



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

APR 01 2002

Ms. Denise Ferguson Southard
Assistant Secretary
Maryland Department of the Environment
2500 Broening Highway
Baltimore, Maryland 21224

Dear Ms. Southard:

The U.S. Environmental Protection Agency (EPA), Region III, is pleased to approve the Sassafras River Total Maximum Daily Load (TMDL), submitted to EPA by the Maryland Department of Environment (MDE) by letter dated December 20, 2001 and received on January 8, 2002. A revised TMDL was received on February 11, 2002. The TMDL was established and submitted in accordance with Sections 303(d)(1)(c) and (2) of the Clean Water Act. The TMDL was established to address an impairment of water quality as identified in Maryland's 1998 Section 303(d) list. Maryland identifies the impairment for this water quality-limited waterbody based on low dissolved oxygen levels and nuisance levels of algae. The Sassafras River is located in the counties of Cecil and Kent.

In accordance with Federal regulations found at 40 CFR §130.7, a TMDL must: 1) be designed to meet water quality standards; 2) include, as appropriate, both wasteload allocations (WLAs) from point sources and load allocations from non-point 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 any uncertainties in the relationship between pollutant loads and in-stream water quality; 7) have a reasonable assurance that the TMDL can be met; and 8) be subject to public participation. The enclosure to this letter describes how the Sassafras River TMDL and supporting documentation satisfies each of these requirements. The supporting documentation provided with the TMDL report, specifically, the Technical Memorandum provides one allocation scenario with nonpoint source load allocations and WLAs for point sources. EPA relied upon this information in reviewing and approving the TMDL submittal and in preparing EPA's Decision Rationale. EPA expects for future TMDLs that the Technical Memorandum will be included in any public notice of the TMDLs.

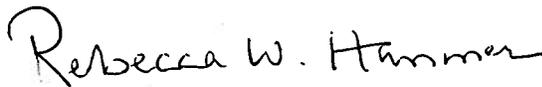
Following the approval of this TMDL, MDE shall incorporate it into the state's Water Quality Management Plan pursuant to 40 CFR §130.7(d)(2). Also, any new or revised National Pollutant Discharge Elimination System (NPDES) permits with applicable effluent limits must be consistent with the TMDL's WLA pursuant to 40 CFR §122.44(d)(1)(vii)(B)(2). If an NPDES permit is issued with an effluent limitation that does not reflect WLA contained in the



approved TMDL and Technical Memorandum, it is expected that Maryland will document this change in the permit Fact Sheet, as discussed in EPA's Decision Rationale.

If you have any questions or concerns, please call me or have your staff contact Mr. Thomas Henry, the TMDL Program Manager, at (215) 814-5752.

Sincerely,

A handwritten signature in black ink that reads "Rebecca W. Hanmer". The signature is written in a cursive style with a large initial 'R'.

Rebecca W. Hanmer, Director
Water Protection Division

Enclosure

cc: Jim George, MDE
Robin Grove, MDE

Decision Rationale

Total Maximum Daily Load for Phosphorus for the Sassafras River, Cecil and Kent Counties, Maryland

4/1/2002

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies 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, that may be discharged to a water quality-limited water body.

This document sets forth the United States Environmental Protection Agency's (EPA) rationale for approving the TMDL for phosphorus in the Sassafras River watershed. The Sassafras River was listed on Maryland's 1996 Section 303(d) list for being impaired by nutrients, due to signs of eutrophication and suspended sediments. The Maryland Department of the Environment (MDE) submitted the *Total Maximum Daily Loads of Phosphorus for the Sassafras River, Cecil and Kent Counties, Maryland*, dated December 2001; EPA received the document for final review on January 08, 2002. A revised draft was submitted on February 11, 2002. The TMDL addresses one segment, the Sassafras River, on Maryland's Section 303(d) list. This TMDL does not address the suspended sediment problem, a separate TMDL will be submitted at a later date addressing the suspended sediment impairment.

EPA's rationale is based on the TMDL Report, information contained in the Appendix to the report, and the Technical Memorandum. EPA's review determined that the TMDL meets the following eight regulatory requirements pursuant to 40 CFR Part 130.

