



## *Maidford River (Segment 2B)*

### Watershed Description

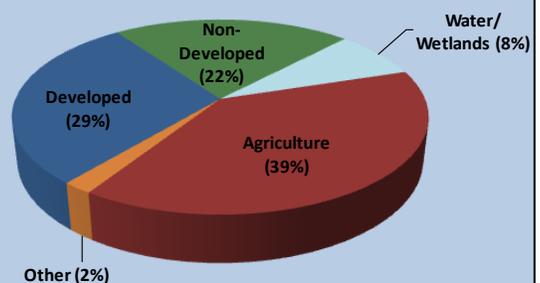
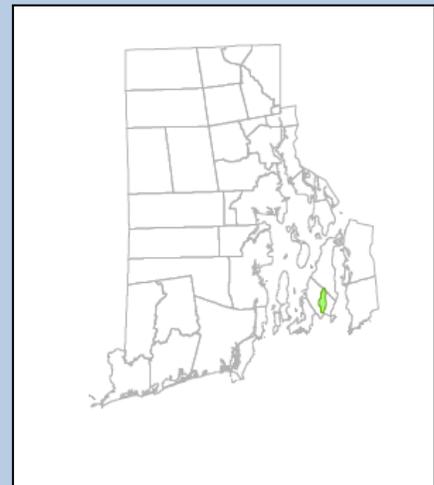
This **TMDL** applies to the Maidford River assessment unit (RI0007035R-02B), a 0.9-mile long stream segment located in Middletown, RI (Figure 1). The Town of Middletown is located on Aquidneck Island and the Maidford River is located in the southern portion of the Island. The Maidford River watershed is presented in Figure 2 with land use types indicated.

The headwaters of the Maidford River begin in a small pond in the central part of the Town of Middletown. The river flows south through agricultural fields along Berkley Avenue and Paradise Avenue to Sachuest Point. This segment of the Maidford River begins just before the stream flows east along Nelson and Gardiner Ponds and discharges into the Sakonnet River at Third Beach. Nelson and Gardiner Ponds are two of the four surface water drinking reservoirs on Aquidneck Island. Nelson Pond is connected by pipeline to Gardiner Pond and the two are operated by Newport Water as a single reservoir. Water from this segment of the Maidford River is diverted into Gardiner Pond. The Maidford River is connected to Paradise Brook, although the Maidford River only receives flow from Paradise Brook during periods of flooding and high flows (Berger, 2006).

