



Mashapaug Pond

Watershed Description

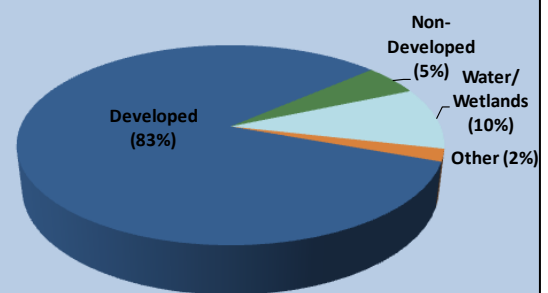
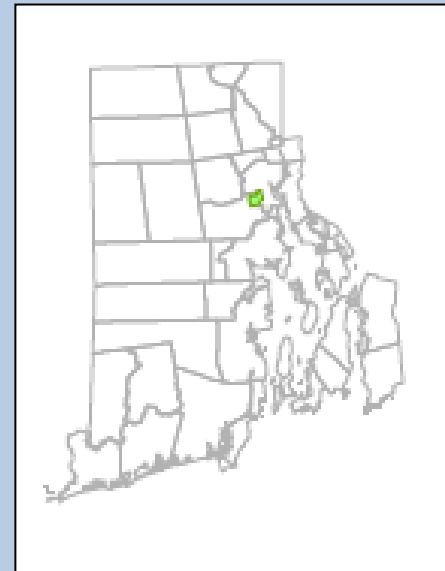
This **TMDL** applies to the Mashapaug Pond assessment unit (RI0006017L-06), a 114-acre pond located in Providence, RI (Figure 1). The City of Providence is located in the eastern portion of the state and Mashapaug Pond is located in the southern section of the city. The Mashapaug Pond watershed is presented in Figure 2 with land use types indicated.

Mashapaug Pond is the largest freshwater lake in the City of Providence and is located within an area locally known as Reservoir Triangle. The Pond is bordered by the City of Cranston to the west, Narragansett Avenue to the east, and Sinclair Avenue to the south. The pond receives freshwater inflow from Spectacle Pond, groundwater, and stormwater. The pond provides the primary flow to the Roger Williams Park Pond system, another bacteria impaired waterbody located southeast of the pond through culverted flow at the western edge of Roosevelt Lake (RIDEM, 2007).

The Mashapaug Pond watershed covers 1.8 square miles. The pond has a long history of development along its banks, dating back to the early 1600s when it was included in Roger Williams' original land purchase from the Narragansett Indians. Today, developed areas (including residential, commercial, and transportation uses) occupy a large portion (83%) of the watershed, as shown in the aerial image of Figure 3. Non-developed uses cover approximately 5%, wetlands and other surface waters occupy 10%, and other land uses combine to occupy 2%. Impervious surfaces cover a total of 61%.

Assessment Unit Facts (RI0006017L-06)

- **Town:** Providence
- **Impaired Segment Size:** 114 acres
- **Classification:** Class B
- **Direct Watershed:** 1.8 mi² (1155 acres)
- **Impervious Cover:** 61%
- **Watershed Planning Area:** Pawtuxet (#12)