- 1) The TMDLs are designed to implement applicable water quality standards.
- 2) The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.
- 3) The TMDLs consider the impacts of background pollutant contributions.
- 4) The TMDLs consider critical environmental conditions.
- 5) The TMDLs consider seasonal environmental variations.
- 6) The TMDLs include a margin of safety.
- 7) There is reasonable assurance that the TMDLs can be met.
- 8) The TMDLs have been subject to public participation.

The Technical Memorandum, *Significant Phosphorus Point Sources in the Sassafras River Watershed* submitted by the MDE, specifically allocates phosphorus waste loads to the two point sources within the watershed. A load allocation was established for all of the land based (nonpoint) sources. Current nonpoint source load estimates were based on existing in-stream data which includes natural background sources, loads from septic tanks, loads from lands based sources, as well as baseflow contributions. The load allocation is broken down into an annual

and seasonal load. There are two point sources in this watershed. Table 1 summarizes the TMDL for the Sassafras River as determined by MDE.

Table 1 - Phosphorus and Sediment TMDLs Summary

Parameter	Rate	TMDL	WLA ²	LA ³	MOS ⁴
Phosphorus (average annual flow)	lbs/yr	13,875	6,824	6,839	212
	lbs/day ¹	38.0	18.7	18.7	0.6
Phosphorous (low flow)	lbs/month	747	569	169	9
	lbs/day ¹	24.9	19.0	5.6	0.3

¹ The TMDL rate of pounds per day is derived by dividing the average annual flow and low flow loadings by 365 and 30 days respectively.

² WLA = Waste Load Allocation

³ LA = Load Allocation

⁴ MOS = Margin of Safety

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 which considers current and foreseeable conditions, the best available data and accounts for uncertainty with the inclusion of a “margin of safety” value. Conditions, available data, and the understanding of natural processes can change more than what was anticipated by the margin of safety. If the above occurs, the state holds the option to refine the TMDL for re-submittal to EPA for approval.

II. Summary

The impaired segment of the Sassafras River is located within Kent and Cecil counties. The Sassafras River is approximately 21 miles in length and drains directly into the Chesapeake Bay. A majority of the stream is tidally influenced. The tidal cycle limits flushing in the upper reaches of the watershed, and therefore, causes an increase in sediment deposition and a decrease in the volume capacity of the upper watershed. This process is partially responsible for the elevated chlorophyll “a”, concentrations observed in these segments. At its mouth, the Sassafras River is approximately 6,500 feet wide. The watershed area is approximately 62,000 acres in size. Mixed agriculture, forest and herbaceous cover, developed lands, and water are the major land uses of the watershed; making up 51, 19, 16, and 14 percent of the watershed respectively.

The topography of the watershed has mild to minimal slopes with well drained soils. As mentioned earlier, the watershed is dominated by agriculture with riparian buffers along the stream banks. Much of the agriculture in the area already uses best management practices (BMPs) to minimize the impacts of land based sources to the stream.

The Sassafras River was identified as having low dissolved oxygen (DO) levels and nuisance levels of algae, and was therefore, included on Maryland’s 1996 and 1998 Section

303(d) lists of water quality limited segments (WQLS). There are twenty water quality monitoring stations located within the watershed, on the tributaries and main stem. The TMDL focused on samples taken from April, May, July, August, and September 1999. The summer season (July thru September) was seen as the more critical period since environmental conditions (high temperatures, low flow, and increased sunlight) are conducive to eutrophication. Eutrophication is the process of accelerated aging of a surface water body; caused by the excessive loading of nutrients and sediment. Samples were analyzed for ammonium, nitrate + nitrite, nitrite, total dissolved nitrogen, particulate nitrogen, ortho-phosphate, total dissolved phosphorous, particulate phosphorous, dissolved organic carbon, particulate carbon, silicate, chlorophyll a, and biological oxygen demand. Physical measurements of depth, water temperature, pH, conductivity, and DO were recorded in the field.

