



Pierce Brook

Watershed Description

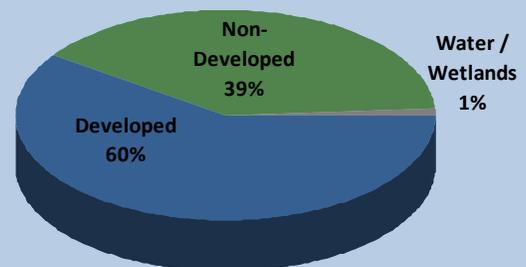
This **TMDL** applies to Pierce Brook (RI0007028R-07), a 1.7-mile long tributary of Hunt River located in East Greenwich and Warwick, RI (Figure 1). The Town of East Greenwich and the City of Warwick are located in the central portion of the state. Pierce Brook watershed is shown in Figure 2 with land use types indicated.

Pierce Brook begins near Kent Drive in an East Greenwich neighborhood north of Nichol's Four Corner. The brook then crosses under Middle Road, traveling parallel to South Pierce Road. Just before Pierce Brook crosses Post Road (Route 1), the Brook enters an underground culvert that takes it under Route 1, a large parking lot, and a shopping plaza. This shopping plaza currently houses a Benny's store and several restaurants among other commercial businesses. Pierce Brook daylight on the backside of the shopping plaza. This is also where Pierce Brook crosses into Warwick. Pierce Brook then turns 90 degrees at the railroad tracks and shortly thereafter enters the Hunt River, just north of the North Kingstown town line.

The Pierce Brook watershed covers 0.98 square miles and includes multiple residential neighborhoods in East Greenwich. Developed areas, predominately medium to high-density residential development occupy a large portion (59.6%) of the watershed. Non-developed uses occupy 39.4% of the watershed. Surface water and wetlands occupy 1% of the watershed.

Assessment Unit Facts (RI007028R-07)

- **Town:** East Greenwich, Warwick
- **Impaired Segment Length:** 1.7 miles
- **Classification:** Class B
- **Direct Watershed:** 0.98 mi² (630 acres)
- **Impervious Cover:** 24.8%
- **Watershed Planning Area:** Hunt River (#6)



