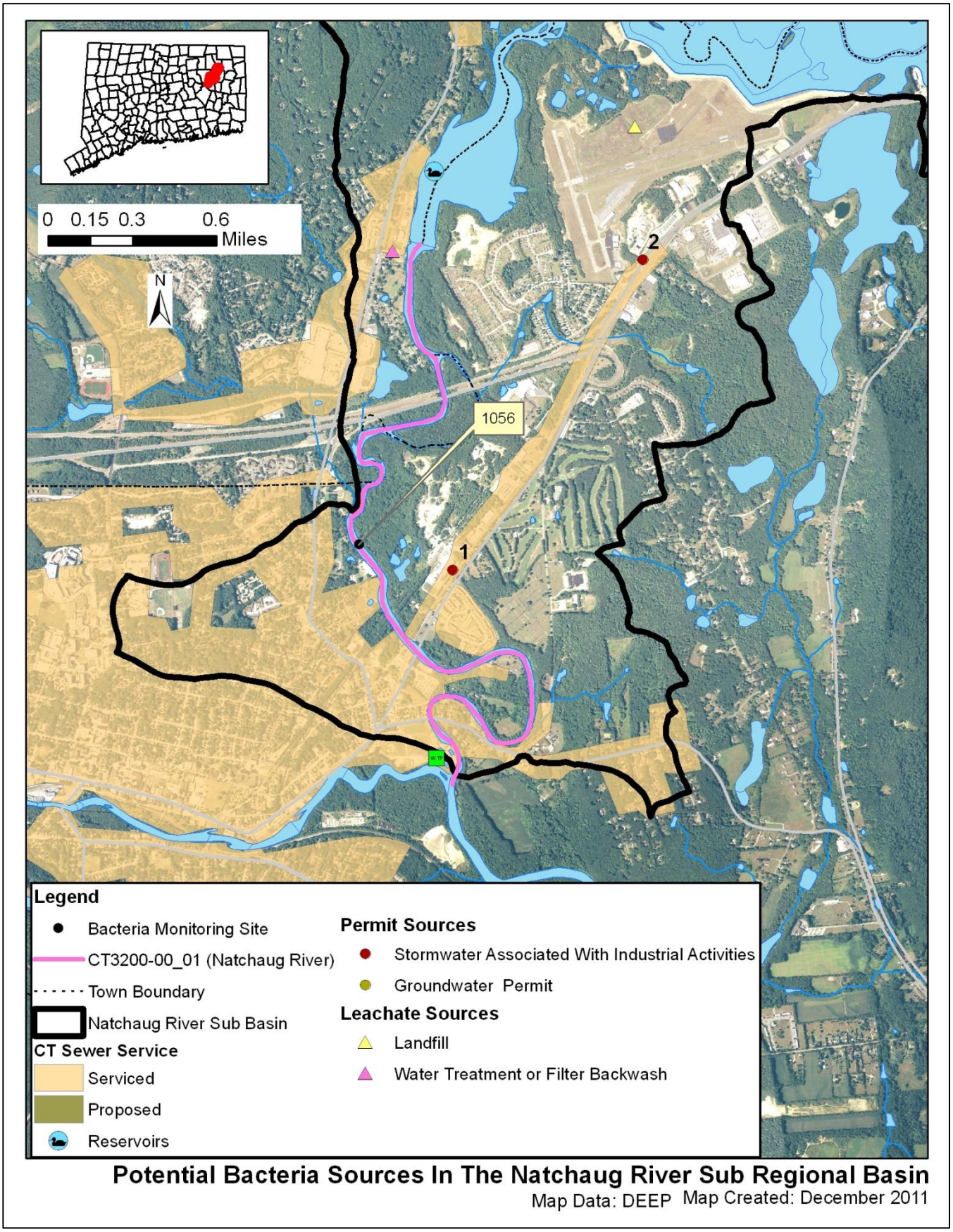
POTENTIAL BACTERIA SOURCES

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 Natchaug River 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 shown in Figure 6. 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. 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 Natchaug River watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/ Pets	Other
Natchaug River CT3200-00_01	**x**	**x**	**x**	**x**		**x**	**x**	

Figure 6: Potential sources in the Natchaug 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 permits in the watershed is included in Table 5 and Table 6. Additional investigation and monitoring could reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type.

