



# Borden Brook

## Watershed Description

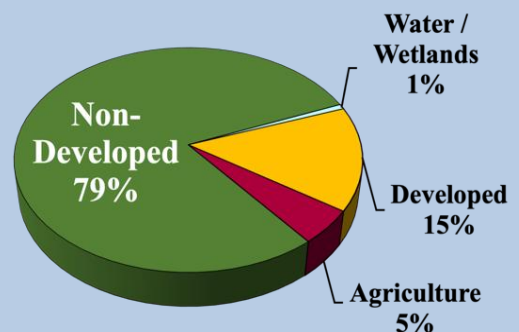
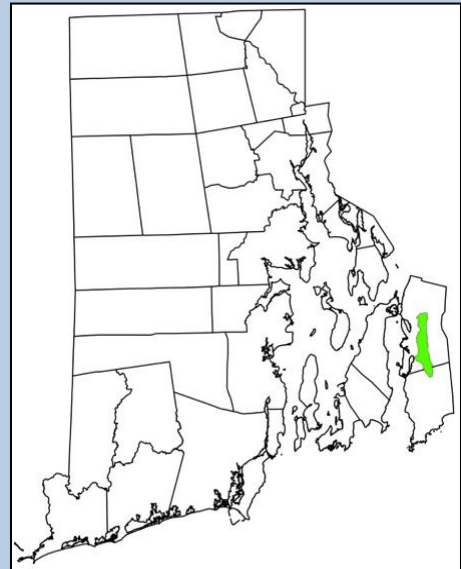
This TMDL applies to the Borden Brook (RI0010031R-01) watershed that ultimately discharges into Nonquit Pond (RI0007035L-08). The pond is one of nine source reservoirs for the Newport Water System. The Newport Water System is comprised of a complex network that provides public water to all of Aquidneck Island with customers in Newport, Middletown, and a portion of Portsmouth, RI. It also provides water to the Portsmouth Water and Fire District and to Naval Station Newport.

Borden Brook is a stream system that totals 11.5 miles, of which 6.99 miles are mapped and tracked for assessment purposes (Figure 1). It originates at Basket Swamp, located to the south of Bulgarmarsh Road (RT 177). The stream passes through Weetamoo Woods and flows past a couple of residential lots and a hay field prior to crossing East Road. An unnamed tributary discharges to Borden Brook immediately downstream of the brook crossing under East Road. Downstream of its confluence with the unnamed tributary, Borden Brook parallels East Road for 450 feet where Quaker Creek (RI0010031R-04) merges with the brook. Downstream of its confluence with Quaker Creek, the brook jogs to the south where it flows past a hayfield and through a small pasture. The stream then flows through a wetland corridor and to a commercial area on Main Road. An unnamed tributary, discussed in the section below, discharges into Borden Brook just upstream of Main Road.

This unnamed tributary to Borden Brook joins the northern segment of Borden Brook approximately 800 feet upstream of the brook's discharge into Nonquit Pond.

## Assessment Unit Facts (RI0010031R-01)

- **Towns:** Tiverton and Little Compton
- **Impaired Segment Length:** 6.99 miles
- **Classification:** Class AA
- **Direct Watershed:** 4.89 mi<sup>2</sup> (3,131 acres)
- **Impervious Cover:** 5 %



**Watershed Land Uses**

## **UPDATE TO THE RHODE ISLAND STATEWIDE TMDL FOR BACTERIA IMPAIRED WATERS - BORDEN BROOK - SEPTEMBER 2023**

This unnamed tributary is composed of two forks that join approximately 1 mile upstream of the confluence with the northern segment.

The northeastern fork of this southern tributary originates in an extensive wetland complex east of Eight Rod Pond. The southwestern fork originates at the discharge of Eight Rod Pond and meets with the northeastern fork approximately 0.2 miles north of Eight Rod Pond. The stream continues its northerly flow through a wetland corridor where it crosses under Eight Rod Way. West of Eight Rod Way, the stream flows through an upland forest and a couple of residential properties before merging with the northern stream segment of the brook behind commercial properties on Main Road. Figure 1 shows the land use coverage along with the stream system for Borden Brook.

### **Why is a TMDL Needed?**

Under Section 303(d) of the federal Clean Water Act, states, territories, and authorized tribes, are required to develop lists of impaired waters. The law also requires states, territories, and authorized tribes to develop total maximum daily loads (TMDLs), a calculation of the maximum amount of a pollutant that can be present in a waterbody and still meet water quality standards for those impaired waters. Based on data collected as described below, Borden Brook is not meeting Water Quality Standards and must receive a TMDL.

During 2017, water samples were collected on selected tributaries to Nonquit Pond, including Borden Brook (RI0010031R-01), as part of the National Water Quality Initiative (NWQI)<sup>1</sup>. The NWQI is collaborative effort between the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), US Environmental Protection Agency (EPA), and the Rhode Island Department of Environmental Management (RIDEM) to work in partnership to restore water quality in watersheds affected by agricultural pollution sources.

