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

February 13, 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 Biochemical Oxygen Demand for the Manokin River, Somerset County, Maryland" which was submitted by the Maryland Department of Environment (MDE) for final agency review on first on July 31, 2000 and again with revisions on January 24, 2001. Pursuant to 40 CFR Section 130.7(d), EPA is approving the Manokin 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 Biochemical Oxygen Demand for
Manokin River Somerset 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 Biochemical Oxygen Demand to the Manokin River. The Maryland Department of the Environment (MDE) had submitted an initial final document for these TMDLs on July 31, 200, but during EPA's review of this document for approval revisions were requested. A revised final document was submitted for final Agency review on January 24, 2001. 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 Point Sources and Nonpoint Sources in the Manokin River Watershed* and submitted by the Maryland Department of the Environment (MDE), specifically allocates nitrogen and biochemical oxygen demand (BOD) to three point sources as well as nitrogen to each of 4 separate land use/source categories (direct atmospheric deposition of nitrogen 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 considers natural background, loads from septic tanks, as well as baseflow contributions. Likewise, the load allocations (LAs) to each land use also consider natural background, septic tanks and baseflow. Each land use load allocation represents yearly allowable loads of nitrogen. MDE also allocates nitrogen and BOD to the Princess Anne Wastewater Treatment Plant (WWTP), Eastern Correctional Institute, and the Westover Goose Creek Food Store. The current load of nitrogen and BOD was determined using effluent concentrations and flows reported in 1998 Discharge Monitoring Reports (DMRs). Table 1 presents a summary of the TMDLs as determined by MDE.

Table 1 - Summary of Nitrogen and BOD TMDLs

Flow Regime (Period)	Parameter	TMDL	WLA[a]	LA[b]	MOS[c]
Low-flow (May 1 - Oct. 31)	Nitrogen (lbs/month)	1,610	1,340	260	10
	BOD (lbs/month)	4,420	3,390	980	50
Average-flow (Nov. 1 - April 30)	Nitrogen (lbs/year)	353,680	42,730	301,890	9,060

[a] WLA = Wasteload Allocation
[b] LA = Load Allocation
[c] MOS = Margin of Safety

II. Summary

The Manokin River[1], approximately 15 miles in length, is a tributary of the Chesapeake Bay. The mainstem Manokin is fed by 4 tributaries which are Loretto Branch, Taylor Branch, Kings Creek, and Back Creek. The surrounding watershed encompasses approximately 52,351 acres (81.8 square miles) and the dominant land uses are forest and other herbaceous land (35,010 acres or 63%), mixed agricultural land (15,060 acres or 27%). Open water (3,150 acres or 6%) and urban (2,280 acres or 4%) 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 Manokin River on the 1996 303(d) list of impaired waterbodies based on available information. The specific causes of impairment included low dissolved oxygen (DO) and signs of eutrophication evidenced by recurrent seasonal 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]. The impact of low DO concentrations or anaerobic conditions is reflected in an unbalanced ecosystem, fish mortality, odors, and other aesthetic nuisances.[4] These impairments interfere with the designated uses[5] of Manokin River by disrupting the aesthetics of the river and causing harm to inhabited aquatic communities through wide fluctuations of the DO levels. MDE originally listed nutrients, both nitrogen and phosphorus, from point, nonpoint, and natural sources as the causes and sources of the impairments, respectively. Upon further analysis, MDE determined that nitrogen and BOD are the dominant pollutants contributing to the impairments. Manokin 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

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[1] The Manokin River watershed, part of the Lower Eastern Shore Tributary Strategy Basin, is located in Somerset County. It is listed as sub-basin 02130208.

[2] Information based on 1997 Maryland Office of Planning information and 1997 Farm Service data.

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

[4] Thomann, R.V., J.A. Mueller. 1987. Principles of Surface Water Quality Modeling. HarperCollins Publishers, Inc.