Table 4: General categories list of other permitted discharges

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

Permitted Sources

As shown in Table 5, there are several permitted discharges in the Natchaug River watershed. Bacteria data from 2001-2002 from 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 water quality standard for fecal coliform bacteria for shellfishing uses, multiple samples were high, with several samples from multiple outfalls at United Abrasives (GSI695) exceeding 600 colonies/100 mL and samples from one site at the State of Connecticut Department of Transportation (GSI918) as high as 38,000 colonies/100 mL. Likewise, runoff from Republic Oil, Inc. exceeded 600 colonies/100 mL.

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 (Figure 6). 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 Natchaug River watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
North Windham	Builders Concrete East LLC	GSI001646	Stormwater Associated With Industrial Activities	Builders Concrete East, LLC	1
North Windham	State Of Connecticut Department Of Transportation	GSI000918	Stormwater Associated With Industrial Activities	Windham Airport	2
North Windham	Town Of Windham	UI0000141	Groundwater Permit	North Windham Elementary School	N/A
Chaplin	Town Of Chaplin	GSI000953	Stormwater Associated With Industrial Activities	Chaplin Transfer Station	N/A

Table 6: Industrial permits on the Natchaug River and available fecal coliform data (colonies/100mL)

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
Windham	United Abrasives	GSI000695	Natchaug River	'10"CI,6"PVC drainpipe 6ft rear of property	09/25/01	1,800
Windham	United Abrasives	GSI000695	Natchaug River	'10"CI,6"PVC drainpipe 6ft rear of property	10/16/02	1,020
Windham	United Abrasives	GSI000695	Natchaug River	Ex 36" Accmp. at entrance of un-named brook	09/25/01	10
Windham	United Abrasives	GSI000695	Natchaug River	Ex 36" Accmp. at entrance of un-named brook	10/16/02	>600
Windham	ST of CT DOT	GSI000918	Natchaug River	Windham Airport DSN A	10/16/02	38,000
Windham	ST of CT DOT	GSI000918	Natchaug River	Windham Airport DSN B	10/16/02	20
Windham	Republic Oil Inc	GSI000983	Natchaug River	Runoff from SW portion	08/29/02	>600

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)

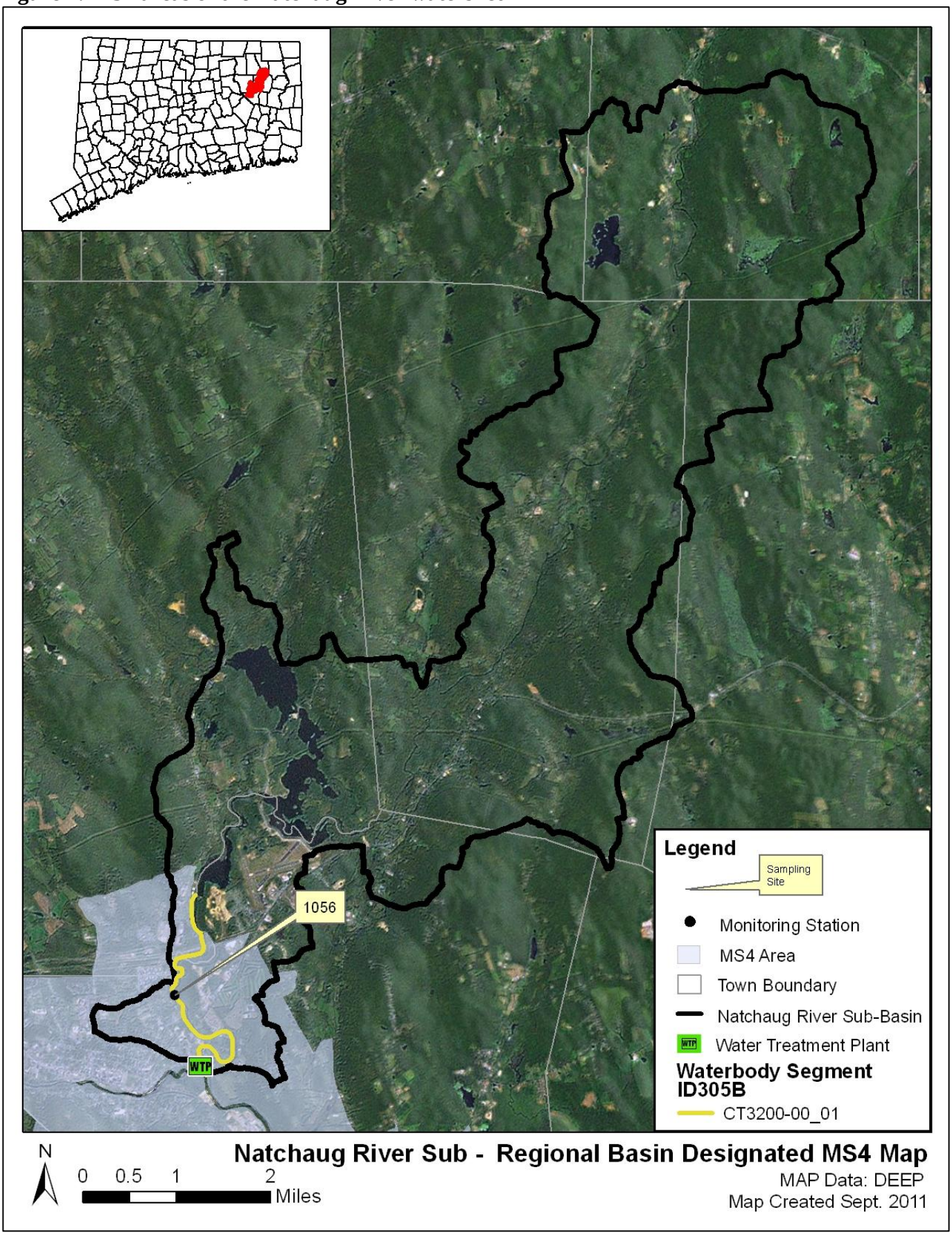
While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some 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 area identified in Figure 7 is the Willimantic Urban Cluster, and is therefore not an MS4 community. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

