



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029
8/20/2009

Richard Eskin, Ph.D., Director
Technical and Regulatory Service Administration
Maryland Department of the Environment
1800 Washington Blvd., Suite 540
Baltimore, Maryland 21230-1718

Dear Dr. Eskin:

The U.S. Environmental Protection Agency (EPA), Region III, is pleased to approve *Total Maximum Daily Loads (TMDLs) of Fecal Coliform for the Restricted Shellfish Harvesting Area in Mill Creek of the Lower Patuxent River Basin, Charles County, Maryland*. The TMDL report was submitted via the Maryland Department of the Environment's (MDE) letter dated July 2, 2008, and was received by EPA for review and approval on July 11, 2008. The TMDL was established and submitted in accordance with Section 303(d)(1)(c) and (2) of the Clean Water Act to address impairments of water quality as identified in Maryland's Section 303(d) List. The Mill Creek Watershed (MD02131101) was included on Maryland's Section 303(d) List as impaired by fecal coliform in 1998. This TMDL addresses this impairment.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) be designed to attain and maintain the applicable water quality standards; (2) include a total allowable loading and as appropriate, wasteload allocations for point sources and load allocations for nonpoint sources; (3) consider the impacts of background pollutant contributions; (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated); (5) consider seasonal variations; (6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality); and (7) be subject to public participation. In addition, these TMDLs considered reasonable assurance that the TMDL allocations assigned to the nonpoint sources can be reasonably met. The enclosure to this letter describes how the fecal coliform TMDLs for the Mill Creek Watershed satisfy each of these requirements.

As you know, all new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL wasteload allocation pursuant to 40 CFR §122.44 (d)(1)(vii)(B). Please submit all such permits to EPA for review as per EPA's letter dated October 1, 1998.

If you have any questions or comments concerning this letter, please do not hesitate to contact María García, at 215-814-3199.

Sincerely,

/S/

Jon M. Capacasa, Director
Water Protection Division

Enclosure

cc: Nauth Panday, MDE-TARSA
Melissa Chatham, MDE-TARSA



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Decision Rationale
Total Maximum Daily Loads of
Fecal Coliform for the Restricted
Shellfish Harvesting Area in Mill Creek of the
Lower Patuxent River Basin
Charles County, Maryland

/S/

Jon M. Capacasa, Director
Water Protection Division

Date: 8/20/2009

Decision Rationale
Total Maximum Daily Loads of
Fecal Coliform for the Restricted Shellfish Harvesting Area in
Mill Creek of the Lower Patuxent River Basin
Charles County, Maryland

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those waterbodies identified as impaired by the State where technology based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a Margin of Safety (MOS), that may be discharged to a water quality limited waterbody.

This document sets forth the U.S. Environmental Protection Agency's (EPA) rationale for approving the TMDL of fecal coliform for the restricted shellfish harvesting Area in Mill Creek of the Lower Patuxent River Watershed. The TMDL was established to address impairments of water quality, caused by fecal coliform, as identified in Maryland's 1998 Section 303(d) List for water quality limited segments. The Maryland Department of the Environment (MDE) submitted the report, *Total Maximum Daily Loads of Fecal Coliform for the Restricted Shellfish Harvesting Area in Mill Creek of the Lower Patuxent River Basin, Charles County, Maryland*, on July 2, 2008. The TMDL in this report addresses the fecal coliform impairment in the Mill Creek Watershed as identified on Maryland's Section 303(d) List. The basin identification for Mill Creek of the Lower Patuxent River Basin is MD02131101.

EPA's rationale is based on the TMDL Report and information contained in the computer files provided to EPA by MDE. EPA's review determined that the TMDLs meet the following seven regulatory requirements pursuant to 40 CFR Part 130.

1. The TMDL is designed to implement applicable water quality standards.
2. The TMDL includes a total allowable load as well as individual wasteload allocations (WLAs) and load allocations (LAs).
3. The TMDL considers the impacts of background pollutant contributions.
4. The TMDL considers critical environmental conditions.
5. The TMDL considers seasonal environmental variations.
6. The TMDL includes a MOS.
7. The TMDL has been subject to public participation.

