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

January 29, 2001

Mr. Robert Hoyt
Assistant Secretary
Maryland Department of the Environment
2500 Broening Highway
Baltimore, Maryland 21224

Dear Mr. Hoyt:

The Environmental Protection Agency (EPA) Region III, has reviewed the report "Total Maximum Daily Loads (TMDLs) of Nitrogen and Phosphorus for the Bohemia River, Cecil County, Maryland" which was submitted by the Maryland Department of Environment (MDE) for final agency review on December 14, 2000. Pursuant to 40 CFR Section 130.7(d), EPA is approving the Bohemia River TMDLs.

The definition of Load Allocation (LA) at 40 CFR Section 130.2(g) states, in part, that "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." Further, a wasteload allocation (WLA), according to 40 CFR Section 130.2(h), is "The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution." In addition, a TMDL is defined at 40 CFR Section 130.2(i) as "The sum of the individual WLAs for point sources and LAs for nonpoint sources and natural background."

The supporting documentation provided with the TMDL report, specifically, the Technical Memorandum provides one allocation scenario with individual point and nonpoint source allocation. 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.

EPA has determined that the TMDL and technical report are consistent with the regulation and requirements of 40 CFR Section 130 (see enclosed Decision Rationale). Pursuant to 40 CFR Sections 130.6 and 130.7(d)(2), the TMDLs and the supporting documentation, including the Technical Memorandum, should be incorporated into Maryland's current water quality management plan.

EPA has authority to object to issuance of a National Pollutant Discharge Elimination System (NPDES) permit that is inconsistent with WLAs established for that point source. If an NPDES permit is issued with an effluent limitation that does not reflect the WLA contained in the approved TMDLS 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 contact me at (215) 814-1111 or contact Thomas Henry at (215) 814-5752.

Sincerely,

/s/

Rebecca W. Hanmer, Director
Water Protection Division

Enclosure

Decision Rationale

Total Maximum Daily Load of Nitrogen and Phosphorus for Bohemia River Cecil County, Maryland

I. Introduction

This document will set forth the Environmental Protection Agency's (EPA) rationale for approving the Total Maximum Daily Loads (TMDLs) of Nitrogen and Phosphorus to the Bohemia River submitted for final Agency review on December 14, 2000. The EPA's rationale is based on the TMDL document, Technical Memorandum, and other information provided to determine if the TMDL meets the following 8 regulatory conditions pursuant to 40 CFR §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) The TMDLs have been subject to public participation.
8) There is reasonable assurance that the TMDLs can be met.

The Technical Memorandum, *Significant Nutrient Point Sources in the Bohemia River Watershed*, submitted by the Maryland Department of the Environment (MDE), specifically allocates nitrogen and phosphorus loads to one minor point source, the Cecilton Waste Water Treatment Plant (WWTP) (NPDES permit # MD0020443). The current nitrogen and phosphorus loads were based on Cecilton's approved water and sewerage plan's discharge flow.

Issues arose concerning the nature of algae production in the Bohemia River during cold weather conditions, when stream flows are higher. MDE has decided to consider average annual TMDLs at a later date. MDE identified low-flow as the critical condition based on current data. Since the submitted TMDLs address critical conditions, EPA accepts this decision. As only a low-flow scenario was included in the TMDLs, specific nonpoint source allocations to different land uses could not be provided by MDE. Table 1 presents a summary of the TMDL as determined by MDE for critical low-flow conditions only.