The water quality impairment of the Sassafras River consists of violations of the applicable numeric water quality criteria for DO and violations of the general narrative criteria applicable to the water. The Sassafras River is designated a Use I water, *Water Contact Recreation and Protection of Aquatic Life*. Under the Code of Maryland Regulations (COMAR), this designation states that “all waters of this State shall be protected for the basic uses of water contact recreation, fish, other aquatic life, wildlife and water supply.” The pollutants causing the water quality criteria violations in the Sassafras River are nutrients and sediment (sediment is not being addressed by this TMDL). Although there were no observed violations of the DO criteria, it is believed that late evening and early morning DO concentrations may be violating the standard. MDE uses the elevated chlorophyll a data and observed DO concentrations just above the criterion to support this position. In the evening hours when photosynthesis no longer occurs, the same photosynthetic organisms that produced oxygen now must consume it (oxygen) for respiration if there is a high enough concentration of these organisms (identified via chlorophyll a), the DO concentration may sag to levels below the standard. The river therefore suffers from excessive eutrophication that interferes with its designated use.

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 TMDLs submitted by MDE are designed to attain an acceptable loading of phosphorus for the River. See Table 1 for a summary of the allowable loads.

III. Discussion of Regulatory Conditions

EPA finds that MDE has provided sufficient information to meet all of the eight basic requirements for establishing a phosphorus TMDL for the Sassafras River. EPA therefore approves the TMDLs for phosphorus for the Sassafras River. This approval is outlined below according to the eight 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. Maryland does not currently have numeric water quality criteria for nutrients (nitrogen or phosphorus) or sediments. Maryland has a numerical criterion for DO. According to the criterion, DO concentrations may not be less than 5.0 milligrams per liter (mg/L) unless resulting from naturally occurring conditions. Although, there were no observed violations of the DO criteria, it is believed that late evening and early morning DO concentrations may be violating the standard (rationale provided above). Also, a narrative criterion states that excessive sedimentation shall not interfere with the Use I designation. The violation of both criteria (the numeric DO criteria and narrative Use I Designation) in the Sassafra River is an indication of a nutrient enrichment problem. The overall objective of this TMDL is to reduce the phosphorus load in order to achieve the numeric DO criteria for a Use I water and control nuisance algal blooms. A goal of this TMDL was to insure that chlorophyll a (a surrogate for nuisance algal blooms) concentrations are maintained at or below 50 ug/L. This level is based on the Use 1 designation, EPA guidance documents (EPA Technical Guidance for developing TMDLs, Book 2, Part 1 (1997)), and academic references.

The TMDL proposes that the violation of the water quality criterion for DO is caused by excessive growth of plants and algae. This excessive growth is linked to the trophic status of the river, which is controlled by phosphorus loading. Phosphorous and nitrogen concentrations were analyzed to determine which was the limiting nutrient. It was determined that phosphorous was the limiting nutrient, and therefore, reductions were applied towards its loading. Because phosphorus binds to sediment, the proposed reduction of phosphorus loadings may result in a reduction in the sediment load as well. A reduction in sediment was not quantified in the TMDL and will be addressed specifically in a future TMDL.

The model used to develop this TMDL was the Water Quality Analysis Simulation Program version 5.1 (WASP 5.1). This model provides a framework for modeling contaminant fate and transport. There is a eutrophication component for this model as well, it is appropriately called EUTRO 5.1, and incorporates solar radiation and the photoperiod, temperature, an extinction coefficient, salinity, sediment oxygen demand, sediment ammonia flux, and sediment phosphate flux. The model was designed to simulate a constant flow and average waterbody volume over the tidal cycle. Dispersion coefficients were used to account for tidal mixing. The waterbody was divided into 27 WASP model segments with conservative substances being exchanged between them. The TMDL looked into a low flow and average annual flow condition. As mentioned earlier, summer low flow conditions, with their high temperatures and sun exposure and low flows, create an environment which is favorable to eutrophication.

A regression analysis was used to estimate stream flow during the critical low flow periods. The regression was based on 30-years of flow data from three United States Geological Survey flow gages located near the Sassafra River. Nonpoint source (NPS)

loads were derived from observed data during both low flow and average flow conditions. Since the loads were obtained from observed data, they represent both human induced and natural loadings. Phosphorous and nitrogen were modeled in their speciated form. Therefore, phosphorous was modeled as ortho-phosphate (PO₄) and organic phosphorous. Ortho-phosphate represents the dissolved form of phosphorous and is more bio-available for algae. The system was run through four scenarios low flow and average flow under and maximum allowable loadings (TMDL) conditions.

Since phosphorus binds to sediments, reducing the phosphorus loads may result in lower sediment loads as well. MDE believes that these reductions will be sufficient to prevent violations of the state's narrative criteria.