Watershed Land Uses

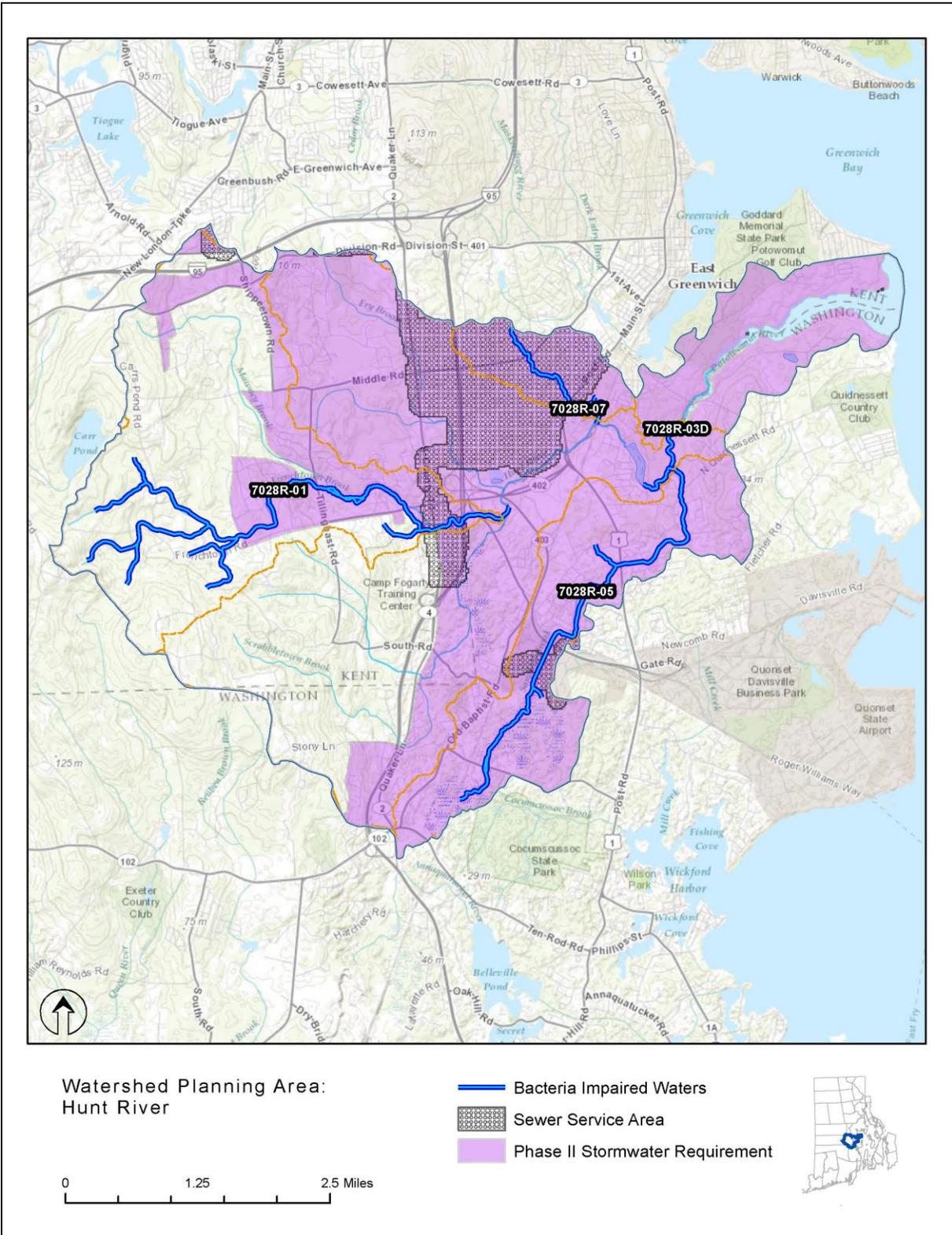


Figure 1: Map of the Hunt River Watershed Planning Area with impaired segments addressed by the Statewide Bacteria TMDL, sewered areas, and stormwater regulated zones.

