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

February 28, 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 Chicamacomico River, Dorchester, Maryland" which was submitted by the Maryland Department of Environment (MDE) for final agency review first on August 22, 31, 2000 and again with revisions on February 13, 2001. Pursuant to 40 CFR Section 130.7(d), EPA is approving the Chicamacomic 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 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.

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
Chicamacomico River

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 Chicamacomico River submitted for final Agency review on August 22, 2000. During EPA's review of this document for approval, revisions were requested. A revised final document was submitted for final Agency review on February 13, 2001. The EPA's rationale is based on the TMDL, Technical Memorandum, and other information provided in the submittal document 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 Nonpoint Sources in the Chicamacomico River Watershed*, submitted by the Maryland Department of the Environment (MDE), specifically allocates nitrogen and phosphorus to each of four separate land use/source categories (direct atmospheric deposition of nitrogen or phosphorus to the water surface is obviously not considered a "land use" source). Each land use or source is allocated some percentage of the total allowed nutrient load originating from nonpoint sources. Current nonpoint source load estimates were based on the Chesapeake Bay Model Phase IV Year 2000 loading coefficients which consider natural background, loads from septic tanks, as well as baseflow contributions. Likewise, the load allocations to each land use also consider natural background, septic tanks and baseflow. Each land use load allocation represents yearly allowable loads of nitrogen and phosphorus. There are no significant point sources to which allocations can be made. Table 1 presents a summary of the TMDLs as determined by MDE.

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

Flow Regime (Period)	Parameter	TMDL	WLA[2]	LA[3]	MOS[4]
Low-flow (May 1 - Oct. 31)	Nitrogen (lbs/month)	1,621	0	1,540	81
	Phosphorus (lbs/month)	27	0	25	2
Average-flow (Nov. 1 - April 30)	Nitrogen (lbs/year)	203,608	0	197,500	6,108
	Phosphorus (lbs/year)	14,007	0	13,587	420

[1] The load allocations for low-flow represent flows developed using a United States Geological Survey regression analysis and 1998 base-flow field data taken in the Chicamacomico River

[2] WLA = Waste Load Allocation

[3] LA = Load Allocation

[4] MOS = Margin of Safety

II. Summary

The Chicamacomico River[1], approximately 16.3 miles in length, originates southeast of the East New Market area and finally drains to the Chesapeake Bay through the Transquaking River about one mile due north to Bestpitch. The Chicamacomico River is tidal throughout its navigable reach, which extends from the confluence with the Transquaking River to approximately 14.6 miles upstream to an area known as Big Millpond. Big Millpond was previously used as a source of water. The Chicamacomico River watershed has an area of approximately 33,017 acres or 51.6 square miles. The dominant land uses in the watershed are forest (21,204 acres or 64%) and mixed agriculture (10,935 acres or 33%). Open water (564 acres) and urban (314 acres) comprise the remaining land use distribution[2].

In response to the requirements of Section 303(d) of the Clean Water Act (CWA), MDE listed the Chicamacomico River on the 1996 303(d) list of impaired waterbodies under Basin Segment 02130308 (Transquaking River Watershed) due to signs of eutrophication in the form of excessive algal blooms and low dissolved oxygen (DO) concentrations. 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 uses[4] of Chicamacomico 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. Chicamacomico 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

[1] The Chicamacomico River watershed, part of the Lower Eastern Shore Tributary Strategy Basin, is located in Dorchester County. It is contained within sub-basin 02-13-03 (Nanticoke River Area)..

[2] This information is based on 1997 Maryland Office of Planning information.

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

[4] The designated use of the Chicamacomico 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.

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 acceptable levels of nitrogen and phosphorus, as demonstrated by the WASP5 model, in order to ensure that water quality standards are maintained. These levels of nitrogen and phosphorus will provide for the control of eutrophication and algae blooms (measured through a surrogate indicator known as chlorophyll-a) and ensure that the instantaneous water quality criterion of 5.0 mg/L for DO is attained.