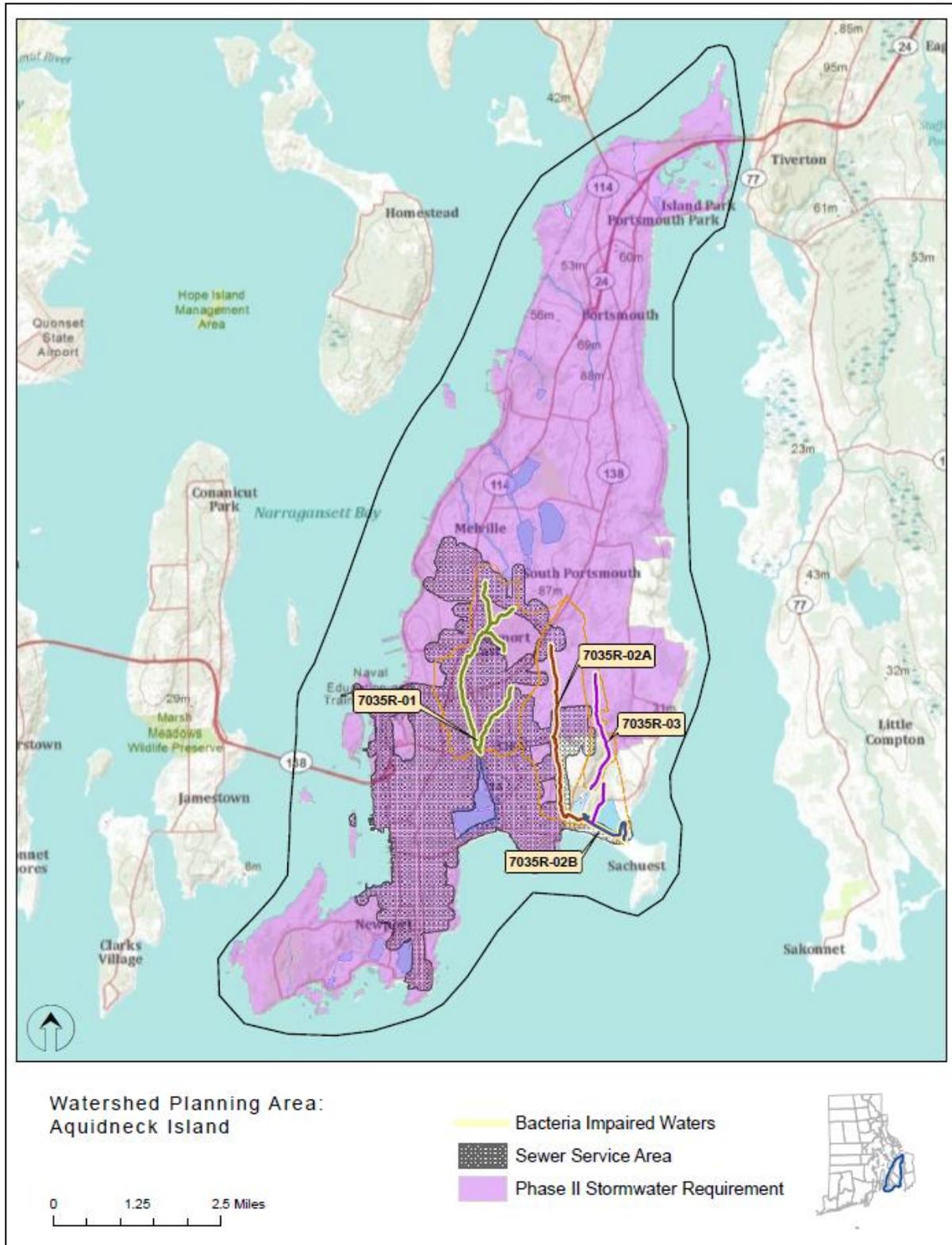
The Maidford River watershed covers 3.5 square miles. As shown in the aerial image of Figure 3, agricultural uses occupy a large portion (39%) of the watershed. Developed uses occupy approximately 29% of the land area. Impervious surfaces cover a total of 9%. Non-developed areas such as forests occupy 22% and include the Norman Bird Sanctuary and the Sachuest Point National Wildlife Refuge. Wetland and surface waters occupy 8% and other land uses combine to occupy 2%.

### Assessment Unit Facts *(RI0007035R-02B)*

- **Town:** Middletown
- **Impaired Segment Length:** 0.9 miles
- **Classification:** Class AA
- **Direct Watershed:** 3.5 mi<sup>2</sup> (2251 acres)
- **Impervious Cover:** 9%
- **Watershed Planning Area:** Aquidneck Island (#1)



**Watershed Land Uses**



**Figure 1: Map of Aquidneck Island with impaired segments addressed by this Statewide TMDL, sewer service areas, and stormwater regulated zones.**

