



Baker Brook

Watershed Description

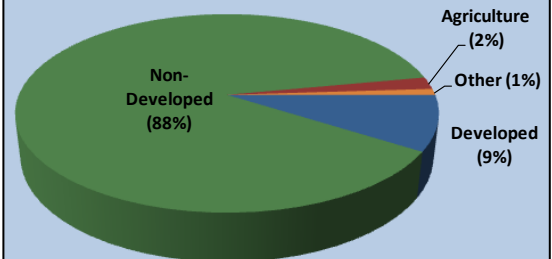
This **TMDL** applies to Baker Brook (RI0008040R-18), a 1.4-mile long stream located in Richmond, RI (Figure 1). The Town of Richmond is located in the southwestern portion of the state and is bordered to the east by South Kingstown, to the west by Hopkinton, to the north by Exeter, and to the south by Charlestown. Baker Brook is located in the northwestern corner of town, near the border with Hopkinton. The Baker Brook watershed is presented in Figure 2 with land use types indicated.

Baker Brook begins in the southeastern corner of the Arcadia Management Area just east of Route 3 and Interstate 95 (I-95). The brook flows west, under Route 3 and I-95, parallel to Baker Pine Road through a predominately-forested area. Baker Brook then crosses K.G. Ranch Road and enters a residential neighborhood. The brook continues west and empties into the Wood River on the town border of Richmond and Hopkinton.

The Baker Brook watershed covers 1.8 square miles. The watershed is predominately non-developed (88%) and includes a portion of the Arcadia Management Area. Developed uses (including residential and commercial uses) occupy approximately 9%, and agricultural land uses occupy another 2% of the watershed.

Assessment Unit Facts *(RI0008040R-18)*

- **Town:** Richmond
- **Impaired Segment Length:** 1.4 miles
- **Classification:** Class B
- **Direct Watershed:** 1.8 mi² (1167 acres)
- **Impervious Cover:** 4.2%
- **Watershed Planning Area:** Wood-Pawcatuck (#23)