- 2) *The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.*

Total Allowable Load

As mentioned above, the endpoint used is a maximum Chl-a of 50 ug/L, since a relationship exists between the level of Chl-a concentration, phosphorus loading, and DO concentrations.

MDE determined that the limiting nutrient is phosphorus. Therefore, a TMDL for nitrogen was not necessary. Separate TMDLs have been calculated for phosphorous under average annual flow and summer low flow conditions. The allocations are presented as yearly and monthly loads respectively. Expressing TMDLs as yearly loads 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 measure.

EPA regulations [40 CFR 130.2.(i)] state that the total allowable load shall be the sum of individual waste load allocations for point sources, load allocations for NPS, and natural background concentrations. The TMDL for phosphorus for the Sassafras River is consistent with 40 CFR 130.2 (i) because the total loads provided by MDE equal the sum of the individual wasteload allocations for point sources and the land-based load allocations for NPS set forth in the Technical Memorandum and TMDL report. Pursuant to 40 CFR 130.6 and 130.7(d)(2), these TMDLs, the Technical Memorandum and supporting documentation, should be incorporated into Maryland's current water quality management plan. See Table 1 for a summary of the allowable loads.

Waste Load Allocations

The watershed that drains to the Sassafras River contains two permitted surface water discharges. These facilities were assigned an individual waste load allocations in the Technical Memorandum submitted with the document. Table 2 documents these waste load allocations.

Federal regulations at 40 CFR 122.44(d)(1)(vii)(B), require that, for a National Pollutant Discharge Elimination System (NPDES) permit for an individual point source, the effluent limitations must be consistent with the assumptions and requirements of any available wasteload allocation for the discharge prepared by the state and approved by EPA. EPA has authority to object to the issuance of an NPDES permit that is inconsistent with wasteload allocations established for that point source. To ensure consistency with these TMDLs, as NPDES permits are issued for point sources that discharge the pollutants of concern to the Sassafra River, any deviation from the wasteload allocations set forth in the Technical Memorandum, TMDL report and described herein for the particular 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 these TMDLs and Technical Memorandum, and 3) describe that portion of the total allowable loading determined in the state's approved TMDL report that remains for 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 load allocation changes may be impacted.

Table 2 - Summary of Waste Load Allocations (WLAs)

Facility Name	Permit Number	Phosphorous Load (lbs/yr)	Flow (gpd)	Concentration (mg/l)
Batterton	MD0020575	4,876	200,000	8.0
Galena	MD0020605	1,948	80,000	8.0
Total	N/A	6,824	280,000	N/A

Load Allocations

Maryland provided adequate land use and loading data in the TMDL report, but did not distribute the total load allocation to specific land use categories in the TMDL report. Maryland included a gross load allocation for the TMDLs. These gross load allocations were presented in Table 1. NPS loading rates represent a cumulative impact from all sources, including naturally occurring and human-induced sources. The loading estimates for phosphorus are based on a total annual load calculated using monitoring data rather than a model.

According to Federal regulations at 40 CFR 130.2(g), load allocations 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 NPS loads should be distinguished. Since MDE used observed data, they were not able to differentiate between sources of phosphorous.

As noted above, Maryland did not provide a breakdown of the load allocation in the TMDL report. The TMDL is based on phosphorus NPS loading from the entire watershed.

Table 3 - Summary of Load Allocations for Phosphorus (average flow)

Source Category	Current Source Load (lbs/year)	TMDL Source Load (lbs/year)	% Reduction
Nonpoint Sources	13,494	6,839	49
Point Sources	6,824	6,824	0

Table 4 - Summary of Load Allocations for Phosphorous (low flow)

Source Category	Current Source Load (lbs/month)	TMDL Source Load (lbs/month)	% Reduction
Nonpoint Sources		169	
Point Sources	569	569	0

Allocations Scenarios

EPA realizes that the above breakouts of the total loads for phosphorus to the point sources and NPS represents one allocation scenario. As implementation of the established TMDL proceeds, Maryland may find that other combinations of point and NPS allocations are more feasible and/or cost effective. However, any subsequent changes in the TMDL must conform to the gross waste load and load allocations and must ensure that the biological, chemical, and physical integrity of the waterbody is preserved.