Table 1, Summary of Nitrogen and Phosphorus TMDLs[1]

Flow Regime (Period)	Parameter	TMDL	WLA[2]	LA[3]	MOS[4]
Low-flow (May 1 - Oct. 31)	Nitrogen (lbs/month)	1,336	365	922	49
	Phosphorus (lbs/month)	139	102	35	2

[1] The load allocations for low-flow represent flows developed using a United States Geological Survey regression analysis and 1999 base-flow field data taken in the Bohemia River
[2] WLA = Waste Load Allocation
[3] LA = Load Allocation
[4] MOS = Margin of Safety

II. Summary

The Bohemia River's[1] modeling domain is approximately 10 miles in length, from its confluence with the Big Elk River to the headwaters upstream of the Maryland/Delaware state line. The Bohemia River is mainly located in Cecil County, Maryland with some small tributaries of the headwaters located in New Castle County, Delaware. It originates west of the Middletown Area and US Rte. 301 and finally drains to the Chesapeake Bay through the Big Elk River roughly four miles due south of Town Point. The Bohemia River is tidal throughout its navigable reach, which extends from the confluence with the Big Elk River to approximately 9 miles upstream to an area known as Bohemia Mills. The Bohemia River watershed has an area of approximately 35,544 acres or 55.5 square miles. The dominant land uses in the watershed are mixed agriculture (22,782 acres or 64%), forest (7,448 acres or 21%), water (3,194 acres or 9.0%), and urban (2,120 acres or 6.0%).[2]

In response to the requirements of Section 303(d) of the Clean Water Act (CWA), MDE listed the Bohemia River on the 1996 303(d) list of impaired waterbodies under Basin Segment 02130602 for nutirents due to signs of eutrophication in the form of excessive algal blooms. A eutrophic system typically contains an undesirable abundance of plant growth, particularly phytoplankton [photosynthetic microscopic organisms (algae)], periphyton (attached benthic algae), and macrophytes (large vascular rooted aquatic plants)[3]. These impairments interfere with the designated use[4] of Bohemia River by disrupting the aesthetics of the river and causing harm to inhabited aquatic communities. MDE listed nutrients, both nitrogen and phosphorus, from nonpoint and natural sources as the causes and sources of the impairments, respectively. Bohemia River was given low priority on the 1996 303(d) list.

Section 303(d) of the CWA and its implementing regulations require a TMDL to be developed for those waterbodies identified as impaired by the State where technology-based and other controls did not provide for attainment of water quality standards. The TMDLs submitted by Maryland are designed to address the excessive nutrient (nitrogen and phosphorus levels) enrichment currently occurring in the Bohemia River during low flow critical conditions. Acceptable levels of nitrogen and phosphorus will provide for the control of eutrophication and algae blooms (measured through a surrogate indicator known as chlorophyll-a). The TMDLs are designed to satisfy the water quality standards and designated use of the Bohemia River for nutrients during low flow critical conditions. Impairments in the remainder of the Elk River watershed are not addressed by this TMDL. In addition, impairments in the Bohemia River due to suspended sediments are not addressed by these TMDLs.

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[1] The Bohemia River watershed, part of the Upper Eastern Shore Tributary Strategy Basin, is located mainly in Cecil County, Maryland. It is contained within sub-basin 02-13-06 (Elk River Area).

[2] This information is based on the 1997 Maryland Office of Planning land cover data, 1997 Delaware Office of State Planning land cover data, and 1997 Farm Service Agency (FSA) information.

[3] Protocol for Developing Nutrient TMDLs. First Edition. November 1999. EPA 841-B-99-007.

[4] The designated use of Bohemia River is Use I (Water Contact Recreation and Protection of Aquatic Life) for all free-flowing tributaries. See Code of Maryland Regulations 26.08.02.

In order to address the impairments of Bohemia River from the 303(d) list, MDE believes it is necessary to control excessive nutrient input to the system. Phosphorus and nitrogen are factors which exert influence on not only the concentrations of DO in a waterbody but also biomass (typically characterized as algae or phytoplankton and measured as chlorophyll-a for modeling purposes). Figure 1 (taken from EPA 823-B-97-002, page 2-14) illustrates the interrelationship of major kinetic processes for BOD, DO, and nutrient analysis.

