

**Attachment 4:**

**BMP 7R Pathogen Methodology**

## Description of MassDOT's Application of BMP 7R for Pathogen TMDL Related Impairments

### Introduction

The Massachusetts Department of Transportation (MassDOT) owns and operates stormwater collection systems along its roadways throughout Massachusetts. In urbanized areas, discharges from these stormwater collection systems are regulated under a Municipal Separate Storm Sewer Systems (MS4) National Pollutant Discharge Elimination System (NPDES) general permit issued by the United States Environmental Protection Agency (USEPA). This permit requires that MassDOT's MS4 discharges to impaired water bodies be consistent with any State or EPA established final Total Maximum Daily Loads (TMDLs) for that water body and any applicable Waste Load Allocations (WLAs).

MassDOT has developed a NPDES Storm Water Management Plan<sup>1</sup> (SWMP) pursuant to the requirements of its NPDES general permit. The SWMP includes BMP 7R,<sup>2</sup> the assessment method used to address pollutant loading from MassDOT's stormwater discharges to the State's impaired water bodies covered by a TMDL (the TMDL method). MassDOT assesses impaired waters across the state to ensure that stormwater discharges from MassDOT's urbanized roadways do not cause instream exceedances of water quality standards. For simplicity, MassDOT is developing this standalone methodology to accompany the Impaired Waters Program assessments for pathogen related impairments addressed by a TMDL.

### Pathogens in MassDOT Stormwater Runoff

Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by an order of magnitude within a given storm event at a single location.<sup>3</sup> Therefore, it is difficult to predict pathogen concentrations in stormwater with accuracy. Due to this difficulty, MassDOT generally will not conduct site specific assessments of pathogen loading for each water body impaired for pathogens. Instead, MassDOT-owned property which discharges to pathogen impaired waters are assessed based on available information on pathogen loading from highways, MassDOT actions, and information available from EPA and MassDEP. Based on this information MassDOT developed an approach to be consistent with relevant TMDL and permit condition requirements and an iterative adaptive management approach to stormwater management.

In addition, while there is a positive relationship between impervious cover (IC) and pathogen loading, the relationship is not as direct as other impairments. According to the Center for Watershed Protection "...Other studies show that concentrations of bacteria are typically higher in

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<sup>1</sup> MassHighway, 2009. NPDES Storm Water Management Plan for MassHighway Owned and Operated Highways. Available at: <http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/SWMP20091223.pdf>

<sup>2</sup> MassDOT, July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: [http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP\\_7R\\_TMDL\\_WatershedReview.pdf](http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf)

<sup>3</sup> MassDEP, 2009. Final Pathogen TMDL for the Cape Cod Watershed. Available at: [MassDEP 2009b Final Pathogen TMDL for the Cape Cod Watershed Area](http://www.mass.gov/dep/water/quality/tmdl/cape-cod-pathogen-tmdl)

urban areas than rural areas<sup>4</sup> but they are not always directly related to IC.”<sup>5</sup> Therefore, MassDOT did not rely on the TMDL method to assess pathogen impairments. Instead, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and pathogen TMDL recommendations.

A study conducted on MassDOT’s South East Expressway measured bacterial concentrations in stormwater runoff.<sup>6</sup> This study found a geometric mean of 186 fecal coliforms/100 mL. Concentrations of pathogens in stormwater runoff from roadways can vary widely and pathogen concentrations in runoff across the state likely deviate significantly from this stretch of roadway’s specific estimate. Event mean concentrations of fecal coliform bacteria in urban stormwater from other sources ranging between 14,000 and 17,000 fecal coliform organisms/100 mL have been reported.<sup>7</sup> These data suggest that pathogen loading from highways may be lower than other urban areas.

Consideration of the potential sources of pathogens supports the idea that pathogens are present in lower concentrations in highway runoff since potential pathogen sources are likely to be less prevalent in the highway environment than along other urban roadways. Potential sources of pathogens and their relationship to the highway setting include:

- Illicit discharges: Due to the typical setback of highways from residential and commercial developments and the stand alone nature of the drainage system, the potential for illicit discharges (e.g. sewer connections, laundry tie-ins) is much lower than in other stormwater systems. This has been confirmed by MassDOT’s illicit discharge detection on many miles of urban roadways within a broad range of areas across Massachusetts. After assessment of almost 140 miles and investigation of more than 2,500 stormwater features, MassDOT’s consultant performing the broad scope reviews has found no confirmed illicit discharges.
- Limited Sewer Utilities in Road Rights-of-Way: Since MassDOT does not provide sewer services, many MassDOT roads do not have sewer utilities within the road’s right-of-way; thereby eliminating the chance of cross-connections or leaking pipes as a source of pathogens into the stormwater system.
- Pet waste: Pets are only present on highways in rare instances. In urban residential areas pets and their associated waste are much more common. MassDOT is aware that pet waste at road side rest stops may represent a potential source of pathogens to stormwater in certain situations, and has a pet waste management program underway to address this source where necessary.
- Wildlife: Highways are not generally an attractive place for wildlife. Wildlife generally avoids highways and only occasionally crosses them.