Watershed Land Uses

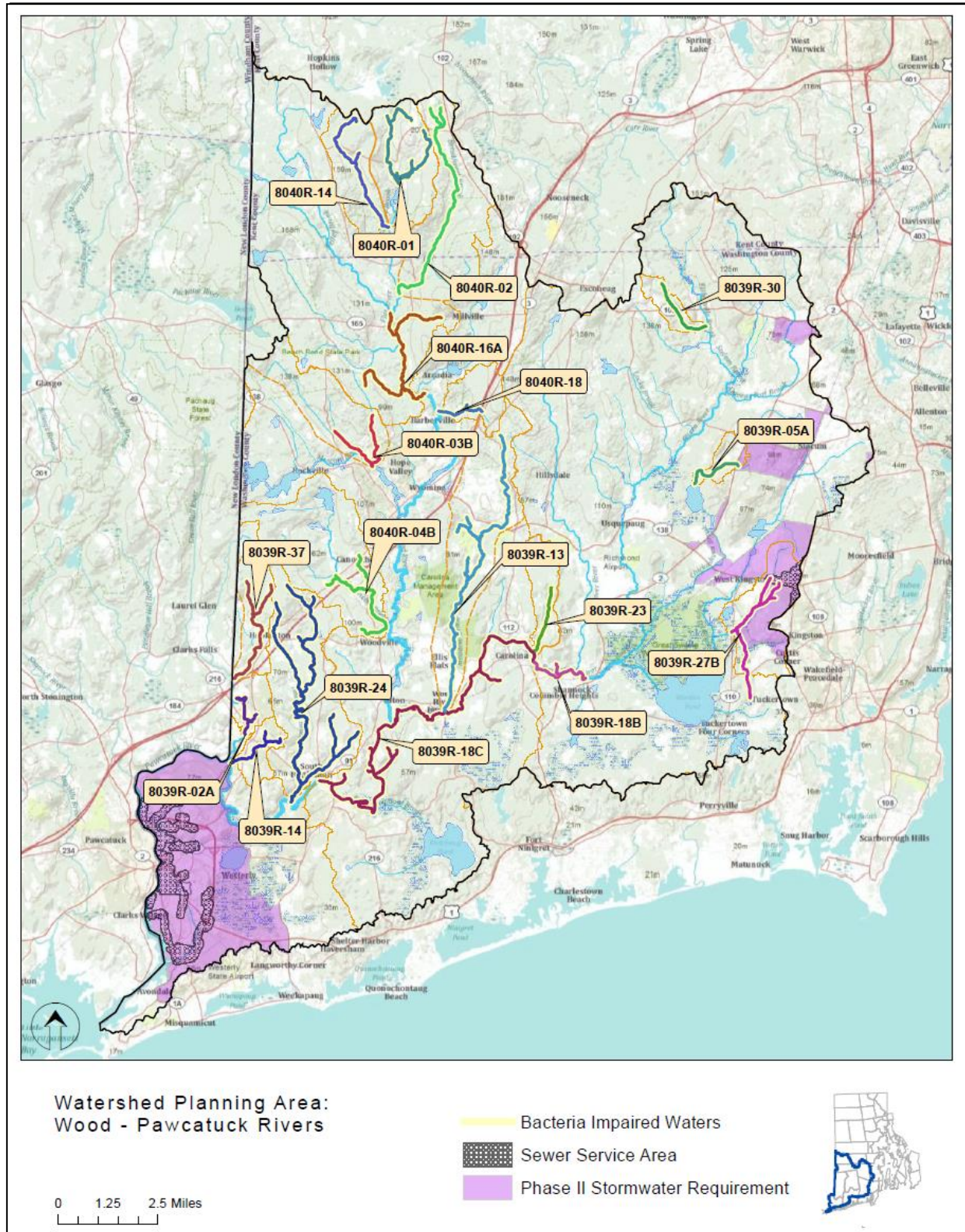


Figure 1: Map of the Wood-Pawcatuck Planning Area with impaired segments, sewer areas, and stormwater regulated zones.