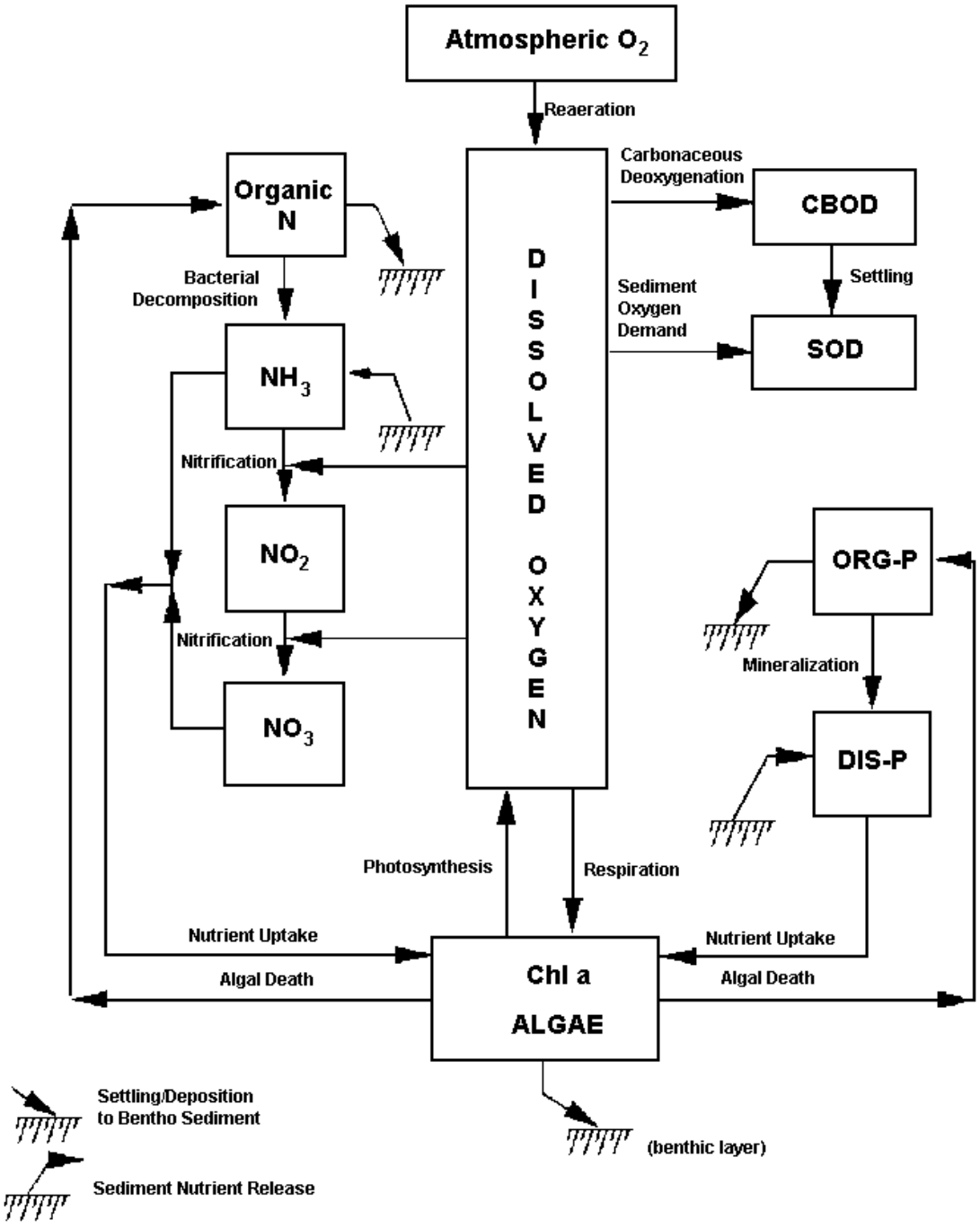

Figure 1

Nutrient enrichment and subsequent algal growth are a concern in rivers and streams because of their effect on DO concentrations. Growing plants provide a net addition of DO to the stream on an average daily basis, yet respiration can cause low DO levels at night that can affect the survival of less tolerant fish species. Also, if environmental conditions cause a die-off of either microscopic or macroscopic plants, the decay of biomass can cause severe oxygen depressions. Therefore, excessive plant growth can affect a streams ability to meet both average daily and instantaneous DO standards[5]. In addition, excessive nutrients lead to an overabundance of aquatic plant growth.