In addition, these TMDLs considered reasonable assurance that the TMDL allocations assigned to nonpoint sources can be reasonably met.

II. Summary

The TMDL specifically allocates the allowable fecal coliform loadings to sources in the restricted shellfish harvesting areas in the Mill Creek. There are no National Pollutant Discharge Elimination System (NPDES) permitted sources in the Mill Creek watershed; therefore, the entire TMDL was assigned to the LA. The fact that the TMDL does not assign WLA to any sources in the Mill Creek watershed should not be construed as a determination either by EPA or MDE that there are not sources in Mill Creek that are subject to the NPDES program. Table 1 below shows the TMDL for fecal coliform for the Mill Creek watershed. The TMDL was expressed as a median TMDL and a 90th percentile TMDL, which is consistent with the format of Maryland's bacteriological criteria, which assign numeric threshold criteria for fecal coliform based on the median and 90th percentile. However, since the 90th percentile criterion is more stringent in this case, the allocation for the TMDL is based on the fecal coliform 90th percentile criterion. The calculation of the TMDLs is explained in Appendix A of the TMDL report.

Table 1. Fecal Coliform 90th Percentile TMDL Summary for the Mill Creek Watershed

Watershed	TMDL (counts per day)	Wasteload Allocation (WLA)	Load Allocation (LA) (counts per day)	Margin of Safety (MOS)
Mill Creek Watershed	3.11×10^{10}	0.0	3.11×10^{10}	Implicit

The TMDL is a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards. The TMDL is a scientifically based strategy that considers current and foreseeable conditions, the best available data, and account for uncertainty with the inclusion of a MOS value. The option is always available to refine the TMDL for re-submittal to EPA for approval if environmental conditions, new data, or the understanding of the natural processes change more than what was anticipated by the MOS.

III. Background

Mill Creek is a small coastal embayment located on the upstream western side of the Lower Patuxent River, approximately 35.2 km from the mouth, in Charles County, Maryland. The embayment flows into the Patuxent River, just north of Indian Creek. Mill Creek has a drainage area of 359 acres. The dominant tide in this region is the lunar semi-diurnal (M_2) tide, with a tidal range of 0.49 m with a tidal period of 12.42 hours. The Mill Creek watershed is characterized as primarily rural, with 56 percent of the area being cropland and more than 28 percent forested or wetland.

Mill Creek of the Lower Patuxent River Basin was identified on Maryland's 1998 Section 303(d) List of impaired waterbodies. It was listed as impaired by fecal coliform in the restricted shellfish harvesting area within the basin. The Mill Creek watershed TMDL addresses this impairment.

The monitoring and analysis for these bacteria TMDLs was performed using fecal

coliform data. Fecal coliform is a bacterium which can be found within the intestinal tract of all warm blooded animals. Fecal coliform in itself is generally not a pathogenic organism. However, fecal coliform indicates the presence of fecal wastes and the potential for the existence of other pathogenic bacteria. The higher concentrations of fecal coliform indicate the elevated likelihood of the presence of pathogenic organisms in shellfish that are harvested from polluted waters and subsequently consumed. Maryland's current water quality standards provide bacteriological criteria for shellfish harvesting (i.e., Use II) waters based on numeric criteria for fecal coliform.

The Surface Water Use Designation for the Mill Creek watershed is Use II Waters: *Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting* (Code of Maryland Regulations, COMAR, 26.08.02.03-3.C(2)). Water quality criteria for shellfish waters are established under the National Shellfish Sanitation Program (NSSP). MDE adheres to the requirements of the NSSP, with oversight by the U.S. Food and Drug Administration. Maryland's water quality standards provide bacteriological criteria for Use II waters, stating that a public health hazard will be presumed if the most probable number (MPN) of fecal coliform organisms exceeds a median concentration of 14 MPN per 100 milliliters, or if the 90th percentile concentration exceeds 49 per 100 milliliters (for a three tube decimal dilution test). The Mill Creek was placed on Maryland's Section 303(d) List because the shellfish area within this system violates Maryland's protective bacteriological criteria for Use II waters.