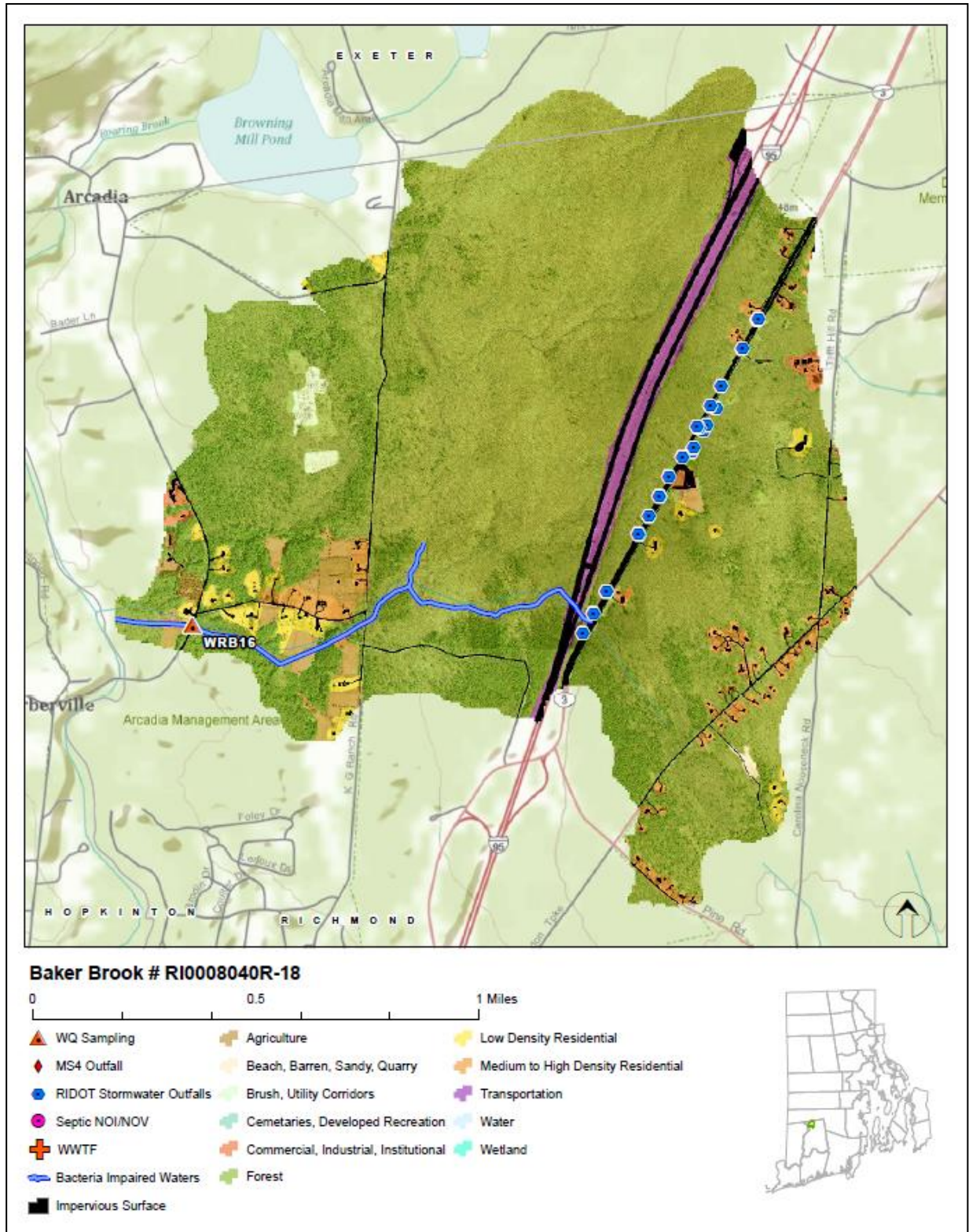


Figure 2: Map of the Baker Brook watershed with impaired segment, sampling location, and land cover indicated.

Why is a TMDL Needed?

Baker Brook is a Class B freshwater stream, and its applicable designated uses are primary and secondary contact recreation and fish and wildlife habitat (RIDEM, 2010a). In 2011 water samples were collected from one sampling location on Baker Brook at Arcadia Road (WRB16) and analyzed for the indicator bacteria, enterococci. The water quality criteria for enterococci, along with bacteria sampling results from 2011 and associated statistics are presented in Table 1. The geometric mean of the data collected at station WRB16 exceeds the water quality criteria for enterococci. Samples were all taken in dry-weather



Figure 3: Partial aerial view of the Baker Brook watershed (Source: Google Maps).

conditions. Possible dry weather sources are described in the sections below. Potential sources include improperly operating onsite wastewater treatment systems (OWTS), wastes from agriculture activities, as well as wastes from waterfowl, wildlife, and domestic pets.

Due to the elevated bacteria measurements presented in Table 1, Baker Brook does not meet Rhode Island's bacteria water quality standards, is identified as impaired, and was placed on the 303(d) list (RIDEM, 2012). 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 water quality standards.

Potential Bacteria Sources

There are several potential sources of bacteria in the Baker Brook watershed including malfunctioning onsite wastewater treatment systems; agricultural and stormwater runoff; and waterfowl, wildlife, and domestic animal waste.

Onsite Wastewater Treatment Systems

All residents in the Baker Brook watershed rely on onsite wastewater treatment systems (OWTS) such as septic systems and cesspools. Failing OWTS can be significant sources of bacteria by allowing improperly treated waste to reach surface waters (RI HEALTH, 2003). If systems are not sized properly, malfunctioning, or in soils poorly suited for septic waste disposal, microorganisms such as bacteria, can easily enter surface water (USEPA, 2002). As shown in Figure 2, no OWTS Notice of Violation/Notice of Intent to Violate (NOV/NOIs) have been issued by the RIDEM Office of Compliance and Inspection in the Baker Brook watershed.

Agricultural Activities

Agricultural operations are recognized as an important economic activity and landscape feature in the state's rural areas. The Town of Richmond is home to multiple horse and dairy farms (Fuss and O'Neill, 2007). Agricultural practices such as allowing livestock to graze near streams, crossing livestock through waterbodies, spreading manure as fertilizer, and improper storage and disposal of manure can contribute to bacterial contamination.

Waterfowl, Wildlife, and Domestic Animal Waste

Most of the Baker Brook watershed is not developed. Waterfowl and wildlife living in the forested and wetland areas throughout the Arcadia Management Area within the watershed may be contributing bacteria to Baker Brook.

Residential development is concentrated in the western portion of the watershed. Waste from domestic animals, such as dogs, in these residential neighborhoods, may also be contributing to bacteria concentrations in Baker Brook.

Developed Area Stormwater Runoff

The Baker Brook watershed has an impervious cover of 4.2%. Impervious cover is defined as land surface areas, such as roofs and roads that force water to run off land surfaces, rather than infiltrating into the soil. Impervious cover provides a useful metric for the potential for adverse stormwater impacts. While runoff from impervious areas in these portions of the watershed may be contributing bacteria to

Baker Brook, as discussed in Section 6.3 of the Core TMDL Document, as a general rule, water quality impairments on streams with watersheds having less than 10% impervious cover are assumed to be caused by sources other than urbanized stormwater runoff.

