

Technical Memorandum

Significant Nitrogen and Biochemical Oxygen Demand Point Sources and Non-point Sources in the Manokin River Watershed

EPA requires that Total Maximum Daily Load (TMDL) allocations account for all significant sources. This technical memorandum identifies, in detail, the significant surface water discharges of nitrogen and biochemical oxygen demand (BOD), and significant non-point sources and their distribution between different land uses. The total nitrogen (TN) and BOD are addressed by the TMDLs for the Manokin River. Modeling input information is provided for simulating all potentially significant point sources as discrete discharges. Details are provided for allocating non-point source loads for nitrogen to different land use categories. These are conceptual values that are within the TMDL thresholds. They represent viable individual allocations to each point source. The Maryland Department of the Environment (MDE) expressly reserves the right to allocate the TMDL among different sources in any manner that is reasonably calculated to achieve water quality standards.

TMDLs are being established in the Manokin River watershed for both low-flow and average annual conditions. Table 1A and Table 1B provide point source modeling information for low-flow TMDLs for TN and BOD respectively. These are supplemented by Table 1C, which provides additional modeling information attributed to each point source for the low-flow TMDL calculation.

Table 1A
Loads Attributed to Significant Point Sources for the Low-flow Nitrogen TMDL^a

Source Name	Permit Number	Flow <i>Mgd</i>	TN Load <i>lb/month</i>	Concentration <i>mg/l</i>
Princess Anne WWTP	MD0020656	1.26	946	3.0
Eastern Correctional Institute	MD0066613	0.48	360	3.0
Westover Goose Creek Food Store	MD0053104	0.0065	29	18

- a. This case corresponds to model scenario 3, in the document *Total Maximum Daily Loads of Nitrogen and Phosphorus and BOD for the Manokin River, Somerset County, Maryland, May 2000*.

Table 1B
Loads Attributed to Significant Point Sources for the Low-flow BOD TMDL^a

Source Name	Permit Number	Flow <i>Mgd</i>	BOD Load <i>lb/month</i>	Concentration <i>mg/l</i>
Princess Anne WWTP	MD0020656	1.26	1576	5.0
Eastern Correctional Institute	MD0066613	0.48	1801	15
Westover Goose Creek Food Store	MD0053104	0.0065	15	9.3

Table 1C
Additional Assumptions for the Low-flow TMDL^{a,b}

		MD0020656	MD0066613	MD0053104
CBOD	<i>kg/d</i>	39.8	45	0.383
DO	<i>mg/l</i>	5	5	5
Chlorophyll <i>a</i>	<i>kg/d</i>	0	0	0
NH₃	<i>kg/d</i>	0.665	1.01	0.3329
ON	<i>kg/d</i>	2.19	1.39	0.0729
NO₂	<i>kg/d</i>	11.5	3.10	0.0377
PO₄	<i>kg/d</i>	0.901	0.497	0.0621
OP	<i>kg/d</i>	0.532	0.103	0.0118
Flow	<i>m³/s</i>	0.0552	0.0210	0.000285
Total Nitrogen	<i>kg/d</i>	14.4	5.5	0.4435
Total Phosphorus	<i>kg/d</i>	1.4	0.6	0.0739

- a. This case corresponds to model scenario 3, in the document *Total Maximum Daily Loads of Nitrogen and BOD for the Manokin River, Somerset County, Maryland*, May 2000.
- b. 1 kg = 2.2 lb

The loadings, concentrations, and flows represented in the above tables are for illustrative purposes only. Actual effluent limits and related permit conditions will be established at the time of permit issuance or renewal and will be based upon conditions present at that time, as reflected in populations projections, infrastructure needs as defined in County Comprehensive Water and Sewer Plans, and appropriate concentrations and loadings needed to address impairments of the water quality limited segments identified by this TMDL and the applicable 303(d) list. The total of load reductions from all sources will, however, remain the same as the subtotals and grand totals reflected on the charts. Point source loadings, flows, and concentrations placed in permits will be based upon the information listed above as well as that provided during the permit adjudication process.