MDE developed these TMDLs to address the excessive nutrient enrichment that Chicamacomico River is currently experiencing. This TMDL is designed to satisfy the water quality standards and designated uses of Chicamacomico River only for nutrients. Impairments in the remainder of the Nanticoke River watershed are not addressed by this TMDL. In addition, impairments due to suspended sediments are not addressed by these TMDLs.

In order to address the impairments of Chicamacomico River from the 303(d) list, MDE believes it is necessary to control excessive nutrient input to the system. Nitrogen and phosphorus 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.

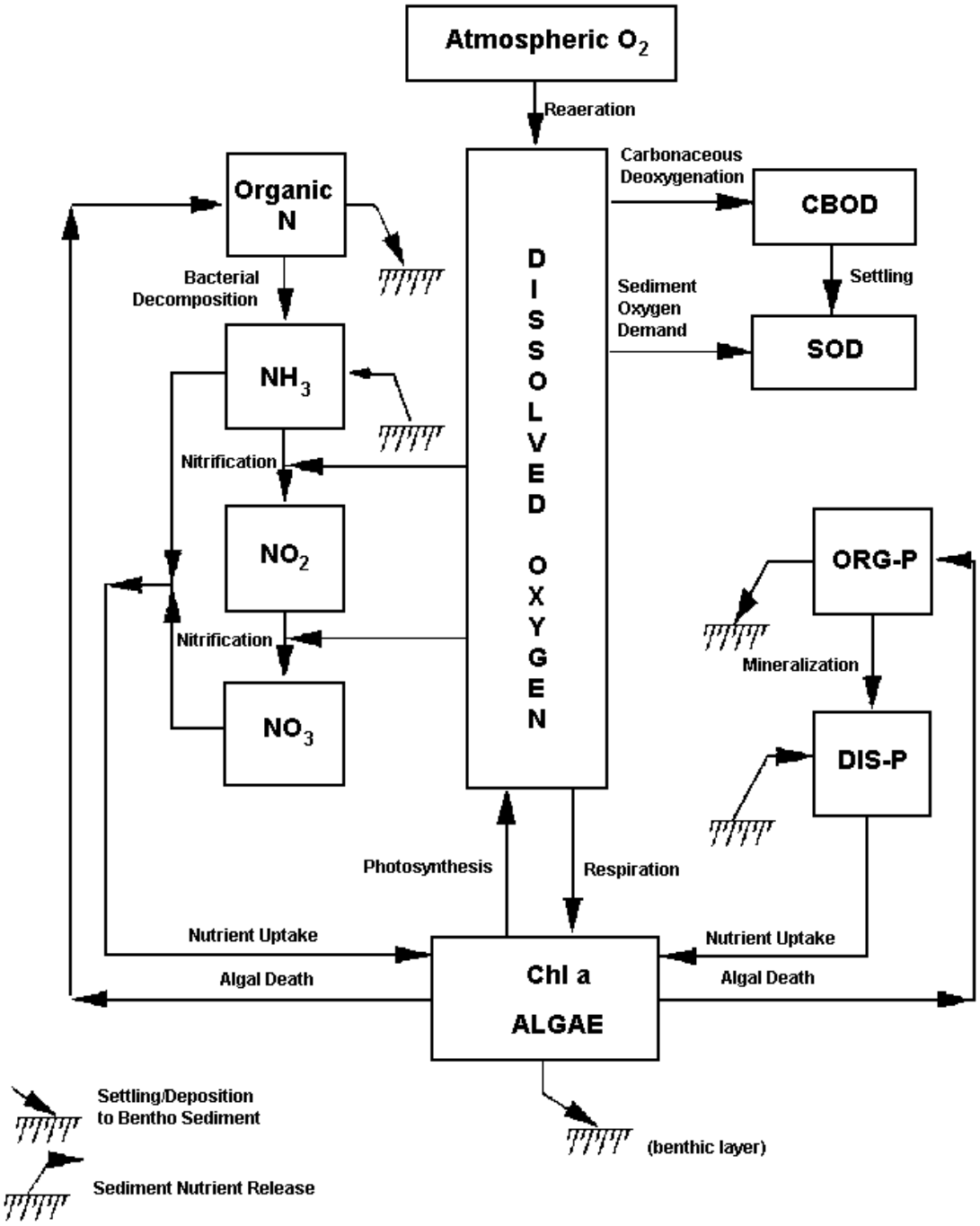

Figure 1

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 stream's 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 Chicamacomico 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 Chicamacomico River. Based on this analysis, MDE has determined that the levels of nutrient input to the Chicamacomico River specified by the TMDL will ensure that water quality standards are achieved by controlling algae blooms and maintaining the DO water quality criterion.