Figure 7: MS4 areas of the Natchaug River watershed



Publicly Owned Treatment Works

As shown in Figure 6, there is one publicly owned treatment works (POTWs), or wastewater treatment plant (WTP) in the Natchaug River watershed. The Windham Water Treatment Control Facility (WTCF) is located on the watershed boundary where the Natchaug River flows into the Willimantic River. While a portion of the treatment facility is located in the watershed, the plant discharges to the Willimantic River. Bacteria data from this permitted facility is not currently available, nor would it have any impact on the impaired Natchaug River segment (Table 6).

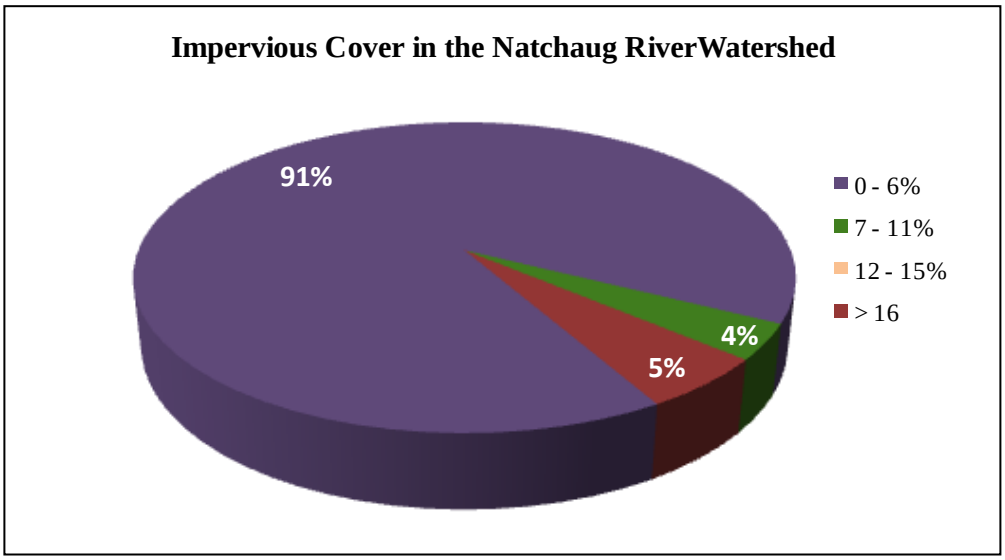
Non-point Sources

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 Natchaug River watershed are described below.