The dearth of pathogen sources on highways and the relatively low concentrations of pathogens measured in the South East Expressway study together suggest that pathogen loading from stormwater runoff from highways is lower than other urban sources.

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<sup>4</sup> U.S. Geological Survey (USGS), 1999. Pesticides and Bacteria in an Urban Stream – Gills Creek. USGS Fact Sheet FS-131-98. Columbia, South Carolina.

<sup>5</sup> Center for Watershed Protection (CWP), 2003. Impacts of Impervious Cover on Aquatic Systems. Watershed Protection Research Monograph No. 1. Ellicott City, MD.

<sup>6</sup> Smith, 2002. Effectiveness of Three Best Management Practices for Highway Runoff Quality along the Southeast Expressway. USGS Water Resources Investigations Report 02-4059. Boston, Massachusetts.

<sup>7</sup> MassDEP, 2009. Final Pathogen TMDL for the Cape Cod Watershed. Available at: <http://www.mass.gov/dep/water/resources/capecod1.pdf>

Furthermore, in almost all cases the contribution of pathogens from MassDOT to a specific water body is likely to be very small relative to other sources of pathogens in the watershed. Since MassDOT urban roadways are linear and usually cross watersheds, they represent a small fraction of the receiving water body's watershed. The water quality within these water bodies is dependent on discharge from various sources, including discharges from other stormwater systems and a large number of other factors.

## Assessment

Unlike other TMDLs that establish pollutant load allocations based on mass per time, many bacteria and pathogen TMDLs in Massachusetts establish bacterial TMDLs that are concentration based and equivalent to the MassDEP water quality standard for the receiving water body. This therefore requires that at the point of discharge to the receiving water, all sources include bacteria concentrations that are equal or less than the MassDEP water quality standard for the receiving water body.

In general, pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and pathogen TMDL recommendations.<sup>8</sup>

TMDLs for pathogen impairments in Massachusetts recognize that pathogens are highly variable and difficult to address and emphasize the need for an iterative adaptive management approach to address pathogens. Examples of relevant language from these TMDLs are included below:

- "given the vast potential number of bacteria sources and the difficulty of identifying and removing them from some sources such as stormwater require an iterative process and will take some time to accomplish. While the stated goal in the TMDL is to meet the water quality standard at the point of discharge it also attempts to be clear that MassDEP's expectation is that for stormwater an iterative approach is needed..."<sup>9</sup>
- "The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The MEP standard is a narrative effluent limitation that is satisfied through implementation of SWMPs and achievement of measurable goals."<sup>10</sup>
- "Although the TMDL presents quantified WLAs for stormwater that are set equivalent to the criteria in the Massachusetts Water Quality Standards, the Phase II NPDES permits will not include numeric effluent limitations. Phase II permits are intended to be BMP based permits that will require communities to develop and implement comprehensive stormwater management programs involving the use of BMPs. Massachusetts and EPA believe that BMP based Phase II permits involving comprehensive stormwater management together

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<sup>8</sup> US EPA, September 2014. Draft General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts. Available at: [http://www.epa.gov/region1/npdes/stormwater/MS4\\_MA.html](http://www.epa.gov/region1/npdes/stormwater/MS4_MA.html)

<sup>9</sup> MassDEP. (2009a). Final Pathogen TMDL for the Buzzards Bay Watershed. Available at: <http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/buzzbay1.pdf>

<sup>10</sup> MassDEP. (2009b). Final Pathogen TMDL for the Cape Cod Watershed. Available at: <http://www.mass.gov/dep/water/resources/capecod1.pdf>

with specific emphasis on pollutants contributing to existing water quality problems can be consistent with the intent of the quantitative WLAs for stormwater discharges in TMDLs.”<sup>11</sup>

This language clearly indicates that an iterative adaptive management approach is the appropriate way to address discharges to pathogen impaired waters. The recommendations in pathogen TMDLs for waters in Massachusetts generally require development and implementation of stormwater management programs, illicit discharge detection and elimination efforts, and in some cases installing BMPs to the maximum extent practicable.