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 Chicamacomico River. EPA therefore approves the TMDLs, Technical Memorandum, and supporting documentation for nitrogen and phosphorus in the Chicamacomico River. EPA's approval is outlined according to the regulatory requirements listed below.

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

MDE has indicated that algal blooms and low DO concentrations due to excessive nutrient input have caused violations of the water quality standards and designated uses applicable to the Chicamacomico River. As previously mentioned, the designated use of Chicamacomico River is 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 its 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

[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.

(chlorophyll-a)[8] to determine acceptable algae levels in the Chicamacomico 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 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

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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.

[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).

Chicamacomico River. Again, 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 believes that the TMDLs for phosphorus and nitrogen will ensure that the designated use and water quality criteria for the Chicamacomico 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 Chicamacomico 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 individual TMDLs for nitrogen and phosphorus that are applicable from May 1 through October 31. Maryland presented these 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. While available data and predictive modeling do not indicate any problems with chlorophyll-a levels or low DO concentrations during these times, Maryland performed the average annual flow analysis as loads from the Chicamacomico River have been shown to contribute to violations of water quality criteria downstream in the Transquaking River (TMDLs for this waterbody were approved 03/09/00). Although the water quality problems occur during low flow, the annual TMDLs are intended to prevent backsliding on current nonpoint source loads, thereby making an initial effort to address possible sedimentation problems when the situation is further evaluated. The TMDLs for nitrogen and phosphorus are presented in Table 1.

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 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

[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.

the Technical Memorandum provided with the TMDLs, the TMDLs for nitrogen, phosphorus, and BOD for Lower Wicomico 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

There are no significant point sources to which allocations can be made.

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 low-flow and average-flow TMDLs. Those gross load allocations are contained in Table 1.

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 loads should be distinguished. MDE uses the Chesapeake Bay Program model Phase IV loading coefficients (Year 2000 scenario) which are land use specific and include natural background contributions, atmospheric deposition (to land and/or water), and baseflow contributions.

As noted above, Maryland did not provide a breakdown of the LA in the TMDL report; however, such a breakdown for average annual flow was provided in the Technical Memorandum. The TMDLs are based on nitrogen and phosphorus loading from the 4 land uses/sources within the watershed. According to the Technical Memorandum and personal communication, the specific load allocations for the TMDL are presented in Tables 2 and 3 for average flow. A breakdown by land use cannot be determined for nonpoint source loads for low flow.

Table 2 - Summary of Load Allocations for Nitrogen (average flow)

Land Use Category	% Land Use	Watershed Area (acres)	% Nonpoint source current load	Nonpoint source current load (lbs/yr)	% nonpoint source TMDL load	Nonpoint source TMDL load (lbs/yr)	% reduction needed
Mixed Agriculture	33.1	10,935	48.2	124,974	48.2	95,258	24
Forest/other Herbaceous	64.2	21,204	46.7	121,085	46.7	92,111	24
Urban	1.0	314	1.0	2,593	1.0	1,988	23
Atmospheric Deposition[1]	1.7	564	4.1	10,631	4.1	8,143	23
Total	100	33,017	100	259,283	100	197,500	-----

[1] The atmospheric deposition load is attributable to deposition only to surface water, atmospheric deposition to land surfaces is included in the loads attributed to mixed agriculture, forest and other herbaceous, and urban land uses.