The Rhode Island Department of Transportation (RIDOT) has identified and mapped stormwater outfalls within the Town of Richmond, including those for Route 3 and I-95. As shown in Figure 2, multiple outfalls are found in the Baker Brook watershed, and are concentrated near the headwaters of Baker Brook along Route 3, also known as the New London Turnpike.

Existing Local Management and Recommended Next Steps

Additional bacteria data collection would be beneficial to support identification of sources of potentially harmful bacteria in the Baker Brook watershed. These activities could potentially include sampling at several different locations and under different weather conditions (e.g., wet and dry). Field reconnaissance surveys focused on stream buffers, stormwater runoff, and other source identification may also be beneficial.

Based on existing ordinances and previous investigations, the following steps are recommended to support water quality goals.

Onsite Wastewater Management

All residents of the Town of Richmond and the Baker Brook watershed rely on OWTS (septic systems or cesspools) (Fuss and O'Neill, 2007). The Town of Richmond has an Onsite Wastewater Management Plan that provides a framework for managing the OWTS (Fuss and O'Neil, 2009). As part of an onsite wastewater planning process, Richmond should adopt ordinances to establish enforceable mechanisms to ensure that existing OWTS are properly installed and maintained. RIDEM recommends that communities create an inventory of onsite 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 OWTS within a reasonable time frame should be adopted. The Rhode Island Wastewater Information System (RIWIS) can help develop an initial inventory of OWTS and can track voluntary inspection and pumping programs (RIDEM, 2010b).

Richmond currently does not have an ordinance to enforce routine maintenance and pumping of OWTS. Also, while Richmond has an approved Onsite Wastewater Management Plan, which makes the Town eligible for the Community Septic System Loan Program (CSSLP) funding, no application has been made to date. The CSSLP program provides low-interest loans to residents to help with maintenance and replacement of OWTS. It is recommended that the town develop a program to assist citizens with the replacement of older and failing systems.

Agricultural Activities

If not already in place, agricultural producers should work with the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) and the RIDEM Division of Agriculture to develop a conservation plan for farming activities, particularly at horse farms within the watershed. NRCS and the RIDEM Division of Agriculture should ensure that all agricultural operations within the watershed have sufficient stream buffers, have fencing to restrict access of livestock and horses to streams and wetlands, and have animal waste handling, disposal, and other appropriate BMPs in place.

Waterfowl, Wildlife, and Domestic Animal Waste

The Town of Richmond should develop education and outreach programs to highlight the importance of picking up after dogs and other pets and not feeding waterfowl. Animal wastes should be disposed of away from any waterway or stormwater system. Richmond should work with volunteers to map locations where animal waste is a significant and a chronic problem. The town should also evaluate strategies to reduce the impact of animal waste on water quality. This may include installing signage, providing pet waste receptacles or pet waste digester systems in high-use areas, enacting ordinances requiring clean-up of pet waste, and targeting educational and outreach programs in problem areas.

Towns and residents can take several measures to minimize waterfowl-related impacts. They can allow tall, coarse vegetation to grow in areas along the shores of Baker Brook that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to the water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. With few exceptions, Part XIV, Section 14.13 of Rhode Island's Hunting Regulations prohibits feeding wild waterfowl at any time in the state of Rhode Island. Educational programs should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in Baker Brook and can harm human health and the environment.

Stormwater Management

RIDOT is a municipal separate storm sewer system (MS4) operator (RIPDES permit RIR040036) in the Baker Brook watershed and has prepared a Phase II Stormwater Management Program Plan (SWMPP). The Town of Richmond is not currently regulated under the Phase II program. However, it is anticipated that Richmond will be regulated within the next few years (Fuss and O'Neill, 2007).

RIDOT's SWMPP and its 2011 Compliance Update outline its goals for compliance with the General Permit. It should be noted that RIDOT has chosen to enact the General Permit statewide beyond the General Permit's requirements regarding stormwater from urbanized and densely populated areas and

from divided highways outside of the urbanized and densely populated areas. RIDOT has finished mapping its outfalls throughout the state and is working to better document and expand its catch basin inspection and maintenance programs along with its BMP maintenance program. Storm Water Pollution Prevention Plans (SWMP) are being utilized for RIDOT construction projects. RIDOT also funds the University of Rhode Island Cooperative Extension's Stormwater Phase II Public Outreach and Education Project, which provides participating MS4s with education and outreach programs that can be used to address TMDL public education recommendations.