CWA Section 303(d), and its implementing regulations, requires that TMDLs be developed for waterbodies identified as impaired by the State where technology based and other required controls do not provide for attainment of water quality standards. The fecal coliform TMDL submitted by MDE is designed to attain acceptable loadings of fecal coliform in order to attain the bacteriological water quality criteria and support the Use II designation. Refer to Table 1 above for a summary of the allowable loads.

For this TMDL analysis, Maryland used fecal coliform data from one monitoring station in Mill Creek (09-01-012) over a four-year period between May 2004 and September 2007. This period is longer than the 30-sample requirement and is consistent with MDE's shellfish program sanitary survey schedule. The TMDL was calculated based on the steady-state tidal prism model. The tidal prism model incorporates influences of freshwater discharge, tidal flushing, and fecal coliform decay, thereby representing the fate and transport of fecal coliform in the Mill Creek restricted shellfish harvesting area. Appendix A of the TMDL report provides a thorough description of the tidal prism model and calculations.

To determine the sources of fecal coliform, MDE used a Bacteria Source Tracking (BST) analysis throughout Patuxent River. The BST analysis result is used to provide evidence regarding contributions from anthropogenic sources (i.e. human or livestock) as well as background sources, such as wildlife. Antibiotic Resistance Analysis (ARA) was the chosen method used to determine the potential sources of fecal coliform in the Patuxent River. ARA compares patterns of antibiotic resistance from known sources collected in the watershed to patterns of unknown sources found in water samples to identify sources. Based on the analysis of BST, wildlife is the predominant bacteria source (33%), followed by livestock (28%), human (20%), and pets (19%). Detailed explanation of the source assessment is described in Appendix

B of the TMDL report.

According to the water quality standards for fecal coliform in shellfish waters, computation of a TMDL requires analyses of both the median and the 90th percentile scenarios. The median concentration water quality criterion for shellfish harvesting is 14 Most Probable Number (MPN)/100 ml, and the 90th percentile criterion concentration is 49 MPN/100 ml for a three-tube decimal dilution. According to the median load calculation, the current load is less than the allowable load; therefore, no load reduction is applied to the watershed for the median scenario. For the 90th percentile load, the current load is 5.95×10^{10} counts per day and the TMDL is 3.109×10^{10} counts per day. This TMDL represents a 47.71 percent reduction from the current load.

IV. Discussion of Regulatory Conditions

EPA finds that MDE has provided sufficient information to meet all seven of the basic requirements for establishing a fecal coliform TMDL for the shellfish harvesting area of the Mill Creek Watershed. EPA therefore approves this TMDL for the Mill Creek Watershed. This approval is outlined below according to the seven regulatory requirements.

1) The TMDLs are designed to implement applicable water quality standards.

Water Quality Standards consist of three components: designated and existing uses; narrative and/or numerical water quality criteria necessary to support those uses; and an anti-degradation Statement. The Surface Water Use Designation for the Mill Creek is Use II Waters: *Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting* (Code of Maryland Regulations, COMAR, 26.08.02.03-3.C(2)). Use II waters may be classified as approved, conditionally approved, restricted, or prohibited. Maryland's listing methodology for shellfish waters provides that approved and conditionally approved shellfish waters are not placed on the Section 303(d) List of water quality limited segments. Approved classifications means that the median fecal coliform MNP of at least 30 water sample results taken over a three year period to incorporate inter-annual variability does not exceed 14 per 100 milliliters, and (1) in areas affected by point source discharges, no more than 10 percent of the samples exceed an MPN of 43 per 100 milliliters for a five tube decimal dilution test or 49 MPN per 100 milliliter for a three tube decimal dilution test, or (2) in other areas, the 90th percentile of water sample results does not exceed an MPN of 43 per 100 milliliters for a five tube decimal dilution test or 49 MPN per 100 milliliters for a three tube decimal dilution test.