Watershed Land Uses

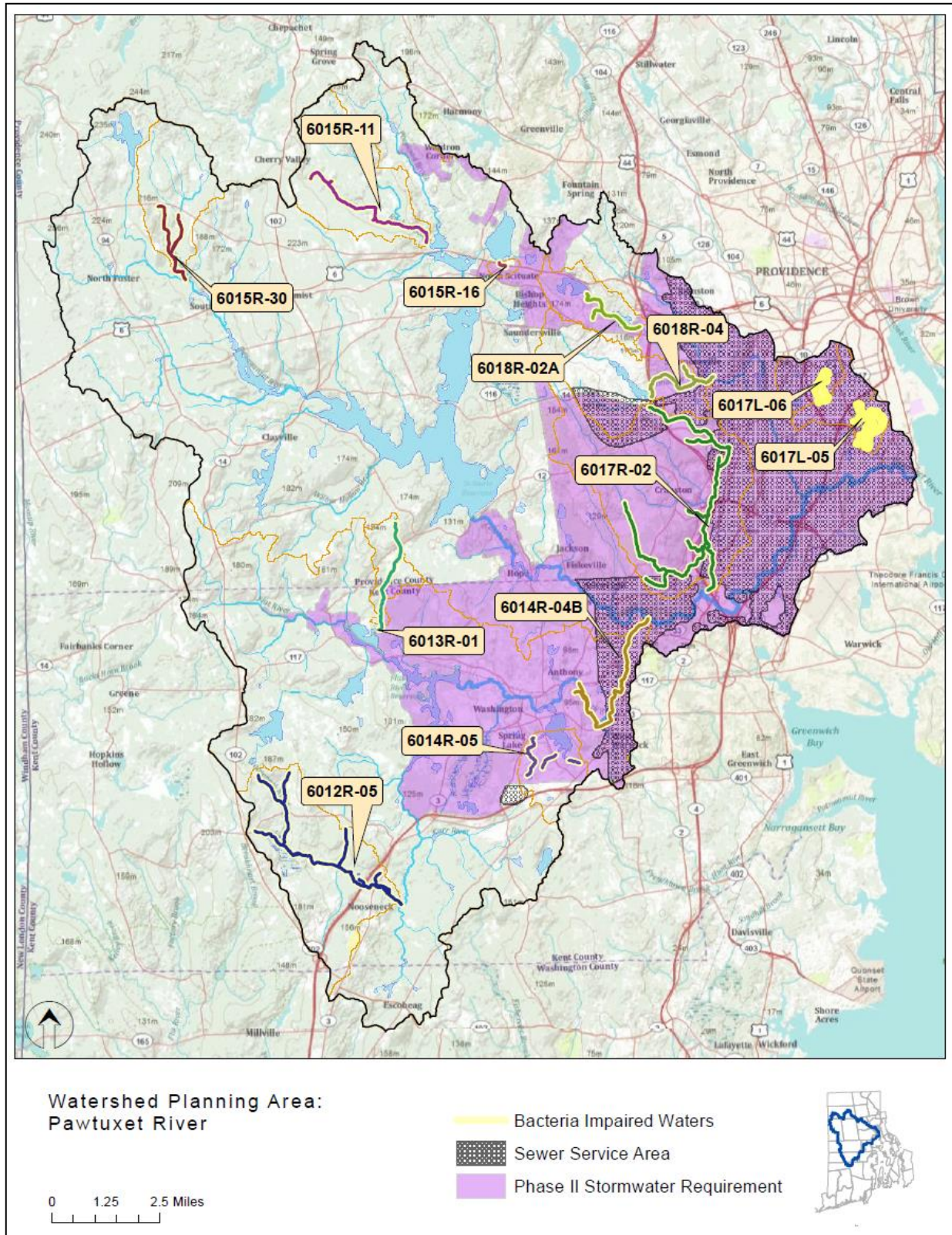


Figure 1: Map of the Pawtuxet Watershed Planning Area with impaired segments addressed by the Statewide Bacteria TMDL, sewered areas, and stormwater regulated zones.