Though only a small portion of the Baker Brook watershed is developed, most of the development is concentrated in the western portion of the watershed, close to the outlet of Baker Brook to the Wood River. The Town of Richmond has developed an initial Phase II SWMP in anticipation of expanded coverage of the Phase II regulations in the future. This SWMP outlines existing stormwater programs and notes goals for these programs in the future. Richmond currently has an annual cleaning and inspection program for its 450 catch basins, and an annual street sweeping program (Fuss and O'Neill, 2007). The town has not mapped or identified their stormwater outfalls or adopted an IDDE ordinance.

The Town of Richmond does not currently have an ordinance to address illicit discharges (Fuss and O'Neill, 2007). This type of ordinance prohibits illicit discharges to the storm drain system and provides an enforcement mechanism. It is recommended that any stormwater outfalls discharging in the near vicinity of the Baker Brook sampling location (WRB16) be monitored to check for illicit discharges. Illicit discharges can be identified through continued dry weather outfall sampling and microbial source tracking.

As it is assumed that stormwater runoff is not the major contributor of bacteria to Baker Brook based on the watershed's imperviousness, RIDOT will have no changes to their Phase II permit requirements and no TMDL Implementation Plan (TMDL IP) will be required at this time.

While these first steps are important to reduce the effects of stormwater runoff to Baker Brook, additional efforts are needed to restore the river's water quality. The Town of Richmond should continue to develop goals for its anticipated Phase II SWMP including water quality sampling, extensive street and catch basin cleaning programs, and public education activities.

Land Use Protection

Woodland and wetland areas within the Baker Brook watershed, particularly in the Arcadia Management Area absorb and filter pollutants from stormwater runoff, and help protect both water quality in the stream and stream channel stability. As these areas represent the majority of the land use in the Baker Brook watershed, it is important to preserve these undeveloped areas, and institute controls on development in the watershed.

The steps outlined above will support the goal of mitigating bacteria sources and meeting water quality standards in Baker Brook.

Table 1: Baker Brook Bacteria Data

Waterbody ID: RI0008040R-18

Watershed Planning Area: 23 – Wood-Pawcatuck

Characteristics: Freshwater, Class B, Primary and Secondary Contact Recreation, Fish and Wildlife Habitat

Impairment: Enterococci (colonies/100mL)

Water Quality Criteria for Enterococci: Geometric Mean: 54 colonies/100 mL

Percent Reduction to meet TMDL: 45% (Includes 5% Margin of Safety)

Data: 2011 from RIDEM,

Single Sample Enterococci (colonies/100 mL) Data for Baker Brook (2005 - 2006) with Geometric Mean Statistics

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean
WRB16	Baker Brook-Arcadia Rd	06/14/2011	131.3	Dry	90.3
WRB16	Baker Brook-Arcadia Rd	07/07/2011	117.8	Dry	
WRB16	Baker Brook-Arcadia Rd	09/14/2011	235.9	Dry	
WRB16	Baker Brook-Arcadia Rd	09/21/2011	56.5	Dry	
WRB16	Baker Brook-Arcadia Rd	10/11/2011	29.2	Dry	
Shaded cells indicate an exceedance of water quality criteria					

Wet and Dry Weather Enterococci Geometric Mean Values for Baker Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
WRB16	Baker Brook-Old Nooseneck Rd	2004-2005	0	5	90.3	NA	90.3
Shaded cells indicate an exceedance of water quality criteria							
Weather condition determined from rain gage at Westerly Airport in Westerly, RI							

References

- Fuss and O'Neill (2007). Stormwater Management Program Plan. Town of Richmond, RI. October 2007.
- Fuss and O'Neill (2009). Onsite Wastewater Management Plan. Town of Richmond, RI. June 2009.
- RIDEM (2010a). State of Rhode Island and Providence Plantations Water Quality Regulations. Amended December, 2010b. Rhode Island Department of Environmental Management.
- RIDEM (2010b). Total Maximum Daily Load Analysis for the Pawcatuck River and Little Narragansett Bay Waters (Bacteria Impairments). Rhode Island Department of Environmental Management.
- RIDEM. 2012. *State of Rhode Island 2012 303(d) List: List of Impaired Waters, Final August 2012*, Rhode Island Department of Environmental Management, Office of Water Resources, Providence, RI.
- RI HEALTH (2003). Aquidneck Island Drinking Water Assessment Results, Source Water Protection Assessment conducted by the University of Rhode Island for the Rhode Island Department of Health, Office of Drinking Water Supply.
- USEPA (2002). Onsite Wastewater Treatment Systems Manual – Office of Water, Office of Research and Development – EPA/625/R-00/008. Online:
www.epa.gov/owm/septic/pubs/septic_2002_osdm_all.pdf.