There were four sampling stations located on the stream system for Borden Brook that were sampled for the NWQI study in 2017 (Figure 2). Three stations were on the northern stream system that originates near Bulgarmarsh Road in Tiverton, RI. The upstream station (B1) was located in Weetamoo Woods, a nature preserve. The middle station (B2) was located at East Road and the downstream station (B3) was located immediately upstream of an old mill dam just before the brook crosses under Main Road. Station Bt was located on the southeastern unnamed tributary approximately 150 feet downstream of the confluence with the northern stem of Borden Brook between Stations B2 and B3.

The RIDEM's Ambient River Monitoring (ARM) station, TLC03, and the University of Rhode Island's Watershed Watch station, WW554, for Borden Brook are co-located at or near the NWQI Station B2. Samples were collected in 2014 by both RIDEM (TLC03) and URI Watershed Watch (WW554) at the

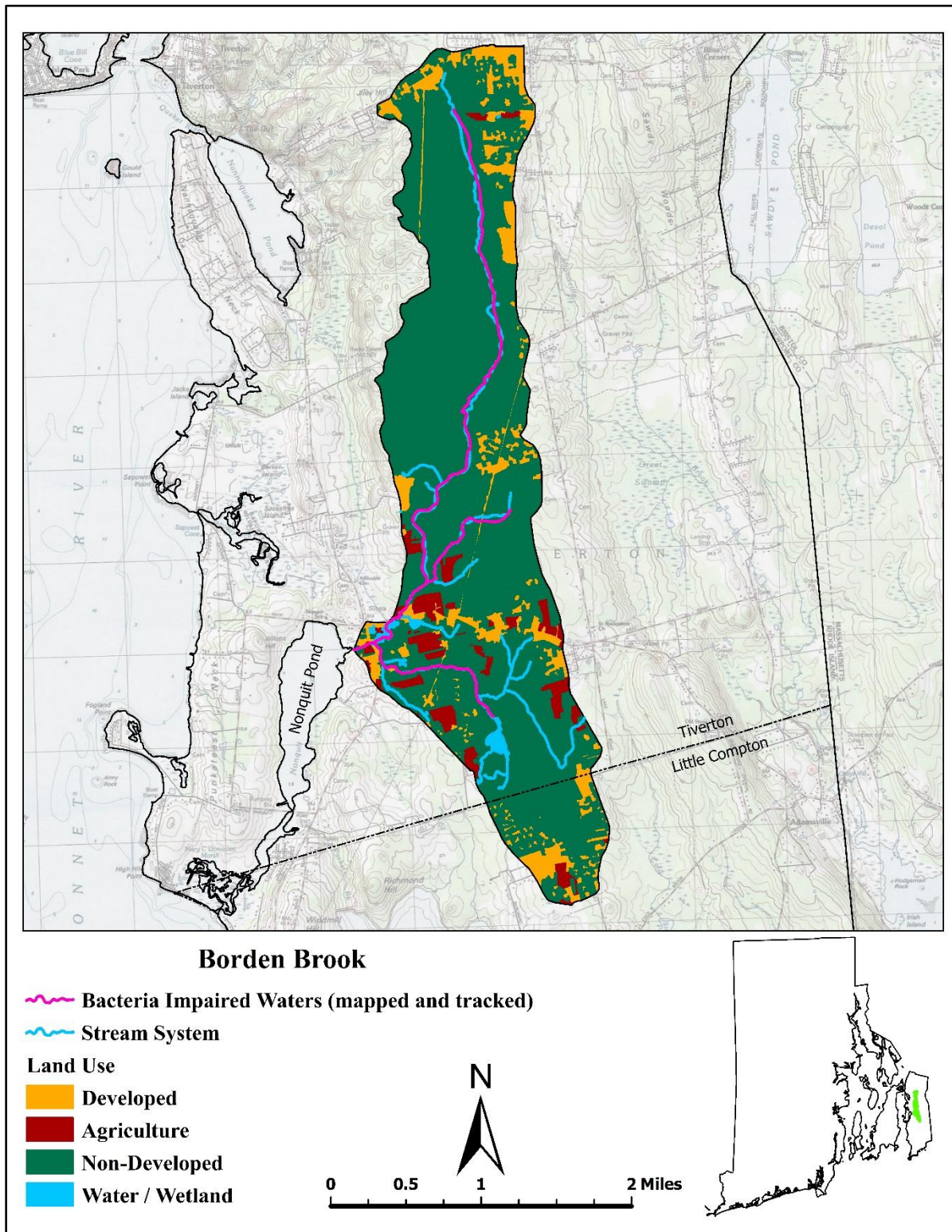
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<sup>1</sup> Nonquit Pond Tributaries: Water Quality Study and Pollutant Source Identification National Water Quality Initiative <http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/tmdl-nonquit.pdf>

