UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029
12/3/2009

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 Bacteria for the Patapsco River Lower North Branch Basin in Anne Arundel, Baltimore, Carroll, and Howard Counties, and Baltimore City, Maryland*. The TMDL report was submitted via the Maryland Department of the Environment's letter dated August 12, 2009, and was received by EPA for review and approval on August 12, 2009. 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 Patapsco River Lower North Branch Basin (MD02130906) was included on Maryland's Section 303(d) List as impaired by fecal bacteria (2008), nutrients (1996, revised in 2008 to phosphorus), sediments (1996), metals (1996), impacts to biological communities (2002, 2004, and 2006), and polychlorinated biphenyls (PCBs) (2008). Herbert Run, a tributary of the Patapsco River, was listed in 2006 as impaired by lead and copper. The listing for metals was addressed in 2002. The Herbert Run listings for lead and copper were addressed in 2008. This TMDL addresses the fecal bacteria impairment only.

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 bacteria TMDLs for the Patapsco River Lower North Branch Basin 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,

John Armstead for

Jon M. Capacasa, Director
Water Protection Division

Enclosure

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

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1650 Arch Street
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Decision Rationale
Total Maximum Daily Loads of
Fecal Bacteria for the Patapsco River
Lower North Branch Basin
Anne Arundel, Baltimore, Carroll, and Howard Counties, and Baltimore City, Maryland

John Armstead for

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Jon M. Capacasa, Director
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Date: 12/3/2009

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Fecal Bacteria for the Patapsco River Lower North Branch Basin
Anne Arundel, Baltimore, Carroll, and Howard Counties, and
Baltimore City, 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 waterbody without exceeding water quality standards.

This document sets forth the U.S. Environmental Protection Agency's (EPA) rationale for approving the TMDL for fecal bacteria in the Patapsco River Lower North Branch Basin (Patapsco River LNB). The TMDL was established to address impairments of water quality, caused by fecal bacteria, as identified in Maryland's 2008 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 Bacteria for the Patapsco River Lower North Branch Basin in Anne Arundel, Baltimore, Carroll, and Howard Counties, and Baltimore City, Maryland*, dated August 2009, to EPA for final review on August 12, 2009. The TMDL in this report addresses the fecal bacteria impairment in the Patapsco River LNB Watershed as identified on Maryland's Section 303(d) List. The basin identification for the Patapsco River LNB Watershed is MD02130906.

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 bacteria loading to the Patapsco River LNB Watershed. There are eight permitted point sources of fecal bacteria which are included in the WLA. The fact that the TMDL does not assign WLAs to any other sources in the watershed should not be construed as a determination by either EPA or MDE that there are no additional sources in the watershed that are subject to the National Pollutant Discharge Elimination System (NPDES) program. In addition, the fact that EPA is approving this TMDL does not mean that EPA has determined whether some of the sources discussed in the TMDL, under appropriate conditions, might be subject to the NPDES program. The annual average TMDLs and Maximum Daily Load for fecal bacteria are presented in Tables 1 and 2, respectively. Individual annual and daily WLAs for permitted point sources are provided in Table 3. The TMDLs include an upstream load from the South Branch Patapsco River watershed. Individual annual and daily WLAs for permitted point sources are provided in Table 3.

Table 1. Patapsco River Lower North Branch Annual Average TMDL

Patapsco River Lower North Branch Fecal Bacteria TMDL (Billion MPN *E. coli*/year)										
TMDL	**=**	**LA**			**+**	**WLA**			**+**	**MOS**
		LA_{SB}[1]	+	LA_{LNB}		Stormwater WLA_{LNB}	+	WWTP WLA_{LNB}		Incorporated
		813,612	+	783,318		388,160	+	2,481		
1,987,571	=	1,596,930			+	390,641			+	

[1] This upstream load allocation is generated outside the assessment unit (South Branch Patapsco River) and it could include point and nonpoint sources.

Table 2. Patapsco River Lower North Branch Maximum Daily Load

Patapsco River Lower North Branch Fecal Bacteria TMDL (Billion MPN *E. coli*/day)										
TMDL	**=**	**LA**			**+**	**WLA**			**+**	**MOS**
		LA_{SB}[1]	+	LA_{LNB}		Stormwater WLA_{LNB}	+	WWTP WLA_{LNB}		Incorporated
		86,817	+	51,384		25,315		21		
163,537	=	138,201			+	25,336			+	

[1] This upstream load allocation is generated outside the assessment unit (South Branch Patapsco River) and it could include point and nonpoint sources.