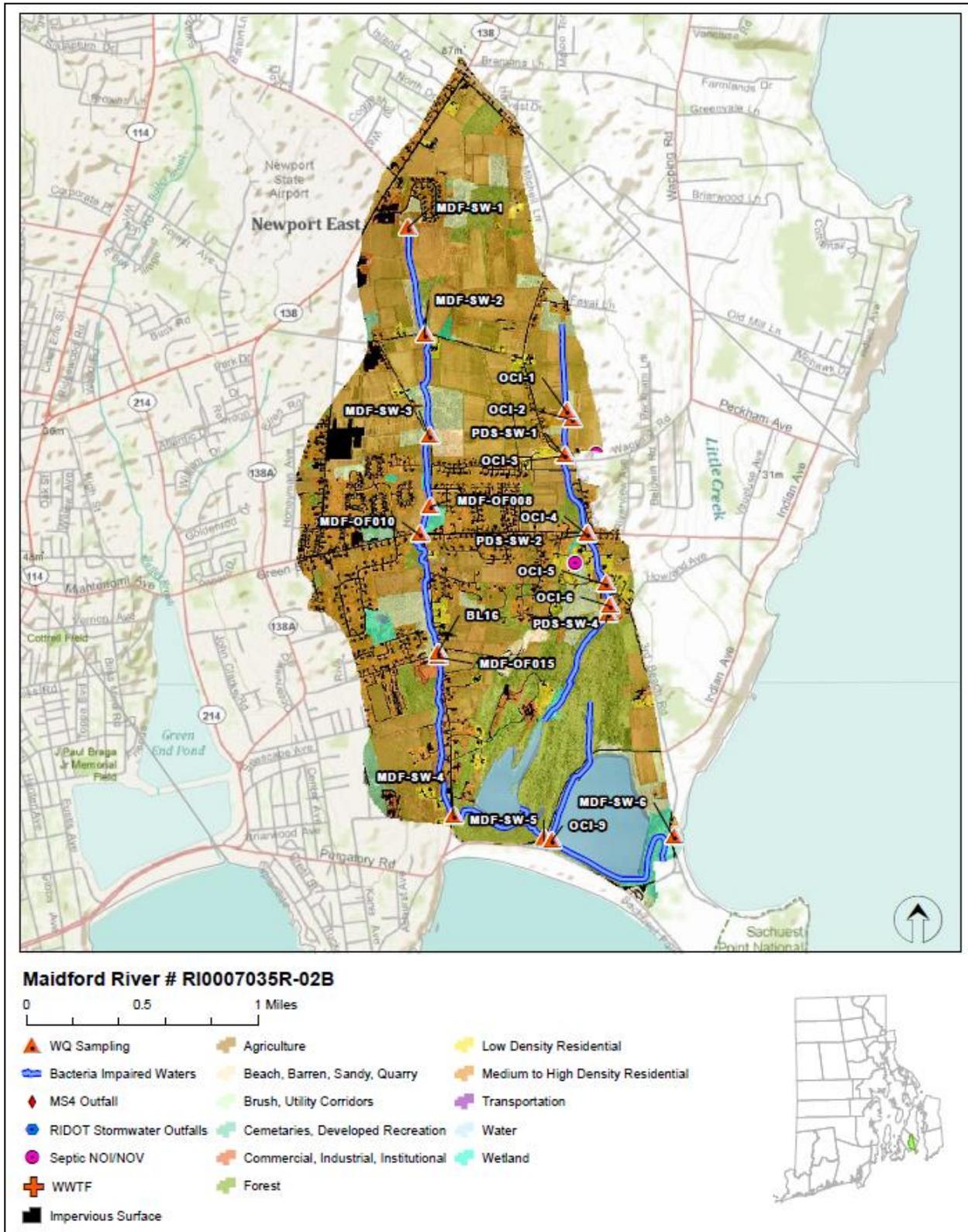
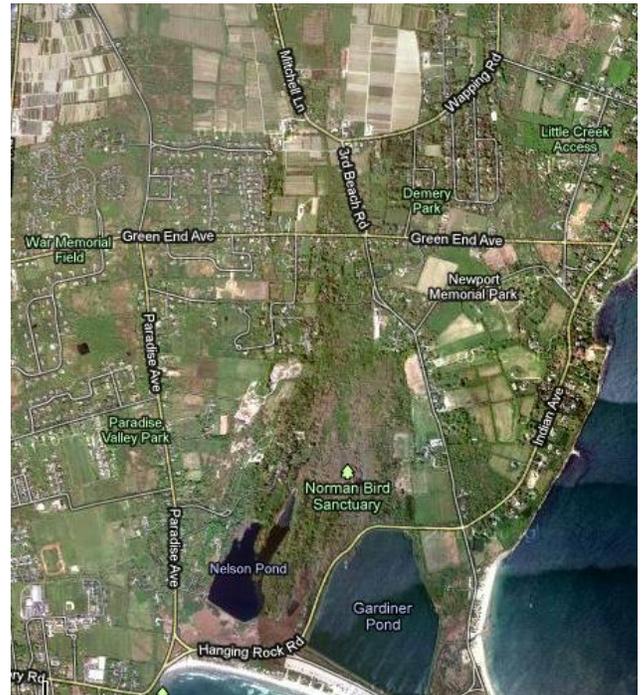


Figure 2: Map of the Maidford River watershed with impaired segments, sampling locations, and land cover indicated.