Maryland developed the bacteria TMDLs for Mill Creek in terms of fecal coliform, because Maryland's current water quality standards contain specific numerical criteria for bacteria in Use II waters that are based on the concentration of fecal coliform, as described above. The TMDLs, therefore, use these applicable numerical criteria as an endpoint. The TMDLs were calculated and expressed as median TMDLs and 90th percentile TMDLs in order to meet the associated numerical criteria. EPA believes that this is a reasonable and appropriate water quality goal.

2) The TMDLs include a total allowable load as well as individual wasteload allocations and

load allocations.

Total Allowable Load

As described above, MDE used as endpoints a median concentration of 14 MPN per 100 milliliters and a 90th percentile concentration of 49 MPN per 100 milliliters. Load calculations were conducted for the restricted shellfish area of the Mill Creek based on these two endpoints. The TMDL allocations were developed based on the criterion requiring the largest percent reduction, in this case based on the 90th percentile. The TMDL and allocations are presented as mass loading rates of counts per day. Expressing TMDLs as daily mass loading rates is consistent with Federal regulations at 40 CFR 130.2(i), which state *that TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures.*

EPA regulations at 40 CFR §130.2(i), state *that the total allowable load shall be the sum of individual WLAs for point sources, LAs for nonpoint sources, and natural background concentrations.* The TMDL for fecal coliform in the Mill Creek Watershed is consistent with 40 CFR §130.2(i) because the total loads provided by MDE equal the sum of the individual WLAs for point sources and the land based LAs for nonpoint sources.

Wasteload Allocations

There are no permitted point sources in this watershed.

Load Allocations

The TMDL summary in Table 1 contains the LA for the Mill Creek Watershed. Since no permitted point sources exist in the Mill Creek watershed, the entire TMDL was assigned to the LA. According to Federal regulations at 40 CFR §130.2(g), LAs are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loadings should be distinguished. As described above in Section III, Maryland conducted a BST analysis throughout the Patuxent River to determine fecal coliform sources. Since there is no BST station in Mill Creek, the BST data used to evaluate the source characterization in Mill Creek was the data at a nearby Patuxent River sampling station (approximately 650 m from monitoring station 09-01-012). Antibiotic Resistance Analysis was the BST method used to determine the potential sources of fecal coliform. In the Mill Creek watershed, wildlife contributions, both mammalian and avian, are considered natural conditions and may represent a background level of bacterial loading. Livestock contributions, such as those from mammalian and avian livestock, mainly result from surface runoff. The watershed is predominantly cropland, wetland, and forest. According to land use information, the wildlife and livestock could be the dominant sources. Pet contributions usually occur through runoff from streets and land. Human sources mainly result from failure of septic systems. Based on the analysis, wildlife is the predominant bacteria source (33%), followed by livestock (28%), human (20%), and pets (19%).

Based on the foregoing, EPA has determined that the TMDLs are consistent with the

regulations and requirements of 40 CFR Part 130.

3) *The TMDLs consider the impacts of background pollutant contributions.*

The TMDLs consider the impact of background pollutants by considering the fecal coliform loads from natural sources such as wildlife.

4) *The TMDLs consider critical environmental conditions.*

EPA regulations at 40 CFR §130.7(c)(1) require TMDLs to account for critical conditions for stream flow, loading, and water quality parameters. The intent of the regulations is to ensure that (1) the TMDLs are protective of human health, and (2) the water quality of the waterbodies is protected during the times when they are most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards¹. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable worst-case scenario condition. Since the data used was collected over a four-year period, the critical condition requirement is implicitly included in the 90th percentile value. Also, a comparison of the median values and the 90th percentile values against the water quality criteria determines which represents the more critical condition or higher percent reduction. If the median values dictate the higher reduction, this suggests that, on average, water sample counts are high with limited variation around the mean. If the 90th percentile criterion requires a higher reduction, this suggests an occurrence of high fecal coliform due to the variation of hydrological conditions.