[5] The designated uses of Manokin River are Use I (Water Contact Recreation and Protection of Aquatic Life) above the confluence with Kings Creek and Use II (Shellfish Harvesting) below the confluence with Kings Creek. 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 BOD, as demonstrated by the WASP5 model, in order to ensure that water quality standards are maintained. These levels of nitrogen and BOD will provide for the control of eutrophication and algae blooms (measured through a surrogate indicator known as chlorophyll-a) and ensure that the water quality criterion for DO is attained.

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

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

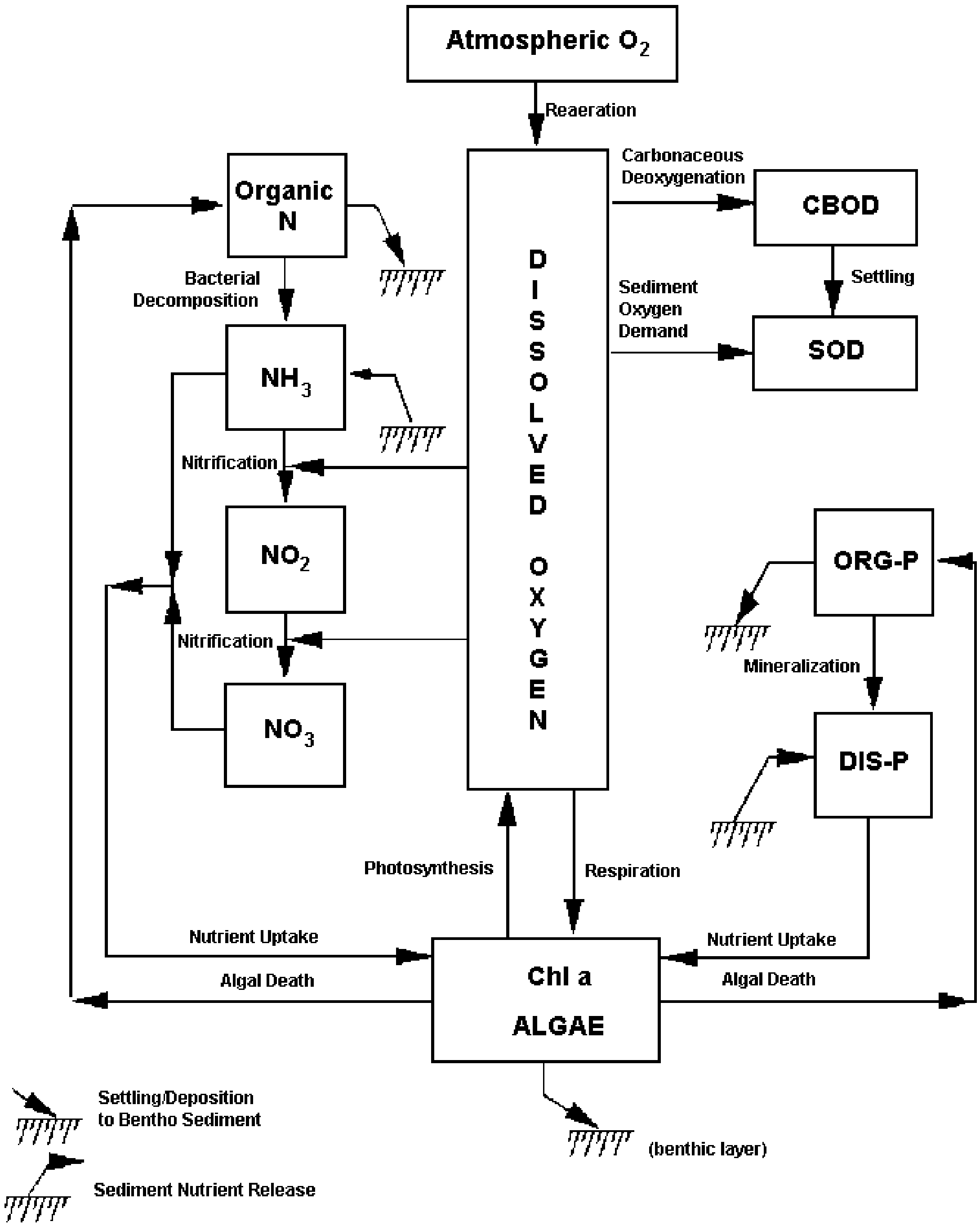

Figure 1

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[6]. In addition, excessive nutrients lead to an overabundance of aquatic plant growth.