### Why is a TMDL Needed?

The Maidford River Segment 2B is a Class AA fresh water stream and is a tributary within Newport's public drinking water supply system. However, as it is not a terminal reservoir, its applicable designated uses are primary and secondary contact recreation (RIDEM, 2009). Due to its location within a drinking water supply and its designation as a critical habitat for rare and endangered species, the Maidford River Segment 2B has been designated by RIDEM as a Special Resource Protection Water (SRPW), providing it with special protections under RIDEM's Antidegradation Provisions. SRPWs are high quality surface waters that have been identified as having significant ecological or recreational uses and/or are public water supplies.



**Figure 3: Partial aerial view of the Maidford River watershed (Source: Google Maps)**

During 2000, 2001, 2004 and 2005, water samples were collected from four sampling locations and analyzed for the indicator bacteria, fecal coliform. The water quality criteria for fecal coliform, along with bacteria sampling results from 2000-2001 and 2004-2005 and associated statistics are presented in Table 1. For all stations, the 90<sup>th</sup> percentile maximum exceeded the water quality criteria value for fecal coliform. The geometric mean exceeded the water quality criteria for fecal coliform at three of the four stations. At the fourth station, the geometric mean criterion was exceeded during one year.

To aid in identifying possible bacteria sources, the geometric mean and 90<sup>th</sup> percentile maximum values were also calculated for wet and dry-weather sample days, where appropriate. Both wet and dry-weather geometric mean and 90<sup>th</sup> percentile values exceeded the water quality criteria for fecal coliform at most stations.

Due to the elevated bacteria measurements presented in Table 1, the Maidford River does not meet Rhode Island's bacteria water quality standards, was identified as impaired and was placed on the 303(d) list (RIDEM, 2008). 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.

This segment of the Maidford River has also been assessed by RIDEM as not meeting water quality standards for biodiversity, though no TMDLs have been completed for these impairments.

### Potential Bacteria Sources

There are several potential sources of bacteria in the Maidford River watershed including agricultural activities, wildlife and domestic animal waste, stormwater runoff from developed areas, and illicit discharges.

#### Agricultural Activities

As indicated in Figures 2 and 3, the Maidford River watershed is highly agricultural (48%), particularly in the northern and central portions of the watershed. Agricultural operations are an important economic activity and landscape feature in many areas of the state. There are approximately 14 farms in the Town of Middletown, and multiple cattle farms are located within the watershed itself (Berger, 2006). Agricultural practices such as allowing livestock to graze near streams, crossing livestock through waterbodies, and spreading manure as fertilizer can significantly contribute to bacterial contamination. A 2003 Department of Health ribotyping study and a 2005 DNA-analysis in the Maidford River identified cattle and other farm animals as a major source of bacteria to the northern portion of the river (Berger, 2006a).

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

A 2003 Department of Health ribotyping study and a 2005 DNA-analysis in the Maidford River (Berger, 2006) identified wildlife as a major source of bacteria to the southern portion of the river. The Norman Bird Sanctuary and the Sachuest Point National Wildlife Refuge are located northeast and southwest of the mouth of the Maidford River, respectively. Waterfowl in these areas represent a likely source of bacteria to the lower segment of the Maidford River (Berger, 2006). 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.

The area near Third Beach is a popular recreation location in the Maidford River watershed. Recreational horse riders have been observed in this area, as well as numerous dog walkers. Waste from these animals may be contributing to bacteria concentrations in the Maidford River.

#### Developed Area Stormwater Runoff

The Maidford River Segment 2B watershed has an impervious cover of 9%. 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 developed portions of the watershed may be contributing bacteria to the Maidford River, as discussed in Section 6.3 of the Core TMDL Document, as a general rule, impaired streams with watersheds having less than 10% impervious cover are assumed to be caused by sources other than urbanized stormwater runoff.

In 2008, all stormwater outfalls and catch basins throughout Middletown were mapped as part of Phase II requirements (Berger, 2008). The Maidford River was shown to receive discharges from approximately 25 stormwater outfalls.

### Onsite Wastewater Treatment Systems

The Maidford River watershed is partially sewered, but also relies on onsite wastewater treatment systems (OWTS) including septic systems and cesspools. Failing OWTS can be significant sources of bacteria by allowing improperly treated waste to reach surface waters (RI HEALTH, 2003). As shown in Figure 2, no OWTS Notices of Violation/Notices of Intent to Violate have been issued by the RIDEM Office of Compliance and Inspection along the Maidford River, though there are two along Paradise Brook, a tributary to the Maidford River.