5) *The TMDLs consider seasonal environmental variations.*

Seasonal variations involve changes in flow as a result of hydrologic and climatological patterns. Generally, water column data for fecal coliform may sometimes exhibit seasonal trends. For example, bacteria levels tend to be lower during the colder months in some areas, but this is not always the case. In order to account for seasonal variation and inter-annual variability, Maryland's shellfish monitoring program collects samples on a monthly basis and a minimum dataset of thirty samples over three years (in this case, four years) is used. The monitoring design and the statistical analysis used to evaluate water quality attainment, therefore, implicitly include the effect of seasonality. Further, Maryland's water quality standard itself reflects the need to account for seasonal variation in assigning both a median (i.e., average condition) criterion and 90th percentile criterion (i.e., to account for fluctuations around the median).

The BST study conducted by Maryland in conjunction with these TMDLs has generated

¹ EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

additional information as to the seasonality of loadings by the types of nonpoint sources investigated in the study.

6) *The TMDLs include a Margin of Safety.*

The requirement for an MOS is intended to add a level of conservatism to the modeling process in order to account for uncertainty. Based on EPA guidance, the MOS can be achieved through two approaches. One approach is to reserve a portion of the loading capacity as a separate term, and the other approach is to incorporate the MOS as part of the design conditions. MDE has adopted an implicit MOS for these TMDLs. The decay rate is one of the most sensitive parameters in the tidal prism model. For a given system, the higher the decay rate, the higher the assimilative capacity. The value of the decay rate varies from 0.7 to 3.0 per day in salt water. A decay rate of 0.7 per day was used as a conservative estimate in the TMDL calculation; therefore, the MOS is implicitly included in this calculation.

7) *The TMDLs have been subject to public participation.*

MDE provided an opportunity for public review and comment on the fecal coliform TMDL for the Mill Creek Watershed. The public review and comment period was open from May 7, 2008 through June 5, 2008. MDE received no comments.

A letter was sent to the U.S. Fish and Wildlife Service pursuant to Section 7(c) of the Endangered Species Act, requesting the Service's concurrence with EPA's findings that approval of this TMDL does not adversely affect any listed endangered and threatened species, and their critical habitats.

V. Discussion of Reasonable Assurance

EPA requires that there be a reasonable assurance that the TMDLs can be implemented. Nonpoint source controls to achieve load allocations will be implemented in an iterative process that places priority on those sources having the largest impact on water quality, with consideration given to ease of implementation and cost. BMPs can be implemented through a number of existing programs and funding sources, including: Maryland's Agricultural Cost Share Program, Environmental Quality and Incentives Program, State Water Quality Revolving Loan Fund, and Stormwater Pollution Cost Share Program. Also, low interest loans are available through MDE to address failing septic systems. It is anticipated that the Bay Restoration Fund will provide funding to upgrade onsite sewage disposal system with priority given to failing systems and holding tanks in the Chesapeake and Atlantic Coastal Bays Critical Areas. Also, Maryland Marina Program includes provisions certain types of facilities require to have pumpout stations. Funds are available through the Maryland Department of Natural Resources to install a pumpout station.

Pursuant to the National Shellfish Sanitation Program, Maryland will continue to monitor shellfish waters and classify harvesting areas. In addition to water quality monitoring and shoreline surveys, MDE also conducted the BST study that was used to confirm the source estimates presented in the TMDL report.

Maryland and EPA acknowledge that while the TMDL does not promote changing natural background conditions due to wildlife, it is possible that implementation measures taken to reduce nonpoint controllable sources will also reduce wildlife loadings. In areas where wildlife is the dominant source of fecal coliform inputs to the shellfish waters, and where water quality standards cannot be attained following TMDL implementation for controllable sources, then MDE would consider conducting either a risk-based water quality assessment or a Use Attainability Analysis to recognize these natural conditions.