The draft Massachusetts General MS4 permit contains specific requirements for compliance with pathogen TMDLs (in Appendix F).<sup>12</sup> While this permit is still in draft form and MassDOT anticipates receiving its own individual permit coverage under the finalized Massachusetts general MS4 permit, the draft permit represents the best available guidance from EPA regarding appropriate measures for addressing stormwater discharges to pathogen-impaired waters in Massachusetts. Section 2.2.1(b) of the permit states “The MS4s specified below discharge to waters within Massachusetts that are subject to TMDLs, or in some cases, to tributaries of such waters, and shall comply with the requirements of Appendix F, Part A.” Appendix F references a number of programmatic BMPs that are necessary to address pathogen loading. These cover the following general topics:

- Residential educational program focused on pet waste management
- Prioritized illicit connection identification, tracking and removal.

## Proposed Mitigation Plan

MassDOT implements a variety of non-structural BMP programs across their system in accordance with their existing SWMP including educational programs, illicit connection review and source control. The specific BMPs that can help reduce potential pathogen loading in the current SWMP include:

- BMP 3C-1: Drainage Connection Policy
- BMP 3C-2: Drainage Tie-In Standard Operating Procedure
- BMP 3D: Illicit Discharge Detection Review
- BMP 5H-1: Post Construction Runoff Enforcement – Illicit Discharge Prohibition
- BMP 5H-2: Post Construction Runoff Enforcement – Drainage Tie-In
- BMP 5H-3: Post Construction Runoff Enforcement – Offsite Pollution to MassHighway Drainage System
- BMP 6A-1: Source Control – 511 Program
- BMP 6A-2: Source Control – Adopt-A-Highway Program
- BMP 6C-1: Maintenance Program

<sup>11</sup> MassDEP, 2002. Total Maximum Daily Loads of Bacteria for the Neponset River Basin. Retrieved from: <http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/neponset.pdf>

<sup>12</sup> US EPA, September 2014. Appendix F of Draft General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts. Available at: [http://www.epa.gov/region1/npdes/stormwater/MS4\\_MA.html](http://www.epa.gov/region1/npdes/stormwater/MS4_MA.html)

MassDOT is also developing a pet waste management program at MassDOT rest areas within pathogen impaired watersheds. MassDOT will be installing signs at rest stops within the subwatershed of impaired waterbodies. The signs will inform the public of the need to remove pet waste, which can minimize contributions of pathogens to stormwater runoff. Pet waste removal bags and disposal cans will be provided.

Furthermore, MassDOT has an ongoing inspection and monitoring program aimed at identifying and addressing illicit discharges to MassDOT's stormwater management system. Any illicit discharges to MassDOT's system could contribute pathogens to impaired waters, however, MassDOT's existing Illicit Discharge Detection and Elimination (IDDE) program is aimed at identifying and addressing these contributions. District maintenance staff are trained to conduct regular inspections of MassDOT infrastructure and note any signs of potential illicit discharges, such as dry weather flow and notable odors or sheens. Similarly, resident engineers overseeing construction projects also receive training to note any suspicious connections or flows, and report these for follow-up investigation and action as appropriate. MassDOT will continue to implement this IDDE training, and District staff will continue to report any suspicious flows requiring further investigation. MassDOT investigates any suspicious flows noted, and will work with owners of confirmed illicit discharges to remove these flows, and thereby minimize the possibility of pathogen contributions to receiving waters.

## Summary

As part of its NPDES MS4 stormwater permit, MassDOT is required to address the discharge of pollutants from its stormwater systems to impaired water bodies identified in MassDEP's *Final Massachusetts Integrated List of Waters*. MassDOT's SWMP identifies the methodology for addressing its stormwater discharges to impaired water bodies covered by a TMDL.

MassDOT has concluded that the BMPs outlined in the SWMP are consistent with its existing permit requirements. These measures achieve pathogen reductions (including fecal coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit and the applicable pathogen TMDLs. As stated previously, pathogen loadings are highly variable and although there is potential for stormwater runoff from MassDOT roadways to be a contributing source it is unlikely to warrant action relative to other sources of pathogens in the watershed. MassDOT will continue to ensure proper non-structural BMPs are being implemented, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education.