### Sewer Leaks

Sewer system leaks and other illicit discharges have historically been reported in Middletown (Berger, 2008). A municipal sewer line does run along Sachuest Point Road in the lower part of the watershed, serving a recreational beach and campground, though no leaks have been reported (Berger, 2006).

## Existing Local Management and Recommended Next Steps

Additional bacteria data collection may be beneficial to support identification of sources of potentially harmful bacteria in the Maidford River 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.

### Agricultural Activities

If not already in place, agricultural producers within the Maidford River watershed should work with the RIDEM Division of Agriculture and the U.S. Department of Agriculture Natural Resources and Conservation Service (NRCS) to develop conservation plans for their farming activities within the

watershed. These plans should ensure that there are sufficient stream buffers, that fencing exists to restrict access of livestock and horses to streams and wetlands, and that animal waste handling, disposal, and other appropriate BMPs are in place.. Fencing or natural vegetative buffers can be installed to mitigate the potential for bacterial contamination from animals, particularly in the northern portion of the watershed where cattle farms have previously been identified as potential sources of bacteria to the Maidford River.

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

Middletown's education and outreach programs should highlight the importance of picking up after horses, dogs, and other pets and not feeding waterfowl, particularly in the lower portion of the watershed. Animal wastes should be disposed of away from any waterway or stormwater system. Middletown should work with volunteers from the town to map locations where animal waste is a significant and chronic problem. This work should be incorporated into the municipalities' Phase II plans and should result in an evaluation of 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.

The town 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 the Maidford River 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 the Maidford River and can harm human health and the environment. Middletown should ensure that discussion of this regulation is included in their SWMPPs.

#### Stormwater Management

The Town of Middletown (RIPDES permit RIR040032) and RIDOT (RIPDES permit RIR040036) are municipal separate storm sewer system (MS4) operators in the Maidford River watershed and have prepared the required Phase II Stormwater Management Plans (SWMPP). However, this lower portion of the watershed area is outside of the area regulated under the Phase II program.

In 2006, the Town of Middletown adopted an illicit discharge detection and elimination ordinance, based on the model ordinance developed by the Center for Watershed Protection (Berger, 2008). This ordinance prohibits illicit discharges to the MS4 and provides an enforcement mechanism. The town

should continue to locate priority areas to identify and eliminate illicit discharges in the Maidford River watershed (Berger, 2008). 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. Storm Water Pollution Prevention Plans (SWMPP) 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.

The upstream segment of the Maidford River (2A) has also been included as part of this statewide bacteria TMDL. As described in the waterbody summary for that segment, RIDEM is requiring the MS4 operators to revise their post-construction ordinances and continue to comply with the remaining six minimum measures in developed areas. Changes to the SWMPP are to be documented in a TMDL Implementation Plan (TMDL IP) and should comply with the relevant provisions of Part IV.D of the RIPDES Stormwater General Permit (RIDEM, 2010b), which are summarized in Section 6.1 (Numbers 1-5) of the Core TMDL Document. Further detail is also included in Sections 6.3 of the Core TMDL Document. While RIDEM is not requiring any changes to the MS4 operators SWMPPs for this segment of the Maidford River (2B), it is expected that improvements in stormwater to the upstream segment will also benefit this downstream segment.

### Onsite Wastewater Management

Though the majority of the Maidford River watershed is sewered, a portion of the watershed relies on OWTS. Currently, the Town of Middletown does not have an Onsite Wastewater Management Plan. As part of an onsite wastewater planning process, Middletown should adopt ordinances to establish enforceable mechanisms to ensure that existing OWTS are properly operated and maintained. RIDEM recommends that communities create an inventory of OWTS through mandatory inspections. Inspections encourage proper maintenance and identify failed and sub-standards systems. Policies that govern the eventual replacement of sub-standard OWTS and cesspools within a reasonable time frame should be adopted. The Rhode Island Wastewater Information Systems (RIWIS) can help develop an initial inventory of OWTS and can track voluntary inspection and pumping programs (RIDEM, 2010b).

The Town of Middletown is 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 the town develop a program to assist citizens with the replacement of older and failing systems.