Stormwater Runoff from Developed Areas

Approximately one-quarter of the Natchaug River watershed is developed (including industrial, commercial and residential development and agriculture). The majority of this development is located south of the Willimantic Reservoir within the land adjacent to the impaired segment. This area includes the Windham Airport, large residential subdivisions and condominium complexes, the North Windham Shopping Center, the Willimantic Country Club, a portion of the Eastern Connecticut State University campus, mining operations, and a mix of commercial and residential development. The remainder of the urban development in the watershed is limited to the roadways and village centers. Approximately 17% of the land use in the watershed is considered urban, with the majority of that urban development adjacent to the impaired segment in the lower watershed (Figures 4 and 8). 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).

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

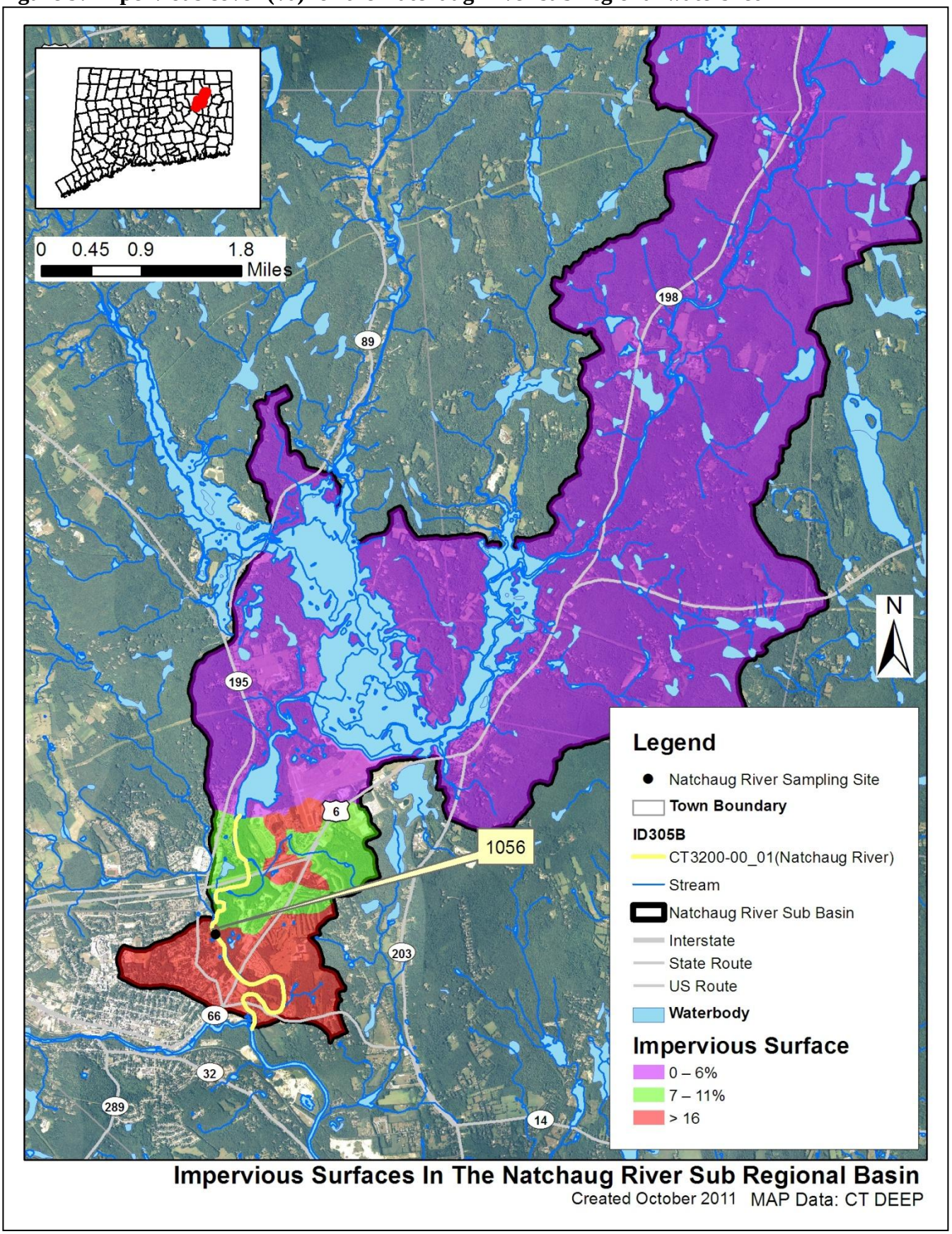


There are at least two active permitted stormwater outfalls in the watershed (Figure 6), with potential for many more inactive permits (Tables 6 and 7) as well as unknown stormwater outfalls to the Natchaug River. Potential bacteria sources from these outfalls could impact the water quality of the Natchaug River. A watershed study to map stormwater outfalls that contribute to the impairment in the river should be considered to improve water quality.