MDE uses WASP5[6] to evaluate the link between nutrient loadings, algal growth, and DO. This evaluation is based on representing current conditions within the Bohemia River system and determining the necessary reductions in nutrient loadings from various sources to achieve and maintain water quality standards. WASP5 is a general-purpose modeling system for assessing the fate and transport of conventional and toxic pollutants in surface waterbodies (Ambrose, 1987)[7]. The model can be applied in one, two, or three dimensions and includes 2 sub-models (EUTRO5 and TOXI5) to investigate water quality/eutrophication and toxics impairments. EUTRO5 can simulate the transport and transformation of eight state variables including DO, carbonaceous biochemical oxygen demand, phytoplankton carbon and chlorophyll-a, ammonia, nitrate, organic nitrogen, organic phosphorus, and orthophosphate. WASP5 has been previously applied in a number of regulatory and water quality management applications and is an appropriate linkage evaluation tool for the Bohemia River. Based on this analysis, MDE has determined that the levels of nutrient input to the Bohemia River specified by the TMDL will ensure that water quality standards are achieved by controlling algae blooms and maintaining the DO water quality criterion. MDE determined TMDLs for critical low-flow conditions only (see Table 1).

III. Discussion of Regulatory Conditions

EPA finds that Maryland has provided sufficient information to meet all of the 8 basic requirements for establishing nitrogen and phosphorus TMDLs for the Bohemia River. EPA therefore approves the TMDLs, Technical Memorandum, and supporting documentation for nitrogen and phosphorus in the Bohemia River. EPA's approval is outlined according to the following regulatory requirements:

1) The TMDL is designed to implement the applicable water quality standards.

MDE has indicated that algal blooms due to excessive nutrient input have caused violations of the water quality standards and designated uses applicable to the Bohemia River. As

[5] Technical guidance Manual for Developing Total Maximum Daily Loads, Book 2: Streams and Rivers, Part 1: Biochemical Oxygen Demand/Dissolved Oxygen and Nutrients/Eutrophication. Section 4.2.1.2. March 1997. EPA 823-B-097-002.

[6] Ambrose, R.B., T.A. Wool, and J.L. Martin. 1993. The water quality simulation program, WASP5 version 5.10. Part A: Model documentation. U.S. EPA, ORD, ERL, Athens, GA.

[7] Compendium of Tools for Watershed Assessment and TMDL Development. May 1997. EPA 841-B-97-006.

previously mentioned, the Bohemia River is designated as Use I. The DO water quality criterion to support this use indicates that DO concentrations may not be less than 5 mg/L at any time. While Maryland does not have numeric water quality criteria for nitrogen and phosphorus, Maryland interprets it's General Water Quality Criteria to provide numerical objectives for nitrogen and phosphorus which will support the DO water quality criterion as well as a surrogate indicator (chlorophyll-a)[8] to determine acceptable algae levels in the Bohemia River. Chlorophyll-a is desirable as an indicator because algae are either the direct (e.g. nuisance algal blooms) or indirect (e.g. high/low DO and pH and high turbidity) cause of most problems related to excessive nutrient enrichment[9]. The WASP5 model used by Maryland will help to determine those nutrient levels and compliance with the DO criterion and chlorophyll-a levels.