Table 2A provides point source modeling information for the average annual TMDL for TN. This is supplemented by Table 2B, which provides additional modeling information attributed to each point source for the average annual TMDL calculation.

Table 2A
Loads Attributed to Significant Point Sources for the Average Annual Nitrogen TMDL^c

Source Name	Permit Number	Flow <i>mgd</i>	TN Load <i>lb/year</i>	Concentration <i>mg/l</i>
Princess Anne WWTP	MD0020656	1.26	30,685	8.0
Eastern Correctional Institute	MD0066613	0.48	11,689	8.0
Westover Goose Creek Food Store	MD0053104	0.0065	356	18.0

Table 2B
Additional Assumptions for the Average Annual TMDL^{b, c}

		MD0020656	MD0066613	MD0053104
CBOD	<i>kg/d</i>	139.3	45.0	0.383
DO	<i>mg/l</i>	5.0	5.0	5.0
Chlorophyll <i>a</i>	<i>kg/d</i>	0.0	0.0	0.0
NH₃	<i>kg/d</i>	1.774	2.676	0.3329
ON	<i>kg/d</i>	5.84	3.66	0.0729
NO₂	<i>kg/d</i>	30.6	8.213	0.0377
PO₄	<i>kg/d</i>	0.901	0.497	0.0621
OP	<i>kg/d</i>	0.532	0.103	0.0118
Flow	<i>m³/s</i>	0.0552	0.0210	0.000285
Total Nitrogen	<i>kg/d</i>	38.214	14.549	0.4435
Total Phosphorus	<i>kg/d</i>	1.433	0.60	0.0739

b. This case corresponds to model scenario 4, in the document *Total Maximum Daily Loads of Nitrogen and BOD for the Manokin River, Somerset County, Maryland*, May 2000.

c. 1kg = 2.2 lb

The loadings, concentrations, and flows represented in the above tables are for illustrative purposes only. Actual effluent limits and related permit conditions will be established at the time of permit issuance or renewal and will be based upon conditions present at that time, as reflected in populations projections, infrastructure needs as defined in County Comprehensive Water and Sewer Plans, and appropriate concentrations and loadings needed to address impairments of the water quality limited segments identified by this TMDL and the applicable 303(d) list. Point source loadings, flows, and concentrations placed in permits will be built upon the information listed above as well as that provided during the permit adjudication process.

The non-point source loads that were used in the model account for both “natural” and human-induced components. Low-flow non-point source loads were based on in-stream monitoring data. Insufficient data are available to distribute the low-flow non-point source load among different land use categories.

The average annual non-point source loads were determined using land use loading coefficients. The land use information was based on 1997 Maryland Office of Planning data, and 1997 Farm Service Agency data. The total non-point source load was calculated by summing all of the individual land use areas and multiplying by the corresponding land use loading coefficients. The loading coefficients were based on the results of the Chesapeake Bay Model¹, which was a continuous simulation model. The Chesapeake Bay Program nutrient loading rates represent loads delivered to the stream, for the year 2000 assuming Best Management Practice (BMP) implementation at levels consistent with current Tributary Strategy progress, and account for atmospheric deposition, loads from septic tanks, and loads coming from urban development, agriculture, and forestland. Table 3A provides one possible scenario for the distribution of average annual nitrogen non-point source loads between different land use categories.

Table 3A
Non-point Source Nitrogen Loads
Attributed to Significant Land Uses for Average Annual TMDLs

Land Use Category	Percent of Non-point Source Load	Non-point Source Load (lb/yr)
Mixed Agricultural	60.4%	182,391
Forest and Other Herbaceous	23.9%	72,025
Urban	8.2%	24,743
Atmospheric Deposition ²	7.5%	22,731
Total	100	301,890

It must be noted that these loads are based on broad-scaled estimates. Efforts are underway to update the Chesapeake Bay model, and Maryland anticipates that better estimates of land use and loading rates will be available in the future.

¹ U.S. EPA Chesapeake Bay Program, “Chesapeake Bay Program: Watershed Model Application to Calculate Bay Nutrient Loadings: Final Findings and Recommendations,” and Appendices, 1996