As shown in Figure 9, the portion of the Natchaug River watershed containing the impaired segment contains a high percentage of impervious cover, ranging from 7-11% in the section immediately below the dam, to greater than 16% impervious cover in the southern portion of the watershed below the sampling station, and around the Windham Airport. The remainder of the watershed above the impaired segment contains areas of impervious cover between 0-6% typical of more rural residential, agricultural, and forested watersheds. High geometric means during wet-weather may indicate that stormwater runoff is contributing to the bacterial impairment in a river segment. As shown in Table 8, the bacteria concentration in the Natchaug River exceeded the WQS at Station 1056 on the impaired segment during a wet-weather sampling event.

The Town of Windham/Willimantic is experiencing continued growth, with a surge of development in the less developed areas of North Windham, new homes filling in previously undeveloped lots in both Windham Center and South Windham, and a major downtown revitalization taking place (Windham, 2012). This new development will increase the percentage of impervious cover in the watershed and if not managed well, could increase the volume of polluted stormwater entering the Natchaug River.

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



Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Natchaug River watershed represent another potential source of bacteria. Wildlife, including waterfowl, may be a significant bacteria source to surface waters, including the Natchaug River, especially in the riparian areas adjacent to the river that wildlife use as wildlife corridors. These corridors provide trail systems for wildlife to get from one food source to the next, and are often linked to large blocks of undeveloped land, including the conservation land located throughout the watershed. In addition, construction of roads and drainage systems may convey these wastes via stormwater runoff to the nearest surface water. These physical land alterations can exacerbate the impact of natural sources on water quality because the wastes are no longer retained on the landscape (USEPA, 2001).

Waterfowl, especially grazers like geese, prefer easy access to water. Reservoirs and other large open bodies of water such as the Willimantic Reservoir and Mansfield Hollow Lake upstream of the impaired segment are attractive to waterfowl such as ducks and geese. Maintaining a natural, uncut vegetated buffer around these waterbodies will help make shoreline less desirable to these birds and limit this bacteria source. Waterfowl are also known to congregate in open areas including recreational fields, public beaches such as Philip Lauter Park, and golf courses such as the Willimantic Country Club. 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.

Residential development in the watershed can result in stormwater runoff containing waste from domestic animals, such as dogs, which may also be contributing to high bacteria concentrations in the impaired segment of Natchaug River.

Insufficient Septic Systems and Illicit Discharges

As shown in Figure 6, residents in the Town of Windham (including Willimantic) are on a sanitary sewer system that is operated by the Town of Windham Water Pollution Control Facility (WPCF). Remaining areas of the watershed rely on onsite wastewater treatment systems such as septic systems. Insufficient or failing septic systems can be significant sources of bacteria by allowing raw waste to reach surface waters. In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient or failing septic systems in a specific municipality. The Town of Windham is a member of the North Central Health District (http://www.ncdhd.org).

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 buffers along the shoreline. Agricultural land use makes up 7% of the Natchaug River watershed, though some areas designated agricultural (especially around the airport-Figure 4), may actually be grass or lawn. The agricultural land is spread across the watershed in small isolated land areas adjacent to forestland, although none could be located near the impaired segment.

Additional Sources

There may be other sources not listed here that contribute to the observed water quality impairment in Natchaug River including small hobby farms containing horses, goats, pigs or other animals that may be a potential source of bacteria to the 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