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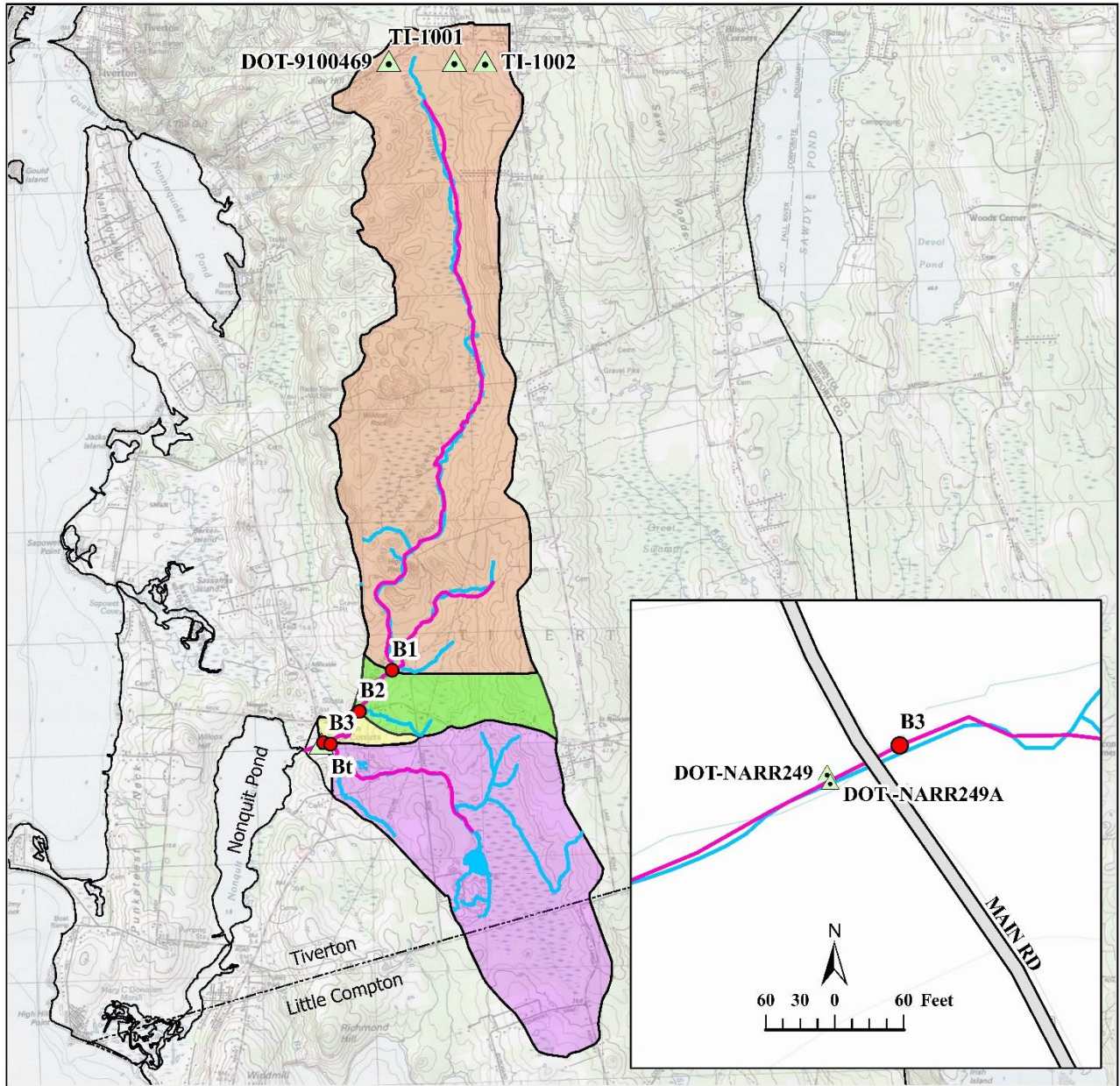
East Road crossing of Borden Brook. Watershed Watch sampled Borden Brook in 2016 (WW616) but moved the collection site to the Main Road crossing, near the NWQI Station B3. The latest set of samples were collected by RIDEM in 2021 as part of the ARM surveys at the East Road crossing station (TLC03). Figure 2 shows the Borden Brook sampling station locations and the sub-watershed associated with each NWQI station. Due to space limitations on this figure, Station TLC03 at B2 and the Watershed Watch stations WW554 at B2 and WW616 at B3 are not shown.

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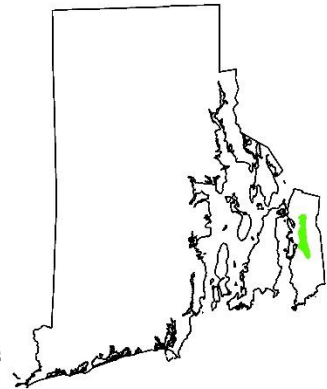
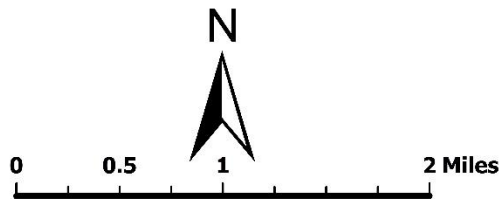
**Figure 1. Borden Brook Watershed with Land Cover and Impaired Waters**

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**Borden Brook**

- Priority Outfalls
- Sample Stations
- Bacteria Impaired Waters (mapped and tracked)
- Stream System
- B1 Sub-watershed
- B2 Sub-watershed
- B3 Sub-watershed
- Bt Sub-watershed



**Figure 2. Borden Brook Sampling Station Locations and Sub-watersheds.**

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**Station B1 in Weetamoo Woods**

The mainstem headwaters for the B1 subwatershed of Borden Brook originate in an extensive linear swamp that runs south of Bulgarmarsh Road to Weetamoo Woods in the southern portion of the sub-watershed. An unnamed tributary east of the mainstem originates in a forested area joins just upstream from Station B1. Closer inspection of aerial views shows extensive areas where there aren't discernable channels and there may be broad areas of standing water. Most of the development is on the periphery of the watershed, with wetland and/or forested buffers adjacent to the stream in most places. However, there are some locations where this buffer is less than 100 feet in width.