Table 3. Wasteload Allocations for Permitted Point Sources in the Patapsco River Lower North Branch

Facility	NPDES ID Number	TMDL Long Term Annual Average Load (Billion MPN *E. coli*/year)	Maximum Daily Load (Billion MPN *E. coli*/day)
Woodstock Job Corps WWTP	MD0023906	87	0.7
Holiday Mobile Estates WWTP	MD0053082	218	1.9
Deep Run WWTP*	MD0056618	2,176	18.5
NPDES Stormwater Permits	N/A	388,160	25,315
Carroll County	MD0068331		
Howard County	MD0068322		
Anne Arundel County	MD0068306		
Baltimore County	MD0068314		
Baltimore City	MD0068292		

*Deep Run WWTP has not been discharging but is included in the analysis because it maintains a discharge permit.

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 accounts for uncertainty with the inclusion of a MOS value. The option is always available to refine the TMDL for resubmittal 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

The Patapsco River LNB Watershed is located in Anne Arundel, Baltimore, Carroll, and Howard Counties, and Baltimore City in Maryland. The total drainage area of the Patapsco River LNB is 118.4 square miles with an additional 85.8 square miles draining from the upstream Maryland 8-digit South Branch Patapsco River watershed.

The Patapsco River LNB watershed can be characterized primarily as urban (40.1%) and forest (35.3%). The total population in the Patapsco River LNB watershed is estimated to be 206,330 people. The human population and the number of households were estimated based on a weighted average from the Census block groups and the 2007 Maryland Department of Planning Property View. Section 2.0 of MDE's TMDL Report provides additional information about the Patapsco River LNB watershed, including land use and population.

The Patapsco River LNB Watershed (MD02130906) was included on Maryland's Section 303(d) List as impaired by fecal bacteria (2008), nutrients (1996, revised in 2008 to phosphorus), sediments (1996), metals (1996), impacts to biological communities (2002, 2004, and 2006), and polychlorinated biphenyls (PCBs) (2008). Herbert Run, a tributary of the Patapsco River, was listed in 2006 as impaired by lead and copper. The listing for metals was addressed in 2002. The Herbert Run listings for lead and copper were addressed in 2008. This TMDL addresses the fecal bacteria impairment only.

The Surface Water Use Designations for the Maryland 8-digit Patapsco River LNB watershed have been designated as Use I: *Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life*. See Code of Maryland Regulations (COMAR 26.08.02.07F(5). Brice Run, also a tributary of the Patapsco River, and its tributaries have been designated as Use III: *Nontidal Cold Water*. See COMAR 26.08.02.08K(3)(a).

The Patapsco River LNB watershed was listed on Maryland's §303(d) List as impaired by fecal bacteria in 2008 due to elevated fecal coliform concentrations detected as high as 46,100 MPN/100 ml.

CWA Section 303(d) and its implementing regulations require 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 bacteria TMDL submitted by MDE is designed to allow for the attainment of the Patapsco River LNB watershed's designated uses, and to ensure that there will be no fecal bacteria impacts affecting the attainment of these uses. Refer to Tables 1 and 2 above for a summary of allowable loads.

For this TMDL analysis, the Patapsco River LNB watershed has been divided into five subwatersheds. The pollutant loads established in the TMDL are for these five subwatersheds. To establish baseline and allowable pollutant loads for this TMDL, a flow duration curve approach was employed, using bacteria monitoring data from MDE and flow strata estimated from United States Geological Survey (USGS) daily flow monitoring data. The sources of fecal bacteria were estimated at five representative stations in the Patapsco River LNB watershed where samples were collected for one year. Multiple antibiotic resistance analysis source tracking was used to determine the relative proportion of domestic (pets and human associated animals), human (human waste), livestock (agriculture-related animals), and wildlife (mammals and waterfowl) source categories. Appendix C of the TMDL report includes the Bacteria Source Tracking Report titled *Identifying Sources of Fecal Pollution in Shellfish and Nontidal Waters in Maryland Watersheds*, prepared by the Salisbury University, Department of Biological Sciences and Environmental Health Services.

The allowable load was determined by first estimating a baseline load from current monitoring data. The baseline load was estimated using a long-term geometric mean and weighting factors from the flow duration curve. The TMDL for fecal bacteria was established after considering two different hydrological conditions: an average annual condition and an average seasonal dry weather condition (the period between May 1 and September 30, when water contact recreation is more prevalent). The allowable load was reported in units of Most Probable Number (MPN)/year and represents a long-term load estimated over a variety of hydrological conditions.

Two scenarios were developed, with the first assessing if attainment of current water quality standards could be achieved by applying maximum practicable reductions (MPRs), and the second applying higher reductions than MPRs. Scenario solutions were based on an optimization method where the objective was to minimize the overall risk to human health, assuming that the risk varies over the four bacteria source categories. In one of the five subwatersheds, it was estimated that water quality standards could not be attained with MPRs,

therefore, higher maximum reductions were applied.