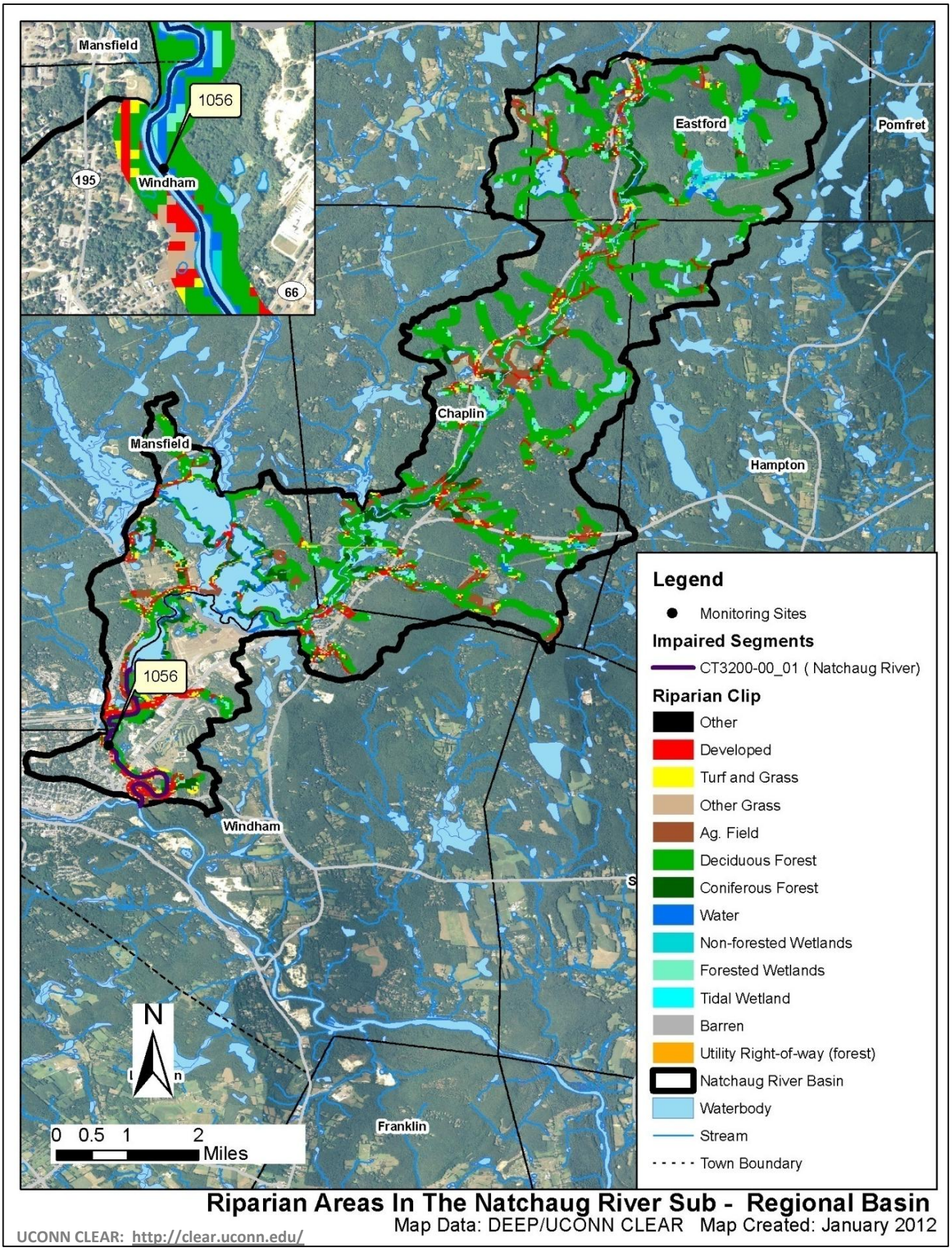
Riparian Buffer Zones

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.

A large portion of the riparian zone for the impaired segment of the Natchaug River is characterized by developed land, with patches of deciduous forests and agricultural land (Figure 10). Riparian areas upstream of the impaired segment are largely comprised of deciduous forest with patches of agricultural land and developed land near roads. As previously noted, if not properly treated, runoff from developed areas and agricultural fields may contain pollutants such as bacteria and nutrients.

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



CURRENT MANAGEMENT ACTIVITIES

The Natchaug River watershed is located in a region that is considered one of the last remaining open spaces in Connecticut due to extensive urban and suburban development pressures. In 2006, the area was designated a Connecticut Greenway. Since then, municipal leaders have been working together to identify potential threats to the watershed and to address those threats. In 2009, the Natchaug River Basin Municipal Regulation Report (Wasstrom-Welz, 2009) was developed, which provided specific municipal zoning recommendations that would protect natural resources in each of the towns in the watershed. In 2010, the Green Valley Institute put out maps that identified unprotected forested parcels with greatest impact on water quality (GVI, 2010) to aid in long-term conservation planning. Working with the Green Valley Institute and The Nature Conservancy, eight municipalities within the Natchaug River watershed took a pledge to protect the water quality within the Natchaug River watershed (Chronicle, 2011). The Natchaug River Basin Conservation Compact is one of many planning tools to protect the natural resources within the watershed.