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

Land Use Category	% Land Use	Watershed Area (acres)	% Nonpoint source current load	Nonpoint source current load (lbs/yr)	% nonpoint source TMDL load	Nonpoint source TMDL load (lbs/yr)	% reduction needed
Mixed Agriculture	33.1	10,935	71.3	13,865	71.3	9,693	30
Forest/other Herbaceous	64.2	21,204	24.5	4,764	24.5	3,330	30
Urban	1.0	314	0.7	136	0.7	87	36
Atmospheric Deposition[1]	1.7	564	3.5	681	3.5	477	30
Total	100	33,017	100	19,446	100	13,587	-----

[1] The atmospheric deposition load is attributable to deposition only to surface water, atmospheric deposition to land surfaces is included in the loads attributed mixed agriculture, forest and other herbaceous, and urban land uses.

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 4 presents the gross LA for low flow.

Table 4 - Summary of low-flow LAs for Nitrogen and Phosphorus

Compound	"Existing" nonpoint source load (lbs/month)	LA (lbs/month)	Reduction needed
Total Nitrogen	6173	4708	24
Total Phosphorus	379	369	3

Allocations Scenarios

EPA realizes that the above breakout of the total loads for nitrogen and phosphorus to specific land uses is one allocation scenario. As implementation of the established TMDLs proceed or more detailed information becomes available, Maryland may find other combinations of land use allocations that are more feasible and/or cost effective. Any subsequent changes, however, in the TMDLs must conform to gross waste load and load allocations and must ensure that the biological, chemical, and physical integrity of the waterbody is preserved.

Based on the foregoing, EPA has determined that the TMDL and the Technical Memorandum for Nitrogen and Phosphorus for Chicamacomico River are consistent with the regulations and requirements of 40 CFR Section 130. Pursuant to 40 CFR 130.6 and 130.7(d)(2), these 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 1998 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.

In terms of the high-flow TMDL analysis, Chesapeake Bay Model Phase IV loading coefficients (Year 2000 scenario) were used which effectively consider natural background, loads from septic tanks, as well as baseflow contributions.

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 Chicamacomico 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 1998 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), 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 Chicamacomico 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 recognizes 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 1998 field data shows that chlorophyll-a levels and DO concentrations were not of concern for the months of February and March. Additionally, MDE addressed meeting the water quality standards downstream in the Transquaking River. MDE approached this situation by developing an annual TMDL for Chicamacomico River which matched the base-lines for the Transquaking River TMDL. Therefore, MDE has developed an annual TMDL based on average flow conditions, which are based on reductions of nonpoint sources of nitrogen and phosphorus from current loading levels, in which both the water quality needs of the Chicamacomico River and the Transquaking River will be met.

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 our 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

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[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.

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

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 both nitrogen and phosphorus, MDE states that it explicitly allocates 5% of the LA value and reserves this for the MOS. For the high-flow TMDL analysis, MDE explicitly allocates 3% 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. The high-flow analysis was run under the assumption that summer water temperatures and summer solar radiation would be experienced by the Chicamacomico River. These conditions are unlikely given that high-flow analyses are typically done during winter and spring months of the year.

7) The TMDLs have been subject to public participation.

The TMDLs of nitrogen and phosphorus to the Chicamacomico River were open for public comment from June 24, 2000 through July 25, 2000. Only one set of written comments were received by MDE. This was provided along with MDE's response document with the TMDL report.

EPA submitted a copy of these TMDLs to the United States Fish and Wildlife Service (USFWS) and to the United States National Marine Fisheries Service (USNMFS) on June 28, 2000. The EPA did not receive a response from the USNMFS on the proposed TMDLs. The USFWS had no comments 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. 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 TMDLs 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]	53	0.0	50.5	2.7
	Phosphorus (lbs/day)[4]	1	0.0	0.8	0.1
Average-flow (Nov. 1 - April 30)	Nitrogen (lbs/day)[5]	558	0	541	17
	Phosphorus (lbs/day)[5]	38	0	37	1

[1] WLA = Waste Load Allocation
[2] LA = Load Allocation
[3] MOS = Margin of Safety
[4] 30.5 days per month were used to convert lbs/month to lbs/day
[5] 365 days per year were used to convert lbs/year to lbs/day