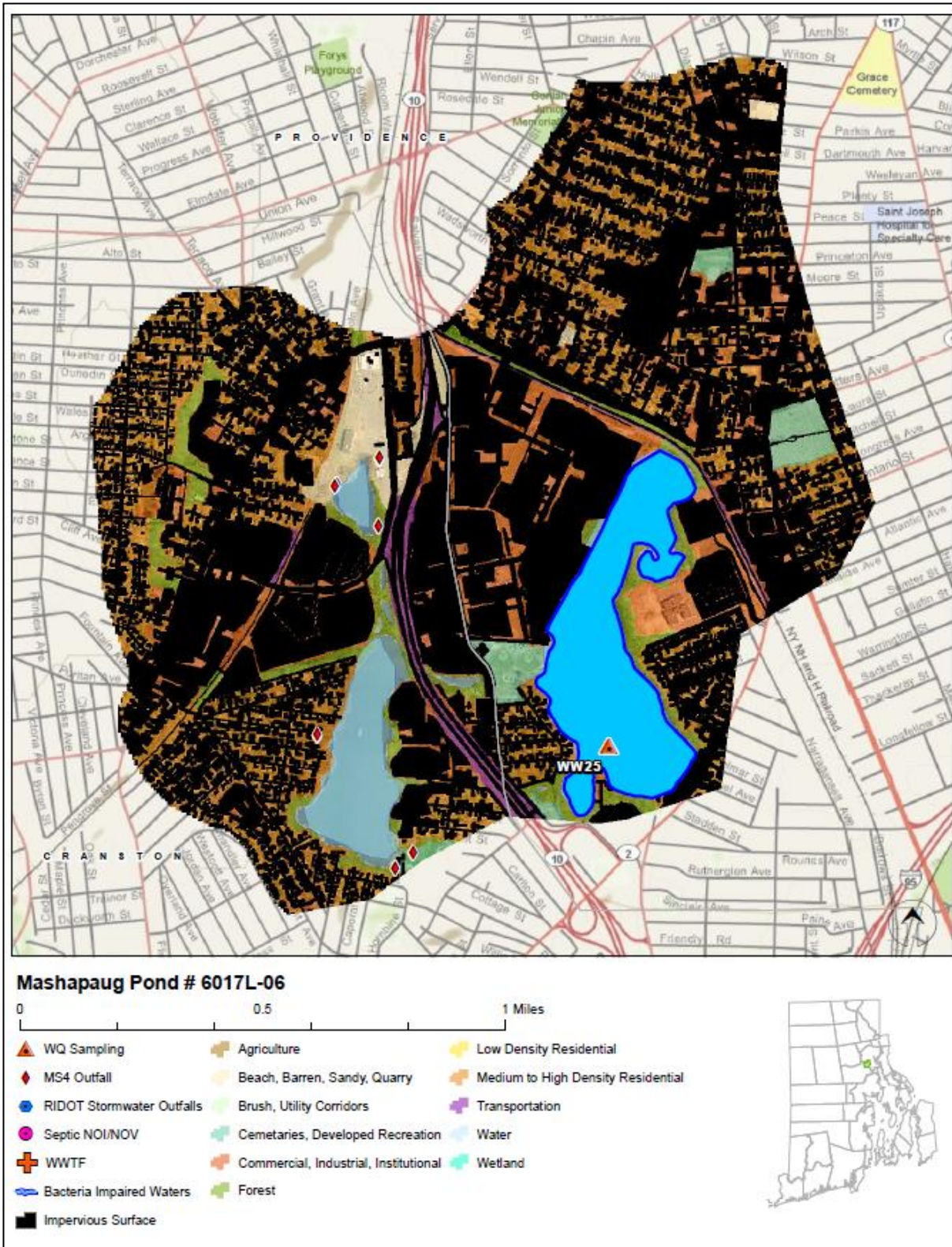


Figure 2: Map of the Mashapaug Pond watershed with impaired segment, sampling location, and land cover indicated.

Why is a TMDL Needed?

Mashapaug Pond is a Class B fresh water lake, and its applicable designated uses are primary and secondary contact recreation and fish and wildlife habitat (RIDEM, 2009). From 2000-2004, water samples were collected from one sampling location (WW25) and analyzed for the indicator bacteria, fecal coliform. The water quality criteria for fecal coliform, along with bacteria sampling results from 2000-2004 and associated statistics are presented in Table 1. Geometric mean and 90th percentile statistics were calculated for station WW25 and did not exceed Rhode Island's water quality criteria for fecal coliform.