Most of the development in the upper brook is located along the periphery of the sub-watershed. The area along Bulgarmarsh Road has some residential areas as well as Tiverton Auto Parts, Inc<sup>2</sup>, an auto recycling business, with the eastern lot of the business within close proximity of the wetland where the brook originates. Along the eastern border paralleling Brayton Road are several residential complexes and an extensive gravel mining operation. The gravel mining operation will be required to get the appropriate industrial stormwater permitting, as applicable. The eastern half of the Tiverton Landfill is located within the western border of the watershed but is within 300 feet of the mainstem. The Tiverton Landfill is in the process of final closure and capping. The RIDEM Office of Land Revitalization and Sustainable Materials Management (LRSMM) License Conditions contain requirements including meeting all Solid Waste Regulations, a final date of solid waste delivery of November 30, 2022 or earlier, and the facility shall meet and comply with stormwater permitting requirements of the DEM Office of Water Resources. The facility is designing stormwater best management practices (BMPs) in accordance with Stormwater Regulations<sup>3</sup>. Therefore, the final closure and capping will effectively manage stormwater and other discharges that could contribute bacteria to Borden Brook. South of the landfill, the mainstem flows between a pasture and a cleared field, both within 100 feet of the stream channel.

Downstream of the pasture and farm, the unnamed tributary joins the mainstem of the northern brook and flows within 50 feet along the western edge of a hayfield. Unlike pastures which are associated with livestock, there was no evidence of grazing of livestock in the field. Approximately 300 feet past the hayfield, the tributary joins the mainstem.

**Station B2 on East Road**

Station B2 is located approximately 1500 feet downstream of Station B1 on the south side of East Road. The stream heads southwest and passes two residential properties and a hay field that are located adjacent to the brook on the north side of East Road. Along this segment, there is approximated 20 to 40

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<sup>2</sup> Tiverton Auto Parts, Inc has an industrial stormwater permit. MSGP # RIR50M001

<sup>3</sup> Stormwater Management, Design, and Installation Rules <https://rules.sos.ri.gov/regulations/part/250-150-10-8>

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feet of vegetative buffer between the residential properties and over 100 feet of buffer at the closest point of approach to the hay field.

There are several different land uses in the central and western portions of the subwatershed, including pastures, an equestrian center, residential areas, hay fields, and a crop field.

A small tributary discharges to Borden Brook just upstream of Station B2 on the south side of East Road. Most of the land south of East Road drains to this tributary. The tributary originates in a forested area east of Eight Rod Way and flows past several residences, a crop field, through a pasture and another residence on East Road. Throughout its course, there are several areas where there is not any vegetated buffer along the stream channel.

### **Station B3 at Main Road**

Borden Brook flows through a wetland corridor through much of the subwatershed, between Stations B2 and B3. As the stream flows southwest from East Road, it flows past an open field on its southern bank, where there is little to no vegetated buffer. Immediately downstream of the hayfield, Quaker Brook crosses under East Road and discharges into Borden Brook.

The stream flows through a broad wetland corridor, downstream of the pasture where a hayfield borders the wetland corridor to the north of the stream. An unnamed tributary discharges to Borden Brook to the rear of commercial properties on Main Road and there is a small pond immediately downstream of the confluence of Borden Brook and the southern unnamed tributary. Station B3 was located on the downstream side of an old mill dam and approximately 700 feet upstream of Nonquit Pond.

### **Station Bt: Upstream of Confluence of Southern Tributary with Borden Brook**

Nearly 71 percent of the watershed for Station Bt is undeveloped, with a mix comprised of wetlands, brushland, deciduous and mixed forest. The stream system for this unnamed tributary originates in the central portion of the watershed with the developed areas located on the southern and eastern portions along the periphery of the watershed.

This unnamed tributary to Borden Brook arises from Eight Rod Pond in the central portion of the subwatershed. The pond is the result of a sand or gravel mining operation that is no longer in operation. The area around the pond is now a DEM management area and is stabilized with vegetation. The stream flows northerly, passes under Eight Rod Way and through a wetland corridor. The stream continues through an upland forest and, as it nears Main Road, it flows along the edge of two residential properties and merges with two smaller streams. The unnamed tributary then parallels Main Road, flowing behind a hayfield, a residence, and commercial properties. There is little to no vegetated buffer along the western streambank, downstream of the confluence of the two streams.

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A smaller stream originating along the west edge of the sub-watershed discharges into the unnamed tributary to Borden Brook upstream of Station Bt. There is a farm pond located within the wetland, that is separated from an adjacent crop field by a 40-foot vegetative buffer. The wetland is seasonally grazed, as evidenced by closely cropped grass and clumps of old manure. Cattle are confined in a fenced enclosure to another part of the farm during the winter. The pasture is part of a large farm that is mostly located in the subwatershed of an unnamed tributary to Nonquit Pond, located to the west.