The presence of aquatic plants in a waterbody can have a profound effect on the DO resources and the variability of the DO throughout a day or from day to day[10]. This is due to the photosynthetic and respiration processes of aquatic plants which can cause large diurnal variations in DO that are harmful to fish. Photosynthesis is the process by which plants utilize solar energy to convert simple inorganic nutrients into more complex organic molecules[11]. Due to the need for solar energy, photosynthesis only occurs during daylight hours and is represented by the following simplified equation (proceeds from left to right):

$$\underset{(Carbon\ Dioxide)}{6CO_2} + \underset{(Water)}{6H_2O} \leftrightarrow \underset{(Sugar)}{C_6H_{12}O_6} + \underset{(Oxygen)}{6O_2}$$

In this reaction, photosynthesis is the conversion of carbon dioxide and water into sugar and oxygen such that there is a net gain of DO in the waterbody. Conversely, respiration and decomposition operate the process in reverse and convert sugar and oxygen into carbon dioxide and water resulting in a net loss of DO in the waterbody. Respiration and decomposition occur at all times and are not dependent on solar energy. Waterbodies exhibiting typical diurnal variations of DO experience the daily maximum in mid-afternoon during which photosynthesis is the dominant mechanism and the daily minimum in the predawn hours during which respiration and decomposition have the greatest effect on DO and photosynthesis is not occurring. In order to ensure that the DO concentration of 5 mg/L is met at all times, MDE calculates both the daily average DO concentrations and the minimum diurnal DO concentrations as a result of photosynthesis and respiration of phytoplankton using the WASP5 model.

In addition to the negative effects on DO, an overabundance of aquatic plant growth

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[8] Chlorophyll-a is typically used as a measure of algal biomass in natural waters because most algae have chlorophyll as the primary pigment for carbon fixation (EPA 823-B-97-002).

[9] Supra, footnote 3

[10] Principles of Surface Water Quality Modeling and Control. Robert V. Thomann., and J.A. Mueller. 1987. Page 283.

[11] Surface Water-Quality Modeling. Steven C. Chapra. 1997. Page 347.

adversely impacts the aesthetic and recreational uses of a waterbody by decreasing water clarity and forming unsightly floating algae blooms which also hinder navigation. MDE utilizes chlorophyll-a, a surrogate indicator for algal biomass[12], to evaluate the link between nutrient loadings and aquatic plant levels necessary to support the designated uses of Bohemia River. Using their General Water Quality Criteria, MDE establishes a numeric chlorophyll-a goal of 50 µg/L. This level is based on the goals/strategies recommended by the Algal Bloom Expert Panel to prevent the occurrence of algal blooms similar to those experienced in the Potomac Estuary in 1983[13]. Specifically, the panel believed that nuisance conditions from algal blooms occurred when chlorophyll-a concentrations exceeded 100 µg/l. Similar to the nutrient-DO evaluation, MDE uses the WASP5 model to determine acceptable levels of loadings of nutrients to achieve a chlorophyll-a concentration of 50 µg/l.

EPA finds that the TMDLs for nitrogen and phosphorus will ensure that the designated use and water quality criteria for the Bohemia River are met and maintained.

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

Total Allowable Loads

The critical season for excessive algal growth in the Bohemia River has been identified by Maryland as the summer months. During these months, flow in the channel is reduced resulting in slower moving, warmer water which has less dilution potential and is susceptible to algal blooms and low DO concentrations. In order to control the algal activity and its impacts on water quality, particularly with respect to DO levels, Maryland has established TMDLs for nitrogen and phosphorus that is applicable from May 1 through October 31. Maryland presented this as monthly loads to be consistent with the monthly concentration limits that are required by National Pollutant Discharge Elimination System (NPDES) permits. Expressing the TMDLs as monthly 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.

Maryland also recognized that nutrients may reach the river in significant amounts during higher flow periods. The available data and predictive modeling indicated no problems with chlorophyll-a levels or low DO concentrations during these times. Therefore, Maryland did not perform an average annual flow analysis.