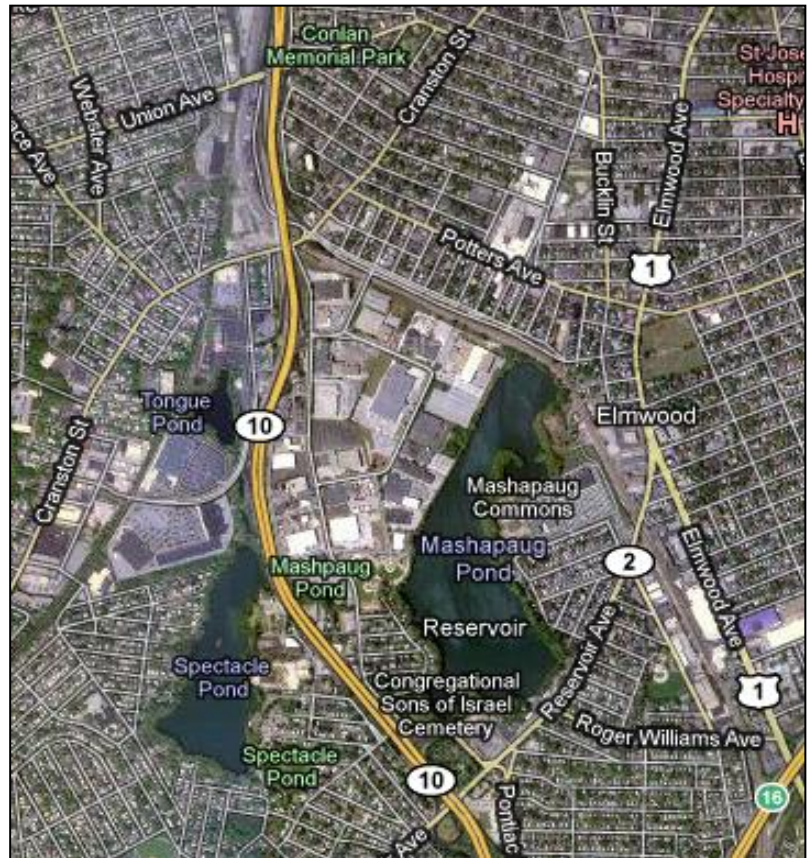


Figure 3: Partial aerial view of the Mashapaug Pond watershed. (Source: Google Maps)

In an effort to identify possible bacteria sources, the geometric mean and 90th percentile values were also calculated for station WW25 for wet and dry weather sampling days. The geometric mean and 90th percentile values also complied with Rhode Island's water quality standards for fecal coliform. However, wet weather monitoring conducted on Mashapaug Pond and its tributaries during a rain event on September 25, 2001 revealed a significant increase in the Pond's water column concentration of fecal coliform with fecal coliform levels returning to pre-storm concentrations within 24-hours after the storm. The fecal coliform concentrations of several storm drains and the inlet from Spectacle Pond were much greater than the background concentrations measured in the Pond's water column. Though the available water quality data, as a whole, do not indicate a violation of the primary contact recreation/swimming criteria, the elevation of fecal coliform during wet weather represents a public health concern.

The pathogen impairment for Mashapaug Pond was added to the 2002 303(d) list following a review of initial fecal coliform data collected as part of an assessment for a phosphorus and dissolved oxygen TMDL. Described previously, though the Mashapaug Pond has since been shown to comply with

Rhode Island's bacteria water quality standards, 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 Mashapaug Pond has previously been assessed by RIDEM as not meeting water quality standards for phosphorus, dissolved oxygen, and PCBs. The phosphorus and dissolved oxygen impairments were addressed in the TMDL for Dissolved Oxygen and Phosphorus, Mashapaug Pond, Rhode Island (2007).

Potential Bacteria Sources

There are several potential sources of bacteria in the Mashapaug Pond watershed including stormwater runoff, domestic animal waste, and sewer system leaks. The 2007 TMDL for Dissolved Oxygen and Phosphorus, Mashapaug Pond, Rhode Island identified stormwater runoff as the most significant source of phosphorus to Mashapaug Pond. This source may also be contributing to bacterial contamination in the pond.