The western fork of the tributary then flows through upland forest and into another small farm pond on what is now a 14-acre residential lot that extends to the edge of the pond. Prior to the confluence with the northeastern fork of the tributary, the stream flows past a hay field and three residential properties. A vegetated buffer that ranges from 10 to 60 feet in width separates the stream from these properties.

### **Sampling Conditions**

Instream sampling surveys were collected under dry and wet weather conditions at Stations B1, B2, B3 and Bt in 2017. Dry weather was defined as less than 0.25 inches of rainfall during the 48-hour period preceding a sampling event. Wet weather was defined as greater than 0.25 inches of rainfall during the preceding 48-hour period prior to sampling. Daily rainfall data reported from the Newport State Airport Weather Underground Station KUUU was used to determine if a survey was conducted under wet or dry conditions. Enterococci samples were collected over the survey dates as shown in Table 1 along with the rainfall data reported for those days and the previous 48-hour period.



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**Table 1. Sampling Dates and Rainfall Amounts for All Surveys**

Newport State Airport (KUUU)				
Date	Organization	Rain 48-hrs Prior (In)	Rain on Sampling Date (In)	Total Rain
5/15/14	URI WW	0	0	
5/28/14	RIDEM-ARM	0.01	0.05	0.06
6/12/14	URI WW	0.10	0	0.10
7/8/14	RIDEM-ARM	0	0	
7/10/14	URI WW	0	0	0.10
7/30/14	RIDEM-ARM	0.33	0	0.33
8/7/14	URI WW	0	0	
8/21/14	RIDEM-ARM	0	0	
10/29/14	RIDEM-ARM	0	0	
5/12/16	URI WW	0	0	
6/9/16	URI WW	0	0.14	0.14
7/7/16	URI WW	0.77	0.00	0.77
3/22/17	NWQI	0	0	
4/26/17	NWQI	0.06	2.00	2.06
5/4/17	NWQI	0.55	0	0.55
6/1/17	NWQI	0.47	0.62	1.09
10/25/17	NWQI	0.03	0.23	0.26
5/18/21	RIDEM-ARM	0.04	0	0.04
6/16/21	RIDEM-ARM	0.35	0	0.35
7/28/21	RIDEM-ARM	0	0.01	0.01
9/8/21	RIDEM-ARM	0.05	0	0.05
9/21/21	RIDEM-ARM	0	0	

**Exceedances and Potential Sources**

As described in the Consolidated Assessment and Listing Methodology<sup>4</sup>, the assessment of recreational use is based on data for enterococci, fecal coliform, and/or *Escherichia coli* (*E. coli*). Enterococci is the primary bacteria indicator for assessing recreational use attainment. For non-designated beach waters, the geometric mean should be less than 54 MPN/100mL. Typically, the geometric mean is calculated using samples collected over the recreational bathing period of May through October; however, with the limited dataset, all samples collected were used to assess recreational use for this assessment and TMDL development.

Geometric mean values were calculated for all stations, and for each organization for both dry and wet weather days as well as the geomean for each station using all survey data. The combined geomeans for three of the four NWQI stations exceeded the geomean of 54 MPN/100mL criteria. RIDEM Ambient River Monitoring station TLC03 did not exceed the geomean criteria in 2014, but it did exceed in 2021.

<sup>4</sup> 2022 Consolidated Assessment and Listing Methodology <http://www.dem.ri.gov/programs/benviron/water/quality/pdf/calm22.pdf>

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The URI Watershed Watch station sampled in 2014 did not exceed the geomean criteria, but the station sampled in 2016 did exceed the geomean criteria.

There are limitations to compare wet and dry weather geomeans due to small sample size at particular stations, which are inherently due to the targeted weather condition of the RIDEM ARM and NWQI programs. However, in general, the geomeans and individual samples of wet weather are higher than dry weather suggesting that stormwater is significant component of bacteria impairment.

Sources in the Station B1 sub-watershed include the extensive swamp contiguous to Borden Brook and developed areas on the periphery of the subwatershed that border the wetland may also contribute to the high pollutant levels. The overall geomean for Station B1 was 35 MPN/100ml. The wet geomean was below criteria at 49 MPN/100ml. There was a single wet weather grab sample that measured 6,870 MPN/100ml during the last wet weather sampling survey.

In the Station B2 subwatershed, the road could potentially provide a pathway for polluted stormwater runoff to reach the stream. An example of this was a manure pile that was located at the end of a paved sunken drive next to a hayfield and adjacent to the north side of East Road (RT 179). Stormwater runoff was observed entering a roadside ditch from the manure pile, which discharges to the brook just upstream of Station B2. Recent inspection at this location in September 2022 did not find any evidence of the manure pile or activity that made the manure pile; however, the potential pathway for pollutants is still present. Within this sub-watershed there are several other potential sources of bacteria pollution to the stream system. The tributary flows past a pasture where cattle appear to have access to the stream and the inadequate buffer for the stream as it flows past crop fields and residences provide an unimpeded pathway to the stream.