EPA's regulations at 40 CFR 130.2(i), define "total maximum daily load (TMDL)" as the "sum of individual WLAs for point sources and LAs for nonpoint sources and natural

[12] Biomass is defined as the amount, or weight, of a species, or group of biological organisms, within a specific volume or area of an ecosystem (EPA 823-B-97-002).

[13] Thomann, R.V., N.J. Jaworski, S.W. Nixon, H.W. Paerl, and J. Taft. March 14, 1985. Algal Bloom Expert Panel. The 1983 Algal Bloom in the Potomac Estuary. Prepared for the Potomac Strategy State/EPA Management Committee.

background." As the total loads provided by Maryland equal the sum of the individual WLAs for point sources and the land-based LAs for nonpoint sources set forth below and in the Technical Memorandum provided with the TMDLs, the TMDLs for nitrogen and phosphorus for Bohemia River are consistent with Section 130.2(i). Pursuant to 40 CFR 130.6 and 130.7(d)(2), these TMDLs and 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 (WLAs)

EPA regulations require that an approvable TMDL include individual WLAs for each point source. Though Maryland's TMDL report for the Bohemia River did not include an individual waste load allocation for the point source, Cecilton WWTP (NPDES permit # MD0020443), of nitrogen or phosphorus, a WLA scenario for low-flow TMDLs was provided in the Technical Memorandum. This WLA is presented in Table 2.

Table 2 - Summary of low-flow WLAs for Nitrogen and Phosphorus

Facility	NPDES permit #	Parameter	Current permit Loading[1] (lbs/month)	WLA (lbs/month)	Reduction needed
Cecilton WWTP	MD0020443	Nitrogen	365	365	-----
		Phosphorus	102	102	-----

[1] The loadings are based on approved water and sewerage plan discharge flow. The design flow is 0.08 mgd, nitrogen concentration of 18 mg/L and a phosphorus concentration of 5 mg/L.

Cecilton WWTP is located near the headwaters of a free-flowing tributary, Black Duck Creek and has a very small flow. Therefore it only minimally impacts the mainstem of the Bohemia River. The WLAs of the TMDL represent point source loads which will provide compliance with the water quality standards mentioned in Section 1 above. The low-flow monthly WLA values are most applicable from May 1 to October 31.

Load Allocations (LAs)

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 LA for the low-flow TMDL.

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 nonpoint source loads should be distinguished.

A breakdown by land use cannot be determined for nonpoint source loads during low flow. These nonpoint source loads, which were based on observed concentrations, account for "natural" and human-induced components. Table 3 presents the gross LAs for low flow.

Table 3 - Summary of low-flow LAs for Nitrogen and Phosphorus

Parameter	"Existing" Nonpoint Source Load (lbs/month)	LA (lbs/month)	Reduction needed (%)
Nitrogen	1,042	922	12
Phosphorus	89	35	61

The low-flow TMDL analysis was accomplished using nonpoint source loads which are based on 1999 field survey data from the Bohemia River.

Allocations Scenarios

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

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. 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 these TMDLs, as NPDES permits are issued for the point sources that discharge the pollutants of concern to Bohemia River, any deviation from the WLAs set forth in the Technical Memorandum 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.

In addition, 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 nonpoint sources 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 for Nitrogen and Phosphorus for Bohemia River are consistent with the regulations and requirements of 40 CFR Section 130. Pursuant to 40 CFR 130.6 and 130.7(d)(2), the TMDLs and the supporting documentation, including the Technical Memorandum, should be incorporated into Maryland's current water quality management plan.

3) The TMDL considers the impacts of background pollutant contributions.

In terms of the low-flow TMDL analysis, Maryland used 1999 field data which would adequately consider pollutant contributions from baseflow, which is considered to be most influential during low-flow periods, as well as other nonpoint source contributions such as atmospheric deposition and loads from septic tanks.

4) The TMDLs consider critical environmental conditions.