BOD is a measure of the amount of oxygen required to stabilize organic matter in wastewater[7]. It is typically determined from a standardized test measuring the amount of oxygen available after incubation of the sample at 20°C for a specific length of time, usually 5 days. Conceptually, BOD requires a distinction between the oxygen demand of the carbonaceous material in waste effluents and the nitrogenous oxygen demanding component of an effluent[8]. Carbonaceous biochemical oxygen demand (CBOD) involves the breakdown of organic carbon compounds while nitrogenous biochemical oxygen demand (NBOD) involves the oxidation of ammonia to nitrate, commonly referred to the nitrification process[9].

MDE uses WASP5[10] to evaluate the link between nutrient and BOD loadings, algal growth, and DO. This evaluation is based on representing current conditions within the Manokin River system and determining the necessary reductions in nutrient and BOD 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)[11]. 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, CBOD, 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 Manokin River. Based on this analysis, MDE has determined that the levels of nutrient input to the Manokin River specified by the TMDL will ensure that water quality standards are achieved by controlling algae blooms and maintained the DO water quality criterion.

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[6] 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.

[7] U.S. Environmental Protection Agency. Office of Water. March 1997. Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2: Streams and Rivers, Part 1: Biochemical Oxygen Demand/Dissolved Oxygen and Nutrients/Eutrophication. EPA 823-B-97-002.

[8] Supra, footnote 1.

[9] Chapra, S.C. 1997. Surface Water-Quality Modeling. WCB/McGraw-Hill.

[10] 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.

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

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 Manokin River. EPA therefore approves the TMDLs, Technical Memorandum, and supporting documentation for nitrogen and phosphorus in the Manokin 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 algae blooms and low DO concentrations due to excessive nutrient and BOD input have caused violations of the water quality standards and designated uses applicable to the Manokin River. As previously mentioned, the designated uses of Manokin River are Use I and II. The DO water quality criterion to support those uses 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, Maryland interprets it's General Water Quality Criteria to provide numerical objectives for nitrogen which will support the DO water quality criterion as well as a surrogate indicator (chlorophyll-a)[12] to determine acceptable algae levels in the Manokin 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[13]. The WASP5 model used by Maryland will help to determine those nutrient levels and compliance with the DO criterion and chlorophyll-a levels. Likewise, while there is no specific numeric water quality standard for BOD, control of BOD is necessary due to its direct impact on DO 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[14]. 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[15]. 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):

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

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

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[12] 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).

[13] Supra, footnote 3

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

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

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[16], to evaluate the link between nutrient loadings and aquatic plant levels necessary to support the designated uses of Manokin 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[17]. 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 loadings of nutrients to achieve a chlorophyll-a concentration of 50 μg/L.

EPA believes it is important to note that these TMDLs are fundamentally different from the majority of TMDLs that MDE has submitted. Typically, MDE has chosen to address phosphorus in order to mitigate eutrophication and low DO impairments. However, water quality modeling of the Manokin River revealed that the system was much more responsive to changes in nitrogen and BOD loads as opposed to phosphorus. Based on these modeling results, MDE developed TMDLs to address nitrogen and BOD.

EPA believes that the TMDLs for nitrogen and BOD will ensure that the designated uses and water quality criteria for the Manokin 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 Manokin 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

[16] 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).

[17] 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.

quality, particularly with respect to DO levels, Maryland has established individual TMDLs for nitrogen and BOD 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 does not indicate any problems with chlorophyll-a levels or low DO concentrations during these times, Maryland performed the average annual flow analysis in order to characterize the impact of nonpoint source nutrient loadings. 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.

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 the Technical Memorandum provided with the TMDLs, the TMDLs for nitrogen and phosphorus for Manokin 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.