As shown in Table 3, this sampling site (known as B2, TLC03, WW554) for Borden Brook has been sampled many times between 2014 and 2021 by different organizations. Dry weather geomeans for RIDEM ARM surveys for 2014 and 2021 were 27 and 151 MPN/100ml respectively, and the URI Watershed Watch program reported 45 MPN/100ml for 2014. Wet weather geomeans were higher at this location with the 2014 NWQI study exceeding the 54 MPN/100ml criteria with a value of 87 MPN/100ml. The highest single grab sample for wet weather at this station was from the 2014 NWQI study with a value of 5,170 MPN/100ml.

In the Station B3 subwatershed, there is a pasture (i.e. actively grazed area) that straddles the stream, between the confluence with Quaker Creek and a sharp southward bend in the river. Much of the pasture directly abuts the stream, with no vegetated buffer, and with clumps of manure in close proximity to the stream. A bridge allows animal access from barns on the west side of the river to its eastern bank. A manure pile was observed approximately 30 feet from the river's western bank. Much of the pasture is seasonally wet and mucky, especially areas immediately adjacent to the stream. In September 2022 field visits, these areas were not accessible to evaluate any changes in activity or condition.

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There are commercial properties on Main Road, adjacent to Station B3, including offices and several small retail shops, including a metal working shop. Several of these commercial properties have lawns that extend to the top of the streambank. There are also several commercial and residential properties in the northwest part of the subwatershed, in the Four Corners area, near the intersection of Main Road and East Road. All of the developed areas likely contribute stormwater to Broden Brook.

Similar to Station B2, there was more than one organization collecting samples the site for Station B3. In addition to the NWQI data, the URI Watershed Watch also sampled here in 2016 (WW616). The dry weather geomean at this location did not exceed the 54 MPN/100ml criteria for freshwater streams, and the highest single grab sample collected by the URI WW in 2016 group was 127.4 MPN/100ml.

During wet weather, the highest single grab value occurred during the October 25, 2017 NWQI wet survey where the enterococci value was 11,500 MPN/100ml. The July 7, 2016 Watershed Watch survey reported a single grab sample that measured 464 MPN/100ml. The overall station geomean values for this location for the NWQI and the URI Watershed Watch surveys were 113 and 76 MPN/100ml respectively, both exceeding the geomean criteria of 54 MPN/100ml.

In the Bt subwatershed, located to the immediate west of the confluence of the two streams is a pasture that extends to the streambank on both sides of the stream. There is a fenced enclosure approximately 50 feet from the stream channel at this location that contains some small farm animals. There is also a large aviary on the property approximately 40 feet from the stream and a barn and attached fenced enclosure set further back. Livestock have occasional access to the stream as evidenced by manure observed near the streambank. In September 2022 field visits, these areas were not accessible to evaluate any changes in activity or condition.

Samples at this station were only collected during the NWQI study in 2017. The overall geomean for Station Bt was 200 MPN/100ml, with the highest single grab sample measuring 14,100 MPN/100ml during the October 25, 2017 wet weather event. This station was behind the Mill Pond shops approximately 150 feet south of the confluence with the northern Borden Brook stream segment. During the same October 2017 survey, Station B3, which is downstream of the confluence, had a grab sample value of 11,500 MPN/100ml, more than twice the value of Station B2 sampled on the same date.

### **Stormwater Runoff**

Studies have shown that the first flush of stormwater runoff from urban and rural areas can contain significant levels of pollution. Stormwater has been determined to be a source of the pollutant of concern, bacteria. The Borden Brook headwaters includes a small portion of the small area of the Phase II area of the Town of Tiverton near the intersection of Bulgarmarch and Brayton roads. Additionally, Bulgarmarsh Road (Route 177) is a state-maintained road under Rhode Island Department of Transportation (RIDOT). The Town of Tiverton and the Rhode Island Department of Transportation

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were issued coverage under the Rhode Island Phase II Stormwater General Permit (issued in 2003) and have prepared the required Phase II Stormwater Management Plans (SWMPP).

As part of the Phase II MS4 requirements, municipalities and RIDOT are required to confirm ownership, map outfalls and catch basins, among other information required by the general permit, and submit this information to RIDEM. However, there is little information for some outfalls, other than pipe diameter, that would allow for evaluation of accurate water quality impacts from specific outfalls. Progress has been made by some entities in documenting outfalls under the MS4 requirements since their inception<sup>5</sup>. It should be noted that information related to these outfalls has not been independently confirmed by RIDEM staff. Given the size of these outfalls and connection to the waterway, which is a tributary to a drinking water supply, it has been determined that these outfalls may be sources of bacteria to Borden Brook, and they have been designated as a priority outfalls and must be sampled in dry and wet weather, if flow is evident, and evaluated for the presence of illicit discharges using Illicit Discharge Detection and Elimination (IDDE) protocols. All illicit discharges shall be eliminated.