#### Land Use Protection

Currently, the Maidford River watershed is approximately 71% undeveloped (RI HEALTH, 2003), a large portion of which is in agricultural production. A portion of the undeveloped land is protected as open space. As source waters to the Newport water supply system, preserving these natural areas is particularly important. Woodland and wetland areas within the Maidford River watershed, such as the Norman Bird Sanctuary and the Sachuest Point National Wildlife Refuge, absorb and filter pollutants from stormwater and agricultural runoff, and help protect both water quality in the stream and stream channel stability. These areas represent approximately 22% of the land in the Maidford River watershed. It is important to preserve these undeveloped areas and institute controls on development in the Maidford River watershed (RI HEALTH, 2003).

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

**Table 1: Maidford River Bacteria Data**

**Waterbody ID:** RI0007035R-02B

**Watershed Planning Area:** 1 – Aquidneck Island

**Characteristics:** Freshwater, Class AA, Tributary within a Public Drinking Supply, Primary and Secondary Contact Recreation, Special resource Protection Water (SRPW)

**Impairment:** Fecal Coliform (MPN/100mL)

**Water Quality Criteria for Fecal Coliform:**

Geometric Mean: 200 MPN/100 mL

90<sup>th</sup> Percentile Maximum: 400 MPN/100 mL

**Percent Reduction to meet TMDL: 100% (Includes Margin of Safety)**

**Data:** 2000-2001; 2005 from RIDEM

**Single Sample Fecal Coliform (MPN/100 mL) Results for the Maidford River (2000-2001; 2005) with Geometric Mean and 90<sup>th</sup> Percentile Statistics**

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean	90th Percentile
MDF-SW5 <sup>‡</sup>	Hanging Rocks Road	10/5/2005	2400	Dry	1281	2000
MDF-SW5 <sup>‡</sup>	Hanging Rocks Road	8/31/2005	1600	Wet		
MDF-SW5 <sup>‡</sup>	Hanging Rocks Road	8/18/2005	1600	Dry		
MDF-SW5 <sup>‡</sup>	Hanging Rocks Road	7/8/2005	900	Wet		
MDF-SW5 <sup>‡</sup>	Hanging Rocks Road	6/24/2005	500	Dry		
MDF-SW5 <sup>‡</sup>	Hanging Rocks Road	6/12/2005	1600	Dry		
WW	Hanging Rocks Road	8/18/2004	1460	Wet	7967	193200 <sup>†</sup> (100%)*
WW	Hanging Rocks Road	8/21/2004	11000	Wet		
WW	Hanging Rocks Road	9/16/2004	21000	Wet		
WW	Hanging Rocks Road	9/18/2004	300000	Wet		
WW	Hanging Rocks Road	10/16/2004	122000	Wet		
WW	Hanging Rocks Road	8/18/2004	1460	Wet		
OCI-9	Hanging Rocks Road, SW Corner Gardiner	11/8/2001	150	Wet		
OCI-9	Hanging Rocks Road, SW Corner Gardiner	8/21/2000	1100	Dry		

**Single Sample Fecal Coliform (MPN/100 mL) Results for the Maidford River (2000-2001; 2005) with Geometric Mean and 90<sup>th</sup> Percentile Statistics (continued)**

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean	90th Percentile
WW	Creek behind campground	8/18/2004	600	Wet	803	8586
WW	Creek behind campground	9/18/2004	620	Wet		
WW	Creek behind campground	10/16/2004	12000	Wet		
OCI-10	Creek behind campground	8/21/2000	93	Dry	584	4760
WW	Upstream of Third Beach	8/11/04	560	Dry		
WW	Upstream of Third Beach	8/18/04	620	Wet		
WW	Upstream of Third Beach	8/21/04	230	Wet		
WW	Upstream of Third Beach	9/16/04	8900	Wet		
WW	Upstream of Third Beach	9/18/04	200	Wet		
WW	Upstream of Third Beach	10/16/04	280	Wet	525	1700
OCI-11	Upstream of Third Beach	8/1/2000	4300	Wet		
OCI-11	Upstream of Third Beach	8/7/2000	30	Wet		
OCI-11	Upstream of Third Beach	8/8/2000	110	Wet		
OCI-11	Upstream of Third Beach	8/9/2000	930	Dry		
OCI-11	Upstream of Third Beach	8/9/2000	900	Dry		
OCI-11	Upstream of Third Beach	8/10/2000	1700	Wet		
OCI-11	Upstream of Third Beach	8/11/2000	930	Wet		
OCI-11	Upstream of Third Beach	8/11/2000	1600	Wet		
OCI-11	Upstream of Third Beach	8/14/2000	1700	Wet		
OCI-11	Upstream of Third Beach	8/15/2000	1700	Wet		
OCI-11	Upstream of Third Beach	8/16/2000	900	Wet		
OCI-11	Upstream of Third Beach	8/21/2000	39	Dry		
OCI-11	Upstream of Third Beach	8/24/2000	80	Wet		
OCI-11	Upstream of Third Beach	8/28/2000	500	Dry		
MDF-SW6 <sup>‡</sup>	Third Beach Road	10/5/2005	40	Dry	60	722
MDF-SW6 <sup>‡</sup>	Third Beach Road	8/31/2005	26	Wet		
MDF-SW6 <sup>‡</sup>	Third Beach Road	8/18/2005	1600	Dry		
MDF-SW6 <sup>‡</sup>	Third Beach Road	7/8/2005	300	Wet		
MDF-SW6 <sup>‡</sup>	Third Beach Road	6/12/2005	2	Dry		
WW	Third Beach Road	8/21/2004	16	Wet		
WW	Third Beach Road	9/16/2004	346	Wet		
WW	Third Beach Road	10/16/2004	30	Wet		