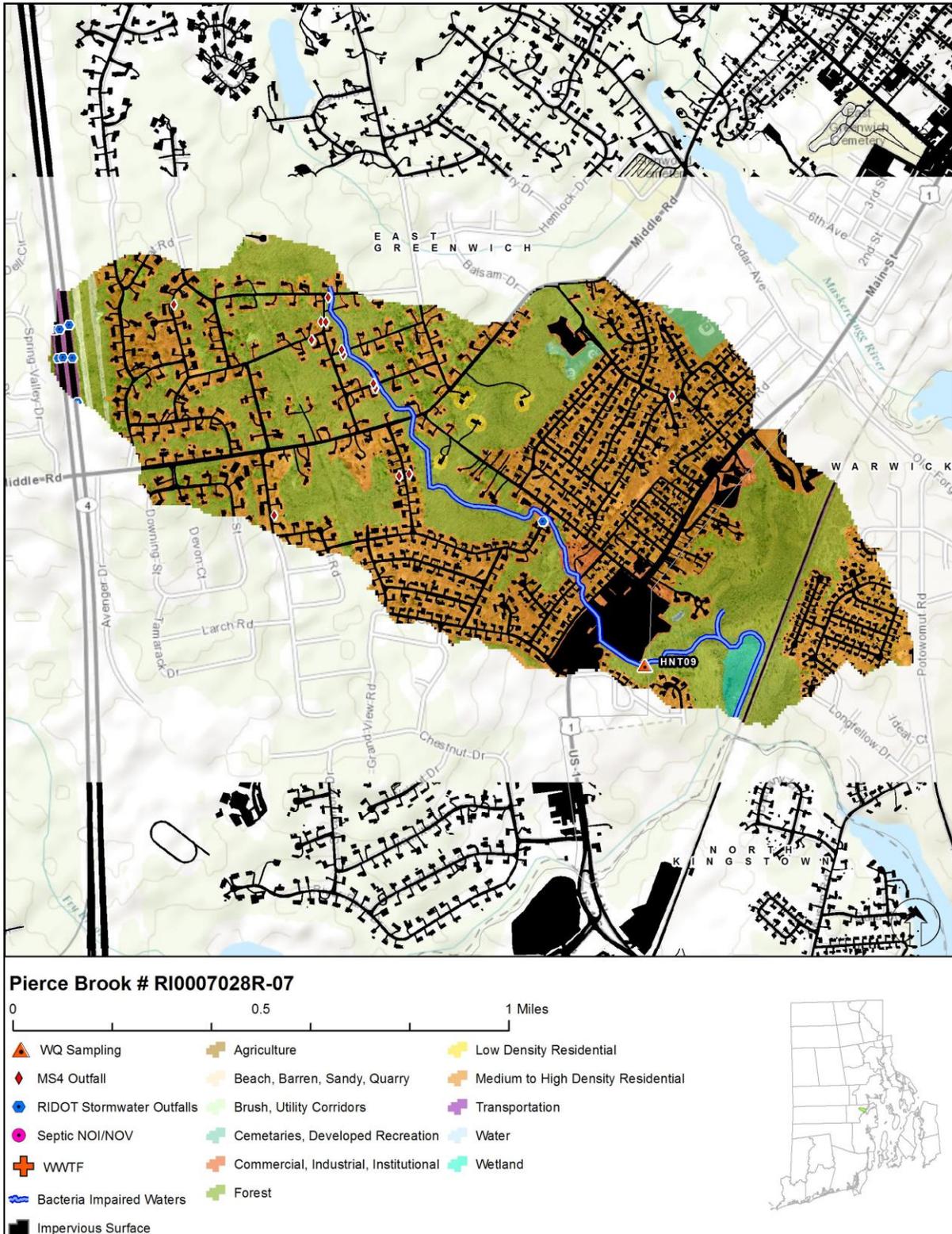
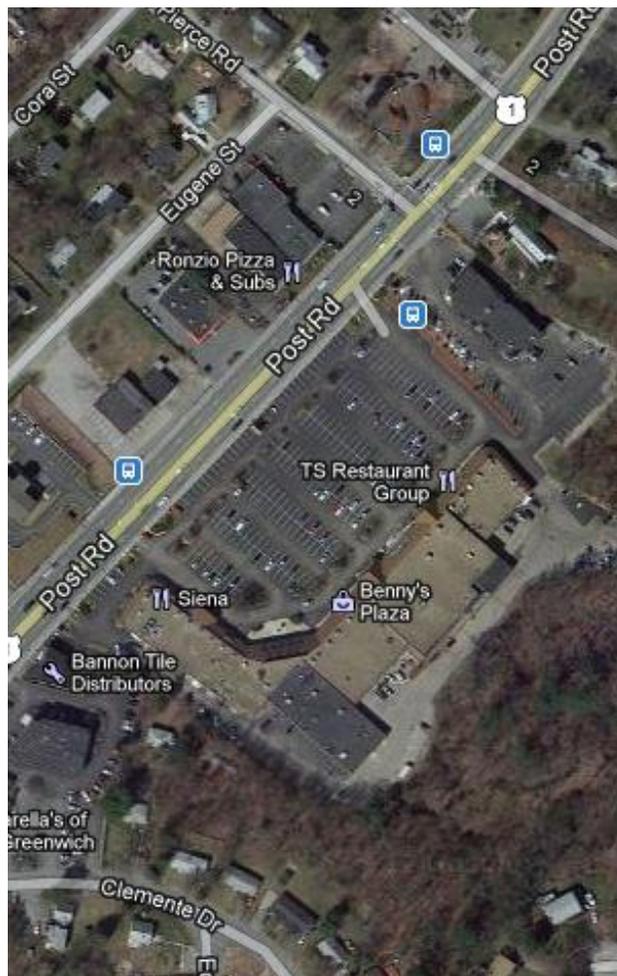


Figure 2: Map of the Pierce Brook watershed with impaired segment, sampling locations, and land cover indicated.

Why is a TMDL Needed?

Pierce Brook is a Class B freshwater stream, and its applicable designated uses are primary and secondary contact recreation and fish and wildlife habitat (RIDEM, 2010c). Water samples collected from Pierce Brook in 2012 by the RIDEM Ambient River Monitoring Program (ARM) and TMDL Program were found to exceed the recreational use water quality criteria for the indicator bacteria, enterococci. The water quality criteria for enterococci, along with bacteria sampling results and associated statistics are presented in Table 1.