Developed Area Stormwater Runoff

The Mashapaug Pond watershed has an impervious cover of 61%. 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 stormwater runoff.

In accordance with Phase II requirements, the City of Providence and the Rhode Island Department of Transportation (RIDOT) have identified and mapped all stormwater outfalls in the Mashapaug Pond watershed. Multiple outfalls were found in the watershed. These outfalls were shown to carry stormwater from high-density residential and commercial areas near the pond (RIDEM, 2007). For the 2007 Mashapaug Pond TMDL for Dissolved Oxygen and Phosphorus, wet-weather samples were collected at five of these storm drains in 2001. Fecal coliform concentrations ranged from 954 MPN/100 mL to 53,288 MPN/100 mL over a 24-hour rain event. The inlet at Spectacle Pond, which includes runoff from Route 10, was the most significant observed source of fecal coliform to Mashapaug Pond (RIDEM, 2007).

Waterfowl, Wildlife, and Domestic Animal Waste

The Mashapaug Pond watershed is predominately developed, with a combination of residential and commercial uses. Waste from domestic animals such as dogs, may be contributing to bacteria

concentrations in the pond. Though the watershed is highly developed, the pond itself may attract 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.

Sewer Leaks

As shown in Figure 1, the Mashapaug Pond watershed is completely sewered. Municipal wastewater is treated within the Narragansett Bay Commission system and discharged to the Providence River. The extensive sewage collection system within the watershed increases the risk of sewer system leaks and subsequent contamination.

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 Mashapaug Pond 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 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 City of Providence (RIPDES permit RIR040005) and RIDOT (RIPDES permit RIR040036) are municipal separate storm sewer (MS4) operators in the Mashapaug Pond watershed and have prepared the required Phase II Stormwater Management Plans (SWMPP). The entire watershed area is regulated under the Phase II program.

Providence's SWMPP outlines goals for the reduction of stormwater runoff to Mashapaug Pond through the implementation of Best Management Practices (BMPs). Many of these BMPs are now in place, including mapping all stormwater outfalls, instituting annual inspections and cleaning of the town's 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 Providence adopted an illicit discharge detection and elimination ordinance in 2005 (RIDEM, 2010a). These ordinances prohibit illicit discharges to the MS4 and provide an enforcement mechanism. The city should continue to select priority areas to identify and eliminate illicit discharges in the Mashapaug Pond watershed. Illicit discharges can be identified through continued dry weather outfall sampling and microbial source tracking.

RIDOT also 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. 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 MS4s 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 Mashapaug Pond, additional efforts are needed to restore the river's water quality. As mentioned previously, the Mashapaug Pond watershed has an impervious cover of 61%, a level where stormwater impacts are expected. At this threshold, RIDEM is requiring the MS4 operators to revise their post-construction stormwater ordinances as described in Section 6.3 of the Core TMDL Document. Providence and RIDOT should also evaluate whether the six minimum measures alone are sufficient to meet the bacteria reduction targets. Per Part IV.D of the General Permit, the MS4 operators should ensure that their minimum measures are consistent with the recommendation of Section 6.2 of the Core TMDL Document. 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.

Additionally, though the Mashapaug Pond Phosphorus and Dissolved Oxygen TMDL (2007) was specific to total phosphorus, it required the design and construction of BMPs that reduce both the stormwater volume and the phosphorus and bacteria loads to the maximum extent practicable. RIDEM identified priority outfalls for treatment. The most significant observed storm drain sources of fecal coliform, ranked in decreasing order by load are storm drains SD 5 (Pawnee St.), SD 6 (Lakeview Dr.), SD 1 (Niantic Ave.), and SD 2 (Dexter St.). More detailed information is provided in the 2007 TMDL document.

The City of Providence should continue to implement the goals of its Phase II SWMPP including dry-weather sampling, extensive street and catch basin cleaning, and public education activities. RIDOT should also continue to implement the goals of its Phase II SWMPP.