<u>Wasteload Allocations</u>

EPA regulations require that an approvable TMDL include individual WLAs for each point source. Maryland's TMDL report for the Manokin River did not include an individual waste load allocations for point sources of nitrogen and BOD. However, the Technical Memorandum did provide a waste load allocation scenario for both the low-flow and average-flow TMDLs. The WLAs for the three point sources are presented in Table 2.

Table 2 - Summary of individual low-flow WLAs for nitrogen and BOD

Flow condition	Parameter	Current permitted loading	WLA	% reduction needed
Princess Anne WWTP NPDES permit # MD0020656				
Flow condition	Parameter	Current permitted loading	WLA	% reduction needed
Low flow	BOD (lbs/month)[a]	1,576	1,576	0
	Nitrogen (lbs/month)[b]	946	946	0
Average-annual	Nitrogen (lbs/year)[g]	30,685	30,685	0
Eastern Correctional Institute NPDES permit # MD0066613				
Flow condition	Parameter	Current permitted loading	WLA	% reduction needed
Low-flow	BOD (lbs/month)[c]	1,801	1,801	0
	Nitrogen (lbs/month)[d]	360	360	0
Average annual	Nitrogen (lbs/year)[h]	11,689	11,689	0
Westover Goose Creek Food Store NPDES permit #MD0053104				
Flow condition	Parameter	Current permitted loading	WLA	% reduction needed
Low-flow	BOD (lbs/month)[e]	15	15	0
	Nitrogen (lbs/month)[f]	29	29	0
Average annual	Nitrogen (lbs/year)[i]	356	356	0

[a] WLA based on a design flow of 1.26 mgd and a BOD concentration of 5 mg/l.
[b] WLA based on a design flow of 1.26 mgd and a nitrogen concentration of 3 mg/l.
[c] WLA based on a design flow of 0.48 mgd and a BOD concentration of 15 mg/l.
[d] WLA based on a design flow of 0.48 mgd and a nitrogen concentration of 3 mg/l.
[e] WLA based on a design flow of 0.0065 mgd and a BOD concentration of 9.3 mg/l.
[f] WLA based on a design flow of 0.0065 mgd and a nitrogen concentration of 18 mg/l.
[g] WLA based on a design flow of 1.26 mgd and a nitrogen concentration of 8 mg/l.
[h] WLA based on a design flow of 0.48 mgd and a nitrogen concentration of 8 mg/l.
[i] WLA based on a design flow of 0.0065 mgd and a nitrogen concentration of 18 mg/l.

The point source loads used to represent the expected current conditions were calculated using effluent data gathered from DMRs from 1998. The WLAs of the TMDL represent point source loads which will provide compliance with the water quality standards mentioned in Section 1 above. While the low-flow, monthly WLA values are most applicable from May 1 to October 31, the average annual WLA values are based on achieving these monthly WLA values year-round. The low-flow TMDL analysis was accomplished using nonpoint source loads which are based on 1998 field survey data from the Manokin River.

It is necessary to distinguish between current permitted loading, the wasteload allocation determined through the TMDL process, and actual loading. Current permitted loading refers to the allowable loading as designated by NPDES permit for each facility prior to the TMDL process. The wasteload allocation represents the allowable point source pollutant load necessary to achieve water quality standards as determined by the TMDL process. The actual loading represents the amount of pollutant loading that a facility is discharging. This load must not exceed the permitted load specified in the NPDES permit. However, it is very likely that actual loading is less than both the current permitted load and wasteload allocation such that pollutant loadings from particular facilities may not be impacted by the TMDL process. Conversely, permit limits may need to be adjusted to reflect the wasteload allocation determined in the TMDL process. Thus, while a facility may not be required to take action to reduce pollutant loadings, the NPDES permit may need to be revised in order to reflect findings from the TMDL process.

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), 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. 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 earlier in this document, Maryland did not provide a breakdown of the load allocation in the TMDL report, however, such a breakdown was provided in the Technical Memorandum. The TMDLs are based on nitrogen loading from the 4 land uses/sources within the watershed. According to the Technical Memorandum, the specific load allocations for the TMDL during average flow are presented in Table 3.