The sampling location, HNT09, is located downstream of the Benny's Shopping Plaza where the stream daylights after traveling underground across Route 1 and the shopping plaza. In response to high levels of enterococci observed at this location during dry weather, RIDEM conducted follow-up dry weather sampling upstream of the HNT09 location in December of 2012. All results were much lower than the results seen in the warmer weather at HNT09. Again in 2013, sampling was conducted to



investigate the elevated dry weather enterococci levels. Sampling was conducted in accordance with the RIDEM Bacteria Sampling and Source Tracking Quality Assurance Project Plan (QA Plan) approved by EPA in July 2013 (RIDEM, 2013c) and with the Pierce Brook Monitoring Plan (RIDEM, 2013b). The study consisted of dry weather enterococci and male-specific bacteriophage analyses, a screening tool to evaluate the presence of human sewage, at HNT09 and at upstream stations. The 2013 sampling results confirmed that Pierce Brook has high bacteria counts during dry weather in the summer (i.e. hot) months. One sampling location (at Maplewood Drive) sampled high for bacteriophage but otherwise attempts at bacteria source tracking were inconclusive in differentiating between human versus non-human sources. It appears that bacteria concentrations become very elevated in Pierce Brook during the summer months. Further information about the study can be found in its Final Data Report (2013a). All data collected from the downstream location, HNT09 are included in Table 1. Data from the other upstream stations, collected in an attempt to isolate the source of bacteria, are not included in Table 1 as insufficient samples were collected to adequately characterize these locations.

Additionally, as shown in the Final Data Report, in each sampling round, the highest bacteria concentrations were found at HNT09.

The geometric mean was also calculated for wet and dry-weather sample days, where appropriate. Since only two wet weather samples were collected, only the dry weather geometric mean could be calculated. It exceeded the water quality criteria. Possible dry and wet weather sources are described in the sections below. Potential sources include wastes from waterfowl, wildlife, and domestic pets. In wet weather, these sources can be carried to the river in stormwater runoff.

Due to the elevated bacteria measurements presented in Table 1, Pierce Brook was 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.

Pierce Brook has previously been identified as a source of bacteria to the Hunt River in the 2001 Fecal Coliform TMDL for the Hunt River, RI (RIDEM, 2001).

Potential Bacteria Sources

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

Developed Area Stormwater Runoff

The Pierce Brook watershed has an impervious cover of 24.8%. 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. As discussed in Section 6.3 of the Core TMDL Document, as a general rule, impaired streams with watersheds having higher than 10% impervious cover are assumed to be affected by urban stormwater runoff.

As part of RIPDES Phase II Stormwater Permit requirements, East Greenwich, Warwick, and the Rhode Island Department of Transportation (RIDOT) have mapped stormwater outfalls within the Pierce Brook watershed. Multiple outfalls have been identified within the watershed (Figure 2). As stormwater is known to carry a suite of pollutants, including bacteria, stormwater runoff is a likely source of bacteria to Pierce Brook.

Onsite Wastewater Treatment Systems

The Pierce Brook watershed relies on both sewers and onsite wastewater treatment systems (OWTS), such as septic systems and cesspools to manage sanitary wastewater. The watershed is predominately sewerred but sewers are not available in the residential neighborhood located to the east of the railroad tracks in Warwick. And while the vast majority of East Greenwich properties in the Pierce Brook watershed are connected to sewer lines, there are several properties that are directly adjacent to Pierce Brook that are not connected. According to East Greenwich records, there are almost forty properties that are not connected to sewer lines on eight streets in the watershed between Middle Road and Post Road. A search of RIDEM septic system records dating back to 1969, of septic systems installed or repaired found records for only 9 parcels with one record from 1969, four records from the 1970s, and four records from the early to mid-1990s. This would suggest that close to thirty parcels in the lower Pierce Brook watershed have sub-standard onsite wastewater systems. It is noted that East Greenwich does not currently require properties to connect to a sewer line if it is available. If on-site systems are improperly sized, malfunctioning, or in soils poorly suited for septic waste disposal, microorganisms such as bacteria, can easily enter surface water (USEPA, 2002).

Illicit Discharges

Illicit discharges, or any discharge to a municipal separate storm sewer system (MS4) that is not composed entirely of stormwater, may also be contributing bacteria to Pierce Brook. As shown in Figure 2, multiple MS4 outfalls discharge into the brook.