As identified by the Newport Water Supply TMDL<sup>6</sup>, two outfalls that are likely owned by the Town of Tiverton and potentially discharge to Nonquit Pond are in the Borden Brook watershed. Upon approval of this TMDL and once the DEM notifies the Town of the TMDLs requirements, the Town must identify any MS4 discharges to Borden Brook and complete the appropriate steps required of their permit. Priority should be given to those outfalls greater than 24-inches in diameter. The Newport Water Supply TMDL also identified RIDOT outfalls that discharge to Borden Brook. Additionally, RIDOT’s stormwater mapping shows an additional 12” pipe (ID = 9100469) in the Borden Brook watershed. Priority outfalls should be subject to Illicit Discharge Detection and Elimination (IDDE) protocols. All illicit discharges will be eliminated.

**Table 2. Priority Outfalls in Borden Brook Watershed**

<b>Outfall ID</b>	<b>Direct Discharge to</b>	<b>LAT</b>	<b>LONG</b>	<b>Pipe Diameter (inches)</b>	<b>Interpreted Responsibility</b>
TI-1001	Unknown	41.623911	-71.172766	Unknown	Town of Tiverton
TI-1002 <sup>7</sup>	Swale	41.623856	-71.169484	18	Town of Tiverton
DOT-NARR249 (aka 464)	Borden Brook	41.569240	-71.187230	18	RIDOT
DOT-NARR249A (aka 9009141)	Borden Brook	41.569240	-71.187230	18	RIDOT

<sup>5</sup> **RIDOT public Stormwater Map**

<https://ridot.maps.arcgis.com/apps/webappviewer/index.html?id=b516ed62a55847e28d0243ac07206856>

<sup>6</sup> Newport Water Supply TMDL

<http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/Newport%20Water%20Supply%20TMDL.pdf>

<sup>7</sup> Table 6.4 of the Newport Water Supply TMDL identifies this as TI-1001. This should be identified as TI-1002.

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### **Agricultural Activities**

Animal manure is the primary source of bacterial pollution from agricultural land uses. Agricultural runoff is generally defined as water leaving agricultural operations because of rain, melted snow, or irrigation and may be associated with soil erosion. Agricultural runoff in the Borden Brook watershed includes that originating from soil erosion, feeding operations, grazing, plowing, animal waste, irrigation water, and fertilizer. The NWQI investigation showed that polluted runoff from agricultural activities was flowing into the stream system during storm events. Field observations found cattle could access flooded areas and to areas adjacent to the stream system itself, and one of the residential areas along the stream had no vegetated buffer zone. Where accessible, these areas were visited to confirm conditions in September 2022.

For Stations B3 and Bt, the most likely source of enterococci may be from contaminated runoff from those areas used for cattle grazing. It is difficult to identify specific sources due to the variability of the samples, but the wetland itself may be a source of bacteria along with the stormwater runoff contaminated by cattle.

### **Onsite Wastewater Treatment Systems**

Most of Tiverton is unsewered, so reliance for wastewater disposal is on onsite wastewater treatment systems (OWTS), such as septic systems and potentially cesspools. Failing OWTS can be a significant source of bacteria by allowing improperly treated waste to reach surface waters. Additionally, cesspools are not considered treatment systems and were the subject of the Rhode Island Cesspool Act of 2007 (RIGL § 23-19.15), as amended in 2015, which mandates that all cesspools within the State of Rhode Island must, over time, be removed from service. Cesspools contribute directly to groundwater and surface water contamination and environmental impacts. No OWTS Notices of Violation/Notices of Intent to Violate have been issued by the RIDEM Office of Compliance and Inspection in the Borden Brook watershed; however, maintaining OWTS that are properly sited and sized is important in this watershed, as well as elimination of cesspools and upgrade of improperly sited and/or sized septic systems.

### **Waterfowl, Wildlife, and Domestic Animal Waste**

Waterfowl, wildlife, and domestic animals within the Borden Brook watershed represent another potential source of bacteria. Over eighty percent of the watershed is undeveloped land that consists of upland forest and wetlands which provide habitat for wildlife and waterfowl, both of which can contribute to the pathogen pollution observed in the stream system. Areas within the watershed that are impervious or constructed may not retain the waste on the land but instead convey it via stormwater to the nearest surface water. Food sources encouraging proliferation of waterfowl and wildlife where

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stormwater is likely to uptake waste and its associated bacterial source should be removed or secured. Domestic animal waste should be properly disposed.

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**Reasonable Assurance**

RIDEM acknowledges that it will take significant effort to reduce bacteria loading to the maximum extent practicable from as many sources as possible, given the variable nature of bacteria sourcing and tracking. In some cases, reductions from individual sources (e.g. manure piles, direct animal access to waterbody) can and should be given greater priority. Reasonable assurance that non-point loads will be reduced include enforcement of Rhode Island’s existing water quality regulations (RIDEM 2018<sup>8</sup>) and the recently enacted Wetlands Regulations (RIDEM 2022<sup>9</sup>) includes expanded jurisdiction, with exception to certain agricultural activities, and strengthened buffer protection for future changes. Because the streams included in this update are tributaries to water supply reservoir, they received the maximum buffer of 200’ in the 2022 Wetlands Regulations for new activities. There are also requirements for creating new buffer for new activities.