Table 3 - Summary of Load Allocations for nitrogen

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	25.74	14,290	60.4	232,311	60.4	182,391	21.5
Forest and other herbaceous	58.06	32,221	23.9	91,738	23.9	72,025	21.5
Urban[1]	10.52	5,839	8.2	31,516	8.2	24,743	21.5
Atmospheric Deposition directly to water	5.66	3,146	7.5	28,953	7.5	22,731	21.5
Total	100	55,496	100	384,517	100	301,890	21.5

[1]Total nitrogen contributions from urban land is inclusive of TN contributions from septics. Septic land use is based on the number of pervious urban acres. In the Manokin watershed, there are 1,398 acres of septics contributing 10,883 pounds per year of total nitrogen loading.

A breakdown by land use cannot be determined for nonpoint source loads during low flow. These nonpoint source loads which were based on observed concentration account for "natural" and human-induced components. Table 4 presents the gross LA for low flow.

Table 4 - Summary of low-flow LA for Nitrogen

"Existing" Nonpoint source load (lbs/month)	LA (lbs/month)	Reduction needed
330	260	21.2%

Allocations Scenarios

EPA realizes that the above breakout of the total loads for nitrogen 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. However, any subsequent changes in the TMDLs must conform to gross wasteload 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 Manokin 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 TMDLs and the Technical Memorandum for Nitrogen and BOD for Manokin 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, Segment 430) 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 Manokin 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.[18] 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 summer months 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

[18] 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.

growth and wide fluctuations in DO concentrations which lead to violations of the designated uses and water quality criteria of Manokin River. Furthermore, the data showed that chlorophyll-a levels were of concern and DO concentrations were violating the water quality criteria in the upper reaches of Manokin River. The low-flow TMDL analysis using the WASP5 model adequately considers those critical conditions.

The State also recognizes that increased nonpoint source loads of nutrients during precipitation events could adversely affect water quality, thus a critical condition itself. In particular, MDE has identified that increased nonpoint source nutrient loads can cause excessive algal growth. MDE has taken an environmentally-conscious approach and developed an annual TMDL based on average flow conditions which quantify the current nonpoint source loading of nutrients and seek to prevent backsliding on those current loading levels.

As previously mentioned, MDE identified low-flow, high temperature summer months as the critical environmental conditions within the Manokin River. Typically, to address this critical period, reductions to point sources would be necessary to reduce pollutant loadings to achieve water quality standards. This approach is based on the fact that during low-flow conditions, point sources are the dominant contributors of pollutants to the system. Precipitation-driven nonpoint sources, such as agricultural lands and urban areas, are considered inactive during low-flow periods.

MDE, however, is not requiring reductions in total nitrogen or BOD loads from point sources in the Manokin River during critical, low-flow periods. MDE states that point sources considered in the TMDL analysis are already under very restrictive permit limits for total nitrogen and BOD. Therefore, while reductions in pollutant loads would positively impact water quality in the Manokin River, the required reductions are not feasible and could not be implemented.

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[19]. 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 (MOS) may be implicit, built into the modeling process, or explicit, taken as a percentage of the WLA, LA, or TMDL.

In terms of the low-flow TMDL analysis for nitrogen, MDE allocates 3.8% of the LA value and reserves this for the MOS. In terms of the low-flow TMDL analysis for BOD, MDE allocates

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

5.1% 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.

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 Manokin 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 Manokin River were open for public comment from March 15, 2000 through April 12, 2000. Four sets of written comments were received by MDE, which was provided along with their 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 March 16, 2000. The EPA did not receive a response from the USNMFS on the proposed TMDLs. The USFWS submitted a response and had no comments on these 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 Maryland’s Lower Potomac Tributary Strategy, which was developed as part of Maryland’s commitment under the Chesapeake bay Agreement. Other existing program include EPA’s Clean Water Action Plan and Maryland’s Water Quality Improvement Act of 1998.

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]	52.7	43.9	8.5	0.3
	BOD (lbs/day)[4]	144.8	111.1	32.1	1.6
Average-flow (Nov. 1 - April 30)	Nitrogen (lbs/day)	969.0	117.1	827.1	24.8

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