Waterfowl, Wildlife, and Domestic Animal Waste

Forested land comprises almost 40% of the Pierce Brook watershed. These forested areas are also home to various wildlife and waterfowl. Wildlife, including waterfowl, may be a significant bacteria source to surface waters. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. As such, these physical land alterations can exacerbate the impact of these natural sources on water quality.

Given that residential development is the predominate land use within the watershed, waste from domestic animals such as dogs, may also be contributing to bacteria concentrations in Pierce Brook.

Existing Local Management and Recommended Next Steps

The City of Warwick and the Town of East Greenwich have developed and implemented programs to protect water quality from bacterial contamination. Additional pollution abatement activities are

necessary to ensure the long-term protection of Pierce Brook. A brief description of existing local programs and recommended next steps from Phase II Stormwater Management Program Plans, Onsite Wastewater Management Plans, Wastewater Facilities Plans, Comprehensive Plans, and other documents are provided below. Interested parties should review these documents directly for more detailed information.

Additional bacteria data collection would be beneficial to support identification of sources of potentially harmful bacteria in the Pierce Brook watershed. These activities could include sampling at several different locations and under different weather conditions (e.g., wet and dry). Field reconnaissance surveys focusing 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.

Stormwater Management

The Town of East Greenwich (RIPDES permit RIR040002), the City of Warwick (RIPDES permit RIR040031) and the Rhode Island Department of Transportation (RIDOT) (RIPDES permit RIR040036) are municipal separate storm sewer (MS4) operators in the Pierce Brook watershed and have prepared Phase II Stormwater Management Program Plans (SWMPP). The entire watershed is regulated under the Phase II Program. East Greenwich has opted to enact its stormwater permit activities town-wide to include all areas of town.

East Greenwich and Warwick's SWMPPs outline goals for the reduction of stormwater runoff to Pierce Brook through the implementation of Best Management Practices (BMPs). Many of these BMPs are reported to be in place, including mapping all stormwater outfalls, instituting annual inspections and cleaning of catch basins, implementing an annual street sweeping program, adopting construction erosion and sediment control and post-construction stormwater control ordinances, and conducting public education activities (RIDEM, 2010a).

The City of Warwick adopted an illicit discharge detection and elimination ordinance in 2008. East Greenwich has also adopted an ordinance to address illicit discharges (RIDEM, 2010a). These ordinances prohibit illicit discharges to the stormwater collection system and provide an enforcement mechanism. It is recommended that any stormwater outfalls discharging upstream of the sampling station located south of Post Road be monitored to check for illicit discharges. Sampling should include any sources that may discharge to the stream when it travels underground in the vicinity of Post Road and the Shopping Plaza. Illicit discharges can be identified through continued dry weather outfall sampling and microbial source tracking.

RIDOT has completed a SWMPP for state-owned roads in the watershed. RIDOT's SWMPP and its 2011 Compliance Update outline its goals for compliance with the General Permit statewide. It should be noted that RIDOT has chosen to enact the General Permit statewide, not just for the urbanized and densely populated areas that are required by the permit. 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. RIDOT should also target its illicit discharge detection to any outfalls located upstream of the sampling station, including those that may discharge to the culverted portion of Pierce Brook. SWMPPs 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 MS4 operators with education and outreach programs that can be used to address TMDL public education recommendations.

While these first steps are important to reduce the effects of stormwater runoff to Pierce Brook, additional efforts may be needed to restore the river's water quality. As mentioned previously, the Pierce Brook watershed has an impervious cover of 24.8%, a level where stormwater impacts are expected. At this threshold, RIDEM is requiring the MS4 operators to revise their post-construction stormwater ordinances to ensure that development and re-development projects include stormwater controls effective at reducing bacteria levels, as further described in Section 6.3 of the Core TMDL Document. RIDEM also requires the MS4 operators to evaluate the sufficiency of their six minimum measures in achieving the TMDL provisions. Changes to the SWMPPs should be documented in a TMDL Implementation Plan (TMDL IP) and should comply with relevant provisions Part IV.D of the RIPDES Stormwater General Permit (RIDEM, 2010b), which are summarized in Section 6.2 (Numbers 1 through 5) of the Core TMDL Document.