The fecal bacteria long-term annual average TMDL for the Patapsco River LNB watershed, including the South Branch upstream load allocation (LA_{SB}) is 1,987,571 billion MPN *E. coli*/year. The TMDL for the Patapsco River LNB Maryland 8-digit is 1,173,959 billion MNP *E. coli*/year, and represents a reduction of 18 percent from the baseline load of 1,432,093 billion MPN *E. coli*/year. TMDLs for the Maryland 8-digit Patapsco LNB are distributed between a LA (LA_{LNB} = 783,318 billion MPN *E. coli*/year) for nonpoint sources, and WLA (WLA_{LNB} = 390,641 billion MPN *E. coli*/year) for point sources. Point sources include wastewater treatment plants (WWTPs) and NPDES regulated stormwater discharges, including county and municipal separate storm sewer systems (MS4s). The TMDL wasteload allocations in Maryland are distributed as follows: Stormwater WLA_{LNB} (388,160 billion MPN *E. coli*/year), and the $WWTP_{LNB}$ (2,481 billion MPN *E. coli*/year).

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 bacteria TMDL for the Patapsco River LNB watershed. EPA, therefore, approves this fecal bacteria TMDL for the Patapsco River LNB 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 indicator organism used in the Patapsco River LNB watershed TMDL analysis was *E. coli* and the state water quality standard used in this study was 126 MPN/100 ml (COMAR 26.08.02.03-3 Water Quality Criteria Specific to Designated Uses; Table 1). EPA believes this is a reasonable and appropriate water quality goal. The Surface Water Use Designations for the Maryland 8-digit Patapsco River LNB watershed have been designated as Use I: *Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life*. See Code of Maryland Regulations (COMAR 26.08.02.07F(5)). Brice Run (also a tributary of the Patapsco River) and its tributaries have been designated as Use III: *Nontidal Cold Water*. See COMAR 26.08.02.08K(3)(a).

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

Total Allowable Load

As described above, the allowable load was determined by first estimating a baseline load from current monitoring data. The baseline load was estimated using a long-term geometric mean and weighting factors from the flow duration curve. To establish baseline and allowable pollutant loads for this TMDL, a flow duration curve approach was employed, using bacteria monitoring data from MDE and flow strata estimated from USGS daily flow monitoring data. The allowable load was reported in units of MPN/year and represents a long-term load estimated

over a variety of hydrological conditions. This load is considered the maximum allowable load the watershed can assimilate and still attain water quality standards. The fecal bacteria TMDL was developed for the Patapsco River LNB watershed based on this endpoint. The allowable load was reported in units of MPN/year for the average annual load and in MPN/day for the long term daily load. Expressing TMDLs using these units is consistent with Federal regulations at 40 CFR §130.2(i), which states that *TMDLs can be expressed in terms of either mass per time, or other appropriate measure*. The average annual and long term daily fecal bacteria TMDLs are presented in Tables 1 and 2, respectively.

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 bacteria for the Patapsco River LNB 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

As indicated in the TMDL report, there are eight permitted point sources of fecal bacteria with NPDES permits regulating the discharge of fecal bacteria in the Patapsco River LNB watershed which are included in the WLA. These point sources include three WWTP NPDES permitted facilities (one is not discharging). See Table 3 above for the WLAs for these facilities. Also, there are five NPDES Phase I stormwater permits identified throughout the Maryland 8-digit Patapsco River LNB watershed. The NPDES regulated stormwater loads within the Maryland 8-digit Patapsco LNB watershed will be expressed as a single NPDES stormwater WLA. The total NPDES stormwater WLA_{LNB} is 388,160 billion MPN *E. coli*/year.

Load Allocations

The TMDL summary in Table 1 contains the LA for the Patapsco River LNB Watershed. 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 source assessment in order to estimate the contributions from domestic animals (pets and human associated animals), human (human waste), livestock (agriculture-related animals), and wildlife (mammals and waterfowl) to the overall nonpoint source loadings. Table 4.7.1, of the TMDL Report, provides a breakdown of the existing average annual fecal bacteria from these four source categories. A similar breakdown was developed for the allocations, which are shown in Table 4.8.2 of the TMDL Report. In this analysis, the upstream load (LA_{SB}) was reported as a single value, but it could include point and nonpoint sources. For the LA_{LNB}, all four bacteria sources could potentially contribute to nonpoint source loads. For human sources, the nonpoint source contribution is estimated by subtracting any WWTP loads from the TMDL human load, and is then assigned to the LA_{LNB}. The livestock loads are all assigned to the LA_{LNB}. Since the entire Patapsco River LNB watershed is covered by NPDES MS4 permits, bacteria loads from domestic animal sources and animal sources are distributed between the stormwater WLA_{LNB} and LA_{LNB}.