**Single Sample Fecal Coliform (MPN/100 mL) Results for the Maidford River (2000-2001; 2005) with Geometric Mean and 90<sup>th</sup> Percentile Statistics (continued)**

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean	90th Percentile
OCI-12	Third Beach Road	8/1/2000	430	Wet	306	1700
OCI-12	Third Beach Road	8/4/2000	13	Wet		
OCI-12	Third Beach Road	8/7/2000	30	Wet		
OCI-12	Third Beach Road	8/8/2000	50	Wet		
OCI-12	Third Beach Road	8/9/2000	430	Dry		
OCI-12	Third Beach Road	8/9/2000	300	Dry		
OCI-12	Third Beach Road	8/10/2000	1700	Wet		
OCI-12	Third Beach Road	8/11/2000	1700	Wet		
OCI-12	Third Beach Road	8/14/2000	1700	Wet		
OCI-12	Third Beach Road	8/15/2000	1600	Wet		
OCI-12	Third Beach Road	8/16/2000	1700	Wet		
OCI-12	Third Beach Road	8/21/2000	9	Dry		
OCI-12	Third Beach Road	8/24/2000	300	Wet		
OCI-12	Third Beach Road	8/28/2000	1600	Dry		

1700 values were reported as >1600 MPN/100 mL.

\*Includes Margin of Safety

† Geometric mean used to determine percent reduction

‡ Station prefix is LBG

**Wet and Dry Weather Geometric Mean Fecal Coliform Values for all Stations**

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
MDF-SW5 <sup>‡</sup> , OCI-9, WW	Hanging Rocks Road	2000, 2004-2005	8	5	3428	6357	1276
OCI-10, WW	Creek behind campground	2000, 2004	3	1	803	1647	NA
OCI-11, WW	Maidford upstream of Third Beach	2000, 2004	15	5	542	605	391
MDF-SW6 <sup>‡</sup> , OCI-12, WW	Third Beach Road	2000, 2004-2005	15	7	169	204	113

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gage at Newport County Airport in Middletown, RI or at Kingston, RI if Newport data was not available

‡ Station prefix is LBG

**Wet and Dry Weather 90<sup>th</sup> Percentile Fecal Coliform Values for all Stations**

Station Name	Station Location	Years Sampled	Number of Samples		90 <sup>th</sup> Percentile Value		
			Wet	Dry	All	Wet	Dry
MDF-SW5 <sup>‡</sup> , OCI-9, WW	Hanging Rocks Road	2000, 2004-2005	8	5	101800	175400	2080
OCI-10, WW	Creek behind campground	2000, 2004	3	1	8586	9724	NA
OCI-11, WW	Maidford upstream of Third Beach	2000, 2004	15	5	1960	3260	918
MDF-SW6 <sup>‡</sup> , OCI-12, WW	Third Beach Road	2000, 2004-2005	15	7	1700	1700	1600

Shaded cells indicate an exceedance of water quality criteria  
 Weather condition determined from rain gage at Newport County Airport in Middletown, RI or at Kingston, RI  
 if Newport data was not available  
<sup>‡</sup> Station prefix is LBG

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