EPA regulations and program guidance provides for effluent trading. Federal regulations at 40 CFR 130.2 (I) state: “If Best Management Practices (BMPs) or other nonpoint source pollution controls make more stringent load allocations practicable, then wasteload allocations may be made less stringent. Thus, the TMDL process provides for nonpoint source control tradeoffs.” The state may trade between point sources and NPS identified in this 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 these TMDLs and Technical Memorandum, and 3) the trading results in enforceable controls for each source. Final control plans and loads should be identified in publicly available planning document, such as the state’s water quality

management plan (see 40 CFR 130.6 and 130.7(d)(2)). These final plans must be consistent with the goals of the approved TMDLs.

Based on the foregoing, EPA has determined that the TMDL and the Technical Memorandum are consistent with the regulations and requirements of 40 CFR Section 130. Pursuant to 40 CFR 130.6 and 130.7(d)(2), the TMDL and the supporting documentation, including the Technical Memorandum, should be incorporated into Maryland's current water quality management plan.

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

Background pollutant contributions were included in the observed stream data that were used for the model.

4) *The TMDLs consider critical environmental conditions.*

EPA regulations in 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. The TMDL addresses the critical values for Chl-a and DO, which are 50 ug/L and 5.0 mg/L, respectively. The TMDL specifically analyzed the effects of phosphorous under the most critical conditions, low flow, high temperature, and excessive sun light.

5) *The TMDLs consider seasonal environmental variations.*

Seasonal variations involve changes in streamflow as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flow normally occurs in early spring from a combination of snowmelt and spring rain, while seasonally low flow typically occurs during the warmer summer and early fall drought periods². The TMDLs appropriately consider seasonal variations by estimating loading rates for both average annual and low flow conditions.

¹EPA 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.

²U.S. USEPA. Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1, Section 2.3.3. USEPA 823-B-97-002. 1997

6) *The TMDL includes a margin of safety.*

The requirement for a margin of safety (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. The second approach, is to incorporate the MOS as part of the design conditions. MDE has adopted an explicit MOS for phosphorus in accordance with the first approach. The load allocated to the MOS is computed as five and three percent of the total allowable load for low flow and average flow conditions respectively.

MDE has also incorporated conservative assumptions that effectively constitute an additional, implicit MOS. Peak chlorophyll a concentrations for a river system is between 50 and 100 ug/L. MDE chose to use 50 ug/L as its goal. In calculating minimum DO concentrations in the fourth scenario, MDE's model used average flow loadings with temperature and solar radiation values associated with summer low flows.

7) *There is reasonable assurance that the TMDLs can be met.*

EPA requires that there be a reasonable assurance that the TMDLs can be implemented. Wasteload allocations 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 wasteload allocation for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with wasteload allocations established for that point source.

NPS controls to achieve load allocations can be implemented through a number of existing programs, including EPA's Clean Water Action Plan and Maryland's Water Quality Improvement Act of 1998, and the state's Chesapeake Bay Agreement's Tributaries Strategies for Nutrient Reduction.

NPS nutrient reductions will depend heavily on implementation of agricultural BMP. The TMDL document lists the following as BMPs: a Soil Conservation and Water Quality Plan, treatment of highly erodible land, conservation tillage, and Nutrient Management Plans. The sediment TMDL will also rely on a number of BMPs, both structural and nonstructural, can be implemented to significantly reduce sediment loads.

In addition, there will be follow-up monitoring within five years as part of Maryland's Watershed Cycling Strategy. This follow-up monitoring will allow Maryland and EPA to determine whether these TMDLs have been implemented successfully.

8) *The TMDL has been subject to public participation.*

MDE provided an opportunity for public review of and comment on the phosphorus and sediment TMDLs for the SassafRAS River. The public review and comment period extended from November 15, 2001 to December 14, 2001. There were no comments received on this TMDL.

On October 4, 2001, EPA initiated informal consultation with the U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS) pursuant to Section 7(c) of the Endangered Species Act, regarding certain Federal agency actions by EPA Region III regarding Maryland TMDLs. The Region forwarded a Biological Evaluation to the Services on February 8, 2002, regarding our proposed action on Maryland TMDLs. On February 27, 2002, EPA received concurrence from the U.S. Fish and Wildlife Services and on March 1, 2002 EPA received concurrence from the National Marine Fisheries Service that our action is not likely to adversely affect endangered species and their critical habitat.