Onsite Wastewater Management

Some residents of the Pierce Brook watershed, primarily in Warwick and at critical locations directly adjacent to Pierce Brook in East Greenwich, rely on on-site wastewater treatment systems (OWTS). As part of an onsite wastewater management planning process, Warwick and East Greenwich should develop Onsite Wastewater Management Plans and adopt ordinances to establish enforceable mechanisms to ensure that existing OWTS are properly operated and maintained. RIDEM recommends that all communities create an inventory of onsite systems through mandatory inspections. Inspections 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. Both communities should consider adopting mandatory connection polices for properties where sewers are available. If an OWTS is failing at a property that has reasonable access to a sewer line, the RIDEM OWTS rules do not allow for the existing OWTS to be repaired or replaced. The property must connect to the sewer line (RIDEM, 2012). 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).

Warwick and East Greenwich are not eligible for the Community Septic System Loan Program (CSSLP). The CSSLP program provides low-interest loans to residents to help with maintenance and replacement of OWTS. It is recommended that both towns develop a program to assist citizens with the replacement of older and failing systems.

Illicit Discharges

Based on increasing bacteria levels, an elevated bacteriophage sample result, apparent sub-standard OWTS, etc., there is the possibility of failed OWTS or other illicit discharges in this watershed. East Greenwich and RIDOT should implement a program to evaluate their storm drain network to identify any potential illicit connections. This program should include mapping the storm drainage networks and using a camera to identify any illicit connections. Camera work should also include the portions of Pierce Brook that travel underground from Eugene Street to downstream of the Benny's Plaza. East Greenwich should also implement a program to evaluate its sanitary sewer system to identify and reduce leaks and overflows. The East Greenwich and RIDOT illicit discharge detection program should include policies and practices to identify whether a discharge from failing and/or sub-standard OWTS are entering its storm drain network. It is not believed that Warwick has any sewer lines in this watershed and its drainage system would enter Pierce Brook downstream of this area.

Waterfowl, Wildlife, and Domestic Animal Waste

Education and outreach programs should 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. The towns should work with volunteers to map locations where animal waste is a significant and chronic problem. 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 in the watershed. They can allow tall, coarse vegetation to grow in areas along the shores of Pierce 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 Frenchtown Brook and can harm human health and the environment.

Land Use Protection

Woodland and wetland areas within the Pierce Brook watershed absorb and filter pollutants from stormwater runoff, and help protect both water quality in the stream and stream channel stability. It is important to preserve these undeveloped areas, and institute controls on future development in the watershed.

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

Table 1: Pierce Brook Bacteria Data

Waterbody ID: RI0007028R-07

Watershed Planning Area: 6 – Hunt River

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: 95.8% (Include 5% Margin of Safety)

Data: 2012 and 2013 from RIDEM

Single Sample Enterococci (colonies/100 mL) Results for Pierce Brook (2012) with Geometric Mean Statistics

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean
HNT09	Pierce Brook Downstream of Post Rd (Rte 1)	10/15/13	119	DRY	588.7
HNT09	Pierce Brook Downstream of Post Rd (Rte 1)	08/01/13	2420	DRY	
HNT09	Pierce Brook Downstream of Post Rd (Rte 1)	07/05/13	1300	DRY	
HNT09	Pierce Brook Downstream of Post Rd (Rte 1)	12/13/12	89.2	DRY	
HNT09	Pierce Brook Downstream of Post Rd (Rte 1)	11/20/12	120	DRY	
HNT09	Pierce Brook Downstream of Post Rd (Rte 1)	09/27/12	1990	DRY	
HNT09	Pierce Brook Downstream of Post Rd (Rte 1)	09/20/12	770	WET	
HNT09	Pierce Brook Downstream of Post Rd (Rte 1)	09/11/12	461	DRY	
HNT09	Pierce Brook Downstream of Post Rd (Rte 1)	06/26/12	2430	WET	
HNT09	Pierce Brook Downstream of Post Rd (Rte 1)	06/12/12	727	DRY	

Shaded cells indicate an exceedance of water quality criteria. Value in red was reported as greater than the detection limit. For the purpose of mathematical calculations, the value was increased one significant number (NSSP, 2007).

Wet and Dry Weather Geometric Mean Enterococci Values for all Stations

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
HNT09	Pierce Brook Downstream of Post Rd (Rte 1)	2012-2013	2	8	588.7	NA	476.8

Shaded cells indicate an exceedance of water quality criteria.
Weather condition determined from rain gage at TF Green Airport in Warwick, RI

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