Additionally, the collaborative efforts of RIDEM, NRCS, ERICD, municipalities, and many agricultural producers in the Newport Water Supply watersheds, as evidenced in Section 5.0 Implementation in the TMDL update cover document, which contains a table of non-point source watershed activities being undertaken. Furthermore, recent inspections of accessible locations in September 2022 documented in this appendix confirm changes in agricultural practices that support reduction of likely large bacteria sources, such as manure pilings and direct animal access to waterbody.

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<sup>8</sup> State of Rhode Island Water Quality Regulations <https://rules.sos.ri.gov/regulations/part/250-150-05-1>

<sup>9</sup> State of Rhode Island Rules and Regulations Governing the Administration and Enforcement of the Fresh Water Wetlands Act <https://rules.sos.ri.gov/regulations/part/250-150-15-1>

**UPDATE TO THE RHODE ISLAND STATEWIDE TMDL FOR BACTERIA IMPAIRED WATERS - BORDEN BROOK - SEPTEMBER 2023**

**Table 3: Borden Brook Bacteria Data**

**Waterbody ID:** RI0010031R-01

**Watershed Planning Area:** 16 – Sakonnet-East

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

**Impairment:** Enterococci (MPN/100mL)

**TMDL for Enterococci:** Geometric Mean: 54 MPN/100mL

**Percent Reduction to meet TMDL:** 78% (Includes 5% reduction for implementation)

**Data:** from RIDEM ARM Program (2014, 2021), NWQI Sampling Survey (2017), and URI Watershed Watch Program (2014, 2016)

**Single Sample Enterococci (MPN/100mL) Results for the Borden Brook with Geometric Mean Statistics**

Station Name	Station Location	Date	Result (MPN/100ml)	Wet/Dry	TMDL (MPN/100mL)	Geometric Mean (MPN/100ml)
B1	Borden Brook in Weetamoo Woods	3/22/17	<10	Dry	54	35
		5/4/17	<10	Wet		
		6/1/17	2	Wet		
		4/26/17	41	Wet		
		10/25/17	6,870	Wet		
B2	South side of East Road immediately downstream of confluence with unnamed tributary	3/22/17	<10	Dry	54	57
		5/4/17	<10	Wet		
		6/1/17	15	Wet		
		4/26/17	75	Wet		
		10/25/17	5,170	Wet		
TLC03	South side of East Road immediately downstream of confluence with unnamed tributary	5/28/14	5.2	Dry	54	46
		7/8/14	105	Dry		
		7/30/14	365	Wet		
		8/21/14	23.3	Dry		
		10/29/14	44.1	Dry		
TLC03	South side of East Road immediately downstream of confluence with unnamed tributary	5/18/21	44.1	Dry	54	160
		6/16/21	201	Wet		
		7/28/21	461	Dry		
		9/8/21	258	Dry		
		9/21/21	98.8	Dry		



**UPDATE TO THE RHODE ISLAND STATEWIDE TMDL FOR BACTERIA IMPAIRED WATERS - BORDEN BROOK - SEPTEMBER 2023**

Station Name	Station Location	Date	Result (MPN/100ml)	Wet/Dry	TMDL (MPN/100mL)	Geometric Mean (MPN/100mL)
Bt	Rear of commercial area on Main Road, approximately 100 ft before confluence with Borden mainstem.	5/4/17	10	Wet	54	<b>200</b> ^ (78%)*
		6/1/17	26	Wet		
		4/26/17	439	Wet		
		10/25/17	14,100	Wet		
B3	Main Road crossing of Borden Bk	3/22/17	<10	Dry	54	<b>113</b>
		5/4/17	20	Wet		
		6/1/17	31	Wet		
		4/26/17	262	Wet		
		10/25/17	11,500	Wet		
WW554	East Road crossing of Broden Brook	5/15/14	20	Dry	54	45
		6/12/14	83.1	Dry		
		7/10/14	50.4	Dry		
		8/7/14	50.4	Dry		
WW616	Main Road crossing of Borden Bk	5/12/16	7.4	Dry	54	<b>76</b>
		6/9/16	127.4	Dry		
		7/7/16	464	Wet		
^- Geometric Mean Used to determine percent reduction for implementation *- Includes 5% reduction for implementation; Bold values exceed the 54 MPN/100ml Geomean criteria. Shaded indicates the sample was below DL (10 MPN/100ml). Following the National Shellfish Sanitation Program (NSSP) Protocol, a value of 10 was used for values <10 MPN/100ml for geomean calculations.						

**Wet and Dry Weather Geometric Mean Enterococci Values for all Stations**

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean (MPN/100mL)		
			Wet	Dry	All	Wet	Dry
B1	Borden Brook in Weetamoo Woods	2017	4	1	35	49	<10*
B2	South side of East Road	2017	4	1	<b>57</b>	<b>87</b>	<10*
TLC03	South side of East Road	2014	1	4	46	365*	27
		2021	1	4	<b>160</b>	201*	<b>151</b>
Bt	Rear of commercial area on Main Rd.	2017	4	0	<b>200</b>	<b>200</b>	0
B3	Main Road	2017	4	1	<b>113</b>	<b>208</b>	<10*
WW554	East Road Crossing	2014	0	4	45	0	45
WW616	Main Road	2016	1	2	<b>76</b>	464*	31

\*These are single grab samples, not a geomean.