RECOMMENDED NEXT STEPS

As discussed above, there is a concerted effort on the part of local municipalities to work together to protect the Natchaug River. However, many of the objectives to protect water quality are directed toward land conservation/preservation activities. While no specific language within these planning documents focus on bacteria impairments in the river, recommendations such as installing Best Management Practices for erosion control in the watershed may potentially help reduce bacteria inputs.

1) Identify areas along the the Natchaug River to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, approximately 17% of the Natchaug River watershed is considered urban, with portions falling within the Willimantic Urban Cluster, according to the US Census. The heaviest development is located at the southern tip of the watershed below the Willimantic Reservoir adjacent to the impaired river segment. Stormwater runoff from these developed areas, including the airport, golf course, commercial and industrial development, and high intensity residential development are likely sources of bacteria and nutrients in the Natchaug River.

Since a large portion of the watershed is located upstream of the impaired segment, it is possible that the bacteria impairment in the river could originate from land uses upstream of the impaired segment. Therefore, it is critical that the Town of Windham communicate with the upstream municipalities to begin discussions about how to address the bacteria problem, especially the Town of Mansfield which contains Willimantic Reservoir and Mansfield Hollow Lake just upstream of the impaired segment.

To identify specific areas that are contributing bacteria to the impaired segments additional wet-weather sampling is needed at stormwater outfalls that discharge directly to the impaired segment of the Natchaug River (including the outflow at the dam). The Natchaug River Compact recommends a stormwater infrastructure inventory be conducted for each town. To treat stormwater runoff, the towns of Windham and Mansfield should identify areas along the river 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.

2) Continue monitoring of permitted sources.

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 Natchaug 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

		Instantaneous *E. coli* (#/100mL)						Geometric Mean *E. coli* (#/100mL)	
Class	**Bacteria Source**	**WLA[6]**			**LA[6]**			**WLA[6]**	**LA[6]**
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.

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

As a large area of the lower Natchaug River watershed is developed, any education and outreach programs in this portion of the watershed should highlight the importance of managing waste from dogs and other pets and not feeding waterfowl and wildlife. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer near public bathing areas and other water sources 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 Natchaug 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.

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

A portion of the Natchaug River watershed relies on a municipal sewer system (Figure 6), including those residents near the river. It is important for the Town of Windham to develop a program to evaluate its sanitary sewer system and reduce leaks and overflows. This program should include periodic inspections of the sewer line.

5) Develop a system to monitor septic systems.

Less developed areas of the Natchaug River watershed rely on septic systems for human waste disposal. If not already in place, towns within the watershed should establish a program to ensure that existing septic systems in the watershed 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. Somers can also develop a program to assist citizens with the replacement and repair of older and failing systems.

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

If not already in place, agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict livestock and horse access to streams and wetlands, and that animal waste handling, disposal, and other appropriate Best Management Practices (BMPs) are in place. Particular attention should be paid to those agricultural operations located within the riparian buffer zone along the impaired segment and directly upstream from the impaired segment (Figure 10).

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 8: Natchaug River Bacteria Data

Waterbody ID: CT3200-00_01

Characteristics: Freshwater, Class A, Potential Drinking Water Supply, 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: 235 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **NA**

Single Sample: **24%**

Data: 1998-2001 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from Station 1056 on Natchaug River with annual geometric means calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1056	Lauter Park off Gordon Avenue	9/25/1998	97	dry	NA
1056	Lauter Park off Gordon Avenue	10/5/1999	**310* (24%)**	wet	NA
1056	Lauter Park off Gordon Avenue	5/11/2001	10	dry	**23* (0%)**
1056	Lauter Park off Gordon Avenue	10/3/2001	52	dry	

Shaded cells indicate an exceedance of water quality criteria

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

Wet and dry weather geometric mean values for Station 1056 on Natchaug River

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1056	Lauter Park off Gordon Avenue	1998, 1999, 2001	1	3	63	NA	37

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gauge at Norwich Public Utility Plant in Norwich, CT

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