EPA regulations at 40 CFR 130.7(c)(1) require TMDLs to take into account critical conditions for streamflow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of Bohemia River is protected during times when it is 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.[14] Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has 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 example, stream analysis often uses a low-flow (7Q10) design condition as critical because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

Based on the 1999 field data and current knowledge regarding eutrophication, Maryland identified the months of July, August, and September as the critical period. The specific conditions that describe this critical period are reduced flows in the stream (low-flow),

[14] 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 Water Management Division Directors, August 9, 1999.

higher concentrations of nutrients, and warmer water temperatures. These conditions combine to create favorable conditions for algal growth and wide fluctuations in DO concentrations which lead to violations of the designated uses and water quality criteria of the Bohemia River. Furthermore, the data showed that chlorophyll-a levels were of concern and DO concentrations are violating the water quality criteria. The low-flow TMDL analysis using the WASP5 model adequately considers those critical conditions.

MDE also recognized that increased nonpoint source loads of nutrients during precipitation events could adversely affect water quality, thus a critical condition itself, despite the fact that the 1999 field data showed that chlorophyll-a levels and DO concentrations were not of concern for the months of February and March.

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 during the colder period of winter and in early spring from snowmelt and spring rain, while seasonally low flow typically occurs during the warmer summer and early fall drought periods[15]. Consistent with EPA's discussion regarding critical conditions, the WASP5 model and TMDL analysis will effectively consider seasonal environmental variations.

6) The TMDLs include a margin of safety.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. Margins of safety may be implicit, built into the modeling process, or explicit, taken as a percentage of the wasteload allocation, load allocation, or TMDL.

In terms of the low-flow TMDL analysis for nitrogen and phosphorus, MDE states that it explicitly allocates 5% of the LA value and reserves this for the MOS. However, analysis indicates that the margins of safety represent much larger percentages of the load allocations.

In addition, MDE uses certain conservative assumptions which are implicitly included in the modeling process. The low-flow analysis sets a goal of 50 µg/l for chlorophyll-a, which MDE believes is conservative given the generally acceptable range of chlorophyll-a values for waters meeting their water quality standards of 50 - 100 µg/l.

7) The TMDLs have been subject to public participation.

The TMDLs of nitrogen and phosphorus to the Bohemia River were open for public comment from October 26, 2000 through November 27, 2000. Only one set of written comments was received by MDE. This was provided along with MDE's response

[15] Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1, Section 2.3.3, (EPA 823-B-97-002, 1997).

document with the TMDL report.

EPA submitted a copy of these TMDLs to the United States Fish and Wildlife Service (USFWS) on October 31, 2000 and to the United States National Marine Fisheries Service (USNMFS) on November 16, 2000. The EPA did not receive a response from the USFWS or USNMFS on the proposed TMDLs.

8) There is a reasonable assurance that the TMDL can be met.

EPA requires that there be a reasonable assurance that the TMDL 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 authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs 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.

MDE believes that agricultural ditching, direct loading from animals, and deposition of nutrient-laden sediment from high-flow events are potential nonpoint sources that negatively impact water quality during critical low-flow periods. MDE believes that nonpoint source control mechanisms are necessary to improve water quality during low-flow periods. MDE states that controlling these nonpoint sources will ensure that water quality standards during low-flow periods will be achieved.

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.

IV. Additional Information

The following table presents the TMDL in pounds per day.

Flow Regime (Period)	Parameter	TMDL	WLA[1]	LA[2]	MOS[3]
Low-flow (May 1 - Oct. 31)	Nitrogen (lbs/day)[4]	43.8	12.0	30.2	1.6
	Phosphorus (lbs/day)[4]	4.6	3.3	1.1	0.1

[1] WLA = Waste Load Allocation
[2] LA = Load Allocation
[3] MOS = Margin of Safety
[4] 30.5 days per month was used to convert lbs/month to lbs/day