Federal regulations at 40 CFR §122.44(d)(1)(vii)(B) require that, for an NPDES permit for an individual point source, the effluent limitations must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the State and approved by EPA. There is no express or implied statutory requirement that effluent limitations in NPDES permits necessarily be expressed in daily terms. The CWA definition of "effluent limitation" is quite broad (effluent limitation is "any restriction…on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources…)." See CWA Section 502(11). Unlike the CWA's definition of TMDL, the CWA definition of "effluent limitation" does not contain a "daily" temporal restriction. NPDES permit regulations do not require that effluent limits in permits be expressed as maximum daily limits or even as numeric limitations in all circumstances, and such discretion exists regardless of the time increment chosen to express the TMDL. For further guidance, refer to Benjamin H. Grumbles memo (November 15, 2006) titled *Establishing TMDL Daily Loads in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in Friends of the Earth, Inc. v. EPA, et al., No. 05-5015 (April 25, 2006) and implications for NPDES Permits*. EPA has authority to object to the issuance of an NPDES permit that is inconsistent with WLAs established for that point source. To ensure consistency with this TMDL, if an NPDES permit is issued for a point source that discharges one or more of the pollutants of concern in the Patapsco River LNB watershed, any deviation from the WLAs set forth in the TMDL Report and described herein for a point source, must be documented in the permit Fact Sheet and made available for public review along with the proposed draft permit and the Notice of Tentative Decision. The documentation should: (1) demonstrate that the loading change is consistent with the goals of the TMDL and will implement the applicable water quality standards; (2) demonstrate that the changes embrace the assumptions and methodology of the TMDL; and (3) describe that portion of the total allowable loading determined in the State's approved TMDL Report that remains for any other point sources (and future growth where included in the original TMDL) not yet issued a permit under the TMDL. It is also expected that Maryland will provide this Fact Sheet for review and comment to each point source included in the TMDL analysis, as well as, any local and State agency with jurisdiction over land uses for which LA changes may be impacted. It is also expected that MDE will require periodic monitoring of the point source(s) for fecal coliform, through the NPDES permit process, in order to monitor and determine compliance with the TMDL's WLAs.

In addition, EPA regulations and program guidance provides for effluent trading. Federal regulations at 40 CFR §130.2(i) state: "if Best Management Practices or other nonpoint source pollution controls make more stringent LAs practicable, then WLAs may be made less stringent. Thus, the TMDL process provides for nonpoint source control tradeoffs." The State may trade between point sources and nonpoint sources identified in the TMDL as long as three general conditions are met: (1) the total allowable load to the waterbody is not exceeded; (2) the trading of loads from one source to another continues to properly implement the applicable water quality standards and embraces the assumptions and methodology of the TMDL; and (3) the trading results in enforceable controls for each source.

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 bacterial 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 standards[1]. 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. For this TMDL, the critical condition was determined by assessing annual and average seasonal dry weather conditions. The critical condition requirement is met by determining the maximum reduction per bacteria source that satisfies all hydrological conditions and meets the water quality standard, thereby minimizing the risk to water contact recreation.

5) The TMDLs consider seasonal environmental variations.

Seasonality was determined using various hydrological conditions and it was assessed as the time period when water contact recreation was expected, specifically May 1 through September 30.

6) The TMDLs include a Margin of Safety.

The requirement for a 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 adopted an explicit MOS for this TMDL. The MOS was determined by estimating the loading capacity of the stream based on a reduced (more stringent) water quality criterion concentration. The *E. coli* water quality criterion concentration was reduced by five percent, from 126 *E. coli* MPN/100 ml to 119.7 *E. coli* MPN/100 ml.

7) The TMDLs have been subject to public participation.

[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.

MDE provided an opportunity for public review and comment on the fecal bacteria TMDL for the Patapsco River LNB watershed. The public review and comment period was open from June 22, 2009 through July 21, 2009. 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. WLAs will be implemented through the NPDES permit process. According to 40 CFR §122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the State and approved by EPA. Furthermore, EPA has the authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

MDE proposed a staged approach to implementation beginning with the MPR scenario, with regularly scheduled follow-up monitoring to assess the effectiveness of the implementation plan. MDE intends for the required reductions to be implemented in an iterative process that first addresses those sources with the largest impact on water quality and human health risk, with consideration given to ease of implementation and cost.