Waterfowl, Wildlife, and Domestic Animal Waste

The City of Providence has multiple programs in place to decrease problems from animal waste. Section 4-27 of Providence's City Ordinance requires owners to properly dispose of pet waste. Violating this law is punishable through fines. The city also has a leash law in public spaces and signage and dog-waste receptacles in many public places throughout the watershed (Fuss and O'Neill, 2004). Due to the concentration of residential neighborhoods adjacent to Mashapaug Pond, further efforts should be taken to limit bacterial contributions from animal waste to the ponds.

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 city should work with volunteers 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 additional signage, providing more pet waste receptacles or pet waste digester systems in high-use areas, enacting stricter ordinances requiring clean-up of pet waste, and targeting educational and outreach programs in problem areas.

The city 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 Mashapaug Pond 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 Mashapaug Pond and can harm human health and the environment.

Land Use Protection

Woodland and wetland areas within the Mashapaug Pond watershed absorb and filter pollutants from stormwater runoff, and help protect water quality. As these areas represent only a small portion of the land use in the Mashapaug Pond watershed, it is important to preserve these sparse 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 Mashapaug Pond.

Table 1: Mashapaug Pond Bacteria Data

Waterbody ID: RI0006017L-06

Watershed Planning Area: 12 – Pawtuxet

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

Impairment: Fecal coliform (MPN/100mL)

Water Quality Criteria for Fecal Coliform:

Geometric Mean: 200 MPN/100 mL

90th Percentile: 400 MPN/100 mL

Data: 2000-2004 from RIDEM

Single Sample Fecal Coliform (MPN/100 mL) Results for Mashapaug Pond (2001 - 2004) with Geometric Mean and 90th Percentile Statistics

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean	90th Percentile
WW25	Mashapaug Pond	10/16/2004	270	Wet	32	187
WW25	Mashapaug Pond	7/16/2004	66	Dry		
WW25	Mashapaug Pond	5/8/2004	50	Dry		
WW25	Mashapaug Pond	7/17/2003	74	Dry		
WW25	Mashapaug Pond	5/3/2003	27	Dry		
WW25	Mashapaug Pond	10/17/2002	42	Wet		
WW25	Mashapaug Pond	7/25/2002	20	Dry		
WW25	Mashapaug Pond	5/4/2002	6	Dry		
WW25	Mashapaug Pond	10/18/2001	23	Dry		
WW25	Mashapaug Pond	5/17/2001	---	Dry		
WW25	Mashapaug Pond	10/19/2000	200	Wet		
WW25	Mashapaug Pond	7/20/2000	8	Dry		
WW25	Mashapaug Pond	5/18/2000	3	Wet		

Wet and Dry Weather Geometric Mean Fecal Coliform Values for Station WW25

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
WW25	Mashapaug Pond	2000-2004	4	9	32	51	32
Weather condition determined from rain gage at the T.F. Green Airport in Warwick, RI							

Wet and Dry Weather 90th Percentile Fecal Coliform Values for Station WW25

Station Name	Station Location	Years Sampled	Number of Samples		90 th Percentile Value		
			Wet	Dry	All	Wet	Dry
WW25	Mashapaug Pond	2000-2004	4	9	187	249	68
Weather condition determined from rain gage at the T.F. Green Airport in Warwick, RI							

References

- Fuss and O'Neill, Inc. (2004). Phase II Stormwater Management Plan. City of Providence Rhode Island. March 2004.
- RIDEM (2007). TMDL for Dissolved Oxygen and Phosphorus for Mashapaug Pond, Rhode Island. Rhode Island Department of Environmental Management.
- RIDEM (2008). State of Rhode Island and Providence Plantations 2008 303(d) List – List of Impaired Water Bodies. Rhode Island Department of Environmental Management.
- RIDEM (2009). State of Rhode Island and Providence Plantations Water Quality Regulations. Amended December, 2009. Rhode Island Department of Environmental Management.
- RIDEM (2010a). MS4 Compliance Status Report for RI Statewide Bacteria TMDL. 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.
- 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.